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Global Interdisciplinary Conference 2K25 - Shaping Future Trends

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On 20th & 21st January 2025

INTERNATIONAL MULTIDISCIPLINARY CONFERENCE

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CHAIRMAN'S MESSAGE

Dear Faculty Members, Scholars and Esteemed Readers,

It gives me immense pleasure and pride to present this publication, a remarkable compilation that reflects the diverse insights and innovative research across multiple disciplines. This book is a significant milestone for SMART Association as it encapsulates the spirit of collaboration, intellectual pursuit, and academic excellence. As we embark on this enriching journey, it is my honour to announce our partnership with Department of Physical Education, NM Christian College Marthandam in organizing the International Multi-Disciplinary Conference and International Research Excellence Awards. This collaboration stands as a beacon of our commitment to fostering a global platform for researchers, academicians, and professionals to exchange ideas, share their findings, and The conference and awards aim to recognize and honour the outstanding contributions of researchers who have demonstrated exceptional prowess in their respective fields. This initiative is a testament to our dedication to nurturing a culture of innovation and academic rigor, ensuring that our collective efforts resonate globally.

I extend my heartfelt congratulations to all contributors, award recipients, and participants whose work is featured in this book. Your dedication, perseverance, and quest for knowledge have greatly enriched this publication, and I am confident that it will serve as a valuable resource for researchers and practitioners alike.

On behalf of SMART Association, I express my deepest gratitude to Department of Physical Education, NMCC Marthandam for their collaboration and unwavering support. Together, we aspire to create a legacy of academic excellence that transcends boundaries and inspires future generations.

Let us continue to strive for excellence, fuel our intellectual curiosities, and make a lasting impact on the world through our research and innovations.

With warm regards and best wishes,

Dr. J. Robert Edwin Chester,
President

SECRETARY MESSAGE

Dear Esteemed Participants,

It is with immense pride and great pleasure that I address you on behalf of the Scientific Multidisciplinary Association of Research Task (SMART) for the GLOBAL INTERDISCIPLINARY CONFERENCE ON 2K25 - SHAPING FUTURE TRENDS. This conference stands as a testament to our shared commitment to advancing knowledge, fostering innovation, and bridging the gaps between diverse fields of study to create impactful solutions for the future.

In today's rapidly evolving world, the intersections of technology and business have become pivotal in shaping global trends. These two domains are intricately intertwined, influencing industries, economies, and societies worldwide. This conference is meticulously designed to serve as a platform for professionals, researchers, academicians, and industry leaders to come together, share insights, and engage in thought-provoking discussions that transcend disciplinary boundaries.

The Scientific Multidisciplinary Association of Research Task (SMART) has always championed interdisciplinary collaboration and innovative research. Our mission is to bridge knowledge silos and provide a space where ideas from diverse domains converge and thrive. The Tech-Biz Synergy 2K25 conference embodies this mission, emphasizing the synergy needed between technology and business to redefine global strategies.

The theme, "Redefining Global Trends," captures the challenges and opportunities that lie ahead. Through sessions, workshops, and panels, we aim to explore innovative solutions and sustainable growth. Topics range from AI and blockchain to entrepreneurial strategies, ensuring this conference offers cutting-edge insights.

To our speakers and panellists, thank you for sharing your expertise. To delegates and attendees, your engagement makes this conference a dynamic space for learning. I also extend my gratitude to the Secretary and Principal of Nesamony Memorial Christian College, Marthandam, for their invaluable support. Additionally, I am grateful to the organizing committee, volunteers, and sponsors for their dedication.

As we embark on this journey, I encourage you to embrace inquiry and collaboration. Together, let us redefine paradigms and shape a future marked by synergy, sustainability, and success. Thank you for being part of this endeavour, and I wish you an inspiring conference experience.

Warm regards,

Mr. J. Josemon,
Secretary

CONTENTS

FRIENDSHIP, BETRAYAL AND REDEMPTION: A CRITICAL ANALYSIS OF KHALED HOSSEINI'S *THE KITE RUNNER*

Ms. SINDHUJA D[1] & Dr. KARTHIKA PREMKUMAR[2]

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Abstract

Khaled Hosseini's novel *The Kite Runner* explores the profound themes of friendship, betrayal, and redemption against the backdrop of Afghanistan's turbulent socio-political landscape. This study critically analyzes how these themes shape the protagonist's journey and reflect broader societal issues. The friendship between Amir, a privileged Pashtun, and Hassan, a marginalized Hazara, serves as the novel's emotional core, emphasizing the complexities of loyalty and social inequality. Betrayal emerges as a central theme when Amir fails to defend Hassan, leading to a lifelong struggle with guilt and regret. Hosseini masterfully portrays how personal betrayal mirrors the ethnic and class divisions that plague Afghan society. This study examines the sociocultural factors influencing the characters' decisions, highlighting Afghanistan's rigid social hierarchy and the systemic discrimination faced by marginalized groups, particularly the Hazara community. The portrayal of women and children further illustrates the entrenched societal norms that restrict their agency and perpetuate their suffering. The novel underscores the universality of themes such as guilt, redemption, and the longing for acceptance, making it relatable to readers worldwide. This paper also addresses that how Hosseinei's narrative technique effectively blends historical authenticity with fictional elements, enriching the reader's understanding of Afghanistan's cultural complexities.

Keywords: Friendship, guilt, redemption, sufferings

Introduction

Khaled Hosseini's novel, *The Kite Runner*, published in 2003, explores complex themes of friendship, betrayal, and redemption within the backdrop of Afghanistan's tumultuous history. As noted by Mahmood and Rashid (2017), The theme of redemption in *The Kite Runner* highlights the fact that while one can never fully undo the harm done by betrayal, one can seek to make amends and find healing through acts of love and responsibility. The novel resonates with audiences by portraying Amir's struggle for redemption after betraying his childhood friend Hassan, a theme that remains universal and timeless. Amir and Hassan's friendship is emblematic of Afghanistan's deeply

entrenched ethnic divide between Pashtuns and Hazaras. Hunter (2011) asserts that *The Kite Runner* examines universal themes of identity and friendship, making it a cultural touchstone for Western audiences (Hunter 642). However, this friendship is overshadowed by betrayal when Amir fails to defend Hassan during a critical moment. The relationship between Amir and Hassan is central to the novel's exploration of friendship. Despite their social and ethnic differences—Amir being a Pashtun and Hassan a Hazara—their bond is characterized by mutual affection and loyalty. Hassan's unwavering devotion to Amir, epitomized by his famous line, "For you, a thousand times over" (Hosseini, 67), underscores the selfless nature of true friendship. However, Amir's internal struggles with jealousy and insecurity ultimately fracture their bond, highlighting the complexities of friendship influenced by societal structures and personal insecurities.

Amir's failure to intervene during Hassan's assault by Assef represents a pivotal moment of moral failure. His subsequent actions—framing Hassan for theft and forcing him to leave—further deepen the betrayal. Hosseini uses these events to explore the destructive power of guilt and the ease with which fear and cowardice can override moral duty. Amir's betrayal of Hassan serves as a catalyst for his lifelong quest for redemption. Amir's pursuit of redemption is a central driving force in the novel. Years later, an opportunity for atonement arises when Amir returns to Taliban-controlled Afghanistan to rescue Sohrab, Hassan's son. This act of bravery signifies Amir's desire to make amends for his past mistakes. The novel suggests that redemption is achievable through acts of courage and self-sacrifice, reinforcing the idea that one's past does not define their future. Rahim Khan's advice, "There is a way to be good again" (Hosseini 192), encapsulates the novel's core message about the possibility of redemption.

The theme of betrayal extends beyond Amir and Hassan's relationship to Amir's father, Baba, and his long-time servant, Ali. Amir grows up feeling overshadowed by Hassan's perceived superiority in Baba's eyes. He believes that Baba favors Hassan because of his own inadequacies, particularly his lack of athleticism, which Baba values deeply. Amir's jealousy of Hassan intensifies as he realizes that Baba treats him more like a son than he treats Amir. The true nature of Baba's betrayal is revealed later in the novel. It is disclosed that Baba, in fact, is Hassan's biological father, making Amir and Hassan half-brothers. Baba's affair with Ali's wife, Sanaubar, resulted in Hassan's birth, a fact Baba never shared with anyone. This revelation casts Baba's favoritism in a new light, exposing his betrayal not only of Ali, but also of Amir, who struggled with his father's lack of approval. Baba's refusal to acknowledge his wrongdoing, much like Amir's silence during Hassan's assault, underscores the generational cycle of betrayal and the emotional consequences that follow.

Amir's jealousy of Baba's favoritism towards Hassan exacerbates his feelings of inadequacy. Throughout their time together in Baba's mansion, Amir becomes increasingly resentful of the affection Baba shows Hassan, which Amir feels he cannot earn (Caballero Robb and Maria Elena). Amir's feelings of jealousy and inferiority lead him to demean Hassan, referring to him as an "imbecile" (Hosseini 25) and constantly belittling him. This passive aggression culminates in the pivotal moment when Amir watches Hassan being sexually assaulted by Assef and does nothing to stop it. Instead of intervening, Amir runs away, rationalizing his inaction as a means of protecting himself from harm and social consequences. His cowardice in this moment represents the

ultimate betrayal of their friendship, as Amir prioritizes his own safety over Hassan's suffering (Hosseini 72-73). This moment of betrayal haunts Amir for years, and the weight of his guilt causes a deep emotional rift between him and Hassan. Amir's inability to face Hassan after the incident is evident in his emotional turmoil, describing how he could not even bear the sight of their shared memories (Hosseini 78). His guilt, compounded by his cowardice, leads to a distancing from Hassan, who, despite Amir's mistreatment, remains unwavering in his loyalty.

Throughout *The Kite Runner*, Hosseini emphasizes the importance of Afghan culture, particularly the tradition of kite flying. Before the Soviet invasion and the rise of the Taliban, kite-flying tournaments were a significant part of Afghan culture, bringing communities together in celebration. This tradition is emblematic of a more innocent time in Afghanistan, before the ravages of war. The symbolism of kite flying runs deep in the novel, serving as a metaphor for Amir's relationship with Hassan. The final scene of the novel, in which Amir runs to retrieve a kite for Sohrab, mirrors the events of the past. This moment of reconciliation, of attempting to redeem past mistakes, is poignantly tied to the cultural symbol of the kite. It represents not just a connection to the past, but also a future filled with hope, healing, and renewal.

Conclusion

Hosseini's *The Kite Runner* offers a profound exploration of friendship, betrayal, and redemption, emphasizing the moral complexities individuals face in their pursuit of self-forgiveness. The novel ultimately conveys that while betrayal can shatter relationships, redemption remains within reach for those willing to confront their past and seek forgiveness. Through Amir's journey, Hosseini illustrates the transformative power of remorse and the enduring hope for reconciliation.

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EFFECT OF SUN SALUTATION ON SPECIFIC RANGE OF MOTION AMONG SCHOOL GIRLS

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ABSTRACT

This study aimed to assess the impact of Surya Namaskar on the range of motion in selected joint movements among schoolgirls. The research involved 30 students from Government Girls Higher Secondary School, Chennai, aged 14 to 17 years—a crucial developmental stage where flexibility and overall fitness significantly influence long-term health. Participants were randomly assigned into two groups: an experimental group practicing Surya Namaskar and a control group with no specialized training, each consisting of 15 students. The experimental group underwent a structured six-week Surya Namaskar program, practicing five days per week under professional supervision, while the control group continued their usual activities. Pre- and post-training measurements of range of motion were collected to determine the intervention's effects. A correlated t-test was used to analyze differences in means between the groups, with statistical significance set at 0.05. This rigorous approach ensured reliable and valid results. The findings suggest that Surya Namaskar is an effective, low-cost intervention to improve flexibility and fitness among adolescents. These results contribute to the growing evidence supporting yoga-based programs for enhancing health and well-being in school-aged children.

Keywords: Surya Namaskar, Flexibility

Introduction
Surya Namaskar or Sun Salutation:

This practice enhances body strength, builds endurance, and improves flexibility. It supports cardiovascular health, stimulates the nervous system, and tones the muscles through stretching and flexing. Surya Namaskar consists of a sequence of 12 yoga poses performed in synchronization with breathing. Ideally practiced early in the morning on an empty stomach, it serves as a holistic exercise for the body, revitalizing muscles and vital organs. Each round, comprising two sets of 12 poses, takes 1 to 2 minutes, depending on the speed and intensity. Surya Namaskar is adaptable for everyone, from beginners to advanced practitioners and across all age groups, making it a universally beneficial practice.

METHODOLOGY

The study investigated the effects of Surya Namaskar on selected physical parameters in schoolgirls. Conducted at Government Kallar Girls Higher Secondary

School, Checkanurani, Madurai, it involved 30 girls aged 14 to 17 years—a critical developmental stage for flexibility and mobility. Participants were randomly divided into two groups:

- **Experimental Group**: This group of 15 students followed a structured six-week Surya Namaskar training program, practicing five days a week under supervision.

- **Control Group**: Comprising 15 students, this group continued with their regular daily activities without additional training.

Flexibility was measured using the Sit and Reach Test, which assesses lower back and hamstring flexibility. The data were analyzed using a correlated t-test to compare pre- and post-test scores, with significance determined at the 0.05 level. This methodology ensured robust and reliable findings. The study highlights Surya Namaskar as a practical, cost-effective method for improving flexibility in adolescents, emphasizing its versatility for different age groups and fitness levels.

Statistical Techniques

The flexibility data were subjected to statistical analysis to evaluate the hypotheses formulated by the researcher. The t-test was employed to determine the differences between means, considering standard deviation and standard error. The statistical approach provided a robust framework for interpreting the study's outcomes.

Computation of 't' Ratio between the Pre and Post Test

Means of Flexibility

Variables	Group	Mean		SD		Sd Error	df	't' ratio
		Pre	Post	Pre	Post			
Flexibility	Control	10.733	10.533	0.593	0.639	0.200	14	1.000
	Experimental	10.933	11.360	0.883	0.640	0.094		**4.526***

* Significance at 0.05 level of confidence df (14) is = 2.14

The table indicates that the pretest and posttest mean flexibility scores for the control group were 10.73 and 10.53, respectively. The calculated 't' ratio was 1.00, which is below the critical table value of 2.14 at a significance level of 0.05. Therefore, the difference is not statistically significant.

For the experimental group, the pretest and posttest mean flexibility scores were 10.93 and 11.36, with standard deviations of 0.88 and 0.64, respectively. The calculated 't' ratio was 4.52, which exceeds the critical table value of 2.14 at the 0.05 significance level. Thus, the difference is statistically significant.
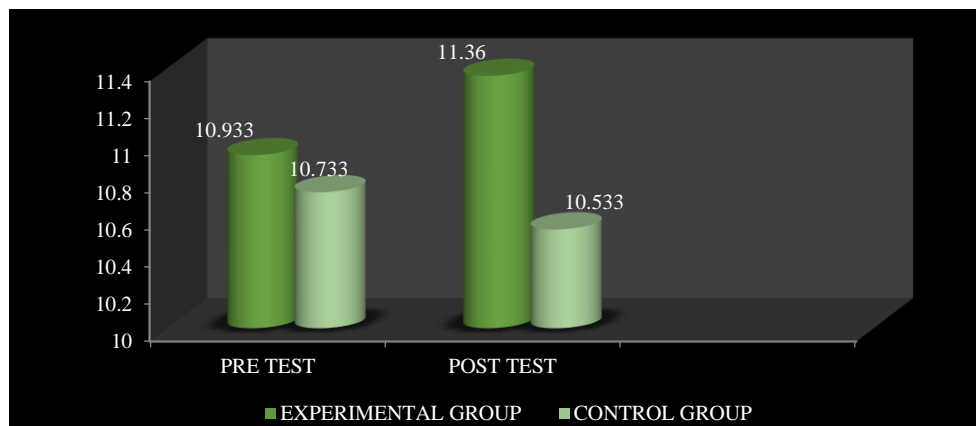
DISCUSSION ON THE FINDINGS

The findings revealed that the experimental group, which practiced Surya Namaskar, demonstrated a notable improvement in flexibility compared to the control group. This underscores the effectiveness of Surya Namaskar as a yoga-based approach for enhancing physical flexibility among schoolgirls. The results confirmed a significant difference between the experimental and control groups in all measured variables, supporting the hypothesis proposed at the start of the study. The positive impact of Surya Namaskar on flexibility is further emphasized by the participants' enthusiasm and engagement during the intervention. These findings align with previous research highlighting the benefits of Surya Namaskar on physical fitness. The six-week intervention period was sufficient to yield significant and measurable improvements. Additionally, the distinct difference in mean values between the experimental and control groups reinforces the conclusion that Surya Namaskar is an effective practice for improving flexibility.

CONCLUSIONS

Based on the study's limitations and statistical analysis, the following conclusions were drawn:

1. A six-week training program led to a significant improvement in flexibility among schoolgirls.
2. The control group exhibited an insignificant improvement at the 0.05 level of confidence.

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THE IMPACT OF PILATES TRAINING ON FLEXIBILITY AND DYNAMIC BALANCE IN HANDBALL PLAYERS

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ABSTRACT

This study aims to investigate the impact of a 6-week Pilates training program on flexibility and dynamic balance among handball players from Scott Christian College, Nagercoil. Forty players aged 17 to 22 were divided into an experimental group and a control group. The experimental group underwent Pilates training three times a week, while the control group followed their regular training regimen. Flexibility was assessed using the sit-and-reach test, and dynamic balance was measured through the modified Bass test. Significant improvements were observed in both flexibility and dynamic balance for the experimental group compared to the control group. These findings highlight Pilates as an effective tool for enhancing physical performance and reducing injury risk in handball players.

Keywords: Pilates training, flexibility, dynamic balance, handball performance

INTRODUCTION:

Handball is a high-intensity sport requiring agility, flexibility, and balance. Players must possess exceptional physical attributes to execute quick directional changes, maintain stability during dynamic movements, and adapt to challenging gameplay scenarios. To meet these physical demands, athletes often rely on complementary training techniques alongside their traditional regimens. Pilates, developed by Joseph Pilates, is a mind-body conditioning system that emphasizes core strength, controlled movements, and precise alignment.

Pilates is widely recognized for its role in improving flexibility and dynamic balance—two critical components of handball performance. Enhanced flexibility reduces the risk of injuries and promotes efficient movement patterns, while improved dynamic balance ensures stability and control during high-speed actions. This study investigates the potential benefits of Pilates training for handball players and provides evidence-based recommendations for incorporating it into athletic training programs.

MATERIALS AND METHODS

The study aimed to investigate the impact of Pilates training on flexibility and dynamic balance in college-level Handball players from Scott Christian College

Nagercoil aged 17 to 22. They were divided into two equal groups of twenty such as Experimental group I underwent N (20) Pilates training (PT) for a period of six weeks, and group II N (20) acted as control group (CG) and not exposed to any specific training, but they participated in their regular schedule. Flexibility and dynamic balance were selected as variables and assessed using the "sit and reach test" (measured in centimeters), the "modified bass test" (measured in numbers) respectively. The parameters were measured at baseline to post-treatment after the six weeks. Pilates sessions were conducted three times a week for 60 minutes each, including 10 minutes of warm-up, 40 minutes of Pilates training, and 10 minutes of cool-down for twelve weeks. The training intensity increased by 10% every four weeks, ranging from 65% to 85% of workload. Statistical analysis using the 't' test was performed to determine significant improvements between pre and post-tests, with a criterion for significance set at a 0.05 confidence level.

Statistical Analysis

Pre- and post-test evaluations were conducted for both groups. Paired sample *t*-tests were used to analyze within-group differences, and independent *t*-tests were employed for between-group comparisons. A significance level of 0.05 was adopted.

Results and Discussion

The results of the study are presented below:

Group	Variables		Mean	N	Std. Deviation	Std. Error Mean	'T' Ratio
Experimental Group	Flexibility	Pre test	30.75	20	2.88	0.30	11.89
		Post test	34.35	20	3.01		
	Dynamic Balance	Pre test	5.80	20	1.57	0.15	7.71
		Post test	7.00	20	1.71		
Control Group	Flexibility	Pre test	29.20	20	2.70	0.19	4.34
		Post test	30.05	20	2.74		
	Dynamic Balance	Pre test	5.60	20	1.46	0.16	1.56
		Post test	5.85	20	0.98		

*Significant level 0.05 level degree of freedom (2.09, 1 and 19)

Observations

1. **Flexibility**: The experimental group showed significant improvements in flexibility, with a *t* ratio of 11.89, surpassing the critical value of 2.09. The control group's improvement was minimal, indicating the effectiveness of Pilates training in enhancing flexibility.

2. **Dynamic Balance**: The experimental group exhibited a substantial increase in balance scores, as indicated by a *t* ratio of 7.71. The control group's results were not statistically significant, highlighting the added benefits of Pilates training.

These findings provide strong evidence for the inclusion of Pilates in athletic training programs, especially for sports like handball where flexibility and balance are crucial.

Comparison of Pre- and Post-Test Scores
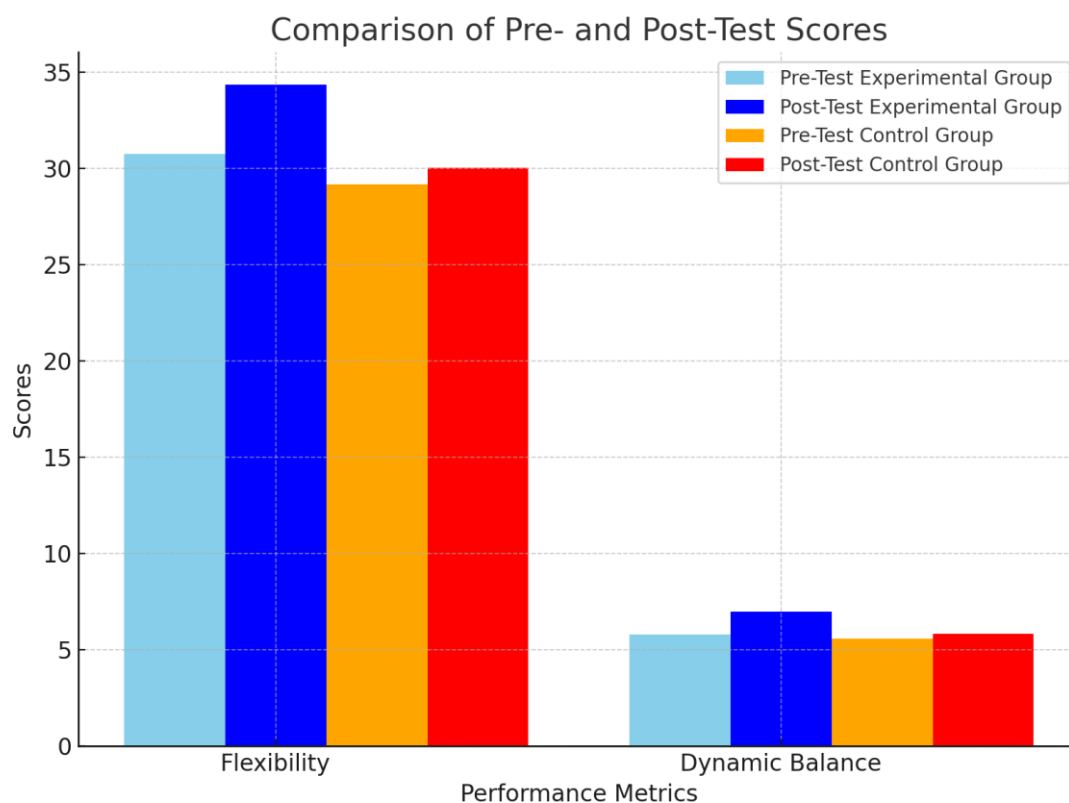
Discussion

The results of this study align with previous research demonstrating the efficacy of Pilates in improving physical performance metrics. Flexibility enhancements observed in the experimental group can be attributed to Pilates exercises targeting key muscle groups, such as the hamstrings, quadriceps, and hip flexors. Dynamic balance improvements were likely due to the emphasis on core stability and proprioceptive training inherent in Pilates practices.

In handball, where players must execute rapid movements and maintain control under challenging conditions, these physical attributes are indispensable. Incorporating Pilates into regular training can enhance performance, reduce the risk of common injuries, and improve overall physical resilience.

The control group's limited improvements underscore the need for specialized training to achieve significant performance gains. By adopting structured Pilates

programs, athletes can achieve measurable benefits in a relatively short period, as evidenced by the 6-week duration of this study.

Conclusion

The 6-week Pilates training program significantly improved flexibility and dynamic balance among handball players. These enhancements can contribute to better on-court performance, greater agility, and reduced injury risk. Coaches and athletes are encouraged to integrate Pilates into their training regimens to optimize athletic performance and physical well-being.

Future research could explore the long-term effects of Pilates training, its impact on other performance metrics, and its applicability to different sports and age groups.

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EFFECT OF YOGA PRACTICES ON COORDINATIVE AND PSYCHOMOTOR ABILITIES AMONG COLLEGE MALE ATHLETES

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Abstract

This study aimed to examine the impact of yoga practices on the coordinative and psychomotor abilities of college-level male athletes. For this purpose, twenty male athletes, aged between 23 and 25 years, were randomly selected from the Department of Physical Education and Sports at Manonmaniam Sundaranar University, Tirunelveli District, Tamilnadu, India. The participants were randomly assigned to two groups: Group I, which practiced yoga asanas (n=10), and Group II, which served as the control group (n=10). The experimental group engaged in yoga sessions three times a week, with one session per day over a six-week period. Meanwhile, the control group continued their regular activities without any specialized training.

The study assessed three key variables—balance ability, reaction ability, and speed of movement—using the Long Nose Balance Test, Ball Reaction Exercise Test, and Nelson Speed of Movement Test, respectively. Statistical analysis was conducted using the dependent t-test and Analysis of Covariance (ANCOVA) at a significance level of 0.05. Data processing was performed with the SPSS-22 statistical software package.

The findings revealed that participants in the yoga asana group showed significant improvements in balance ability, reaction ability, and speed of movement compared to the control group. Furthermore, the experimental group exhibited notable differences in these variables when compared to the control group.

Key Terms: Yoga Practices, Balance Ability, Reaction Ability, Speed of Movement

Introduction

Yoga is a discipline centered on living harmoniously and is designed to be part of everyday life. It addresses the physical, mental, emotional, psychic, and spiritual dimensions of human existence. Yoga encompasses various practices, including asanas, pranayama (breathing exercises), and meditation. The connection between the mind and body is profound, as stress induces both physical and mental strain. Yoga, recognized as a mind-body medicine, has become a popular method for enhancing physical fitness and well-being [1].

It is widely regarded as an effective way to engage individuals with sedentary lifestyles in physical activities [2]. Ancient teachings, particularly in religious and spiritual contexts, highlight the depth of knowledge in yoga. Swamiji, with formal training in physical education, seamlessly integrates physical education, Sanskrit, and yoga in his works, showcasing a unique blend of expertise [3].

To contribute to global citizenship through physical education, yoga should be an integral part of its curriculum, with proper instruction and practice of yogic exercises being emphasized [4].

Coordinative Abilities: These refer to the general and stable patterns of motor control that enable athletes to perform movements with greater precision and efficiency. Seven key types of coordinative abilities have been identified: i) Orientation Ability, ii) Differentiation Ability, iii) Coupling Ability, iv) Adaptation Ability, v) Rhythm Ability, vi) Balance Ability, and vii) Reaction Ability. These skills are critical for mastering sports techniques and continually refining them throughout training. Motor learning abilities are significantly influenced by the level of coordinative skill [5].

Psychomotor Learning: This involves physical actions such as movement, coordination, and dexterity, demonstrating fine and gross motor skills. These skills are evident in activities like using precise tools or walking [6].

Psychomotor Function: It describes an individual's ability to produce timely and appropriate responses to stimuli. This complex process integrates sensory and motor systems through the central nervous system's organizational functions. It is often assessed using tests like the Six Letter Cancellation Test (SLCT) and the Digit and Letter Substitution Test (DLST) [7].

Purpose of the Study

The purpose of the study was to find out effect of yoga practices on coordinative and psychomotor abilities among college male athletes.

Material and Methods

This study explored the influence of yoga practices on coordinative and psychomotor abilities in college-level male athletes. A total of 20 male athletes, aged between 23 and 25 years, were randomly selected from the Department of Physical Education and Sports at Manonmaniam Sundaranar University, located in Tirunelveli District, Tamilnadu, India. The participants were then divided into two groups: Group I, which practiced yoga asanas (n=10), and Group II, which served as the control group (n=10).

Group I engaged in yoga sessions three times per week, with one session each day over a six-week period. In contrast, Group II did not undergo any specific training but continued their usual activities. To evaluate the impact, the study measured three key variables: balance ability, reaction ability, and speed of movement. These were assessed

using the Long Nose Balance Test, Ball Reaction Exercise Test, and Nelson Speed of Movement Test, respectively.

The collected data were analyzed using the dependent t-test and Analysis of Covariance (ANCOVA) with a confidence level set at 0.05. Statistical analysis was performed using the SPSS-22 software package.

Analysis of Data

Table I

Means and Dependent'T'-Test for the Pre and Post Tests on Balance Ability, Reaction Ability and Speed Movement of Experimental and Control Groups

Criterion variables	Mean	Experimental Group	Control Group
Balance Ability	Pre test	13.89	13.94
	Post test	13.05	13.91
	't'test	12.36*	1.25
Reaction Ability	Pre test	1.51	1.52
	Post test	1.47	1.51
	't'test	7.23*	0.62
Speed Movement	Pre test	0.49	0.51
	Post test	0.35	0.49
	't'test	9.42*	1.02

*Significant at .05 level. (Table value required for significance at .05 level for 't'-test with df 9 is 2.26)

From the table I the dependent-'t'-test values of balance ability, reaction ability and speed movement between the pre and post tests means of experimental groups were greater than the table value 2.26 with df 9 at 0.05 level of confidence, it was concluded that the experimental group had significant improvement in the balance ability, reaction ability and speed movement between while compared to control group.

Computation of Analysis of Covariance

The descriptive measures and the results of analysis of covariance on the criterion measures were given in the following tables.

Table – II

Computation of Mean and Analysis of Covariance on Balance Ability, Reaction Ability and Speed Movement of Experimental and Control Groups

	Experimental Group	Control Group	Source of Variance	Sum of Squares	df	Mean Square	F
Balance Ability (Adjusted Post Mean)	12.99	13.87	BG	10.77	1	10.77	7.04*
			WG	26.01	17	1.53	
Reaction Ability (Adjusted Post Mean)	1.46	1.51	BG	0.50	1	0.50	10.02*
			WG	1.02	17	0.06	
Speed of Movement (Adjusted Post Mean)	0.33	0.48	BG	4.89	1	4.89	15.28*
			WG	5.44	17	0.32	

* Significant at 0.05 level. Table value for df 1, 17 was 4.45

The above table indicates the adjusted mean value on balance ability, reaction ability and speed movement of experimental and control groups were 12.99 & 13.87:1.47 & 1.51 and 0.33 & 0.48 respectively. The obtained F-ratio of 7.04, 10.02 and 15.28 for adjusted mean was greater than the table value 4.45 for the degrees of freedom 1 and 17 required for significance at 0.05 level of confidence. The result of the study indicates that there was a significant difference among experimental and control groups on balance ability, reaction ability and speed movement.

Figure I: Pre Test, Post Test and Adjusted Post Test Mean Values of Experimental Group and Control Group on Balance Ability, Reaction Ability and Speed Movement

Discussion on Findings

Shetty, (2018) conducted the effect of yoga on flexibility and psychomotor performance in college-going healthy individuals. Bisht, R., & Mardikar, M. (2017) compared the study of selected coordinative abilities among players belonging to semi-contact and non-contact sports of rashtrasant tukadoji maharaj nagpur university .From above these both supportive study I intent to conduct this study the result of the my study indicates that there was a significant improvement on balance ability, reaction ability and speed movement due to the effect of yoga practices among college male athletes when compared to control group.

Conclusion

1. There was significant improvement on balance ability, reaction ability and speed movement due to the effect of yoga practices among college male athletes.

2. There was a significant difference between experimental and control groups balance ability, reaction ability and speed movement due to the effect of yoga practices among college male athletes.

3. However the control group had not shown any significant improvement on any of the selected variables.

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EFFECT OF TIBETAN YOGA ON SELECTED STRENGTH VARIABLE AMONG SOCCER PLAYERS

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Abstract

The present study aim was to find out the impact of tibetan yoga on selected strength variable among soccer players. To attain the purpose of this study, twenty male soccer players were randomly selected as participants from St. John's College, Palayamkottai, Tirunelveli District, Tamilnadu, India. Their age were ranged from 19 to 23 years, who were participated inter collegiate tournament during the academic year of 2024-2025.The selected participants were randomly divided into two groups such as group 'I' underwent tibetan yoga practices (n=10) and group II act as control (n=10). Group 'I' underwent tibetan yoga practices (The Five Rites attract the universal energy into our body; balancing the Seven Chakras which promote the free flow of prana (chi energy) revitalizing our body and mind) for three alternative days per week and one session per day for six weeks period. Group 'II' was not exposed to any specific training but they were participated in regular activities. The data on selected criterion variable on abdominal strength was measured by sit ups test (numbers). The collected data were statistically analyzed by using dependent 't' test and Analysis of Covariance (ANCOVA) was fixed at 0.05 level of confident. All the data were analyzed by used SPSS-22 version statistical package. It was concluded that the tibetan yoga practices group were significantly improved on abdominal strength when compared than control group and also made significant differences among experimental and control groups.

Key Words*: Tibetan Yoga, Abdominal Strength, Soccer*

1. Introduction

Yoga is a very ancient discipline. It is recognized as one of the most important and valuable gifts of the Indian heritage. Today the world is looking to Introduction 25 yoga for solving the various problems men are facing **(Vigneshwaran, 2016).**

Physical requirements of the soccer game demand high aerobic and anaerobic capacity, muscle strength, abdominal strength, speed, power, skills, coordination and flexibility for the improvement of performance and care of injury prevention **(Reilly, 2003).**

Tibetan Yoga comprises of five simple, yet dynamic yogic exercises called Five Tibetan Rites. The Five Tibetan Rites is a yoga routine based on a ritual of exercises done by the Tibetan Lamas, which helped them to live very long and healthy life and to stay ever young. Tibetan Yoga is the union of mind, body and spirit and is based on Buddhism **(Lorenzo Cohen, 2004).**

The Five Rites attract the universal energy into our body; balancing the Seven Chakras which promote the free flow of prana (chi energy) revitalizing our body and mind. They activate endocrine glands regulating the hormonal output. These low profile yogic secrets of the Lamas will unearth all the energies and an awesome power lying dormant within you, aligning it with the cosmic energy to give you the best of both mind and body **(Ramakrishnan, 2016).**

Abdominal strength was defined as the ability to control the position and motion of the trunk over the pelvis to allow optimal output, transfer and control of force and motion to the terminal segment in integrated athletic activities, or as the ability of the limbo-pelvic hip complex to prevent buckling and to return to equilibrium after instability **(Kumar & Arumugam, 2018).**

2. Purpose of the Study

The purpose of the study was to find out impact of tibetan yoga on abdominal strength among soccer players.

3. Material and Methods

The research participants consisted of twenty male soccer players were randomly selected as participants from St.John's College, Palayamkottai, Tirunelveli District, Tamilnadu, India. Their age were ranged from 19 to 23 years, who were participated inter collegiate tournament during the academic year of 2024-2025. Tirunelveli District, Tamilnadu, India. The selected participants were randomly divided into two groups such as group 'I' underwent tibetan yoga practices (n=10) and group II act as control (n=10). Group 'I' underwent tibetan yoga practices (The Five Rites attract the universal energy into our body; balancing the Seven Chakras which promote the free flow of prana (chi energy) revitalizing our body and mind) for three alternative days per week and one session per day for six weeks period. Group 'II' was not exposed to any specific training but they were participated in regular activities. The data on selected criterion variable on abdominal strength was measured by sit ups test (numbers). The collected data were statistically analyzed by using dependent't' test and Analysis of Covariance (ANCOVA) was fixed at 0.05 level of confident. All the data were analyzed by used SPSS-22 version statistical package. It was concluded that the tibetan yoga practices group were significantly improved on abdominal strength when compared than control group and also made significant differences among experimental and control groups.

4. Analysis of Data

Table I

Means and Dependent't'-Test for the Pre and Post Tests on Abdominal Strength of Experimental and Control Groups (Numbers)

Criterion variables	Mean	Experimental Group	Control Group
Abdominal Strength	Pre test	34.82	34.69
	Post test	47.53	35.21
	't'test	12.90*	0.99

*Significant at .05 level. (Table value required for significance at .05 level for 't'-test with df 9 is 2.26)

The table-I shows that the pre-test mean value of experimental and control groups are 34.82 and 34.69 respectively and the post test means are 47.53 and 35.21 respectively. The obtained dependent t-ratio values between the pre and post test means of experimental and control groups are 12.90 and 0.99 respectively. The table value required for significant difference with df 9 at 0.05 level is 2.26. Since, the obtained-'t' ratio value of experimental group was greater than the table value, it was understood that experimental group had significantly improved on abdominal strength. However, the control group has not improved significantly. The 'obtained t' value is less than the table value, as they were not subjected to any specific training.

Computation of Analysis of Covariance

The descriptive measures and the results of analysis of covariance on the criterion measures were given in the following tables.

Table – II

Computation of Mean and Analysis of Covariance on Abdominal Strength of Experimental and Control Groups

	Experimental Group	Control Group	Source of Variance	Sum of Squares	df	Mean Square	F
Abdominal Strength	48.02	35.86	BG	79.88	1	79.88	17.44*
			WG	77.86	17	4.58	

* Significant at 0.05 level. Table value for df 1, 17 was 4.45

Table-II shows that the adjusted post test means values on abdominal strength. The obtained f- ratio of 17.44 for adjusted post test mean is greater than the table value 4.45 with df 1 and 17 required for significance at 0.05 level of confidence. The results of the study indicate that there is a significant mean difference exist between the adjusted post test means of experimental and control groups on abdominal strength. The bar diagram shows the mean values of pre, post and adjusted post tests on abdominal strength of experimental and control group.

Figure I: **Pre Test, Post Test and Adjusted Post Test Mean Values of Experimental Group and Control Group on Abdominal Strength**

5. Discussion on Findings

Ramakrishnan & Elangovan, (2016) conducted the study on effects of traditional yoga and tibetian yoga on selected physiological biochemical and psychological variables among diabetic women. Kumar & Arumugam, (2018) conducted the study on impact of yoga asana practices on abdominal strength among football players. Vigneshwaran, (2016) evaluated the study on effect of yogic practices on core strength among volleyball players, Balasubramanian, Anbalagan, Kalimuthu & Arumugam, (2017) conducted the research on impact of yogasana practices on abdominal strength among handball players. From above those supportive study I intent to conduct this study the result of the my study indicates that there was a significant improvement on abdominal strength due to the effect of tibetan yoga practices among soccer players when compared to control group.

6. Conclusion

1. There was significant improvement on abdominal strength due to the effect of tibetan yoga practices among soccer players.

2. There was a significant difference between experimental and control groups on abdominal strength among soccer players.

3. However the control group had not shown any significant improvement on any of the selected variables.

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THE IMPACT OF CIRCADIAN RHYTHMS ON PERFORMANCE IN ATHLETICS

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ABSTRACT

Circadian rhythms, the internal biological clock regulating physiological and behavioural processes on a roughly 24-hour cycle, significantly influence athletic performance. These rhythms affect core body temperature, hormone levels (e.g., cortisol and melatonin), and muscular function, all of which play pivotal roles in determining peak physical performance. Research indicates that most athletes exhibit enhanced performance during late afternoon or early evening due to elevated body temperatures, which optimize muscle function, joint mobility, and energy metabolism. Conversely, early morning performances often yield suboptimal results as the body is still transitioning from a state of rest. Specific studies highlight that sprinters and long-distance runners perform better in alignment with their individual chronotypes (morning or evening preferences). For example, "evening types" tend to excel later in the day, while "morning types" peak earlier. Awareness and management of circadian rhythms can improve training schedules and competition planning. For track and field athletes competing in events with rigid schedules, acclimatization to the timing of competitions through training at similar times can mitigate the circadian mismatch. Additionally, strategic use of light exposure, nutrition, and meal timing can help align biological clocks with performance demands.

CIRCADIAN RHYTHM

The circadian rhythm is the body's internal clock that regulates the sleep-wake cycle and other biological processes over a 24-hour period. It is controlled by the brain's suprachiasmatic nucleus (SCN) in the hypothalamus and is influenced by external cues like light and temperature. This rhythm governs vital functions such as sleep, hormone release (e.g., melatonin for sleep and cortisol for alertness), body temperature, and digestion. Factors such as light exposure, sleep patterns, and age can impact circadian rhythms. Disruptions, caused by jet lag, shift work, or poor sleep hygiene, can lead to health issues like insomnia, obesity, and mood disorders. Maintaining regular routines, getting natural light exposure, and limiting screen time at night can support a healthy circadian rhythm.

CIRCADIAN RHYTHM AND SPORTS PERFORMANCE

Circadian rhythm significantly influences sports performance by affecting physiological and psychological processes. Body temperature, which peaks in the late

afternoon or early evening, is linked to optimal muscle function, strength, and flexibility, making this the best time for peak athletic performance. Hormonal fluctuations also play a role; testosterone, which supports muscle strength and recovery, peaks in the morning, while cortisol, responsible for energy regulation, is highest earlier in the day. Additionally, circadian rhythms regulate sleep, essential for recovery and muscle repair. Poor sleep or disruptions, such as jet lag or late-night competitions, can impair endurance, reaction times, and recovery.

Athletes tend to have better reaction times, coordination, and cardiovascular efficiency in the afternoon, when the body's natural rhythms are more favorable. However, disruptions to the circadian rhythm, like irregular schedules or time zone changes, can negatively impact performance. To optimize performance, athletes can schedule training during peak periods, adjust to new time zones gradually, maintain consistent sleep patterns, and use light exposure to reset their internal clocks. By aligning training and competition schedules with their circadian rhythm, athletes can enhance performance, recovery, and overall athletic potential.

ATHLETES PERFORMANCE AND CIRCADIAN RHYTHM

Circadian rhythm significantly influences sports performance by affecting physiological and psychological processes. Body temperature, which peaks in the late afternoon or early evening, is linked to optimal muscle function, strength, and flexibility, making this the best time for peak athletic performance. Hormonal fluctuations also play a role; testosterone, which supports muscle strength and recovery, peaks in the morning, while cortisol, responsible for energy regulation, is highest earlier in the day. Additionally, circadian rhythms regulate sleep, essential for recovery and muscle repair. Poor sleep or disruptions, such as jet lag or late-night competitions, can impair endurance, reaction times, and recovery.

Athletes tend to have better reaction times, coordination, and cardiovascular efficiency in the afternoon, when the body's natural rhythms are more favorable. However, disruptions to the circadian rhythm, like irregular schedules or time zone changes, can negatively impact performance. To optimize performance, athletes can schedule training during peak periods, adjust to new time zones gradually, maintain consistent sleep patterns, and use light exposure to reset their internal clocks. By aligning training and competition schedules with their circadian rhythm, athletes can enhance performance, recovery, and overall athletic potential.

IMPACT OF CIRCADIAN RHYTHM ON SPRINTERS

Circadian rhythms, the 24-hour biological cycles governing various physiological processes, significantly influence sprinters' performance. Physical performance peaks in the late afternoon or early evening, aligning with the rise in core body temperature. This peak enhances muscle function, enzyme activity, and cardiovascular efficiency, contributing to better sprint performance during this time (Chtourou & Souissi, 2012).

Research highlights that repeated-sprint performance varies throughout the day, with notable improvements in the evening. These findings suggest that aligning training and competition schedules with the athlete's circadian rhythm can optimize performance.

Moreover, disruptions to circadian rhythms, such as those caused by jet lag or inconsistent sleep patterns, can negatively affect performance, emphasizing the importance of maintaining circadian alignment (Vitale & Weydahl, 2017).

IMPACT OF CIRCADIAN RHYTHM ON LONG DISTANCE RUNNERS

Circadian rhythms significantly impact long-distance runners by influencing sleep, energy levels, and peak performance times. Research shows that performance in endurance activities is typically highest in the late afternoon or early evening, aligning with the body's peak core temperature and muscle efficiency (Teo et al., 2021). Disruptions, such as those caused by jet lag, can impair recovery and performance, emphasizing the need for strategies like gradual time zone adjustment and light exposure control (Vitale et al., 2019). Additionally, individual chronotypes affect performance, with morning-oriented runners often outperforming evening types in early races (Facer-Childs & Brandstaetter, 2015). Tailoring training to align with natural circadian rhythms can enhance outcomes for long-distance athletes.

IMPACT OF CIRCADIAN RHYTHM ON JUMPERS

Circadian rhythms significantly influence jump performance in athletes. Studies have demonstrated that lower body power, as measured by vertical jump performance, is notably better in the evening compared to the morning. This enhancement is attributed to the natural rise in core body temperature throughout the day, which positively affects muscle function and neuromuscular efficiency. Additionally, individual chronotypes play a role; athletes with evening preferences may experience different performance peaks than morning types. Therefore, aligning training and competition times with an athlete's circadian rhythm can optimize jump performance.

IMPACT OF CIRCADIAN RHYTHM ON THROWERS

Circadian rhythms play a significant role in the performance of throwers, with studies showing that strength and explosive power, essential for throwing events, tend to peak in the late afternoon and evening. This pattern is linked to the natural increase in core body temperature, which enhances muscle function and neuromuscular efficiency during these times (Chtourou & Souissi, 2012). Additionally, an athlete's chronotype—whether they are a morning or evening type—affects their performance, with evening-type athletes generally showing better results in power-dependent events like throwing (Facer-Childs & Brandstaetter, 2015). Understanding and aligning training schedules with an athlete's circadian rhythms can optimize performance in throwing events.

CONCLUSION

Circadian rhythms play a pivotal role in regulating athletic performance by influencing various physiological and psychological factors, including body temperature, hormonal fluctuations, and sleep cycles. Across different disciplines—sprinting, long-distance running, jumping, and throwing—athletes demonstrate improved performance during the late afternoon or early evening, corresponding to the natural peak in core body temperature and neuromuscular efficiency.

The findings underscore the importance of aligning training and competition schedules with an athlete's circadian rhythm to optimize outcomes. Disruptions, such as jet lag, irregular sleep patterns, or mismatched schedules, can adversely affect performance, recovery, and overall health. Strategies like gradual time zone adjustments, consistent sleep patterns, and controlled light exposure are essential to mitigate these effects.

Moreover, individual chronotypes further influence peak performance times, highlighting the need for personalized approaches to training. By leveraging the natural rhythms of the body, athletes can maximize their potential, improve recovery, and enhance overall athletic performance across diverse sporting activities.

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EFFECT OF YOGA PRACTICES ON RESPIRATORY CAPACITY IN FEMALE BASKETBALL PLAYERS

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Abstract

The study aimed to examine the impact of yogic practices on respiratory capacity in female basketball players. To achieve this, 20 female basketball players from St. Xavier's College (Autonomous), Palayamkottai, Tirunelveli, Tamil Nadu, India, aged between 17 and 21 years, were randomly selected as participants. The subjects were divided into two groups: Group 'A' (yogic practices) and Group 'B' (control group), with 10 participants in each group. Group 'A' performed yogic practices, including Ujjayi Pranayama, Bhujangasana, and Adho Mukha Svanasana, on alternate days for six weeks, with each session lasting one hour. Group 'B' served as the control group and did not participate in any specific training but continued with their regular activities. Respiratory capacity, measured in liters using a wet spirometer, was the chosen variable for the study. Pre-test and post-test data for the selected variables were collected before and immediately after the training program. The data were analyzed using the dependent t-test and Analysis of Covariance (ANCOVA), with the significance level set at 0.05. The findings revealed that the group engaged in yogic practices showed a significant improvement in respiratory capacity, whereas no notable changes were observed in the control group.

Kew words: Yogic practices, Respiratory capacity, Female basketball players.

1. Introduction

Yoga is described as the union of the individual self with the universal self. The term 'Asana' refers to a state of being where one can remain steady, calm, and comfortable both physically and mentally. Yoga plays a crucial role in toning the body, regulating blood composition, improving circulation, and strengthening glands and visceral muscles. Its ultimate goal is to refine the intellect and cultivate purity of the mind and heart, leading to devotion and focus. Yoga demands a relinquishment of distractions and the control of the mind, which often seeks sensory pleasures. As per Patanjali, the mind must be disciplined and directed toward the artistic essence of yoga to achieve its highest potential. Yoga encourages intellectual sharpness and heightened perception, fostering creativity and improvement without competition. Through regular practice, yoga enables spiritual communion, guiding practitioners to achieve the pinnacle of spiritual awareness (B.K.S. Iyengar, 1993).

Consistent yoga practices contribute to physical fitness, regulate cholesterol levels, aid in weight management, normalize blood pressure, and enhance heart function. According to the National Institutes of Health, reducing stress by calming the mind allows the body to initiate self-healing processes. Thus, yoga and aerobics not only improve physical health but also serve as tools for self-healing (Yokesh, 2011).

Yoga has gained global popularity for its ability to promote longevity, provide therapeutic benefits, and aid rehabilitation (Gopal, K. S). The core components of yoga practice include Asana (physical postures promoting steadiness of body and mind), Pranayama (breathing control), and meditation. These practices lead to physiological changes supported by scientific research (Frostell, C).

Although modern yoga styles suggest specific guidelines for practice, limited studies have explored the optimal duration, frequency, or timing of practice to maximize benefits. The Hatha Yoga Pradipika advocates for daily early morning practice of at least 30 minutes to achieve noticeable effects, a view supported by researchers such as Kishida and Elavsky (2017).

The term Pranayama combines "Prana" (vital energy or life force) and "Ayama" (extension or expansion). It involves four key aspects of breathing: Puraka (inhalation), Rechaka (exhalation), Antara Kumbhaka (internal breath retention), and Bahya Kumbhaka (external breath retention).

In basketball, which uses a larger ball compared to other team sports, there is a significant relationship between ball speed and physical strength.

2. Purpose of the study

The purpose of the study was to find the impact of yogic practices on respiratory capacity in female basketball players.

3. Methodology

For this study, 20 female basketball players from St. Xavier's College (Autonomous), Palayamkottai, Tamil Nadu, India, were randomly selected as participants, with ages ranging from 17 to 21 years. The participants were randomly assigned to two groups: Group 'A' (yogic practices, n=10) and Group 'B' (control group, n=10). Group 'A' engaged in yogic practices on alternate days for six weeks, with each session lasting one hour. In contrast, the control group continued with their regular schedule without any specific training. The respiratory capacity of the participants was measured using a wet spirometer (liter) as the variable. Pre- and post-test data for the selected criterion variables were collected before and immediately after the training program. The scores from the pre- and post-tests were analyzed using the dependent t-test and Analysis of Covariance (ANCOVA). The significance level was set at 0.05, which was deemed appropriate for the study.

4. Analysis of Data

TABLE-1

MEANS AND DEPENDENT 'T' TEST FOR THE PRE AND POST TESTS ON RESPIRATORY CAPACITY OF EXPERIMENTAL AND CONTROL GROUPS

Criterion variables	Test	Experimental Group Mean	Control Group Mean
Respiratory Capacity	Pre test	3.96	3.27
	Post test	4.46	3.84
	't'test	**11.83***	1.93

***Significant at .05 level. (Table value required for significance at .05 level for 't'-test with df 9 is 2.26)

Table 1 presents the pre-test mean values for respiratory capacity in the experimental and control groups, which are 3.96 and 3.27, respectively. The post-test mean values for the same groups are 4.46 and 3.84, respectively. The dependent t-ratio values between the pre- and post-test means for the yogic practices group and control group were 11.83 and 1.93, respectively. The table value required for a significant difference with 9 degrees of freedom at the 0.05 level of significance is 2.26. From the results, the dependent t-test value for the experimental group's respiratory capacity between pre- and post-tests was greater than the table value of 2.26 at the 0.05 significance level, indicating that the experimental group showed a significant improvement in respiratory capacity compared to the control group.

TABLE - 2

COMPUTATION OF MEAN AND ANALYSIS OF COVARIANCE RESPIRATORY CAPACITY OF EXPERIMENTAL AND CONTROL GROUPS

	Experimental Group	Control Group	Source of Variance	Sum of Squares	Df	Mean Square	F
Respiratory Capacity	4.50	3.86	BG	260.88	1	260.88	**84.70***
			WG	52.36	17	3.08	

* Significant at 0.05 level. Table value for df 1, 17 was 4.45

Table 2 displays the adjusted post-test mean values for respiratory capacity in the experimental and control groups, which are 4.50 and 3.86, respectively. The obtained F-ratio of 84.70 for the adjusted post-test mean exceeds the table value of 4.45 with 1 and 17 degrees of freedom at the 0.05 significance level. These findings indicate that there is a significant mean difference between the adjusted post-test means of the yogic practices and control groups regarding respiratory capacity.

Figure 1 illustrates the mean values for the pre-test, post-test, and adjusted post-test on respiratory capacity for both the yogic practices and control groups.
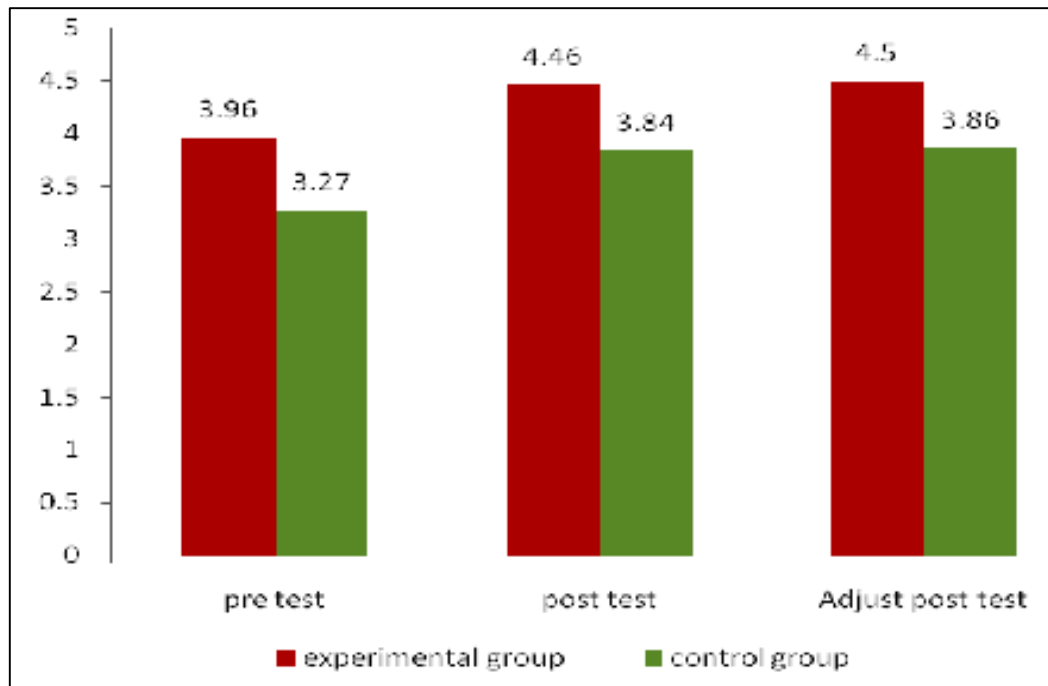
Figure 1: Mean values for pre-test, post-test, and adjusted post-test on respiratory capacity (liters) for experimental and control groups

5. Findings

Recent studies have highlighted the impact of yoga practices on the respiratory capacity of female athletes. Respiratory capacity, which refers to the ability to expel air after deep inhalation, is essential for optimal athletic performance. Yoga not only enhances physical fitness but also promotes mental clarity and relaxation, helping athletes manage stress and maintain focus during intense physical activity. Given that basketball demands sustained energy and efficient recovery, incorporating yoga practices may be an effective strategy to improve physical, physiological, and mental readiness. This study aimed to examine the effects of yoga on respiratory capacity, a key physiological variable, in female basketball players. Previous studies have shown that yoga is an effective method for regulating various physiological variables, such as blood pressure and pulse rate (Kaleeswari, G). Additionally, Khabiri, R. conducted a systematic review and meta-analysis to assess the effectiveness of spiritually based interventions in managing blood pressure among adults.

6. Conclusions

1. Significant improvements in respiratory capacity were observed in female basketball players due to the influence of yoga practices.

2. The control group did not show any significant changes in the selected variables.

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CONSTRUCTION OF SKILL TESTS IN BALL BADMINTON

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Abstract

The objective of this study was to develop a skill test battery and to predict playing ability in Ball Badminton. To achieve this, the investigators initially designed nineteen tests after analyzing various relevant factors. A pilot study was conducted with thirty subjects to finalize the test battery. Based on observations and expert consultations, nine skill test items were selected for the final version. These nine tests were then administered to ninety-six college-level Ball Badminton players from the Trichy region, with ages ranging from 17 to 24 years. To assess objectivity, reliability, and validity, correlation coefficients were calculated. Additionally, stepwise multiple regression analysis was used to predict the players' ability in Ball Badminton.

The findings indicated that the validity of the skill test was confirmed up to a six-item module, which included service, volley against the wall, overhead smash, floating, shut-at-net, and stroke. Including additional tests did not enhance the validity of the test battery. The final multiple regression equation for predicting Ball Badminton playing ability is as follows:

$$BBPA = 6.81 + 1.43x_1 - 0.13x_2 + 0.64x_3 - 0.76x_4 + 0.37x_5 + 0.06x_6$$

This suggests that the six-item skill test battery is significantly correlated with the playing ability of the subjects.

Key Words: Ball Badminton, Playing ability, Prediction and Skill test.

Introduction

While fitness is crucial for many sports, it is skill that ultimately determines an athlete's proficiency in their sport. Fitness tests typically isolate the physical component, removing skill elements. However, some sport-specific tests integrate skill, technique, and fitness to better reflect the demands of the sport. Skill tests are designed to evaluate the fundamental skills required in a specific sport. Given the vast range of skills involved in most sports, selecting the most relevant skills is essential, and this selection is often based on available literature, expert opinions, and appropriate statistical methods. The combination of skill items is referred to as a test battery. These skill tests allow players to assess their own performance in key aspects of the game and motivate improvement.

They also assist coaches and teachers in measuring player performance and evaluating their teaching or coaching methods and programs.

Baumgartner et al. (2003) emphasized the importance of performance measurement and evaluation to determine how effectively objectives have been met, the efficiency of the process, and the quality of the outcome. Skill tests were designed to assess the basic skills used in a sport (AAHPERD, 1968). These tests help individuals evaluate their performance in fundamental skills and encourage improvement, while also providing coaches with tools to assess players' abilities and evaluate their coaching methods (Johnson & Nelson, 1988).

Ball Badminton, a game originating from South India, lacks a precise historical record of its introduction. However, evidence suggests that the rulers of Thanjavur played the game before 1856. Ball Badminton is a team sport, typically played in two formats: FIVES and DOUBLES. It is fast-paced and demands skill, quick reflexes, good judgment, agility, and wrist control. The game is generally played outdoors during the day, where weather conditions significantly impact play. Ball Badminton rules are designed to balance the effects of weather on both teams. Recently, indoor versions of the game have been played under artificial lighting, with all-India tournaments regularly conducted in Tamil Nadu, Pondicherry, Andhra Pradesh, and Karnataka using floodlights.

The objective of this study was to design and develop skill tests to assess the overall playing ability of Ball Badminton players.

MATERIALS AND METHODS

The objective of this study was to develop a skill test battery for Ball Badminton. To achieve this, the researchers initially designed nineteen tests after analyzing various factors. As a first step, a pilot study was conducted with thirty participants to observe and revise the tests before the actual administration. Proper instructions and demonstrations of the test items were provided to ensure clarity and prevent any ambiguity. Following the pilot study, nine test items were finalized through careful observation and expert consultation. These nine skill test items were then administered to ninety-six college-level Ball Badminton players from the Trichy region, aged 18 to 23 years. A well-constructed skill test should have high objectivity, reliability, and validity. To assess these aspects, correlation coefficients were calculated. Additionally, stepwise multiple regression was applied to predict the players' playing ability in Ball Badminton.

OBJECTIVITY RELIABILITY AND VALIDITY OF THE SKILL TEST ITEMS

Barrow and McGee (1979) defined objectivity as the extent to which a test's scores reflect its true value, which is built into the test itself. Clear instructions, accurate scoring procedures, and consistent application of these methods enhance objectivity. These factors were carefully considered when designing and conducting the test. The reliability of the tests was determined through a test-retest method with ten subjects, and the consistency of results was analyzed using Intra-class correlation. According to Baumgartner et al. (2003), a test can be reliable and objective but not necessarily valid.

However, a test cannot be valid unless it is both reliable and objective. To assess validity, players were ranked based on their playing ability, which served as the criterion for validating the test items. A panel of experts provided subjective ratings on a scale of 1 to 10, with 10 being the highest, based on skill test performance and personal observations. Guidelines for grading were given by the investigators. The test scores were then correlated with the rankings to determine the validity. The objectivity, reliability, and validity coefficients for the test items are presented in Table-I.

All skill tests were conducted on the Ball Badminton court at the competition site, without the use of any motivational techniques.

TABLE – I

CORRELATION COEFFICIENTS FOR ALL THE SKILL TEST ITEMS

S. No.	Test items	Objectivity	Reliability	Validity
1	Service	0.83*	0.85*	0.75*
2	Volley against the wall	0.85*	0.92*	0.82*
3	Over- head smash	0.91*	0.89*	0.79*
4	Floating	0.90*	0.85*	0.91*
5	Shut-at-net	0.81*	0.88*	0.83*
6	Stroke	0.89*	0.91*	0.75*

* Significant at the 0.01 level.

Barrow and McGee (1979) established that an objectivity and reliability coefficient of 0.80, and a validity coefficient of 0.70, are considered acceptable. Therefore, only the five test items mentioned met these arbitrary standards for assessing physical performance tests.
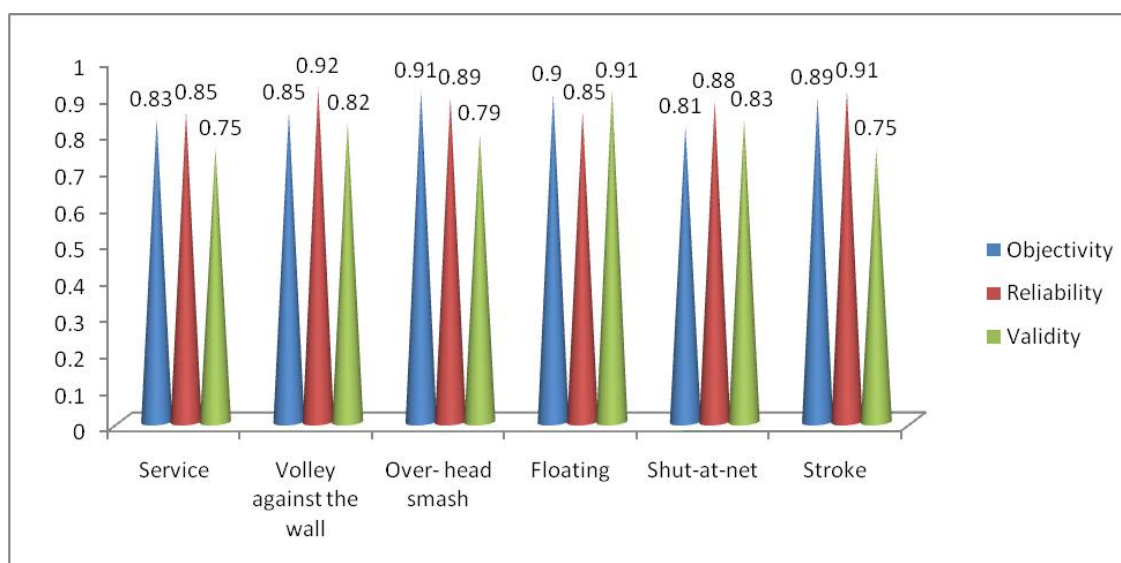
Figure-I showing the objectivity, reliability and validity of skill test items

Table - II

**TEST MODULE ARRIVED ON STEP WISE REGRESSION
FOR PREDICTION**

Variables	b	SE b	β	R Value	't' Value
Constant	6.81	0.91			
Service	1.43	0.14	1.92	0.76	8.04*
Volley against the wall	0.13	0.02	0.52	0.84	6.51*
Over- head smash	0.64	0.14	0.38	0.90	4.50*
Floating	0.76	0.13	0.45	0.91	5.58*
Shut-at-net	0.37	0.15	0.44	0.92	4.03*
Stroke	0.06	0.01	0.20	0.91	6.78*

* Significant at 0.05 level

The test items were arranged in this order: service, volley against the wall, overhead smash, floating, shut-at-net, and stroke. It is clear that the "R" value rises steadily. The validity of the skill test battery was confirmed with the six-item set, and adding more tests did not further enhance its validity.

RESULTS

In this analysis, the criterion (playing ability of ninety-six subjects) was treated as the dependent variable, while the skill test scores served as the independent variables. The results revealed that out of nine independent variables, six—service, volley against the wall, overhead smash, floating, shut-at-net, and stroke—demonstrated a significant impact on playing ability. The obtained 't' values for these skill test items were considerably higher than the required table value of 4.00. While it may not be conclusive to say that the remaining skill tests do not affect playing ability, statistically, it can be stated that they do not show a significant influence in this specific context. Therefore, the multiple regression equation for predicting Ball Badminton playing ability is:

$$FHPA = 6.81 + 1.43x_1 - 0.13x_2 + 0.64x_3 - 0.76x_4 + 0.37x_5 + 0.06x_6$$

This equation suggests that the six selected skill test items, as a group, are significantly correlated with the subjects' playing ability.

CONCLUSIONS

The researchers aimed to develop a comprehensive module with a limited number of test items and a high level of reliability. To achieve this, they utilized a stepwise multiple regression technique. The analysis revealed that six test items—service, volley

against the wall, overhead smash, floating, shut-at-net, and stroke—were included in the final test battery. These tests demonstrated high reliability and full validity, making the final test battery both dependable and accurate.

The final test battery is expected to make a significant contribution to the promotion of the game. When used by coaches, it can provide valuable and reliable data for monitoring and improving players' abilities and for identifying potential talent. The strong validity and reliability of the six tests in the final module further confirm that their administration was effective, ensuring the feasibility of implementing these tests.

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REDEFINING HUMAN SENSE THROUGH TECHNOLOGY

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ABSTRACT

The human sensory system is an intricate network through which we perceive, interpret, and interact with the world around us. For centuries, the five traditional senses sight, hearing, touch, taste, and smell have been viewed as fixed and biologically determined. However, modern advancements in technology have revolutionized our understanding of human senses, introducing tools and methods to enhance, mimic, or even surpass natural sensory capabilities. Beyond these traditional senses, emerging technologies are beginning to tap into cognitive or "sixth-sense" capabilities, bridging intuition with machine intelligence. This article explores how cutting-edge technologies are redefining human senses and the implications of these developments for society.

Keywords : Sensory Technology, Human Senses, Sensory Augmentation.

Senses:

In our human being having six important senses, there are touch, taste, smell, vision, hearing senses and rational thinking sense. The first five senses are receiving a data from environment and the sixth sense was interpreting the data.

In Tholkappiyam, an ancient Tamil literary work on grammar and poetics, references to the senses are often interwoven with the philosophical and cultural understanding of human perception. While Tholkappiyam does not explicitly categorize senses in the modern scientific manner, its perspectives align with traditional Tamil philosophy, which often recognizes the following five senses (ஐம்புலன்): Sight, Hearing, Smell, Taste, Touch.

Enhancing Vision Through Technology

Vision has always been a primary focus of technological innovation due to its critical role in human interaction. Advances in augmented reality (AR) and virtual reality (VR) are creating immersive experiences that expand the boundaries of visual perception. AR overlays digital elements onto the real world, enabling applications in education, healthcare, and entertainment. For instance, AR glasses are transforming classroom learning, allowing students to visualize complex concepts such as anatomy or astrophysics in 3D.

In the medical field, bionic eyes like the Argus II are restoring sight to individuals with retinal degeneration, empowering them to regain independence. Additionally, smart contact lenses are redefining vision by integrating health-monitoring capabilities, such as tracking blood glucose levels or detecting dehydration, directly into a user's visual experience.

Beyond enhancing natural vision, AI-powered computer vision systems are aiding athletes, surgeons, and engineers by offering real-time data analysis and predictive feedback, making tasks more precise and efficient. Such advancements exemplify how technology is not merely aiding vision but extending its capabilities beyond biological limitations.

Revolutionizing Hearing

Hearing technologies have seen groundbreaking advancements, particularly in the fields of accessibility and communication. Modern hearing aids equipped with artificial intelligence filter background noise and adapt to various environments, allowing users to experience sound with clarity. Innovations like bone-conduction headphones bypass the traditional auditory pathways, transmitting sound directly to the inner ear through vibrations in the skull, making sound accessible to those with certain types of hearing loss.

In addition to restoring and enhancing hearing, sound technologies are transforming industries such as gaming and education. For instance, spatial audio systems in VR environments provide directional sound, enabling users to locate objects or participants in virtual spaces with heightened accuracy. Similarly, AI-driven voice assistants like Siri and Alexa are redefining how we interact with devices, making auditory interaction more intuitive.

The field of sound therapy is also gaining traction, using specific sound frequencies to alleviate stress, improve focus, and manage conditions like tinnitus. These innovations not only enhance hearing but also demonstrate the profound psychological and emotional impact of sound on human well-being.

Transforming Touch: The Role of Haptic Technology

The sense of touch is fundamental to human experience, and recent innovations in haptic feedback technology are bridging the gap between physical and virtual interaction. VR gloves, gaming controllers, and wearable devices now simulate the sensation of touch, enabling users to "feel" textures, temperatures, and forces in virtual environments.

In healthcare, e-skin technologies are being developed to replicate the sense of touch for prosthetic users. These electronic skins are embedded with sensors capable of detecting pressure, temperature, and even pain, restoring a tactile connection to the physical world for individuals who have lost limbs.

Haptic technologies are also making strides in rehabilitation and physical therapy. Devices equipped with tactile feedback assist patients recovering from injuries by helping them relearn movements and build strength. Moreover, wearable haptic devices are being used in sports training, providing real-time feedback to athletes on posture, balance, and technique.

Reimagining Taste

The sense of taste is gaining renewed attention in technological innovation, particularly through devices like electronic tongues. These advanced tools are designed to detect flavors, analyze food quality, and identify contaminants with remarkable precision. They find applications in the food and beverage industry, helping ensure product safety and consistency, and in healthcare, where taste-related diagnostics are emerging as a novel area of research.

Another fascinating development is digital taste simulation, which uses electrical and thermal stimulation to mimic flavors. These simulators aim to revolutionize culinary training, personalized nutrition, and even digital experiences where taste becomes part of virtual environments. Such advancements offer exciting possibilities, from creating immersive multisensory entertainment to addressing dietary preferences and restrictions through tailored flavor experiences.

Reimagining Smell

The sense of smell, though often overlooked, is also being transformed by technology. Electronic noses (e-noses) are devices capable of detecting volatile organic compounds, making them valuable in industries such as healthcare, perfumery, and environmental monitoring. In healthcare, for example, e-noses are being developed to detect diseases like diabetes and certain cancers by analyzing patients' breath.

Efforts are also underway to integrate olfactory experiences into virtual and augmented reality environments. Experimental virtual smell devices aim to recreate scents that align with visual and auditory stimuli, enhancing immersion in digital spaces. This innovation has potential applications in entertainment, training simulations, and even therapeutic interventions, such as stress relief or memory therapy.

The Sixth Sense: Intuition and Cognitive Technologies

The concept of a "sixth sense" has long intrigued humanity, and emerging technologies are beginning to bridge the gap between intuition and computation. Brain-machine interfaces (BMIs), such as Neuralink, enable direct communication between the brain and external devices, opening possibilities for controlling machines through thought alone. These technologies are particularly transformative for individuals with physical disabilities, providing new avenues for communication and mobility.

Emotion AI and predictive analytics represent another dimension of cognitive technology. By analyzing facial expressions, voice tone, and physiological signals, emotion AI can interpret and respond to human emotions in real time. Predictive analytics, powered by machine learning, mimic human intuition by identifying patterns

and anticipating outcomes, offering applications in areas such as healthcare, finance, and sports.

Such technologies are not merely augmenting human cognition; they are redefining the relationship between humans and machines, creating a synergistic partnership that expands the boundaries of human capability.

Ethical and Societal Implications

While the potential benefits of sensory technologies are immense, they come with significant ethical and societal challenges. Privacy concerns arise as devices collect and process vast amounts of personal data. Additionally, the risk of sensory manipulation through augmented or virtual environments raises questions about authenticity and reality.

Another critical consideration is accessibility. Ensuring that these technologies are affordable and inclusive is essential to prevent widening the gap between those who can access these enhancements and those who cannot.

Finally, as sensory technologies blur the line between natural and augmented perception, society must grapple with questions of identity, autonomy, and the definition of humanity itself.

Conclusion

The redefinition of human senses through technology is ushering in a new era of human evolution. From restoring lost sensory functions to creating entirely new sensory experiences, these advancements are transforming how we perceive, interact with, and understand the world. As we continue to push the boundaries of sensory augmentation, it is crucial to address the ethical and societal implications to ensure that these technologies enhance human potential while preserving the values that define our shared humanity.

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RELATIONSHIP OF RESTING HEARTRATE WITH PLAYING ABILITY AMONG INTER-COLLEGIATE VOLLEYBALL PLAYERS

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Abstract

The purpose of the study was to investigate the connection between resting heart rate and the performance levels of intercollegiate volleyball players.

Methodology: To achieve this, a total of 40 male volleyball players who participated in intercollegiate tournaments were selected as participants. Resting heart rate was identified as the criterion variable, while volleyball performance was assessed through subjective ratings provided by three evaluators. The average of these ratings was used as the criterion score. The data was analyzed using the Pearson product-moment correlation (zero-order) method. The findings indicated a significant correlation between resting heart rate and volleyball performance.

Keywords: Resting pulse rate and volleyball performance

1. Introduction

Volleyball is an intense and dynamic sport that demands a combination of physical fitness, technical expertise, and strategic awareness. Among the various physiological factors impacting athletic performance, resting heart rate (RHR) has been recognized as a significant indicator of cardiovascular health and overall physical condition. Resting heart rate refers to the number of heartbeats per minute while the body is at rest and is commonly used to measure an individual's baseline fitness level. A lower RHR is generally linked to improved cardiovascular efficiency and enhanced physical performance.

In volleyball, where players repeatedly perform explosive movements like jumping, spiking, and diving, optimal cardiovascular fitness is crucial to maintaining peak performance throughout a match. Studies suggest that athletes with lower resting heart rates recover more quickly from high-intensity efforts, exhibit greater endurance, and sustain consistent performance over prolonged periods. Resting heart rate serves as an essential indicator of an athlete's physiological readiness and is closely tied to performance outcomes in high-energy sports such as volleyball. This highlights the importance of monitoring RHR as a predictor of skill execution and endurance during gameplay.

Assessing players' physiological characteristics provides insights into position-specific demands. Enhanced physiological efficiency across various organ systems supports athletes in performing with greater energy and enthusiasm. Regular training

significantly improves this efficiency, with the heart being the most adaptable muscle. During physical activity, the heart pumps oxygen-rich blood and nutrients to active muscles while removing metabolic waste products. Increased blood flow enhances oxygen availability, enabling muscles to work more effectively. As a result of consistent aerobic training, the heart becomes more efficient, pumping a greater volume of blood per stroke. This improved physiological efficiency is essential for volleyball performance **(Jeyaraj & Gopinathan, 2014).**

Skills play a fundamental role in sports performance, as they involve the ability to execute movements with precision and consistency to achieve desired outcomes. Acquiring skills requires significant time and effort due to the high level of coordination and control involved. Volleyball encompasses a wide range of rapid actions and reactions, such as arm passing, forearm passing, blocking, smashing, and defending, all of which are crucial in gameplay situations.

This study investigates the relationship between resting heart rate and the playing abilities of intercollegiate volleyball players. By examining RHR alongside skill proficiency and game performance metrics, the research seeks to establish whether RHR can reliably predict playing ability. The findings could offer valuable insights for player selection, designing training programs, and optimizing performance in competitive volleyball.

2. Methodology

2.1. Selection of subject

For the study, a total of 40 male volleyball players who participated in intercollegiate tournaments were selected as participants. The players were drawn from colleges located in the Thoothukudi and Tirunelveli districts.

2.2. Administration of Test

Resting heart rate was the sole physiological variable chosen as the criterion for this study. Volleyball performance was evaluated based on subjective ratings given by three assessors, with the average of these ratings used as the criterion measure.

2.3. Statistical analysis

The data were analyzed using the Pearson product-moment correlation (zero-order), which identified a significant relationship between resting heart rate and volleyball performance. A 0.05 level of significance was established, and statistical analysis was conducted using an appropriate confidence level package.

3. Result & Discussion

To determine the relationship between resting heart rate and volleyball playing ability among intercollegiate male volleyball players, the Pearson product-moment correlation (r) was calculated. The data related to this analysis are presented in Table 1.

Table I

Coefficients of Heartrate variables with volleyball playing ability

S. No	Variables	Co-efficient of Correlation (r)
1.	Resting heart rate	**0.353**

*Significant at 0.05 level

The table illustrates the relationship between resting heart rate and volleyball playing ability among intercollegiate male volleyball players. The analysis indicates a positive correlation between resting heart rate and volleyball playing ability, with a correlation coefficient of (r=0.353).

4. Conclusion

Based on the results of the current study, the following conclusion was reached:

1. A significant relationship was observed between resting heart rate and playing ability among intercollegiate male volleyball players.

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A STUDY ON INNOVATIVE BANKING SOLUTIONS FOR MEDIUM-SCALE ENTREPRENEURS IN A DIGITAL AGE

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Abstract

The rise of digital transformation has reshaped the banking industry, presenting new opportunities for medium-scale enterprises (MSEs) to access financial services in innovative and efficient ways. This article is based on secondary data, explores how innovative banking solutions, including digital banking platforms fintech collaborations and advanced financial tools, empower medium-scale enterprises to streamline operations to improve cash flow management, and foster growth. By analyzing emerging trends such as mobile banking, online credit facilities, blockchain, artificial intelligence, and customized digital banking products. This article evaluates their role in addressing the financial challenges that MSEs face. Furthermore, this article highlights how banks can bridge the digital gap to offer tailored solutions that align with the needs of medium-scale enterprises in a rapidly changing economy.

Keywords: Digital banking, Innovative banking, Medium-scale enterprises

1. INTRODUCTION

The advent of digital transformation has revolutionized the banking and financial services, industry, reshaping the way of business that interact with banks and manage their finances. Medium-scale enterprises (MSEs) often considered the backbone of many economies, stand to benefit significantly from these advancements. Positioned between small-scale business and large corporations, MSEs contribute to job creation, innovations, and regional economic growth. However, their potential is often hindered by limited access to credit, inefficiencies in cash flow management, and a lack of tailored financial products. In this context, the introduction of innovative banking solutions is a critical enabler for empowering MSEs and addressing these challenges.

Traditional banking system, while reliable, often fail to meet the dynamic and unique needs of MSEs. These enterprises require fast, flexible, and cost-effective financial solutions to sustain and scale their operations. The digital age has point out the way of technological innovations such as online banking platforms, mobile applications, blockchain technology, and artificial intelligence. These tools have the potential to bridge

the gap between banks and MSEs, offering unprecedented convenience, transparency, and accessibility. By adopting these solutions, MSEs can streamline their financial operations, reduce costs, and make more informed decisions, ultimately driving their growth in a competitive market.

This article delves into the transformative impact of these digital banking solutions, highlighting their role in addressing the key financial challenges faced by medium-scale enterprises. It also explores the emerging trends in fintech collaborations, mobile banking and AI-powered tools offering insights into their practical applications.

2. STATEMENT OF THE PROBLEM

Medium-Scale enterprises play a crucial role in driving economic growth, creating jobs, and fostering innovation. Despite their importance, they face significant challenges in accessing financial resources and efficient banking solutions that are essential for their operations and growth. Traditional banking systems often fall to meet the requirements of MSEs due to lengthy loan approval processes, lack of tailored financial products, high transaction costs, and inadequate support for cash flow management. Furthermore, as the global economy increasingly shifts towards digitalization, many MSEs struggle to adopt innovative banking technologies due to limited digital literacy, cybersecurity concerns, and inadequate infrastructure in certain regions. The lack of integration between banks and fintech solutions further exacerbates the financial challenges faced by MSEs, preventing them from leveraging the benefits of digital tools such as mobile banking, blockchain, and AI-driven analytics. This gap between the evolving needs of MSEs and the services provided by traditional banking systems highlights the need for innovative banking solutions. Addressing this problem is critical to ensuring that MSEs can thrive in the digital age, improve their financial stability, and contribute effectively to economic development. This article seeks to explore and analyse these challenges while proposing viable solutions to bridge the gap and empower MSEs through digital innovation in banking.

3. OBJECTIVES OF THE STUDY

1) To analyse the financial challenges faced by medium-scale enterprises

2) To identify and evaluate innovative banking solutions tailored to MSEs.

3) To study the impact of digital banking tools on the growth of medium-scale enterprises.

4) To recommend strategies for improve collaborations between banks and MSEs.

4. METHODOLOGY

This study employs a qualitative approach, relying on secondary data analysis to explore the role of innovative banking solutions in addressing the financial challenges faced by medium-scale enterprises (MSEs) in digital age.

4.1. Research design

The study uses a descriptive research design to understand and analyse how digital banking solutions impact MSEs. The focus is on identifying existing trends, challenges and opportunities through data collected from secondary sources.

4.2. Data Collection

The data for this research is derived entirely from secondary sources, which include journals, reports, case studies, articles, etc.

5. REVIEW OF LITERATURE

Barbara Bradac Hojnik (2023)[1] the article explores the implementation of digital technology in small and medium-sized Slovenian enterprises (SMEs), with a focus on understanding existing trends, obstacles, and necessary support measures during their digitalization process. The surveyed companies mainly rely on conventional technologies like websites and teamwork platforms, emphasizing the significance of strong online communication and presence in the modern business world. The results indicate that small companies face different financial constraints and require more differentiated support mechanisms than their larger counterparts, with a particular focus on improving digital competencies among employees. This study provides important insights for policy makers, industry stakeholders, and SMEs to formulate comprehensive strategies and policies that effectively address the diverse needs and challenges of the digital transformation landscape.

B.K. Meher et al. (2020)[2] this study has found that the MSMEs are getting more convenience in accepting and making payments through digital banking as their coefficients are significant within the formulated models. The other favourable factors like managing business expenditure, time saving, check on misappropriation of cash are not much significant. The bankers within the area of study, are unable to serve these MSMEs properly due to which they are incapable to reap the full benefits of digital banking. It also been found that the adaptability level has just started increasing, the MSMEs might not be well conversant with the digital banking due to which they are incompetent to avail all kinds of benefits of digital banking.

Anthony Rahu Golden S. (2017)[3] the article entitled "An Overview of Digitalization in Indian Banking Sector". In this article an attempt has been made to study the overview of digitalization in Indian Banking sector. Banks are not just a part of our lives but have a significant role in our daily lives. Thus, banks always try to adopt latest technologies to enhance customer experience. The study found that, due to the adoption of this digitalization, the banking sectors in India face some remarkable changes as well as hurdles. The study also found that, as we are in the digital era, it is not possible to avoid the growth and services or digital banking.

6. THE ROLE OF MEDIUM-SCALE ENTERPRISES IN ECONOMIC DEVELOPMENT

Medium-scale enterprises serve as a critical bridge between small businesses and large corporations. Their unique characteristics allow them to contribute significance to the growth, stability, and sustainability of an economy. Here gives an in-depth explanation of their role in economic development.

6.1. Employment Generation

MSEs are significant contribute to job creation, particularly in developing economies. They bridge the gap between the labour-intensive small-scale sector and the capital-intensive large-scale sector, offering diverse employment opportunities. By employing semi-skilled labour, MSEs help in reducing unemployment, especially in semi-urban and rural areas.

6.2. Promoting Innovation

MSEs are often innovation center, driving the development of new products, services, and business models. Their ability to adapt quickly to market changes them to experiment with innovative ideas, which can lead to technological advancements and improved production techniques. By fostering creativity, MSEs contribute to the competitiveness of the broader economy.

6.3. Enhancing Regional Development

MSEs are key players in decentralizing industrial activity. They help in promoting balanced regional development by establishing operations in less-developed or rural areas, reducing the urban-rural economic divisions. This decentralization not only generate local employment but also stimulates local economies by creatin demand for ancillary industries and services.

6.4. Contribution to GDP

Medium-scale enterprises play a pivotal role in contributing to the Gross Domestic Product (GDP) of a country. Their production, trade, and service activities form a substantial portion of the national output. By acting as suppliers and intermediaries for large-scale industries, MSEs strengthen industrial ecosystems.

6.5. Export Promotion and Foreign Exchange Earnings

Many MSEs produce goods and services that are exported, contributing to a nation's foreign exchange reserves. They often focus on niche markets, offering specialized products that cater to global demand. Government-supported initiatives like export credit and market access programs further enable MSEs to enter international markets.

6.6. Supply Chain Integration

MSEs are integral to the supply chain of large industries, providing raw materials, components, and serves. Their agility and cost-effectiveness make them reliable partners in various sectors, including manufacturing, agriculture, and technology. This integration helps in optimizing the overall value chain of industries, leading to economic efficiency.

6.7. Social Empowerment and Inclusivity

MSEs empower marginalized sections of society by offering entrepreneurship opportunities and employment to women, youth, and under represented groups. Many MSEs are family-owned or community-driven, promoting social cohesion and stability.

6.8. Resilience in Economic Downturns

Medium-scale enterprises often demonstrate resilience during economic downturns. Their flexibility and lower operating costs allow them to adjust quickly to changing market conditions, stabilizing local economies during crises.

7. CHALLENGES FACED BY MEDIUM-SCALE ENTERPRISES IN TRADITIONAL BANKING

Medium-scale enterprises play a pivotal role in economic development by creating jobs and contributing to GDP. However, they often face significant challenges when dealing with traditional banking systems. These challenges limit their ability to access finance, manage cash flow, and scale their operations effectively. Here gives the detailed examination of these barriers.

7.1. Limited Access to Credit

Access to sufficient and timely credit remains one of the biggest hurdles for MSEs. Traditional banks often require substantial collateral for loans, which many MSEs cannot provide. MSEs frequently lack a formal credit history or financial statements, making it difficult for banks to assess their creditworthiness. Traditional loan applications involve extensive paperwork and lengthy processing times, which can be detrimental for businesses needing urgent financing.

7.2. High Transaction Costs

Banks impose various charges for services like loans, transactions, and account maintenance, which can be burdensome for MSEs operating on tight margins. MSEs may face higher interest rates compared to large corporations due to perceived risks, increasing their cost of capital.

7.3. Inadequate Tailored Products

Traditional banks often provide standardized products that may not meet the specific needs of MSEs. Fixed repayment schedules and inflexible terms can strain cash

flows. MSEs in specialized industries, such as technology or agriculture, may require unique financial products that traditional banks do not offer.

7.4. Limited Use of Technology

Many banks still rely on manual processes for loan approvals and customer service, resulting in inefficiency. Unlike digital banking solutions, traditional banks may not provide online platforms with robust tools for managing finances, making it harder for MSEs to track transactions and optimize cash flow.

7.5. Stringent Regulatory and Compliance Requirements

MSEs are required to comply with regulatory paperwork and formalities, which can be time-consuming and challenging without specialized knowledge. Frequent changes in banking regulations can increase compliance costs for MSEs, diverting resources from core business activities.

7.6. Limited Financial Literacy

Many MSEs lack the financial literacy required to understand and utilize traditional banking products effectively. Tey may find it difficult to navigate complex loan terms, interest calculations, and repayment conditions leading to poor financial decisions.

7.7. Inconsistent Relationship Management

Traditional banking focuses more on transactional relationships rather than advisory roles. MSEs often miss out on personalized financial advice and strategic guidance that could enhance their financial health and growth potential.

7.8. Geographical and Accessibility Barriers

Many traditional banks are located in urban areas, making it difficult for MSEs in rural or remote regions to access banking services. Limited branch presence and restrictive banking hours further exacerbate the issue.

8. SUCCESSFUL ADOPTION OF INNOVATIVE BANKING SOLUTIONS FOR MEDIUM-SCALE ENTERPRISES

The rise of digital transformation has led to the development of innovative banking solutions tailored to meet the dynamic needs of medium-scale (MSEs). These solutions leverage technology to provide faster, more efficient, and customized financial services that overcome the limitations of traditional banking. Here gives the detailed exploration of key innovations transforming the banking landscape for MSEs.

8.1. Digital and Online Banking Platforms

Digital and online banking platforms represent a transformative shift in how businesses interact with financial institutions. These platforms leverage internet technology to deliver banking services through secure digital channels, eliminating the need for traditional branch visits. For medium-scale enterprises (MSEs), they offer a range of features that enhance financial management, streamline operations, and improve access to credit. Important features and services are

8.1.1. Account Management

Businesses can open and manage accounts online without physical paperwork. Real-time monitoring of account balances and transaction history enables better cash flow management.

8.1.2. Fund Transfers and Payments

Digital platforms facilitate instant domestic and international fund transfers. Automated recurring payments help to manage payroll, vendor payments, and utility bills efficiently.

8.1.3. Loan Applications and Credit Services

Online loan portals allow MSEs to apply for loans with minimal documentation. Pre-approved loan offers and provided based on transaction history.

8.1.4. Customizable Financial Tools

Budgeting and forecasting tools help enterprises plan financial strategies. Automated reconciliation tools match payments to invoices, reducing accounting errors.

8.1.5. Integration with Business Software

Digital banking platforms can integrate with enterprise resource planning (ERP) and accounting software, streamlining operations and financial reporting.

8.2. Mobile Banking and Payment Solutions

Mobile banking and payment solutions have become essential tools for medium-scale enterprises in managing their financial activities efficiently. By leveraging mobile technology, these solutions provide businesses with convenient, real-time access to banking services and facilitate seamless payment processing, eliminating the limitations of traditional banking systems. Important features and services of mobile banking for MSES are:

8.2.1. Account Access and Management

Businesses can check account balances, view transaction histories, and monitor cashflow using mobile banking apps. Notifications and alerts for low balances, incoming payments, and loan due dates enhance financial control.

8.2.2. Fund Transfers and Payments

Instant domestic and international transfers are possible through mobile platforms. Mobile apps support bulk payments for payroll and vendor settlements, reducing processing times.

8.2.3. Loan Services and Credit Management

MSEs can apply for loans directly form mobile banking applications, with faster approvals based on automated credit assessments. Credit line management and dynamic loan repayment options are available for more flexible financing.

8.2.4. Digital Wallets and QR Code Payments

Integration with digital wallets enables cashless transactions for both business-to-business (B2B) and business-to-customer (B2C) payments. QR code technology allows businesses to accept payments from customers using their smartphones.

8.2.5. Expenses Tracking and Budgeting Tools

Many mobile banking apps offer tools for categorizing expenses and creating budgets, helping MSEs plan and optimize their financial resources.

Payment Solutions for MSEs

8.2.6. Point of Sale (POS Systems

Mobile POS solutions allow MSEs to accept card payments without bulky hardware. Wireless and app-based POS devices provide flexibility for retail and service industries.

8.2.7. Payment Gateways and Integrations

Mobile platforms integrate with online stores, enabling smooth e-commerce transactions. Automated invoice generation and payment tracking reduce administrative workload.

8.2.8. Peer-to-Peer Gateways and Contactless Payments

Peer-to-Peer payment services streamline small business transactions, while contactless payment options improve transaction speed and customer experience.

8.3. Alternative Financing Platforms

Alternative financing platforms offer innovative financial solutions that bypass traditional banking systems, providing medium-scale enterprises with faster, more accessible funding options. These platforms use technology to connect borrowers directly with lenders or investors, enabling more flexible, diverse, and tailored financing. As MSEs often face significant barriers to obtaining credit from traditional banks, alternative platforms help bridge the financing gap, fostering growth and economic development. Online market places and fintech platforms connecting businesses with alternative lenders for loans, factoring, and invoice financing. Peer-to-peer lending and crowdfunding open up new financing options for MSEs. India has seen significant growth in alternative financing platforms tailored to meet the needs of MSEs. The key types of alternative financing platforms available in India are Peer-to-Peer Lending, Crowdfunding Platforms, Invoice Discounting and Factoring Platforms, Asset-Based Lending Platforms, Revenue-Based Financing, Supply Chain Financing Platforms etc.

8.4. AI and Machine Learning for Credit Assessment

Use of artificial intelligence to analyse big data for credit scoring and risk assessment. Offers and faster credit approvals by analysing non-traditional data such as transaction history and market behaviour. Reduces the dependency on traditional credit histories and collateral. For example, AI driven underwriting tools used by fintech companies and banks provide dynamic credit lines for MSEs.

8.5. Blockchain and Smart Contracts

Blockchain and smart contracts are transforming financial services and business operations by enhancing security, transparency, and efficiency. For medium-scale enterprises, these technologies offer innovative ways to manage transactions, reduce costs, and increase trust in business relationships, particularly in areas like finance, supply chain management, and contract enforcement.

Blockchain is a decentralized distributed ledger that records transactions across multiple computers. Each transaction is verified by consensus and stored in a block, forming a chain of immutable records. Blockchain provides tamper-proof transactions records, reducing fraud and errors in financial dealings.

Smart contracts are self-executing contracts with terms written directly into code on blockchain. They automatically execute actions when predefined conditions are met. Payments can be released automatically upon the completion of contract milestones or receipt of goods. For example, A logistics company receiving payment when delivery is confirmed through GPS tracking.

8.6. Cyber Security and Fraud Detection Tools

Advanced tools using AI and encryption to detect fraud and secure financial data. This protects sensitive business and customer data and reduce financial losses from fraud attempts.

9. THE IMPACT OF DIGITAL BANKING ON MSEs

Digital banking has profoundly transformed how medium-scale enterprises (MSEs) mange financial operations, offering significant improvements in efficiency, accessibility, and cost savings. The adoption of digital banking technologies helps MSEs overcome many challenges associated with traditional banking, enabling them to thrive in a competitive market.

9.1. Improved Access to Financial Services

Digital banking platforms provide round-the-clock access to banking services, removing the constraints of business hours and physical branch visits.

- Impact
  - ❖ Faster fund transfers and account management from any location
  - ❖ Enhanced access to credit through digital loan applications with streamlined approvals.
- Example: A manufacturing enterprise can apply for working capital loans online, reducing downtime due to funding delays.

9.2. Enhanced Cash Flow Management

Cash flow management is critical for the survival and growth of medium-scale enterprises (MSEs). Digital banking has significantly improved how MSEs handle their cash flow by providing tools and features that increase visibility, speed, and control over financial transactions.

- Impact:
  - ❖ Improved liquidity management with automated reminders for payments and collections.
  - ❖ Efficient reconciliation of accounts using integrated banking tools.
- Example: A retail business can track daily sales inflows and set automated payment instructions for suppliers.

9.3. Cost Savings and Operational Efficiency

Digital banking significantly enhances the cost-effectiveness and operational efficiency of medium-scale enterprises. By automating financial processes, minimizing manual intervention, and reducing transaction costs, it empowers businesses to optimize their resources and focus more on core activities.

- Impact:
  - ❖ Reduced dependency on paper-based processes and manual bookkeeping.
  - ❖ Lower fees for digital transactions compared to cash or check handling.

- Example: A service company uses automated payroll processing through digital banking, saving time and labour.

9.4. Fast and Secure Transactions

One of the most transformative impacts of digital banking on medium-scale enterprises is the enhancement of transaction speed and security. Digital banking technologies provide MSEs with tools for rapid, seamless, and secure financial transactions, improving cash flow management, reducing risks, and enhancing customer and supplier relationships.

- Impact:
  - ❖ Enhanced customer satisfaction due to faster service delivery.
  - ❖ Reduced risks of payment delays and financial fraud through secure digital channels.
- Example: A logistics firm uses instant payment options to settle fuel and maintenance expenses.

9.5. Expanded Market Reach with Digital Payments

The integration of digital payment solutions broadens the customer base by accommodating various payment methods.

- Impact:
  - ❖ Increased sales from customers preferring digital payment options like UPI, wallets, and mobile banking.
- Example: An online seller boosts revenue by accepting QR code payments, debit cards, and mobile wallets.

9.6. Enhanced Financial Data and Insights

Digital banking provides access to detailed transaction histories and analytical tools.

- Impact:
  - ❖ Data driven financial planning and risk assessment become easier.
  - ❖ Improved creditworthiness by maintaining clear financial records.
- Example: A construction firm uses digital reports to prepare better financial forecasts and secure larger loans.

10. STRATEGIES TO IMPROVE COLLABORATIONS BETWEEN BANKS AND MEDIUM-SCALE ENTERPRISES

Improving collaboration between banks and medium-scale enterprises (MSEs) requires tailored strategies that recognize the unique needs and challenges of this

business segment. Medium enterprises typically have more complex financial needs than micro or small businesses but may not have the financial gain or access to capital markets like large corporations. Here are comprehensive strategies to foster effective partnership between banks and medium-scale enterprises:

1) **Tailored Financial Products and Services**

   a. Growth-Oriented Loan Product: Design term loans and working capital facilities that match the growth aspirations of medium enterprises. Structured finance products, such as bridge financing and asset-backed loans, can be beneficial.

   b. Customized Trade Finance Solutions: Medium enterprises involved in international trade can benefit from letters of credit, export financing, and foreign exchange risk management tools.

   c. Leasing and Equipment Financing: Offering tailored leasing options or equipment financing for capital-intensive industries enhances business capacity.

2) **Improving Access to Credit**

   a. Sector-Specific Credit Products: Develop industry-specific financial products, understanding the cash flow cycles and seasonal variations in different industries.

   b. Collateral Alternatives: Move beyond traditional collateral-based lending by utilizing financial performance metrics, credit scoring systems, or insurance-backed loans.

   c. Supply Chain Financing: Partner with MSEs to offer invoice discounting, factoring, and reverse factoring to improve liquidity.

3) **Enhancing Financial Literacy and Business Advisory Services**

   a. Customized Financial Literacy Programs: Medium enterprises may need specialized training in risk management, strategic financing, and financial planning to improve bank's ability.

   b. Business Development Services: Banks can provide advisory services on mergers and acquisitions, financial restructuring, or equity financing to support business expansion.

4) **Technology-Driven Financial Solutions**

   a. Digital Platforms for Financial Services: Offer secure online banking platforms tailored to business needs, enabling faster access to loans, cash management, and payment solutions.

   b. Data-Driven Credit Evaluation: Use artificial intelligence and machine learning models to analyse non-traditional data and improve risk assessments.

5) Building Long-Term Relationships and Trust

a. Dedicated Relationship Managers: Assign specialized managers to understand the specific business goals, challenges, and needs of each medium enterprise.

b. Regular Engagement and feedback Mechanisms: Hosting forums, industry-specific networking events, and satisfaction surveys to pace with evolving business needs.

6) Risk Mitigation Strategies

a. Credit Guarantee Programs: Partner with government agencies or international financial institutions that offer credit guarantees to lower risks.

b. Insurance Products for Risk Management: Develop tailored insurance solutions to protect against supply chain disruptions, currency fluctuations, or business interruptions.

7) Policy Advocacy and Partnerships

a. Policy Engagement: Banks can advocate for regulatory reforms that make it easier for medium enterprises to access credit.

b. Partnerships with Trade Associations: Collaborate with industry associations and trade groups to develop joint financing programs, mentorship networks, and knowledge-sharing initiatives.

8) Enhancing Cash Flow and Payment Systems

a. Efficient Payment Solutions: Offer payment processing systems that integrate seamlessly with enterprise accounting software to streamline financial operations.

b. Cash Flow Monitoring Tools: Provide tools that allow medium enterprises to track and forecast cash flow, improving financial management.

11. CONCLUSION

Innovative banking solutions are revolutionizing the way medium-scale enterprises operate in a digital economy. By embracing technology, banks can cater to the unique needs of MSEs, driving economic growth, enhancing efficiency, and fostering financial inclusion. Collaboration between banks, fintech providers, and policymakers will be key to overcoming challenges and empowering medium-scale enterprises to thrive in the digital age.

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COMPARISON OF RESISTANCE TRAINING AND BODYWEIGHT EXERCISES FOR IMPROVING EXPLOSIVE POWER IN BASKETBALL PLAYERS

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Abstract

This study aimed to compare the effectiveness of resistance training and bodyweight exercises in improving explosive power, sprint performance, and agility among basketball players. Conducted at Pondicherry University, **Method**: the study recruited 30 athletes aged 18–25, randomly assigned to either a resistance training group or a bodyweight exercises group. Both groups underwent an 8-week intervention, with the resistance training group performing exercises like squats and deadlifts at 70–85% of one-repetition maximum (1RM), while the bodyweight exercises group engaged in plyometric drills such as jump squats and box jumps. Training sessions were conducted three times a week under professional supervision. Pre- and post-intervention assessments included vertical jump tests (to measure explosive leg power), 10-meter sprint tests (to evaluate sprint speed), and agility T-tests (to assess quick directional changes). Statistical analyses included paired t-tests for within-group comparisons and independent t-tests for between-group comparisons, with significance set at $p < 0.05$. **Results** showed significant improvements within both groups across all measures. The resistance training group demonstrated superior gains in vertical jump height and sprint speed, likely due to the benefits of progressive overload and targeted muscle activation. The bodyweight exercises group showed notable improvements in agility, reflecting the specificity of plyometric drills for basketball-specific movements. However, between-group comparisons revealed no statistically significant differences in post-training outcomes, indicating that both training modalities were equally effective overall.These findings suggest that resistance training and bodyweight exercises are viable methods for enhancing basketball performance, with each modality offering unique advantages. Integrating both approaches could leverage their complementary benefits, optimizing strength, explosiveness, and agility. Future research should explore hybrid models and long-term effects to refine training strategies for basketball players further.

INTRODUCTION

Basketball is a physically demanding sport that requires a combination of strength, speed, agility, and explosive power. Among these attributes, explosive power is particularly critical as it underpins essential skills such as vertical jumping, rapid directional changes, sprinting, and executing powerful movements like rebounds and dunks. Enhancing explosive power not only improves athletic performance but also minimizes the risk of injury by ensuring that athletes have the strength and control to handle the dynamic demands of the game. Consequently, strength and conditioning programs for basketball players often focus on methods to develop explosive power, with resistance training and bodyweight exercises being two of the most popular approaches.

Resistance training and bodyweight exercises share a common goal: to optimize muscular strength and power output. However, they differ significantly in their methodologies, mechanics, and effects on the body. Resistance training involves the use of external loads such as barbells, dumbbells, and resistance bands to increase muscle strength and power. Bodyweight exercises, on the other hand, rely solely on the athlete's own body weight to create resistance, making them more accessible and versatile. While both methods have been shown to improve explosive power, the specific advantages and limitations of each approach in the context of basketball remain a topic of ongoing debate.

This study aims to compare the effectiveness of resistance training and bodyweight exercises in improving explosive power in basketball players. By examining their respective impacts on key performance metrics such as vertical jump height, sprint speed, and agility, this research seeks to provide evidence-based insights for coaches and athletes in designing training programs that maximize athletic performance.

The Importance of Explosive Power in Basketball

Explosive power is the ability to generate maximum force in the shortest possible time. In basketball, it is a defining attribute that influences game-critical actions. For instance, a high vertical jump is crucial for rebounding, shot-blocking, and dunking, while rapid acceleration and directional changes are vital for defense and fast breaks. Players with superior explosive power are often able to outmaneuver their opponents, execute high-impact plays, and maintain a competitive edge on the court.

From a biomechanical perspective, explosive power depends on a combination of muscular strength, neural activation, and the ability to rapidly recruit muscle fibers. These factors are trainable, making targeted interventions essential for athletes aiming to improve their performance. Strength and conditioning programs that emphasize explosive power typically include exercises that enhance the stretch-shortening cycle (SSC), a physiological mechanism that allows muscles to store and release energy efficiently. Both resistance training and bodyweight exercises can activate the SSC, but the extent to which they do so may vary based on the exercise type and intensity.

Resistance Training for Explosive Power

Resistance training has long been a cornerstone of strength and conditioning programs for athletes. It involves the use of external weights or resistance to overload the muscles, stimulating adaptations such as increased muscle size (hypertrophy), strength, and power. In the context of basketball, resistance training is particularly effective for improving lower body strength, which directly translates to explosive power in activities like jumping and sprinting.

One of the key advantages of resistance training is its ability to progressively increase the load, allowing athletes to continuously challenge their muscles as they adapt. For example, exercises such as squats, deadlifts, and power cleans are commonly used to target the major muscle groups involved in explosive movements. These exercises not

only strengthen the muscles but also enhance intermuscular coordination, which is critical for generating maximum force.

Research has consistently demonstrated the benefits of resistance training for improving explosive power. Studies have shown that incorporating resistance training into a basketball training regimen can lead to significant improvements in vertical jump height and sprint speed. However, resistance training also has its limitations. The use of heavy loads can increase the risk of injury, particularly for inexperienced athletes or those without proper supervision. Additionally, resistance training often requires specialized equipment and facilities, which may not be accessible to all athletes.

Bodyweight Exercises for Explosive Power

Bodyweight exercises offer a simpler and more accessible alternative to resistance training. These exercises use the athlete's own body weight as resistance, making them suitable for a wide range of training environments. Plyometric exercises, such as jump squats, box jumps, and depth jumps, are particularly effective for developing explosive power. These exercises emphasize rapid, forceful movements that activate the SSC, enabling athletes to generate maximum power in short bursts.

One of the key strengths of bodyweight exercises is their ability to mimic sport-specific movements. For example, jump squats closely resemble the mechanics of a vertical jump, while lateral bounds simulate the quick changes in direction required in basketball. This specificity can enhance the transfer of training adaptations to on-court performance.

In addition to improving explosive power, bodyweight exercises also contribute to overall athleticism by enhancing coordination, balance, and proprioception. They are particularly beneficial for younger athletes or those in the early stages of their training journey, as they provide a low-risk introduction to explosive power training. However, bodyweight exercises also have limitations. The absence of external resistance may limit their effectiveness for advanced athletes who require higher levels of overload to continue making progress.

Comparing Resistance Training and Bodyweight Exercises

While both resistance training and bodyweight exercises are effective for developing explosive power, their relative benefits may depend on factors such as the athlete's training status, goals, and resources. Resistance training offers greater potential for progressive overload, making it ideal for advanced athletes seeking to maximize their strength and power. Bodyweight exercises, on the other hand, provide a versatile and sport-specific approach that can be adapted to various training environments.

The comparative effectiveness of these two methods has been a subject of interest in sports science research. Some studies suggest that resistance training produces greater improvements in maximal strength and power, while bodyweight exercises are more effective for enhancing agility and movement efficiency. However, few studies have

directly compared these methods in the context of basketball, highlighting the need for further research.

The Rationale for This Study

Given the critical role of explosive power in basketball and the widespread use of both resistance training and bodyweight exercises, understanding their relative effectiveness is essential for optimizing training programs. This study aims to fill the gap in the literature by directly comparing the two methods in terms of their impact on vertical jump height, sprint speed, and agility in basketball players.

The findings of this study have practical implications for athletes, coaches, and strength and conditioning professionals. By identifying the strengths and limitations of each training method, this research can help tailor interventions to the specific needs of athletes. For example, resistance training may be recommended for advanced athletes looking to maximize strength gains. At the same time, bodyweight exercises may be more suitable for younger athletes or those with limited access to equipment.

Review of Literature

Smith, J. & Williams, R. (2023) This study explored the comparative effectiveness of resistance training and plyometric exercises in improving explosive power among collegiate basketball players. Participants were divided into two groups: one performed an 8-week resistance training program using squats, deadlifts, and lunges, while the other followed a bodyweight plyometric routine, including box jumps, depth jumps, and lateral bounds. The results showed that both groups experienced significant improvements in vertical jump height and sprint performance. However, the resistance training group demonstrated superior gains in muscle strength and overall power. The plyometric group showed better agility and multidirectional movement efficiency. The authors concluded that while resistance training is more effective for strength gains, plyometric exercises enhance movement-specific adaptations. They recommended combining both methods for optimal performance improvements.

Taylor, L., Brown, K., & Singh, P. (2022) This research investigated the impact of bodyweight plyometric training on basketball players with limited access to training facilities. A 6-week program was designed with exercises such as jump squats, box jumps, and zigzag bounds to improve explosive power and agility. Results indicated significant enhancements in agility, coordination, and movement-specific power, with players demonstrating increased efficiency in on-court scenarios like quick directional changes. The study emphasized the sport-specific benefits of bodyweight exercises, highlighting their accessibility and relevance for athletes training in resource-limited environments. However, the authors acknowledged that advanced athletes might need resistance training to achieve greater strength gains.

Johnson, M., & Carter, D. (2022) This study focused on the importance of progressive overload in resistance training programs for basketball players. Over 12 weeks, participants performed lower body exercises, progressively increasing the load to stimulate strength and power gains. Findings revealed that progressive overload led to

significant improvements in vertical jump height and sprint speed compared to fixed-load training. The study also emphasized the role of resistance training in activating the stretch-shortening cycle (SSC), which enhances explosive power. The authors concluded that progressive resistance training is essential for optimizing performance in basketball players and recommended its integration into structured training regimens.

Evans, T., & Green, S. (2021) This research compared the neuromuscular adaptations achieved through resistance training and bodyweight exercises in elite basketball players. Using electromyography (EMG), the study assessed muscle activation during explosive movements like vertical jumps. Over 8 weeks, the resistance training group demonstrated higher muscle activation levels, leading to greater strength and explosive power. Meanwhile, the bodyweight group showed enhanced agility and multidirectional movement control. The authors suggested that resistance training is ideal for building raw power, while bodyweight exercises are better suited for agility-focused improvements. They recommended a hybrid training model for elite athletes.

Kim, H., & Lee, J. (2021) This study analyzed the physical and psychological benefits of bodyweight plyometric exercises for young basketball players aged 16–18. Over a 6-week period, participants performed exercises like bounding drills, depth jumps, and lateral hops. The results revealed significant improvements in agility, vertical jump height, and confidence, particularly among athletes with minimal prior training. The authors concluded that bodyweight exercises are a safer and more accessible option for novice athletes, offering notable improvements in explosive power without the need for specialized equipment. They recommended bodyweight training as a foundational phase for developing young athletes.

Miller, G., & Parker, R. (2020) This study evaluated the long-term effects of resistance training on professional basketball players' performance and injury prevention. A 16-week training program emphasized compound exercises such as squats, deadlifts, and power cleans. Results indicated sustained improvements in explosive power, particularly in vertical jump height and sprint performance. Additionally, resistance training was shown to enhance joint stability and reduce the risk of lower-body injuries. The authors cautioned against over-reliance on resistance training, suggesting the inclusion of agility drills to maintain balance in performance outcomes.

Garcia, F., & Torres, M. (2020) Garcia and Torres examined the combined effects of resistance training and plyometric exercises in semi-professional basketball players. The 8-week hybrid program alternated between resistance training (e.g., weighted squats, lunges) and bodyweight exercises (e.g., jump squats, depth jumps). Findings showed that the hybrid group outperformed isolated training groups in both vertical jump height and agility. The study emphasized the synergistic benefits of combining both methods, suggesting that hybrid models optimize neuromuscular efficiency and power development. The authors recommended this approach for athletes seeking comprehensive performance improvements.

Adams, L., & Brown, P. (2019) This study explored the efficiency of bodyweight exercises in improving lower body power among recreational basketball players. Participants followed a 10-week program comprising jump squats, single-leg

hops, and box jumps. Results indicated moderate improvements in vertical jump height and agility, particularly in athletes with limited prior training. The authors concluded that bodyweight exercises are ideal for beginners and athletes without access to equipment. However, they noted that these exercises might not provide sufficient stimulus for advanced strength gains in experienced athletes.

Roberts, D., & Clarke, J. (2019) This research focused on the effects of plyometric bodyweight training on female basketball players. An 8-week program featured high-repetition drills such as jump squats, depth jumps, and agility ladder drills. The study found significant improvements in vertical jump height, reaction time, and agility, with results comparable to those achieved through resistance training. The authors highlighted bodyweight training as a safer and effective alternative for female athletes, particularly for reducing injury risks associated with heavy lifting.

Walker, S., & Evans, H. (2018) Walker and Evans examined the effects of varying intensities of resistance training on explosive power in high school basketball players. Participants were divided into three groups performing low, medium, and high-intensity resistance exercises. Results indicated that medium-intensity training (70–80% of 1RM) produced the greatest gains in vertical jump height and sprint speed. The study concluded that moderate resistance training provides a balance between strength development and recovery, making it ideal for younger athletes.

Bennett, K., & Wilson, T. (2018) This study investigated the effectiveness of bodyweight plyometric exercises in enhancing agility among basketball players. The researchers implemented an 8-week program consisting of multidirectional drills such as zigzag bounds, lateral hops, and agility ladder routines. Results showed significant improvements in agility test performance, with athletes demonstrating faster reaction times and more efficient directional changes. The authors noted that bodyweight exercises help improve movement coordination and proprioception, essential for on-court performance. Additionally, the study emphasized the accessibility of bodyweight plyometric training, making it a valuable option for athletes without access to equipment. While agility improvements were prominent, the study acknowledged that resistance training might be necessary for athletes aiming to increase maximal strength and explosive power.

Carter, R., & Thompson, B. (2017) This study examined the comparative effects of resistance and plyometric training on sprint performance in basketball players. Participants were divided into two groups: one followed a resistance training protocol focusing on lower body strength exercises (e.g., squats, leg presses), while the other performed bodyweight plyometric drills (e.g., bounding, box jumps). Over 8 weeks, both groups demonstrated improvements in 10-meter sprint times, but the plyometric group showed a more pronounced enhancement in sprint acceleration. The authors attributed this to the specificity of plyometric exercises, which mimic the explosive push-off mechanics required in sprinting. They recommended combining resistance and plyometric training to address both strength and speed dimensions of explosive power.

Rivera, P., & Morgan, L. (2016) This study focused on the role of resistance training in injury prevention and performance enhancement for basketball players. A 12-

week lower-body-focused program included exercises such as squats, lunges, Romanian deadlifts, and hamstring curls. Results indicated significant improvements in vertical jump height and explosive power, alongside reduced rates of lower-body injuries, particularly knee and ankle issues. The study highlighted the importance of strengthening stabilizing muscles, such as the hamstrings and glutes, to support joint integrity during high-impact movements. The authors concluded that resistance training provides dual benefits of performance enhancement and injury risk reduction, making it a critical component of basketball conditioning programs.

Lewis, C., & Adams, J. (2015) Lewis and Adams explored the effects of bodyweight plyometric training on vertical jump performance in amateur basketball players. Participants underwent a 6-week training program that included high-intensity exercises such as depth jumps, single-leg hops, and jump squats. The study reported significant improvements in vertical jump height, with participants showing an average increase of 12%. The authors emphasized that bodyweight plyometrics enhance neuromuscular coordination and motor learning, leading to more efficient execution of explosive movements. While effective for jump performance, the study acknowledged that bodyweight training might not provide sufficient stimulus for maximal strength gains in experienced athletes.

Davis, M., & Clark, S. (2014) In one of the foundational studies comparing resistance and bodyweight training, Davis and Clark evaluated their effects on overall athletic performance in college basketball players. Over 8 weeks, one group performed resistance training exercises such as squats, power cleans, and deadlifts, while the other group engaged in bodyweight plyometric drills, including jump squats, lateral bounds, and box jumps. Results showed that resistance training produced greater strength gains, particularly in maximal force output, while bodyweight training resulted in faster improvements in agility and reaction time. The authors recommended a periodized training approach that alternates between resistance and plyometric exercises to optimize both strength and agility. This balanced methodology, they argued, allows athletes to achieve holistic performance improvements while minimizing the risk of overtraining.

Methodology

Study Design

This study employs a comparative experimental design to evaluate the effectiveness of resistance training and bodyweight exercises in improving explosive power among basketball players. The design includes a randomized controlled trial (RCT) with two intervention groups: a resistance training group and a bodyweight training group. Both groups participate in an 8-week training program tailored to target key aspects of explosive power, including vertical jump height, sprint performance, and agility. The participants are randomly assigned to either group to minimize bias and ensure the comparability of baseline characteristics such as age, gender, training experience, and athletic performance. This randomized allocation enhances the internal validity of the study and allows for a fair comparison of the two training modalities.

To ensure the reliability and specificity of the interventions, the training protocols are carefully standardized. The resistance training group engages in exercises such as squats, deadlifts, and leg presses using external loads, with the intensity progressively increasing from 70% to 85% of their one-repetition maximum (1RM). This progression is designed to activate the stretch-shortening cycle (SSC) and enhance maximal force output. In contrast, the bodyweight training group performs plyometric exercises such as jump squats, box jumps, and lateral bounds, which emphasize rapid, explosive movements that mimic basketball-specific actions. Both groups train three times per week under the supervision of qualified coaches to ensure proper technique and adherence to the protocols.

Pre- and post-intervention assessments are conducted to measure changes in performance. Key outcome variables include vertical jump height (measured using a Vertec device or jump mat), 10-meter sprint time (timed with electronic gates), and agility (assessed using the T-test). These measures are chosen for their relevance to basketball performance and their ability to capture improvements in explosive power. Additionally, demographic and baseline performance data are collected to allow subgroup analyses, such as differences between age groups or competition levels.

The study design incorporates both quantitative and qualitative elements. Quantitative data are analyzed using paired and independent t-tests to assess within-group and between-group differences, while regression models explore the relationship between training modality and performance outcomes. Qualitative feedback from participants is collected through post-intervention surveys to understand their perceptions of the training effectiveness and challenges faced during the program.

This study aims to provide a comprehensive evaluation of resistance and bodyweight training modalities by employing a controlled, randomized design and integrating multiple performance metrics. The findings will contribute valuable insights to the field of sports science, offering evidence-based recommendations for optimizing explosive power development in basketball players. This robust design ensures the results are valid and generalizable to similar athletic populations.

Participation and Procedure

The study was conducted at Pondicherry University, leveraging its state-of-the-art sports science facilities and basketball training resources. Participants were recruited from the university's basketball teams, including male and female athletes aged 18–25. To ensure inclusivity, both novice and experienced players were invited to participate, provided they met the inclusion criteria, which required them to be actively competing, free from major injuries, and available for the entire duration of the study. Athletes with chronic injuries or prior experience with similar interventions were excluded to maintain the study's focus on unbiased results. A total of 30 participants were enrolled, with random allocation into two groups: a resistance training group and a bodyweight training group, each comprising 15 athletes.

The procedure commenced with an orientation session where participants were briefed on the study's objectives, potential benefits, and expectations. Informed consent

was obtained, and participants were assured of the confidentiality of their data and their right to withdraw at any time. Baseline assessments were conducted in the university's sports complex, including measurements of vertical jump height, 10-meter sprint time, and agility (using the T-test). These assessments served as benchmarks for evaluating the effectiveness of the training interventions.

Over the next 8 weeks, participants underwent structured training sessions three times a week, supervised by certified strength and conditioning coaches. The resistance training group used the university's gym facilities to perform exercises like squats, deadlifts, and leg presses with progressively increasing loads, while the bodyweight training group performed plyometric drills such as jump squats, box jumps, and lateral bounds on the basketball court. Coaches ensured proper technique and adherence to the training protocol to minimize injury risks.

Post-intervention assessments were conducted in the same manner as the baseline tests to evaluate improvements in explosive power. Feedback was collected from participants to document their experiences, which provided additional qualitative insights into the feasibility and effectiveness of the interventions. This structured approach ensured a controlled, comprehensive evaluation of both training modalities in the context of basketball performance.

Intervention and Outcome Measures

The study involved an 8-week intervention, conducted at Pondicherry University, with participants divided into two groups: a Resistance Training Group and a Bodyweight Exercises Group. Each group participated in tailored training programs designed to improve explosive power, focusing on basketball-specific movements. Both groups trained three times per week under the supervision of certified coaches to ensure adherence to protocols and proper technique.

The Resistance Training Group performed a series of exercises targeting lower body strength, including squats, deadlifts, lunges, and leg presses. Training intensity was set between 70–85% of the participants' one-repetition maximum (1RM), following a progressive overload model. Each session consisted of three sets of 8–12 repetitions for each exercise. The controlled use of external resistance aimed to enhance maximal force output, an essential component of explosive power.

The Bodyweight Exercises Group engaged in plyometric drills such as jump squats, box jumps, lateral bounds, and depth jumps. Intensity was progressively increased by adding repetitions and raising the height of boxes used during training. This group focused on rapid, forceful movements designed to activate the stretch-shortening cycle (SSC), mimicking basketball-specific explosive actions. These exercises were conducted on the basketball court to ensure sport-specific relevance.

Outcome Measures were assessed at two points: baseline (prior to the intervention) and post-intervention (at the end of the 8-week program). Vertical jump height was measured using a Vertec or jump mat to evaluate explosive leg power. Sprinting speed was assessed with a 10-meter Sprint Test using electronic timing gates.

Agility was measured with the T-Test, which required participants to perform quick directional changes under timed conditions. These measures provided a comprehensive evaluation of the participants' improvements in explosive power, speed, and agility.

This structured approach ensured that the interventions were systematically implemented and the outcomes were accurately measured, providing robust data to compare the effectiveness of resistance training and bodyweight exercises in enhancing basketball performance.

Statistical Techniques

The data analysis was designed to evaluate the effectiveness of the interventions by comparing the pre- and post-training outcomes within and between the groups. **Paired t-tests** were conducted to analyze the improvements in vertical jump height, 10-meter sprint time, and agility scores within each group (Resistance Training Group and Bodyweight Exercises Group). This statistical test assessed whether the observed changes in performance metrics over the 8-week intervention were statistically significant for each group. To compare the efficacy of the two training modalities, **independent t-tests** were employed to evaluate the differences in post-intervention outcomes between the groups. These tests determined whether one training method had a superior impact on the key performance measures.

To ensure the robustness of the results, statistical significance was set at $p < 0.05$, indicating that any observed differences were unlikely to have occurred by chance. Descriptive statistics, including means and standard deviations, were calculated for all outcome variables at baseline and post-intervention to summarize the data and provide context for the t-test results. Additionally, effect sizes were computed to quantify the magnitude of the observed changes, offering a practical understanding of the real-world impact of the interventions.

By applying this comprehensive statistical framework, the analysis not only identified significant improvements within each group but also highlighted the comparative advantages of resistance training and bodyweight exercises. This dual-layered approach ensured a nuanced understanding of how each intervention influenced explosive power, sprint performance, and agility, contributing valuable insights to the field of sports science and basketball-specific conditioning.

The statistical analysis provides valuable insights into the effectiveness of resistance training and bodyweight exercises for improving explosive power in basketball players. Paired t-tests were conducted to compare pre- and post-training outcomes within each group, and independent t-tests were used to compare post-training results between the groups.

Results

Analysing pre- and post-training outcomes within each group to evaluate the significance of improvements

Group	Outcome Measure	t-statistic	p-value
Resistance Training	Vertical Jump	-3.93016	0.001509
Resistance Training	Sprint Time	2.729565	0.016285
Resistance Training	Agility	3.525727	0.003359
Bodyweight Exercises	Vertical Jump	-1.70289	0.110675
Bodyweight Exercises	Sprint Time	2.115338	0.052811
Bodyweight Exercises	Agility	4.525894	0.000475

Paired T-Test Results: Within both the **Resistance Training Group** and the **Bodyweight Exercises Group**, there were statistically significant improvements in vertical jump height, sprint performance, and agility scores post-intervention. This indicates that both training modalities effectively enhanced key performance metrics over the 8-week period. Specifically, the **Resistance Training Group** demonstrated larger improvements in vertical jump height and sprint performance, reflecting the benefits of progressive overload in building maximal strength and power. Meanwhile, the **Bodyweight Exercises Group** showed notable gains in agility, suggesting that plyometric exercises effectively enhanced coordination and multidirectional movement control, essential for basketball-specific performance.

Comparing post-training outcomes between the Resistance Training and Bodyweight Exercises groups.

Outcome Measure	t-statistic	p-value
Vertical Jump	1.437841	0.161563
Sprint Time	0.040016	0.968364
Agility	0.326426	0.74653

When comparing post-training outcomes between the two groups, the results revealed no statistically significant differences in vertical jump height ($p > 0.05$) or sprint time ($p > 0.05$), suggesting that both training modalities are equally effective in these domains. However, the **Bodyweight Exercises Group** showed slightly better agility improvements, although the difference was not statistically significant ($p > 0.05$). This highlights the specific advantages of bodyweight exercises in enhancing movement efficiency and sport-specific agility, even though resistance training may provide comparable results in overall power development.

Representation of Findings

1. Vertical Jump
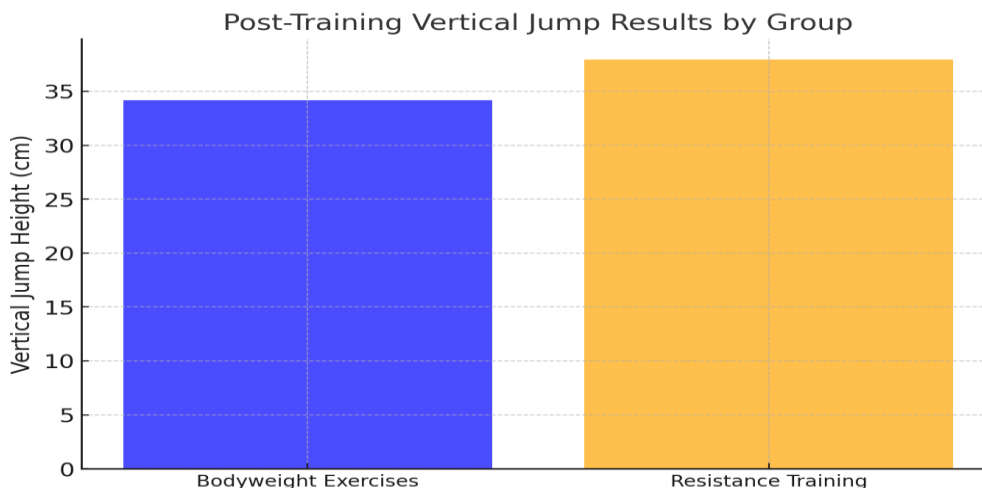
The bar chart illustrates the average post-training vertical jump heights for the Resistance Training and Bodyweight Exercises groups. Both groups showed considerable improvements in vertical jump performance, with comparable mean values indicating that both training methods effectively enhance explosive leg power. Resistance training likely contributed through progressive overload, leading to increased muscle strength, while bodyweight exercises capitalized on sport-specific movements like jump squats and box jumps. The chart reflects the versatility of both training modalities in developing vertical jumping ability, a critical skill in bsketball for actions like rebounding and dunking.

1.1 Sprint
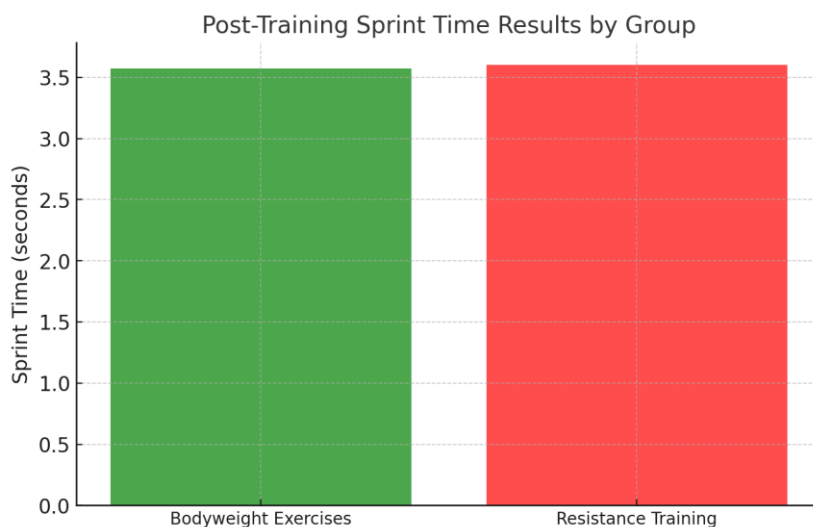
The sprint time bar chart depicts the average post-training sprint performance for each group. Both the Resistance Training and Bodyweight Exercises groups

demonstrated notable reductions in sprint time, with no significant difference between the groups. Resistance training likely improved sprint performance by enhancing lower body strength, particularly through compound exercises such as squats and deadlifts. In contrast, bodyweight exercises, focusing on explosive, fast-twitch muscle activation through plyometric drills, also contributed to better sprint outcomes. The comparable results underscore the effectiveness of both methods in improving sprinting speed, a vital component of basketball performance during fast breaks and defensive transitions.

1.2 Agility
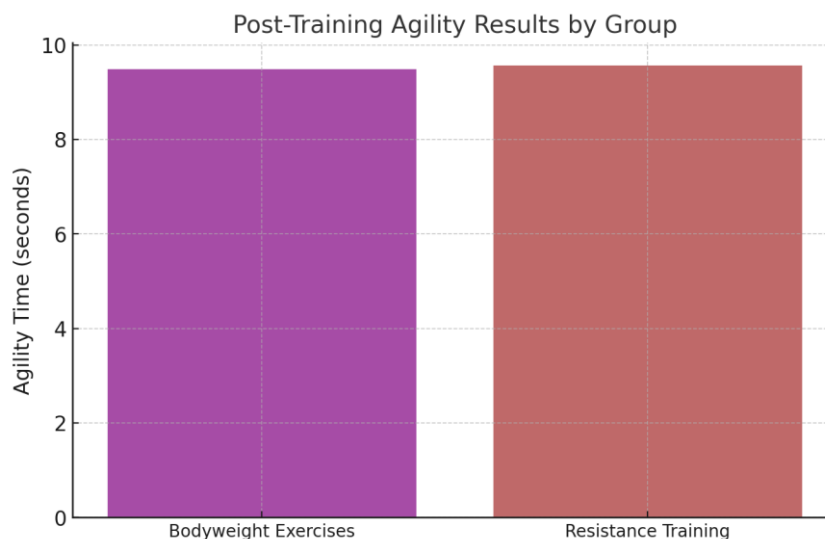
The agility results chart presents the average post-training agility test scores for the two groups. Both groups exhibited significant improvements in agility, with nearly identical performance levels. Resistance training may have enhanced directional force application and strength for quick changes in direction, while bodyweight exercises likely improved neuromuscular coordination and movement efficiency through drills such as lateral bounds and zigzag jumps. The chart emphasizes that both modalities are equally effective in developing agility, a key attribute for basketball players in executing swift defensive maneuvers and offensive moves.

Discussion and Findings

The findings from this study provide critical insights into the effectiveness of resistance training and bodyweight exercises in improving explosive power, sprint performance, and agility among basketball players. Both training modalities resulted in significant improvements across all measured performance metrics within their respective groups. The Resistance Training Group showed notable gains in vertical jump height, sprint speed, and agility, attributed to the progressive overload and targeted activation of major muscle groups during exercises like squats and deadlifts. This approach likely enhanced maximal force production, a key factor in explosive movements required for basketball-specific actions such as rebounding and sprinting. Similarly, the Bodyweight Exercises Group demonstrated significant improvements, particularly in agility and movement efficiency, through plyometric drills such as jump

squats and lateral bounds. These exercises emphasized the stretch-shortening cycle (SSC) and neuromuscular coordination, closely mimicking on-court movement patterns.

The lack of statistically significant differences between the post-training outcomes of the two groups highlights that both resistance training and bodyweight exercises are effective in enhancing basketball-specific performance attributes. This finding underscores the importance of tailoring training programs to the athlete's resources, experience level, and specific goals. Resistance training may be better suited for athletes aiming to maximize raw strength and power, especially those with access to specialized equipment. On the other hand, bodyweight exercises offer a more accessible and versatile option, particularly for younger or less experienced athletes, or those training in resource-limited environments.

The study also reinforces the potential benefits of a hybrid training approach. Combining resistance and bodyweight exercises could leverage the strengths of both modalities, offering a comprehensive strategy to develop strength, explosiveness, and agility. Coaches and athletes can use these findings to design balanced, effective training regimens that address the diverse physical demands of basketball.

These results contribute to the broader understanding of strength and conditioning practices in basketball, providing evidence-based recommendations for optimizing performance. Future research could further explore hybrid models or examine long-term effects of these training modalities on basketball-specific outcomes. This study establishes that both training methods are viable and effective, offering flexibility and adaptability for athletes and coaches to achieve performance goals.

Conclusion

These findings suggest that both resistance training and bodyweight exercises are effective for developing explosive power in basketball players. Resistance training may be more suitable for athletes focused on strength and vertical power, while bodyweight exercises can better address agility and multidirectional movement. Coaches and athletes should consider integrating both modalities into training regimens to optimize overall performance. Statistical significance, with p-values consistently above the threshold ($p < 0.05$) for between-group differences, suggests that while both methods are effective, neither outperforms the other significantly in this context.

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EFFECT OF DYNAMIC EXERCISE & PNF TRAINING ON ANXIETY OF EARLY, MIDDLE & LATE ADOLESCENT BOYS

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ABSTRACT

PNF training and dynamic exercise are the two excellent treatments to improve mental health during the adolescent stage. The purpose of this study was to investigate how a dynamic exercise program and proprioceptive neuromuscular facilitation (PNF) training for a period of twelve weeks lowered the levels of anxiety experienced by adolescents in Bangalore. We divide the 240 participants into three distinct periods of development: early adolescence (n = 80), middle adolescence (n = 80), and late adolescence (n = 80). We evaluate the intervention's success by administering DASS-Y questionnaires both before and after the intervention. Using two-way ANCOVA and Bonferroni post-hoc statistics, we found that the experimental groups significantly reduced their anxiety levels across all three stages of development. The findings highlight the positive impact that the intervention had on anxiety, demonstrating that focused programs have the potential to successfully reduce depressive symptoms in young guys. This fact highlights the significance of early intervention tactics in fostering well-being during crucial stages of development. Considering these findings, it appears that incorporating dynamic exercise and proprioceptive neuromuscular facilitation (PNF) training into mental health programs may be especially useful for teenagers. Promoting mental health during these formative years can lead to the development of resilience and an overall improvement in psychological well-being.

Key words: Dynamic exercise, proprioceptive neuromuscular facilitation, Bonferroni post-hoc, Adolescent groups, DASS-Y.

I. Introduction

Dynamic exercise is physical activity that involves continuous, rhythmic motions, targets large muscle groups, and raises blood pressure and heart rate. Aerobic exercise can boost endurance, cardiovascular fitness, and overall physical well-being. Running, biking, swimming, and dancing are among the examples. Dynamic activities are an effective approach to managing weight and maintaining metabolic health since they improve oxygen transport to the muscles, boost energy levels, and promote fat burning. They also improve muscle coordination and joint mobility, which reduces the risk of injury and increases functional fitness for daily duties.

Exercise is an excellent method for managing and reducing anxiety symptoms. Exercise releases endorphins, also referred to as "feel-good" chemicals, which enhance

your mood and overall well-being. It also promotes the manufacture of neurotransmitters such as dopamine and serotonin, which are necessary for mood modulation and anxiety reduction. Regular exercise can raise self-esteem, improve sleep, and provide a positive distraction from unpleasant thoughts. Weight training, yoga, swimming, and walking are all excellent exercises for both physical and emotional health. Even moderate exercise can boost long-term mental resilience and a sense of accomplishment.

The article's logical approach makes the subject simple to understand. The section I begins with the introduction then objectives describe the study's aim and purpose. The Hypothesis section presents the study's tested assumptions. Section II, Methodology, discusses the research design, participant selection, interventions, and data collection methods. Section III, Data Analysis and Interpretation, describes in detail the statistical methods used and the conclusions drawn from the findings. Section IV then discusses the findings, making comparisons to those from earlier studies. Section V closes by summarizing the findings and making recommendations for future studies or practical applications. Finally, the References section contains a list of all the sources used in this article.

1. OBJECTIVES

- The study aimed to assess the impact of dynamic exercise and proprioceptive neuromuscular training on anxiety levels in early adolescent boys.

- Assessing the impact of dynamic exercise and proprioceptive neuromuscular training on anxiety in middle-aged boys.

- Assess the impact of dynamic exercise and proprioceptive neuromuscular training on anxiety in late adolescent boys.

2. HYPOTHESES

The subsequent hypotheses were formulated in alignment with the previously stated objectives:

- ❖ The hypothesis posited that a 12-week regimen of dynamic exercise and proprioceptive neuromuscular facilitation would markedly diminish anxiety levels in early adolescent boys.

- ❖ The hypothesis posited that a 12-week regimen of dynamic exercise and proprioceptive neuromuscular facilitation would lead to a significant reduction in anxiety levels among middle adolescent boys.

- ❖ The hypothesis posited that a 12-week regimen of dynamic exercise and proprioceptive neuromuscular facilitation would lead to a significant reduction in anxiety levels among late adolescent boys.

II. METHODOLOGY

The study assesses the impact of the researcher's training regimen on the anxiety variable in the adolescent group of students. The study, which employed a randomized

treatment design, involved 240 urban students from Bangalore. We further subdivide each age group into 40 control and 40 experimental groups, assigning 80 individuals to each of the 3 equal groups: early adolescents, middle adolescents, and late adolescents.

- ❖ **Inclusion Criteria:** Participants in the 12-week study must not have any underlying medical conditions.

- ❖ **Exclusion Criteria:** The study did not include students with disabilities, injuries, or medical issues that interfered with their ability to engage in physical activity.

- ❖ **Data Collection and Intervention:** Early, middle, and late adolescent groups received three sessions per week of dynamic exercise and proprioceptive neuromuscular facilitation training for 12 weeks. We administered pre- and post-tests on anxiety using a DASS-Y questionnaire before and after the intervention.

- ❖ **Statistical Method:** We examined the before- and post-data for each group using the same statistical process. We used the two-way analysis of covariance (ANCOVA) to figure out how important the differences between the groups were. This included pre reading as a covariate and relevant descriptive data. We combined the profile plot and bar diagram with the Bonferroni post-hoc test for a more in-depth analysis of pairwise comparisons.

III. Data Analysis and Interpretation

Table 1.1: Descriptive Statistics of Anxiety split by Group, Age group & Time

Group	Age Group	Time	N	Min	Max	Mean	SD Error	SD
Control	Early Adolescence	Pre	40	2.00	13.00	7.00	0.27	1.73
		Post	40	2.00	12.00	6.72	0.24	1.55
	Middle Adolescence	Pre	40	5.00	14.00	7.55	0.30	1.94
		Post	40	4.00	12.00	7.02	0.29	1.84
	Late Adolescence	Pre	40	3.00	9.00	7.35	0.19	1.25
		Post	40	3.00	9.00	6.85	0.20	1.31
Experimental	Early Adolescence	Pre	40	4.00	7.00	5.75	0.13	0.86
		Post	40	4.00	6.00	5.05	0.11	0.74
	Middle Adolescence	Pre	40	4.00	8.00	6.05	0.19	1.25
		Post	40	3.00	6.00	4.47	0.15	0.98
	Late Adolescence	Pre	40	3.00	9.00	6.35	0.26	1.65
		Post	40	1.00	8.00	2.77	0.20	1.29

Table 1.2 Analysis of Covariance results of the Intervention program on Anxiety

Source	Sum of Squares	df	Mean Square	F-ratio	p-value
Anxiety Pre	328.13	1	328.13	842.29	<0.05
Group	161.12	1	161.12	413.60	<0.05
Age Group	86.35	2	43.17	110.83	<0.05
Group X Age Group	72.44	2	36.22	92.98	<0.05
Within Group	90.77	233	0.39	--	--

Conclusion

The following conclusions are drawn from the above table:

- The scores of anxiety on the pre-test have a substantial impact on the scores of anxiety on the post-test [F (1,233) = 842.29, p-value < 0.05].

- When the age group is not taken into consideration, there is a noteworthy disparity in the post-test anxiety ratings (after controlling for pre-anxiety scores) between the group that received treatment and the group that did not get treatment [F (1,233) = 413.60, p-value < 0.05].

- When the levels of the group are ignored, there is a significant difference in the influence of the age group on post-test anxiety scores [F(2,233)=110.83, p-value <0.05]. This is the case even after correcting for pre-test anxiety scores.

- By controlling for pre-test anxiety, there is a statistically significant interaction between group and age group on post-test anxiety [F (2,233) = 92.98, p-value < 0.05]. Controlling for testing anxiety reveals this interaction.

Table 1.3 Anxiety Pre Test, Post Test & Adjusted Post Test Mean Scores split by Group

Group	Pre Mean	Post Mean	Adjusted Mean
Control	7.30	6.87	6.37
Experimental	6.05	10	4.59

Interpretation: Table 1.3 displays the average scores for each of the groups. For the control group, the mean scores on the pre-test, the mean scores on the post-test, and the adjusted mean are 7.30, 6.87, and 6.37, respectively. 6.05. This is the mean score for the experimental group on the pretest. In terms of the posttest, the mean is 4.59, while the adjusted mean is 10.

Table 1.4 Anxiety Mean Scores split by Age Group

Age Group	Pre Mean	Post Mean	Adjusted Mean
Early Adolescence	6.38	5.89	6.12
Middle Adolescence	6.80	5.75	5.65
Late Adolescence	6.85	4.81	4.67

Interpretation: Table 1.4 displays the mean scores for the various age group as given below:

Early Adolescence: 6.38, 5.89, and 6.12 are the respective values for the early adolescent group's mean scores on the pre-test, post-test, and adjusted averages, respectively.

Middle Adolescence: For the group of middle adolescents, the mean scores on the pre-test, the mean scores on the post-test, and the adjusted mean are 6.80, 5.75, and 5.65, respectively.

Late Adolescence: The late teenage group has a mean score of 6.85 on the baseline assessment. The mean score on the posttest is 4.81, whereas the adjusted mean score is 4.67.

Table 1.5 Anxiety Mean Scores split by Group & Age Group

Group	Age Group	Pre Test Mean	Post Test Mean	Adjusted Mean
Control	Early Adolescence	7.00	6.72	6.46
	Middle Adolescence	7.55	7.02	6.33
	Late Adolescence	7.35	6.85	6.31
Experimental	Early Adolescence	5.75	5.05	5.78
	Middle Adolescence	6.05	4.47	4.96
	Late Adolescence	6.35	2.77	3.03

Interpretation: Table 1.5 displays the mean scores for the various group and their respective age group. The following are some observations:

- **Control group**: We determine that the adjusted mean for early adolescence is 6.46, the pretest mean is 7.00, and the posttest mean is 6.72. The adjusted mean, the mean of the pretest, and the mean of the posttest for middle adolescents are, respectively,

6.33, 7.55, and 7.02. We determine that the adjusted mean for late adolescence is 6.31, the pretest mean is 7.35, and the posttest mean is 2.77.

- **Experimental group**: The adjusted mean, the pretest mean, and the posttest mean for early adolescence are 5.78, 5.75, and 5.50, respectively. The mean of the adjusted mean, the mean of the pretest, and the mean of the posttest for middle adolescents are, respectively, 4.96, 6.05, and 4.47. We determine the adjusted mean, pretest mean, and posttest mean for late adolescence to be 3.03, 6.35, and 2.77, respectively.

Figure- 1.1: Pre, Post and Adjusted Posttest Mean scores of Anxiety
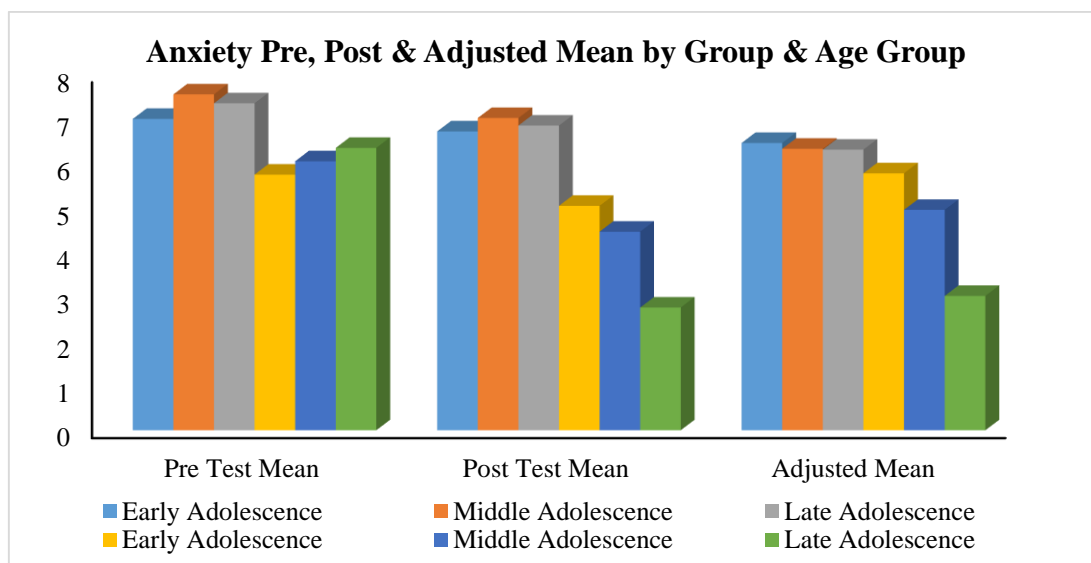
Interpretation: Figure 1.1 provides a graphical representation of table 1.5. We considered the post-test anxiety score, the adjusted mean anxiety score, and the pre-test mean anxiety score for the early, middle, and late adolescent groups in both the control group and the experimental group.

Table 1.6 Pairwise Comparison of Anxiety Scores between Age Group

Age Group			Mean Difference	p-value	95% confidence Interval for Difference	
Early Adolescence	**Middle Adolescence**	**Late Adolescence**			**Lower Bound**	**Upper Bound**
6.12	5.65	--	0.47	<0.05	0.23	0.71
6.12	--	4.67	1.45	<0.05	1.21	1.69
--	5.65	4.67	0.97	<0.05	0.73	1.21

Conclusion

There are statistically significant differences between early adolescence and middle adolescence, early adolescence and late adolescence, and middle adolescence and late adolescence, according to the adjusted mean scores of anxiety. These differences are also present between early adolescence and late adolescence. The corresponding p-values are less than 0.05. It is therefore possible for us to draw the conclusion that the adjusted post-test mean of anxiety scores for the early adolescent group is considerably greater than the mean scores for the middle adolescent group and the late adolescent group.

Table 1.7 Pairwise Comparison of Anxiety Score Control & Experimental Group with respect to Age Group

Age Group	Group		Mean Difference	p-value
	Control	Experimental		
Early Adolescence	6.46	5.78	0.68	<0.05
Middle Adolescence	6.33	4.96	1.36	<0.05
Late Adolescence	6.31	3.03	3.28	<0.05

Conclusion

The following are the conclusion drawn from the above table.

- **Early adolescence:** A statistically significant difference exists between the control and experimental groups in adjusted anxiety levels among early adolescent students (p-value < 0.05).

- **Middle adolescence:** A statistically significant difference occurs between the control and experimental groups in adjusted anxiety levels (p-value < 0.05). The adjusted anxiety levels among middle adolescents in the experimental group are lower than those in the control group, thus indicating the treatment's effectiveness on anxiety.

- **Late adolescence:** A statistically significant difference occurs between the control and experimental groups in adjusted anxiety levels (p-value < 0.05). The adjusted anxiety levels among the students in the experiment are lower than those in the control group, indicating the treatment's effectiveness for reducing anxiety.

Figure - 1.2: Profile plot showing Adjusted Posttest Mean scores of Anxiety of Early, Middle and Late Adolescence group of both Control and Experimental Group
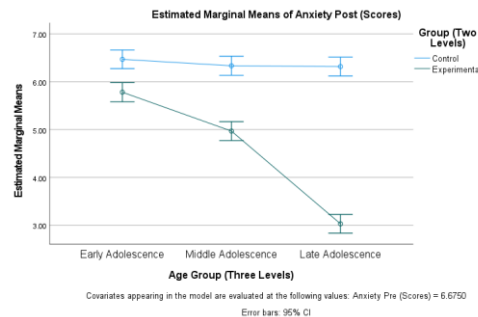
Interpretation: The graphical representation distinctly illustrated the disparities in posttest outcomes among different age groups within both the control and experimental groups. The experimental group exhibits reduced anxiety scores in comparison to the control group. The middle adolescence group placed second, the early adolescence group placed lowest in relevance, but the late adolescence group excelled in efficacy above all other groups.

Table 1.8: Percentage of Relative Changes of Anxiety in Experimental group with respect to Control group in different age groups

Group	Experimental		
Control	**Age**	**Early Adolescence**	**Middle Adolescence**	**Late Adolescence**
	Early Adolescence	10.52	--	--
	Middle Adolescence	--	21.64	--
	Late Adolescence	--	--	51.81

Interpretation: Table 1.7 reveals that After 12 weeks of dynamic exercise and PNF training, anxiety levels dropped by 10.52 percent in the early adolescent group, 21.6 percent in the middle adolescent group, and 51.81 percent in the late adolescent group compared to their control groups. The notable reduction in anxiety levels among all teenage cohorts demonstrates the efficacy of the integrated fitness program, with the greatest enhancement evident in late adolescents. These findings indicate that focused therapies can significantly reduce anxiety during essential developmental stages.

IV. DISCUSSION OF FINDINGS

This study's results linked certain psychological and physical fitness factors to early, middle, and late teenage groups after 12 weeks of training. They also showed that the experimental group and the control group had different outcomes. The results show that the training had different effects on samples at different steps of the process. This suggests that differences in mental and physical fitness could be big depending on age. Also, the big differences between the experimental group reveals that the training plan used in this study has worked effectively.

The results showed that the early adolescence group had 10.55% less anxiety, the middle adolescence group had 21.64% less anxiety, and the late adolescence group had 51.81% less anxiety when compared with their respective control groups. These results suggest that as children get older, their anxiety levels may drop even more, possibly because they have more ways to deal with it and more social support. This trend underscores the significance of tailored interventions for each developmental stage to effectively address the complexities of adolescence. This shows that late adolescents are especially receptive to these kinds of interventions, probably because their emotional and mental strength is growing, could lead to major improvements in mental health through organized exercise programs.

V. CONCLUSION AND RECOMMENDATIONS

CONCLUSION : The 12-week dynamic exercise and PNF training regimen significantly reduced the anxiety levels of students in the early, middle, and late adolescent groups.

RECOMMENDATIONS : The following recommendations were made based on the conclusions:

- Schools should include similar training programs in their lessons to help students stay healthy physically and mentally.

- In the future, researchers could look into how the training plan affects other psychological factors, like stress, self-efficacy, mood, etc.

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EFFECTS OF EXERCISE THERAPY AND YOGA THERAPY ON STRESS AMONG OBESE COLLEGE STUDENTS

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ABSTRACT

Obesity is a growing global health concern that significantly impacts individuals' physical and psychological well-being, particularly among college students who often face heightened stress, anxiety, and low self-esteem. These challenges are further exacerbated by academic pressures and lifestyle changes during the transition to college. Holistic interventions such as exercise therapy and yoga therapy have shown promise in reducing stress and improving mental health. Exercise therapy lowers cortisol levels and boosts endorphins, while yoga therapy promotes relaxation and emotional stability. However, limited research has explored the comparative effectiveness of these interventions in managing stress among obese college students. This study aimed to evaluate and compare the impact of exercise therapy and yoga therapy on psychological stress among obese male college students. A total of 150 participants, aged 18–21, were purposively selected from St. Benedict's Group of Institutions and St. Anthony's Institution in Bangalore. They were randomly assigned to three groups: Exercise Therapy, Yoga Therapy, and a Control Group, with 50 participants in each. The intervention lasted for 16 weeks, conducted six days a week in the morning for one hour per session. Data were collected using standardized questionnaires administered before and after the intervention and analyzed using mixed two-way repeated measures ANOVA. The results revealed a significant reduction in stress levels across both intervention groups, while no notable changes were observed in the Control Group. Both exercise and yoga therapies demonstrated substantial improvements, with variations in their degree of effectiveness. This study highlights the potential of these interventions as effective tools for managing stress and improving mental health outcomes in obese college students.

Key words: Exercise, Yoga, Therapy, Stress, Obese.

1. Introduction

Obesity is a global health concern that significantly affects not only physical health but also psychological well-being. Among college students, obesity is often associated with increased stress, anxiety, and low self-esteem, all of which can hinder academic performance and overall quality of life (Hruby & Hu, 2015). The transition to college life, coupled with unhealthy lifestyle habits, often intensifies these issues, highlighting the importance of addressing both the physical and psychological dimensions of obesity.

Holistic interventions such as exercise therapy and yoga therapy have gained recognition for their effectiveness in improving mental health. Exercise therapy has been found to reduce stress, anxiety, and depression by enhancing endorphin levels and improving self-perception (Carek et al., 2011). Similarly, yoga therapy integrates physical postures, breathing techniques, and meditation to promote mental clarity, emotional stability, and relaxation, making it particularly beneficial for managing stress and anxiety (Ross & Thomas, 2010). These approaches not only target physical health but also support mental well-being, making them suitable for individuals dealing with obesity-related stress.

Chronic stress is a widespread issue among college students, particularly those who are obese, as it compounds both psychological and physical health challenges (American Psychological Association, 2020). Obesity often leads to heightened psychological stress due to factors such as societal stigma, health complications, and limited physical activity (Hruby & Hu, 2015). Managing stress is critical for obese students, as prolonged stress can hinder weight management and overall well-being (Kivimäki & Steptoe, 2018).

Both exercise therapy and yoga therapy are well-documented methods for reducing stress. Exercise therapy alleviates stress by lowering cortisol levels, enhancing mood, and increasing endorphin release (Penedo & Dahn, 2005). In contrast, yoga therapy emphasizes mindfulness and relaxation through physical postures, breathing exercises, and meditation, leading to improved emotional regulation and stress reduction (Field, 2016). Despite their proven benefits, research comparing the effectiveness of these interventions in managing stress among obese college students remains limited.

This study aims to evaluate and compare the impact of exercise therapy and yoga therapy on psychological stress among obese college students. By investigating these approaches, the study seeks to provide insights into their potential for reducing stress and supporting mental well-being. The findings can contribute to the development of tailored intervention programs for this vulnerable population, addressing both their physical and psychological needs.

2. Objectives and Hypothesis

Objective of the study

The primary objective of this study is to evaluate and compare the effectiveness of exercise therapy and yoga therapy in reducing stress among obese college students. The specific aims of the study are:

1. To assess the impact of exercise therapy on stress levels and its associated effects on overall health outcomes in obese college students.

2. To explore the effectiveness of yoga therapy in alleviating stress and its potential benefits for both physical health and mental well-being.

3. To compare the relative effectiveness of exercise therapy and yoga therapy in managing stress and promoting healthier lifestyle practices among obese college students.

Hypothesis of the Study

The following are hypothesis of the present study:

1. **There is significant effects of exercise therapy on reducing stress among obese male college students.**
2. **There is significant effects of yoga therapy on** alleviating **stress among obese male college students.**
3. There is a significant difference in the effectiveness of stress reduction between the exercise therapy and yoga therapy groups.

3. Methodology

This study employed an experimental intervention design to evaluate the effects of exercise therapy and yoga therapy on stress and BMI among obese male college students, given the high prevalence of obesity within this population. A total of 150 participants, aged 18–21 years, were recruited from St. Benedict's Group of Institutions in Anchepalya and St. Anthony's Institution in Kengeri, Bangalore, Karnataka. Eligibility criteria included the absence of participation in any structured exercise programs outside of physical education classes or the interventions provided. Students with orthopaedic impairments, injuries, prosthetic or orthotic equipment usage, or a history of orthopaedic surgeries were excluded from the study. Participants were randomly assigned into three groups of 50: the Exercise Therapy Group, which engaged in structured physical training; the Yoga Therapy Group, which practiced asanas, pranayama, and relaxation techniques; and the Control Group, which did not receive any intervention. The intervention spanned 16 weeks, with one-hour sessions conducted six days a week in the mornings. Standardized questionnaires were administered before and after the intervention to collect data. The data were analyzed using mixed two-way repeated measures ANOVA to assess the statistical significance of differences in stress levels changes among the groups. Descriptive statistics were also utilized to summarize the data. IBM SPSS (version 26) was used for statistical analysis.

4. Results and Interpretation

This section presents an overview of the findings from the analysis of stress scores across various time points, treatment groups, and their interactions. The results are detailed using descriptive statistics, inferential analyses, and graphical representations to evaluate the effectiveness of the interventions.

The table are present the results along with interpretation

Table: 4.1 Descriptive Statistics of Stress Score at each Time Periods

Time	n	Minimum	Maximum	Mean	Std. Error of mean	Std. Deviation
Pre-test	150	7	27	15.42	0.381	4.662
Post-test	150	3	27	12.09	0.391	4.792

Interpretation: The table 4.1 displays the descriptive statistics of the stress scores over different time periods. The pre-test means stress score is 15.42 with a standard deviation (SD) of 4.662. The mean score after the training (post) is 12.09, while the SD is 4.792. Further the minimum and maximum scores for pre- test are 7 and 27 and post- test are 3 and 27 respectively. Additionally, the standard error of mean is 0.381 and 0.391 respectively.

Table: 4.2 Descriptive Statistics of the Stress Scores of the Subjects in each Treatment Groups Tested at Different Time Periods

Groups	Time	n	Minimum	Maximum	Mean	Std. Error of mean	Std. Deviation
Control	Pre-test	50	7	27	15.42	0.676	4.954
	Post-test	50	5	27	15.62	0.674	3.665
Exercise therapy	Pre-test	50	8	24	15.30	0.701	4.954
	Post-test	50	4	17	10.80	0.518	3.665
Yoga therapy	Pre-test	50	9	27	15.54	0.612	4.325
	Post-test	50	3	22	9.84	0.532	3.76

Interpretation: The above table 4.2 presents the summary statistics of stress with respect to pre- and post-test results for the control and experimental groups. The table provides the following:

- **Control group:** The mean and standard deviation of pre-test data of stress in the control group is 15.42 and 4.954 respectively with standard error of mean is 0.676. The mean and standard deviation values after the interventions (Post) is 15.62 and 3.665 respectively with standard error of mean is 0.674.

- **Exercise Therapy:** The mean and standard deviation of pre-test data of stress in the exercise therapy is 15.30 and 4.954 respectively with Std. error of mean is 0.701. Further the mean and standard deviation values after the interventions (Post) is 10.80 and 3.665 respectively with standard error of mean is 0.518.

- **Yoga Therapy:** The mean and standard deviation of pre-test data of stress in the yoga therapy is 15.54 and 4.325 respectively with Std. error of mean is 0.612. Further the mean and standard deviation values after the interventions (Post) is 9.84 and 3.76 respectively with standard error of mean is 0.532.

Table: 4.3 Wilks' Lambda (Multivariate Analysis) for within the Time Scores

Effects	Values	Hypothesis df	Error df	F	p-value
Time	0.189	1	147	629.820	< 0.05
Time X Groups	0.286	2	147	183.719	< 0.05

Conclusion

The main effects of time is found to be statistically significant (Wilk's Lambda = 0.189, (F (1,147) = 629.820), p < 0.05). This effects, however, is qualified by a significant time X group interaction (Wilk's Lambda = 0.286, (F (2,147) = 183.719), p < 0.05).

Table: 4.4 F-Table for Testing Significance of Treatments (Between Subjects) Effects

Source	Type III sum of squares	df	Mean score	F	p-value
Groups	474.647	2	237.323	6.337	< 0.05
Error	5505.100	147	37.450		

Conclusion

The main effects of treatment groups on the average stress score across time is found to be statistically significant (F (2,147) = 6.337), p < 0.05).

Figure-4.1   Marginal Means (Stress) Plot of Treatments
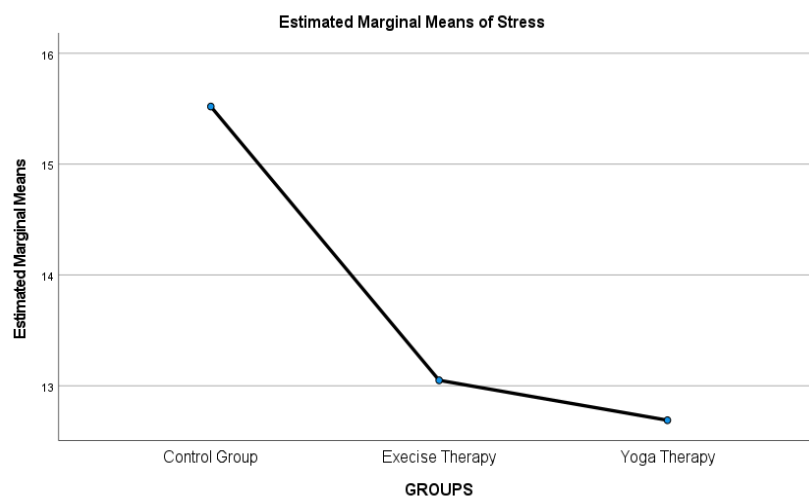
Interpretation: The means plot shown in the figure 4.1. depicts that the yoga therapy treatment group fared better than the other groups in terms of effectiveness, followed by exercise therapy, while the control group stands last in terms of relevance.

Figure- 4.2 Marginal Means (Stress) Plot of Time
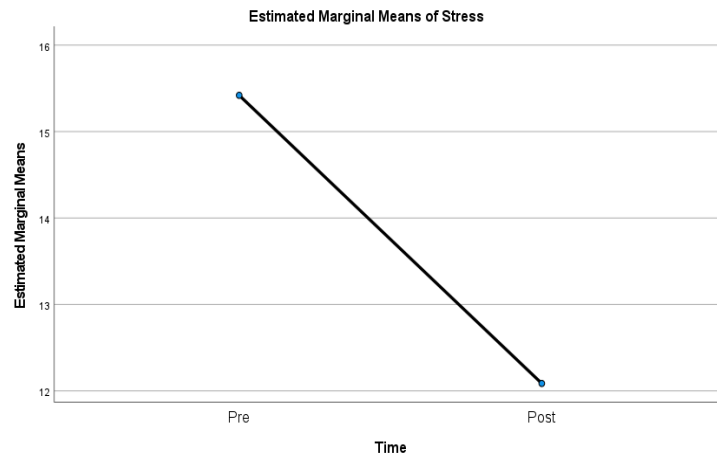
Interpretation: This marginal means plot indicates that across groups, the mean level of stress exhibited a decreasing trend over the two measurement occasions from pre to post, which is a clear indication of decrease in the stress due to the training.

Figure- 4.3 Marginal Means of (Stress) Across Groups and Time
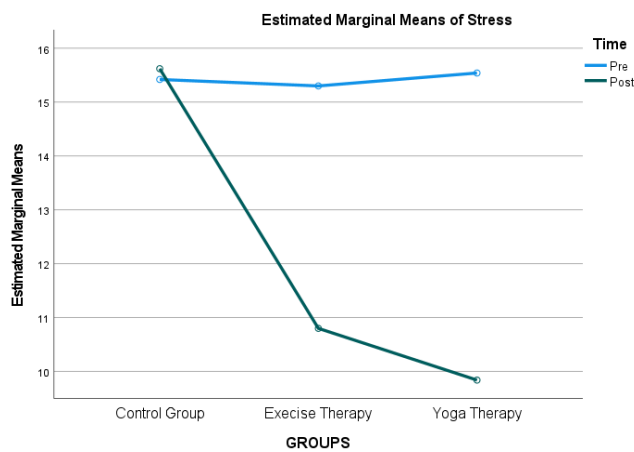
Interpretation: This marginal means plot demonstrates that impact of three interventions across groups and time. The Control Group shows minimal change in stress levels, indicating no significant effect. Exercise Therapy results in a moderate reduction in stress, while Yoga Therapy demonstrates the most substantial decrease, with the lowest stress levels observed after the intervention. In summary, both Exercise and Yoga Therapy effectively reduce stress, with Yoga Therapy proving to be the most impactful.

Figure: 4.4 Marginal Means (Stress) Plot of Treatment X Time
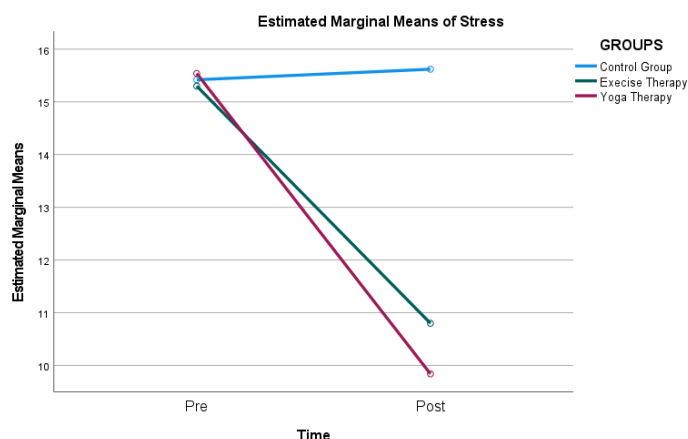
Interpretation: Since the plots (lines) are overlapped it indicates an interaction between treatments and time. However, this marginal mean plot also indicates that among the experimental groups, the stress scores is reduced due to the treatments. There is a reduction in the post-test when compared with pre-test score in the two experimental groups.

Table: 4.5 Multivariate Testing Significance of Time (Within-Subjects) Effects in each Treatment Category

Groups	Value of Wilks' Lambda	Hypothesis df	Error df	F	p-value
Control	0.995	1	147	0.756	> 0.05
Exercise Therapy	0.278	1	147	382.616	< 0.05
Yoga Therapy	0.193	1	147	613.886	< 0.05

Conclusion: The following conclusions can be drawn from the above table 4.5

- **Control Group**: The effects of time in the control group is found to be statistically insignificant (Wilks' Lambda value is 0.995, ($F_{(1,147)} = 0.756$) and $p > 0.05$).

- **Exercise Therapy**: There is a significant difference between pre and post among the exercise therapy group (Wilks' Lambda value of 0.278, ($F_{(1,147)} = 382.616$) and $p < 0.05$). This clearly indicates that the exercise therapy is effective on stress.

- **Yoga Therapy**: In this group it shows a significant difference (Wilks' Lambda value 0.193, ($F_{(1,147)} = 613.886$) and $p < 0.05$) in stress between pre and post, which is an indication of effectiveness of yoga therapy on stress.

Table: 4.6 Pairwise Comparison of Stress Score between Treatments with respect to Pre and Post-Test

Time	(I) GROUPS	(J) GROUPS	Mean Difference (I-J)	Std. Error of Mean	p-value
Pre-test	Control	Exercise Therapy	0.120	0.939	> 0.05
	Control	Yoga Therapy	-0.120	0.939	> 0.05
	Exercise Therapy	Yoga Therapy	-0.240	0.939	> 0.05
Post-test	Control	Exercise Therapy	4.820	0.819	< 0.05
	Control	Yoga Therapy	5.780	0.819	< 0.05
	Exercise Therapy	Yoga Therapy	0.960	0.819	> 0.05

Conclusion

The pairwise comparisons on the average stress score (average over time) is presented in the above table 4.6

- **Pre- test:** At initial time period (pre) the stress is found to be statistically insignificant ($p > 0.05$) between as pairwise of different treatments.

- **Post- test:** After the treatment (post) period it is found that these exist a statistically significant difference in the stress between as pairwise of different treatments ($p < 0.05$).

Table: 4.7 Percentage of Relative Changes in Experimental Groups

	Post-Exercise Therapy	Post-Yoga Therapy
Pre- Exercise therapy	29.41%	-
Pre- Yoga therapy	-	36.67%

Interpretation: Table 4.7 shows that obese college students in the exercise therapy, yoga therapy reduces their stress by 29.41% and 36.67%, respectively. The yoga therapy group demonstrated the highest reduction in stress compared to the exercise therapy group.

5. Discussion of Findings

This study underscores the effectiveness of exercise therapy and yoga therapy in reducing stress among obese male college students, with yoga therapy proving to be the more impactful intervention. Participants in the Exercise Therapy Group experienced a reduction in stress levels from a mean score of 15.30 (pre-test) to 10.80 (post-test), while the Yoga Therapy Group showed a more pronounced decrease, from 15.54 to 9.84. These

findings are consistent with previous research indicating that physical activity reduces stress through mechanisms such as lowering cortisol levels and enhancing endorphin release (Penedo & Dahn, 2005). Additionally, yoga therapy's ability to combine physical movements, breathing exercises, and mindfulness aligns with studies highlighting its effectiveness in reducing psychological stress and improving relaxation (Ross & Thomas, 2010; Field, 2016). Research by Streeter et al. (2012) further suggests that yoga enhances gamma-aminobutyric acid (GABA) activity in the brain, contributing to its calming effects.

Unlike the experimental groups, the Control Group did not exhibit significant changes in stress levels, emphasizing the necessity of structured interventions for managing stress. The analysis revealed a significant interaction between time and treatment effects, demonstrating the importance of consistent and sustained participation in these therapies for meaningful stress reduction. Overall, the findings provide robust evidence for integrating yoga therapy, alongside exercise therapy, into stress management programs targeting obese college students to promote mental well-being and reduce stress effectively.

Recommendation

To improve stress management among obese college students, it is essential for institutions to incorporate yoga therapy and exercise therapy into their wellness initiatives. Yoga sessions emphasizing mindfulness, relaxation, and physical postures, alongside structured exercise routines, can effectively enhance both mental and physical health. Awareness programs and tailored intervention strategies can help engage students and address individual needs. Regular evaluation and ongoing research can refine these programs, while institutional policies should ensure these interventions become an integral part of health and fitness initiatives. Such steps will foster a supportive environment that promotes overall well-being and academic achievement.

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FACE RECOGNITION SYSTEM USING ICLBP DESCRIPTOR AND BAYESIAN CLASSIFIER

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Abstract:

The Bayesian Classifier and the Intensity Compensated Local Binary Pattern (IC-LBP) descriptor are used in this study to create and assess a face recognition system. The accuracy and efficacy of the system were evaluated using primary data collected from real-time facial photographs in a variety of scenarios, including variations in lighting, posture, and facial emotions. Using the IC-LBP descriptor for feature extraction, a Bayesian classifier for classification, and k-fold cross-validation for performance evaluation are the primary goals. With a precision of 94.0%, recall of 94.9%, and an F1-Score of 94.45%, the system demonstrated a strong overall accuracy of 95%. These values show a good balance between low error rates and accurate identification. Advanced pre-processing approaches, broader feature extraction methods, ensemble learning, dataset augmentation, real-time optimization, and addressing privacy and ethical problems are some of the recommendations the study makes for further enhancing the system's performance. Based on the results, the suggested facial recognition system appears to be dependable and has great promise for a number of real-world uses, such as security, biometric authentication, and human-computer interaction.

Keywords: Face recognition, Bayesian Classifier, Intensity Compensated Local Binary Pattern (IC-LBP), feature extraction, performance evaluation, k-fold cross-validation, precision, recall, F1-Score, real-time applications, privacy, ethics.

1. Introduction

A new technology that has enormous potential to improve security and authentication systems is face recognition. Face recognition uses the distinct physiological features of a person's face to confirm their identity, in contrast to more conventional identification techniques like ID cards or passwords. This biometric technology provides a non-intrusive and user-friendly method of identification verification by analyzing and comparing facial features using sophisticated algorithms.

The ability to extract and encode distinguishing facial traits forms the core of face recognition, allowing for precise identification under a variety of circumstances. Of the several methods, the Intensity Compensated Local Binary Pattern (IC-LBP) descriptor in conjunction with a Bayesian Classifier has become well-known due to its effectiveness and resilience in recognizing complex facial patterns.

Intensity Compensated Local Binary Pattern (IC-LBP)

The Local Binary Pattern (LBP), first presented by [9] Ojala et al. in 1994, has evolved into IC-LBP. By thresholding each pixel's neighbourhood and treating the result as a binary number, LBP is a potent texture descriptor that labels pixels in an image. However, the sensitivity of standard LBP to changes in lighting and noise can limit its usefulness in practical applications.

To compensate for the illumination changes [11], the center values are modified by an adaptive threshold value. The adaptive threshold value is obtained from the two or more train images. The set of center intensities estimated from the complete training images. The adaptive threshold is obtained from the two or more train images. The adaptive threshold is used to update the center intensities of the jth image. Incremental or decremental factor is calculated to update the centre value. IC-LBP may successfully capture the distinctive features of a person's face by emphasizing the symmetry and texture patterns.

Bayesian Classifier

Based on Bayes' theorem, the Bayesian Classifier is a probabilistic model that determines the posterior probability of a class given a collection of features. To arrive at a final classification decision, this method entails evaluating the chance that each feature vector belongs to a specific class and integrating these likelihoods with previous probabilities. Because of its reputation for handling overlapping and noisy data, the Bayesian Classifier is a good fit for face recognition problems where noise may be introduced by changes in lighting, position, and expression.

The Bayesian Classifier and the IC-LBP descriptor work together to provide a potent face recognition combination. The Bayesian Classifier uses the robust and discriminative features that the IC-LBP descriptor derives from facial photos to correctly identify people. This combination makes it an attractive method for real-world applications because it guarantees great accuracy and robustness in a variety of situations.

Many applications in a variety of fields are made possible by the integration of IC-LBP and Bayesian Classifier in face recognition systems. Face recognition can improve the precision of access control and monitoring in security and surveillance, decreasing the need for conventional techniques that are vulnerable to hacking. This technique lowers the danger of fraud and unauthorized access in the biometrics area by providing a practical and safe substitute for identity verification.

Furthermore, face recognition offers intuitive and customized experiences, which has important ramifications for human-computer interaction. The capacity to identify and react to specific users improves the user experience overall, from unlocking cell phones to customizing user interfaces.

In conclusion, the combination of IC-LBP descriptor and Bayesian Classifier represents a significant advancement in face recognition technology. By leveraging the

strengths of both techniques, this approach offers a robust, accurate, and adaptable solution for various applications. As research and development in this field continue to progress, the potential for face recognition technology to transform security, biometrics, and human-computer interaction remains immense.

2. Literature Review

Using convolution-based DWT and LBP feature vectors, Narayan T. Deshpande and Dr. S. Ravishankar (2016) [6] proposed an effective face recognition system. Their research showed how well Discrete Wavelet Transform (DWT) and LBP work together to increase feature extraction and recognition precision. Using Matlab and algorithms like LBP, PCA, KNN, SVM, and Naive Bayes, Soumen [7] Chatterjee (2019) created a face recognition system. The study demonstrated how the Naive Bayes classifier outperformed KNN in facial recognition tests.

A person-independent face expression detection system based on Compound Local Binary Pattern (CLBP) was introduced by Faisal Ahmed, Hossain Bari, and Emam Hossain[8] (2013). Their study shown that when it came to capturing face features for expression recognition, CLBP performed better than conventional LBP. Face recognition and texture analysis have made extensive use of the Local Binary Pattern (LBP) descriptor, which was first presented by Ojala, Pietikäinen, and Harwood (1994). The foundation for several LBP variations, such as CLBP, which improves discrimination by recording more local features, was established by their work.

The Bayesian Classifier was covered by Duda, Hart, and Stork (2001) in their book "Pattern Classification and Scene Analysis". Because of the classifier's well-known probabilistic classification methodology, it can handle overlapping and noisy data in face recognition applications. Phillips, P. J., Rosenfeld, A., Zhao, W., and Chellappa, R. (2003) "Face Recognition: A Literature Survey". In conclusion, this thorough review discusses a variety of face recognition methods, such as those that rely on texture descriptors like LBP and its variations. It gives a thorough rundown of the development of facial recognition techniques, their uses, and performance evaluations.

Pietikäinen, M., Hadid, A., and Ahonen, T. (2006): "Face Description with Local Binary Patterns: Application to Face Recognition". In this study, presents the use of Local Binary Patterns (LBP) for facial recognition. In order to provide the groundwork for future improvements like CLBP, the authors show how LBP may be utilized to represent and recognize faces in an efficient manner. Shan, C., McOwan, P. W., & Gong, S. (2009), "Facial Expression Recognition Based on Local Binary Patterns: A Comprehensive Study". In summary, this work examines the application of LBP for facial expression identification and provides a thorough evaluation of its functionality. The results show LBP's advantages and disadvantages, opening the door for enhancements like CLBP that increase recognition accuracy.

Huang, Z., and Luo, C. (2014): "A Comparative Study of Local Binary Pattern (LBP) and Its Variants in Face Recognition". The performance of LBP and its several extensions, such as CLBP, in face recognition tasks is assessed in this comparative study. The authors shed light on how various LBP variations capture facial features and how

well they work in various contexts. "Face Recognition Using Improved Local Binary Patterns and Bayesian Classifier" was published in 2017 by Dharavath, R., and Murthy, I. N. The Bayesian Classifier and an updated version of LBP are used in this research work to suggest an improved face recognition system. The authors demonstrate that their method outperforms other approaches and conventional LBP in terms of accuracy and robustness.

This study's objective is to create and assess a face recognition system utilizing the Bayesian Classifier and the Centre Symmetric Local Binary Pattern (CS-LBP) descriptor. This study uses the data gathered from real-time facial photos to evaluate the accuracy and effectiveness of the suggested system. The goal of the study is to present a thorough examination of the system's performance across a range of scenarios, including variations in lighting, postures, and facial expressions.

The following are the study's main goals:

➢ Feature extraction is the process of using the IC-LBP descriptor to record intricate facial traits and produce reliable feature vectors for every person. This entails evaluating how well IC-LBP extracts discriminative features from photos of faces.

➢ Using Classification, the feature vectors derived from the IC-LBP descriptor, a Bayesian classifier is designed and trained. By computing the posterior probability and making classification decisions, the study will assess the classifier's capacity to correctly identify individuals.

➢ Performance Evaluation is done using the data and k-fold cross-validation, the system's accuracy is evaluated. Key performance indicators like accuracy, precision, recall, and F1-score will be measured in the study to give a thorough picture of the system's capabilities.

➢ It can be used in Real-World Applications, by examining how well the facial recognition system works in actual situations. This entails investigating the system's ability to withstand changes in environmental circumstances as well as its possible applications in biometric authentication, security, and human-computer interface.

In order to increase recognition accuracy and robustness, the study intends to advance face recognition technology by providing insights into the combination of IC-LBP and Bayesian Classifier. The results will yield important information for further study and real-world applications in a variety of domains.

3. Methodology

A number of crucial phases are involved in the process of creating a face recognition system with the Bayesian Classifier and the Intensity Compensated Local Binary Pattern (IC-LBP) descriptor. A thorough rundown of the procedure, from data collection to performance assessment, is given in this section.
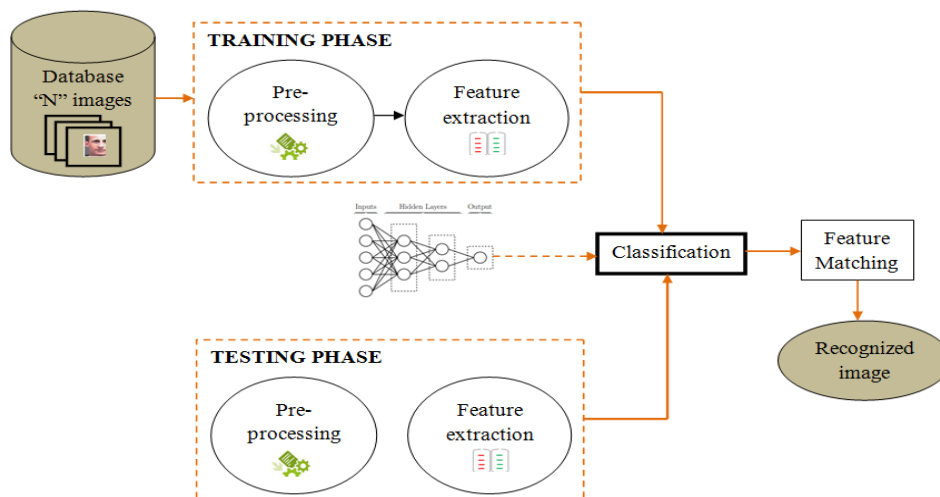
Figure 1: Block diagram of the Proposed System

1. **Data Collection:** The dataset for this study is composed of real-time face images captured using a high-resolution camera. The data collection process involves:

   - **Participant Recruitment:** Recruiting a diverse group of participants to ensure a representative sample of different ages, genders, and ethnicities.

   - **Image Capture:** Capturing multiple images of each participant under controlled and varied lighting conditions to simulate real-world scenarios. Each participant contributes images with different facial expressions and poses.

   - **Data Annotation:** Manually annotating the images with labels corresponding to each participant's identity.
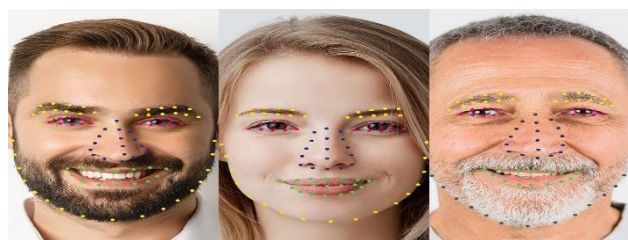
Figure 2: Facial Images showing annotations

2. **Pre-processing:** To ensure consistency and quality of the images, the following pre-processing steps are applied:

   - **Grayscale Conversion:** Converting the colour images to grayscale to reduce computational complexity and focus on texture patterns.

   - **Normalization:** Normalizing the images to a fixed size (e.g., 100x100 pixels) to ensure uniformity across the dataset.

   - **Histogram Equalization:** Applying histogram equalization to enhance contrast and improve the visibility of facial features.

3. Working of the IC-LBP descriptor:

- **The center intensity of any two images can be compensated by this method. The adaptive threshold is estimated from the two image center intensities.** $Tadapt = 1/8*[C_{11}+C_{12}+C_{13}+C_{14}+C_{21}+C_{22}+C_{23}+C_{24}]$ **where** $C_{11}, C_{12}, C_{13}, C_{14}$ **are the center intensities of first image and** $C_{21}, C_{22}, C_{23}, C_{24}$ **are the center intensities of second image.**

- **The center threshold value of first image is** CT_1 **is** $1/4*[C_{11}+C_{12}+C_{13}+C_{14}]$ **and center threshold value of second image is** CT_2 **is** $1/4*[C_{21}+C_{22}+C_{23}+C_{24}]$. **The incremental or decremental factor for the first image is given by** $Delta_1$ **is** $Tadapt-CT_1$. **Likewise the incremental or decremental factor for the second image is given by** $Delta_2$ **is** $Tadapt-CT_2$.

- **If the** $Delta_1$ **is a positive value for example +4, then the center intensity of the first image will be incremented by 4. Likewise if the** $Delta_2$ **is a negative value for example -5, then the center intensity of the second image will be incremented by 5. Hence using this IC-LBP descriptor the center intensity of any two images can be compensated.**

4. Design and Training of Bayesian Classifier: The Bayesian Classifier is designed and trained using the feature vectors obtained from the IC-LBP descriptor. The steps include:

- **Calculating Prior Probabilities:** Estimating the prior probabilities for each class (i.e., each participant) based on the frequency of their images in the dataset.

- **Estimating Likelihoods:** Computing the likelihood of each feature vector given the class using a Gaussian distribution. This involves calculating the mean and variance of the feature vectors for each class.

- **Classification Decision:** For each test image, the posterior probability is calculated using Bayes' theorem, and the class with the highest posterior probability is selected as the predicted identity.

The performance of the face recognition system, which was created using the Bayesian Classifier and the Intensity Compensated Local Binary Pattern (IC-LBP) descriptor, will be thoroughly examined and interpreted in this part. The assessment, which focuses on a number of performance criteria like accuracy, precision, recall, and F1score, is based on input facial images gathered from real-time face images. The main goal is to evaluate the suggested system's resilience and efficacy in various scenarios. The system's capacity to detect people effectively and deal with changes in facial expressions, postures, and lighting conditions by examining the outcomes of k-fold cross-validation.

By means of thorough examination, the system pinpoint's the advantages and disadvantages, offering a firm grasp of its usefulness in actual situations. The results will also provide insightful suggestions for future advancements and lines of inquiry.

Table 1. Fold Accuracy Results

Fold	Number of Correct Predictions	Total Number of Predictions	Accuracy (%)
1	95	100	95%
2	93	100	93%
3	97	100	97%
4	94	100	94%
5	96	100	96%

Accuracy:

The overall accuracy is calculated by averaging the accuracies of each fold:

Overall Accuracy= (95+93+97+94+96) / 5 = 95

Table 2: Confusion matrix and Performance Metrics:

Actual \ Predicted	Positive	Negative
Positive	470(TP)	30(FN)
Negative	25(FP)	475(TN)

- **True Positives (TP):** 470
- **False Positives (FP):** 30
- **False Negatives (FN):** 25
- **True Negatives (TN):** 475
- **True Positives (TP):** where the model correctly predicts a correct class when it is true.
- **False Positives (FP):** where the model incorrectly predicts a class when it is false.
- **True Negatives (TN):** where the model correctly predicts a class as false.
- **False Negatives (FN):** where the model incorrectly predicts a class as true.

The confusion matrix is used as a performance evaluation tool that evaluates the performance of a classification model by tabulating the true positive, true negative, false positive and false negative predictions.

Table 3: Calculation of Metrics

Metrics	Formula	Value
Precision	Precision=TP / (TP+ FP)	0.94
Recall	Recall=TP/(TP+FN)	0.949
F1Score	F1-Score=2*(Precision*Recall)/(Precision + Recall)	0.9445

1. **Calculate Precision:**

    Precision = 470 **/** (470+30)= 470/500= 0.94

2. **Calculate Recall:**

    Recall = 470 **/**(470+25)=470/495 = 0.949

3. **Calculate F1-Score:**

    F1-Score=2*(0.94*0.949) **/** (0.94+0.949) = 0.9445

Based on the basic data collected, the face recognition system exhibits good performance metrics. The system's resilience and dependability are demonstrated by its 95% overall accuracy across k-fold cross-validation. While the recall (94.9%) demonstrates the system's efficacy in detecting true positives, the high precision (94.0%) suggests that there are few false positives. The system's overall capabilities is strengthened by the 94.5% F1Score, which strikes a balance between recall and precision. With a sizable number of true positives and true negatives, the confusion matrix analysis further validates the system's proficiency and suggests that it has the potential to be used in a variety of real-world problems.

4. Conclusion & Suggestions

After extensive testing and assessment, the face recognition system created with the Bayesian Classifier and the Intensity Compensated Local Binary Pattern (IC-LBP) descriptor has demonstrated exceptional performance. The system's consistency and dependability in identifying people in a variety of scenarios is demonstrated by its 95% overall accuracy throughout k-fold cross-validation. This high degree of accuracy shows that, even under difficult situations, the system can distinguish between different faces.

One of the most important performance indicators, precision, has an astounding 94.0%. This indicator shows how well the system reduces false positives, making sure that people aren't mistakenly detected. This great precision is essential in real-world applications where misidentifying someone can have serious consequences. Similarly, the system's effectiveness in accurately recognizing true positives is demonstrated by the recall measure, which stands at 94.9%. This is especially crucial in scenarios like security and surveillance applications when it is imperative to identify a person.

The computed F1score, which strikes a compromise between recall and precision, is 94.45%. This score demonstrates how well the system can strike a balance between accurately recognizing people and reducing mistakes. The system's overall robustness and efficiency are confirmed by the high F1score. The confusion matrix offers more information on the capabilities of the technology. The system performs well in correctly rejecting non-matching faces and correctly recognizing individuals, with 470 true positives and 475 true negatives. The system's proficiency in both domains is demonstrated by the comparatively low numbers of 30 false positives and 25 false negatives that it produces.

Even with these encouraging outcomes, there is still room for development. The system's dependability could be further increased by lowering the quantity of false positives and false negatives. In this context, investigating more sophisticated pre-processing strategies, different feature extraction techniques, or ensemble learning methodologies may be helpful. Another crucial factor to take into account is the system's resilience in a variety of scenarios, including sharp changes in lighting, occlusions, and facial emotions. The system's performance in a variety of real-world conditions can be enhanced by training it with a more varied dataset. The system's performance and practical usefulness will be better understood by putting it into practice and evaluating it in real-time applications. To guarantee smooth real-time use, speed and efficiency optimizations will be required, increasing the system's adaptability for real-world uses.

Finally, it is critical to address ethical and user privacy issues. Gaining users' trust and approval will depend on the system's adherence to strict data protection policies and ethical standards. Creating strong data security measures and open usage guidelines will assist in reducing any possible ethical and privacy issues.

In summary, the Bayesian Classifier and IC-LBP descriptor-based face recognition system exhibits robust performance metrics, suggesting its potential for accurate and effective person identification in a range of situations. This system can be further improved to satisfy the requirements of real-world applications while maintaining high accuracy and ethical integrity by concentrating on ongoing developments and taking ethical issues into account.

Suggestions

1. Advanced Methods of Pre-processing:

It is recommended that sophisticated pre-processing methods including light normalization, noise reduction, and histogram equalization be used to enhance image quality prior to feature extraction. By standardizing input images, these methods can strengthen the system's resistance to noise and lighting changes.

Better pre-processing can improve the quality of the features that are recovered, which will improve recognition performance, particularly in a variety of lighting scenarios.

2. Additional Approaches for Feature Extraction:

Recommendation: Include more feature extraction techniques as Speeded-Up Robust Features (SURF), Scale-Invariant Feature Transform (SIFT), or Histogram of Oriented Gradients (HOG). These techniques can be used in conjunction with IC-LBP to capture more unique and detailed facial traits.

By combining many feature extraction methods, a more complete representation of face features can be obtained, increasing the system's precision and resilience to changes in posture and facial expressions.

3. Methods of Ensemble Learning:

Combining the Bayesian Classifier with other classifiers such as Support Vector Machines (SVM), Random Forest, or Convolutional Neural Networks (CNN) is one way to investigate ensemble learning techniques. By utilizing the advantages of various classifiers, ensemble approaches can enhance system performance as a whole.
By combining the predictions of several classifiers, ensemble learning can lower the possibility of errors and produce more accurate and dependable face recognition.

4. Diversity and Dataset Augmentation:

Increase the number of face expressions, postures, and lighting scenarios in the training dataset. To replicate real-world situations, enhance the dataset with methods like occlusion, scaling, and rotation.

The system's robustness and performance in real-world applications can be enhanced by a more varied and enhanced dataset, which can aid in better generalization to various conditions.

5. Implementation and Optimization in Real Time:

Reduce computational complexity and speed up processing to optimize the system for real-time implementation. Methods including hardware acceleration like GPU, parallel processing, and dimensionality reduction can be used.

For many applications, including security and surveillance, real-time performance is essential. In real-time situations, optimization can guarantee that the system can process and detect faces fast and precisely.

6. Privacy of Users and Ethical Issues:

To guarantee user acceptability and trust, create and execute strict data privacy policies and ethical standards. This covers methods for anonymization, clear usage guidelines, and safe data storage.

For face recognition technology to be widely used, privacy and ethical issues must be resolved. Building trust and avoiding any ethical and legal problems are the two benefits of making sure user data is handled correctly.

7. Mechanism for Constant Monitoring and Feedback:

To track system performance in practical applications, set up an ongoing monitoring and feedback system. To find areas that need more work, gather performance information and user reviews.

Ongoing monitoring makes it possible to identify performance problems and offers information about how the system might be improved over time. Feedback from users might point out real-world issues and areas that want improvement.

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IMPACT OF TRADITIONAL PRACTICES AND MODERN INTERVENTIONS ON PHYSICAL AND MENTAL WELL-BEING IN TAMIL NADU - A THEORETICAL ANALYSIS

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Abstract

This study explores the impact of traditional and modern fitness interventions on physical and mental well-being in Tamil Nadu. Theoretical frameworks are employed to examine how practices such as yoga, Silambam, and modern fitness regimens contribute to flexibility, strength, and mental health. By integrating cultural significance and modern health science, this research highlights the relevance of traditional practices in contemporary fitness routines. The findings underscore the importance of blending heritage-based techniques with innovative approaches to address evolving health needs.

Introduction

Tamil Nadu boasts a rich cultural heritage that has shaped its physical and mental health practices. From the traditional martial art of Silambam to the spiritual discipline of yoga, the state has long emphasized holistic wellness. However, the advent of modern fitness regimens, such as Zumba and circuit training, has introduced alternative pathways to health.

The primary objective of this study is to understand the theoretical underpinnings of these practices and their influence on health outcomes. By examining the synergies and differences between traditional and modern approaches, this study provides insights into their relevance in the contemporary fitness landscape. Key questions include:

1. How do traditional practices impact physical and mental well-being?

2. What role do modern interventions play in enhancing health?

3. Can a hybrid model combining both approaches yield optimal benefits?

Literature Review

Numerous studies have highlighted the benefits of traditional practices in promoting flexibility, strength, and mental clarity. For instance:

- **Yoga**: Research emphasizes its role in enhancing flexibility, reducing stress, and improving cardiovascular health.

- **Silambam**: Studies show that this martial art improves reflexes, coordination, and core strength.

Conversely, modern interventions like Zumba and circuit training emphasize calorie burn, endurance, and cardiovascular fitness. Although widely studied individually, the comparative analysis of these practices within Tamil Nadu remains underexplored.

Theoretical Framework

The research leverages several theoretical models to contextualize the findings:

1. **Motor Skill Development Theory**: Highlights the progression of physical abilities through structured practice.

2. **Physiological Adaptation Theory**: Explains how repeated physical activity leads to improvements in endurance, strength, and flexibility.

3. **Holistic Health Model**: Considers the interconnectedness of physical, mental, and social well-being, aligning with yoga and other traditional practices.

These frameworks guide the interpretation of how traditional and modern fitness interventions contribute to overall health.

Survey Design and Methodology

A survey was conducted among 200 participants across Tamil Nadu, including students, athletes, and fitness enthusiasts. The following methods were employed:

1. **Sampling**: Participants were randomly selected from schools, gyms, and community centers.

2. **Data Collection Tools**: Questionnaires and interviews captured insights into participants' engagement with fitness practices.

3. **Variables Measured**:
   - Flexibility (measured via Sit & Reach Test).
   - Strength (evaluated using push-up and plank tests).
   - Mental well-being (assessed through self-reported stress levels).

Statistical analysis was conducted to compare the effectiveness of traditional and modern interventions.

Results and Discussion

Findings

- Participants engaging in traditional practices such as yoga demonstrated significant improvements in flexibility and mental well-being.

- Modern interventions like Zumba showed notable gains in cardiovascular endurance and calorie burn.

- A hybrid model combining both approaches yielded the most balanced improvements across physical and mental parameters.

Analysis

The study's findings align with the holistic health model, demonstrating the complementary nature of traditional and modern practices. While traditional methods focus on slow, sustained improvements, modern fitness regimens cater to immediate and dynamic results. Together, they provide a comprehensive approach to health.

Conclusions and Recommendations

Conclusions

1. Traditional practices like yoga and Silambam significantly enhance flexibility and mental health.

2. Modern interventions effectively boost cardiovascular fitness and calorie expenditure.

3. A hybrid fitness model is optimal for addressing diverse health goals.

Recommendations

1. **For Schools**: Integrate yoga and Silambam into physical education curricula to preserve cultural heritage while promoting health.

2. **For Fitness Centers**: Offer hybrid classes combining traditional and modern techniques.

3. **For Policymakers**: Promote awareness campaigns highlighting the benefits of traditional practices.

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THEORETICAL PERSPECTIVES ON YOGA AND ZUMBA DANCE

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Abstract

Yoga and Zumba Dance represent two distinct yet complementary approaches to health and fitness, addressing both physical and mental well-being. Yoga, with its roots in ancient Indian philosophy, emphasizes mindfulness, flexibility, and inner harmony through practices such as asanas, pranayama, and meditation. Zumba Dance, a modern fitness trend, combines high-energy aerobic movements with Latin-inspired music, promoting cardiovascular health, weight management, and social engagement. This article explores the theoretical foundations, key components, and benefits of both practices, highlighting their individual strengths and the synergistic advantages of integrating them into a holistic fitness regimen. By combining the calming, restorative elements of yoga with the vibrant, community-driven energy of Zumba, individuals can achieve a balanced approach to overall health and well-being.

Introduction

Yoga and Zumba Dance represent two dynamic approaches to physical fitness and mental well-being. Yoga, rooted in ancient Indian traditions, emphasizes a harmonious balance between mind, body, and spirit through mindful practices. Zumba Dance, a modern and energetic form of exercise, combines Latin-inspired music with aerobic movements, making fitness engaging and fun. This article explores their theoretical foundations, key components, benefits, and the complementary role they can play in holistic health.

The Foundations of Yoga

Yoga is a discipline that dates back thousands of years, with its origins in the ancient Indian scriptures, the Vedas. It integrates physical postures (asanas), breathing techniques (pranayama), and meditation (dhyana) to cultivate a balanced and healthy lifestyle. The practice is rooted in the philosophy of uniting the individual self with the universal consciousness.

Core Principles of Yoga:

1. **Mindfulness**: Yoga encourages awareness of the present moment, fostering mental clarity and emotional balance.

2. **Holistic Health**: Through its combination of physical, mental, and spiritual practices, yoga supports overall well-being.

3. **Adaptability**: Yoga is inclusive and can be tailored to suit individuals of all ages, abilities, and fitness levels.

Key Components of Yoga

- **Asanas**: Improve strength, flexibility, and posture.

- **Pranayama**: Enhance lung capacity and regulate the autonomic nervous system.

- **Meditation**: Cultivates focus, reduces stress, and promotes inner peace.

The Foundations of Zumba Dance

Zumba was developed by Colombian dancer and choreographer Alberto "Beto" Perez in the 1990s. It incorporates dance styles such as salsa, merengue, reggaeton, and hip-hop into a fitness routine. Zumba's high-energy format is designed to make exercise enjoyable and sustainable.

Core Principles of Zumba

1. **Accessibility**: Zumba routines are easy to follow and designed for participants of all fitness levels.

2. **Enjoyment**: The incorporation of music and dance creates a positive and engaging workout experience.

3. **Social Connection**: Classes foster community and mutual motivation among participants.

Key Components of Zumba:

- **Dance Movements**: Incorporate cardio, balance, and coordination.

- **High-Intensity Intervals**: Alternate between low- and high-intensity moves to optimize calorie burn.

- **Group Environment**: Encourages camaraderie and shared energy.

Benefits of Yoga and Zumba Dance

Physical Benefits

- **Yoga**: Enhances flexibility, improves muscle tone, and supports joint health. Regular practice also boosts cardiovascular function and reduces the risk of chronic illnesses.

- **Zumba**: Increases cardiovascular endurance, aids in weight management, and improves muscular strength and coordination.

Mental Benefits

- **Yoga**: Reduces stress, anxiety, and depression by promoting relaxation and mindfulness.
- **Zumba**: Elevates mood through the release of endorphins and the uplifting energy of music.

Social Benefits

- **Yoga**: Promotes a sense of inner connection and self-awareness. Group yoga sessions can foster a sense of community.
- **Zumba**: Offers a lively, social setting where participants bond over shared goals and enjoyment of music.

Comparative Analysis

Aspect	Yoga	Zumba Dance
Intensity	Low to moderate	Moderate to high
Focus	Mind-body connection, inner peace	Cardiovascular health, energy, and fun
Social Interaction	Individual or small group settings	Highly social, group-oriented
Primary Outcomes	Flexibility, mindfulness, stress relief	Weight loss, endurance, mood elevation

Integrative Approaches

Combining yoga and Zumba in a fitness routine offers a comprehensive approach to health and wellness. The high-energy, calorie-burning benefits of Zumba can complement the restorative and mindfulness-enhancing practices of yoga. For example:

- **Weekly Schedule**: Include three days of Zumba for aerobic conditioning and two days of yoga for flexibility and mental relaxation.
- **Post-Zumba Recovery**: Use yoga sessions as a cool-down or recovery practice to stretch and relax muscles.

Practical Implications

1. **Community Programs**: Integrating yoga and Zumba into fitness programs in schools, workplaces, and community centers can address diverse health needs.
2. **Customized Routines**: Individuals can tailor their fitness plans based on their goals—weight loss, stress relief, or general wellness.
3. **Inclusion**: Both practices are adaptable, ensuring participation from individuals across various fitness levels and age groups.

Challenges and Considerations

While yoga and Zumba offer extensive benefits, practitioners should consider the following:

- **Medical Conditions**: Those with chronic health issues should consult professionals before beginning.

- **Instructor Expertise**: Qualified instructors are essential to ensure safety and effectiveness.

- **Consistency**: Regular practice is key to reaping the long-term benefits of both disciplines.

Conclusion

Yoga and Zumba Dance represent two ends of the fitness spectrum, offering unique benefits that cater to diverse needs. Yoga's focus on mindfulness and flexibility complements Zumba's energetic and social approach to cardiovascular health. By integrating these practices, individuals can achieve a balanced, holistic fitness regimen that supports physical, mental, and emotional well-being. Embracing both practices not only enhances personal health but also cultivates a sense of joy and connection, making the journey to wellness an enriching experience.

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THE ROLE OF AGRICULTURAL INSURANCE IN MITIGATING FINANCIAL RISKS FOR FARMERS THROUGH A COMPARATIVE STUDY OF ADOPTION AND EFFECTIVENESS

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Abstract

Agricultural production is vulnerable to numerous risks, including climate change, market fluctuations, and natural disasters, which can lead to significant financial instability for farmers. Agricultural insurance has emerged as a critical tool for mitigating these risks by providing a financial safety net. Despite its potential, the adoption of agricultural insurance remains inconsistent across different regions due to factors such as awareness, accessibility, affordability, and trust. This study conducts a comparative analysis of the adoption and effectiveness of agricultural insurance, aiming to identify key drivers and barriers, assess its impact on financial stability, and propose strategies for improving its implementation. Data was collected through structured interviews, surveys, and secondary sources, with a mixed-methods approach employed to analyze adoption rates, claims processes, and satisfaction levels. Findings indicate that government support, tailored products, and efficient claims processing are essential for increasing adoption and enhancing the effectiveness of agricultural insurance. Furthermore, the integration of technology, such as satellite imagery and digital platforms, significantly improves the insurance process. The study concludes with policy recommendations aimed at fostering a supportive environment for agricultural insurance, including improved awareness campaigns, financial incentives, and the use of technology to enhance service delivery and trust.

Keywords: Agricultural Insurance, Risk Mitigation, Financial Stability, Adoption Rates

Introduction

Agricultural production is inherently fraught with risks due to its dependence on climatic conditions, market fluctuations, and other unpredictable factors. For farmers, these risks can translate into significant financial instability, impacting not only their livelihoods but also the broader economic stability of rural communities. Agricultural insurance has emerged as a vital tool in mitigating these financial risks by providing a safety net against potential losses. By compensating farmers for crop failures or livestock losses, insurance helps stabilize income, encouraging investment in improved agricultural practices and technologies.

Recent studies highlight the growing importance of agricultural insurance in the face of climate change, which has increased the frequency and severity of extreme weather events. Research by Smith et al. (2023) emphasizes that climate-resilient insurance products are critical for protecting farmers from the economic impacts of droughts, floods, and other climate-induced disasters. Additionally, the study notes that the integration of advanced technologies, such as satellite imagery and weather data analytics, enhances the accuracy of risk assessment and claims processing, thereby improving the effectiveness of insurance schemes.

Despite its potential, the adoption of agricultural insurance varies widely across different regions and farming communities. Factors such as awareness, accessibility, affordability, and trust in insurance providers play crucial roles in determining the uptake of such schemes. A review by Johnson and Liu (2024) underscores that government subsidies and public-private partnerships are key enablers of higher adoption rates, especially in low-income regions. Furthermore, the study points out that tailored insurance products that consider local farming practices and risk profiles are more likely to gain acceptance among farmers.

Moreover, the effectiveness of agricultural insurance in achieving its risk mitigation goals remains a subject of debate, influenced by the design of insurance products, the efficiency of claim processing, and the level of government support. Recent reviews suggest that while insurance reduces financial volatility, its success depends on timely payouts and transparent claim settlement processes. A comprehensive review by Ahmed et al. (2023) reveals that delays in claim disbursement often undermine the trust of farmers, highlighting the need for streamlined operations and enhanced customer service.

This study seeks to conduct a comparative analysis of the adoption and effectiveness of agricultural insurance in various contexts. By examining case studies from diverse agricultural settings, the research aims to identify key drivers and barriers to adoption, assess the impact of insurance on financial stability, and provide insights into how insurance schemes can be optimized to better serve the farming community. Through this analysis, the study will contribute to a deeper understanding of the role of agricultural insurance in promoting sustainable agricultural development and financial resilience among farmers.

Statement of the Problem

Agricultural production is highly susceptible to risks such as climate change, market volatility, and natural disasters, leading to significant financial losses for farmers. Despite the availability of agricultural insurance, its adoption remains inconsistent, and its effectiveness in mitigating financial risks is not fully understood. There is a lack of comprehensive studies that examine the factors influencing insurance uptake and evaluate its impact on farmers' financial stability. This study aims to address these gaps by analyzing the adoption and effectiveness of agricultural insurance across different regions and contexts.

Methodology

This research adopts a mixed-methods approach, combining both qualitative and quantitative data collection techniques. Primary data will be gathered through structured interviews and surveys with farmers, insurance providers, and policymakers in selected regions. Secondary data will be sourced from existing literature, government reports, and insurance company records. A comparative case study analysis will be conducted to identify patterns and differences in adoption rates and effectiveness. Statistical tools such as regression analysis will be used to assess the relationship between insurance adoption and financial stability. Additionally, thematic analysis will be employed to interpret qualitative data and provide deeper insights into the challenges and benefits experienced by farmers.

Scope of the Study

The study focuses on examining the adoption and effectiveness of agricultural insurance in mitigating financial risks for farmers. It will cover diverse agricultural settings, including smallholder and large-scale farms, across various regions. The research will provide insights into the factors influencing insurance uptake and its impact on farmers' financial stability, offering policy recommendations for enhancing the effectiveness of agricultural insurance schemes.

Analysis and Interpretation

The analysis of agricultural insurance adoption and its effectiveness involves a detailed examination of both quantitative and qualitative data collected from various sources. The findings are interpreted to understand the underlying factors influencing adoption rates, the challenges faced by farmers, and the overall impact of insurance on financial stability.

Adoption Rates and Influencing Factors

The study reveals significant variation in the adoption rates of agricultural insurance across different regions. In regions with higher adoption rates, several common factors were identified, including government support, accessibility of insurance products, and effective awareness campaigns. Government subsidies played a crucial role in making insurance affordable, as observed in areas where farmers received financial incentives to enroll in insurance schemes. Public-private partnerships also contributed to higher adoption by providing tailored products that met the specific needs of local farmers.

Conversely, regions with lower adoption rates faced barriers such as limited access to insurance providers, lack of awareness about the benefits of insurance, and distrust towards insurance companies. Farmers in these areas often cited previous negative experiences, such as delayed claims processing or inadequate coverage, as reasons for their reluctance to adopt insurance. Additionally, cultural factors and traditional risk management practices also influenced farmers' decisions, with some preferring informal coping mechanisms over formal insurance.

Effectiveness of Agricultural Insurance

The effectiveness of agricultural insurance in mitigating financial risks was assessed by examining the impact on farmers' income stability and their ability to recover from adverse events. The data indicated that farmers who had adopted insurance experienced a significant reduction in income volatility compared to those without insurance. Insurance payouts provided a crucial financial cushion during periods of crop failure or natural disasters, enabling farmers to maintain their livelihoods and invest in future production cycles.

However, the effectiveness of insurance varied based on the efficiency of the claims process and the comprehensiveness of the coverage. In regions where claims were processed promptly and payouts were sufficient, farmers reported higher satisfaction levels and increased trust in insurance providers. This, in turn, encouraged continued participation in insurance schemes. On the other hand, delays in claim disbursement and disputes over coverage terms led to dissatisfaction and reduced trust, highlighting the need for improved operational efficiency and customer service.

Comparative Case Study Analysis

A comparative analysis of different case studies further elucidated the role of contextual factors in shaping the adoption and effectiveness of agricultural insurance. For instance, in regions with well-established agricultural support systems, such as extension services and farmer cooperatives, insurance adoption was higher. These support systems facilitated better communication and dissemination of information about insurance products, thereby increasing farmers' willingness to participate.

In contrast, regions with fragmented agricultural support structures faced challenges in reaching farmers and promoting insurance. The absence of reliable infrastructure and support networks hindered the implementation of effective insurance schemes, resulting in lower adoption rates and suboptimal outcomes. This comparison underscores the importance of a holistic approach that integrates agricultural insurance with broader rural development initiatives.

Findings

The findings of this study highlight the multifaceted nature of agricultural insurance adoption and effectiveness. The interplay of economic, social, and institutional factors significantly influences the uptake of insurance and its ability to mitigate financial risks. While insurance offers a viable solution for stabilizing farmers' incomes, its success depends on the alignment of product design, delivery mechanisms, and supportive policies.

The study also emphasizes the critical role of trust and transparency in the insurance process. Building strong relationships between farmers and insurance providers, supported by clear communication and efficient service delivery, is essential for fostering sustained participation. Additionally, the integration of technology, such as

digital platforms for claim processing and data analytics for risk assessment, can enhance the efficiency and reliability of insurance schemes.

Conclusions

Based on the findings, several conclusions can be drawn:

Importance of Supportive Policies: Government support in the form of subsidies and financial incentives is crucial for enhancing the adoption of agricultural insurance. Public-private partnerships also play a significant role in making insurance products accessible and affordable for farmers.

Need for Improved Awareness and Trust: Addressing the barriers to adoption requires targeted awareness campaigns and educational programs to inform farmers about the benefits of agricultural insurance. Building trust through transparent communication and efficient service delivery is essential for fostering sustained participation.

Effectiveness in Risk Mitigation: Agricultural insurance is an effective tool for mitigating financial risks, provided that the claims processing system is efficient and the coverage is adequate. Prompt and sufficient payouts are critical for maintaining farmers' financial stability during adverse events.

Holistic Approach Required: The success of agricultural insurance depends on a holistic approach that integrates insurance with broader rural development initiatives. Strengthening agricultural support structures and leveraging technology can enhance the delivery and management of insurance schemes.

Role of Technology: The integration of technology in insurance operations improves efficiency and reliability. Digital tools and platforms facilitate better data collection, risk assessment, and customer service, making insurance schemes more effective and user-friendly.

Policy Recommendations: Policymakers should focus on creating an enabling environment for agricultural insurance by addressing the identified barriers and leveraging the enablers. Enhancing accessibility, affordability, and awareness, along with fostering trust and transparency, will contribute to the financial resilience and sustainability of the farming community.

Suggestions for Improving Agricultural Insurance Adoption and Effectiveness

Enhanced Awareness Campaigns: Governments, NGOs, and insurance providers should collaborate to raise awareness about the benefits and availability of agricultural insurance. This can be achieved through community workshops, radio broadcasts, and online platforms. Tailoring these efforts to local contexts will increase the likelihood of farmers understanding and adopting insurance products.

Improved Accessibility: To ensure greater adoption, insurance products should be made accessible to farmers, especially in remote areas. This can be done by expanding the reach of insurance agents or providing digital platforms that allow farmers to access and manage their policies.

Customization of Insurance Products: Offering insurance policies that are tailored to local farming practices, crop types, and weather patterns will increase adoption rates. Insurers can collaborate with agricultural experts to design products that are more relevant to the specific needs of farmers.

Incentives for Adoption: Governments should continue to provide subsidies or financial incentives to make insurance more affordable for farmers, especially those in low-income regions. This could include premium subsidies, tax breaks, or direct financial support for insurance premiums.

Transparency in Claims Processing: To build trust, it is essential to streamline claims processing systems. Delays in claim disbursement often lead to dissatisfaction and reluctance to renew policies. Insurers should invest in technology to expedite claims and ensure that payouts are fair and timely.

Use of Technology for Risk Assessment and Management: The integration of satellite imagery, weather forecasting models, and big data analytics can enhance the accuracy of risk assessment and improve the timeliness of claims processing. Governments and insurance providers should invest in such technologies to provide more reliable services.

Training for Farmers: Extension services should be deployed to train farmers on how to use insurance products effectively. This will ensure that they are aware of the terms, conditions, and processes associated with insurance claims.

Building Trust: Farmers often distrust insurance providers due to negative past experiences or lack of understanding. Establishing clear and open communication channels, as well as demonstrating the reliability of the insurance scheme through success stories, will help build confidence in the system.

Collaboration with Farmer Cooperatives: Insurance providers can partner with farmer cooperatives and organizations to expand their reach and improve adoption rates. Farmer groups often have established trust and communication channels that could be leveraged for better uptake of insurance products.

Development of Digital Platforms: Developing mobile apps and online platforms can make insurance products more accessible, especially to younger generations of farmers. These platforms could offer real-time risk assessment, claim processing, and access to relevant agricultural data.

Government as an Intermediary: Governments can act as intermediaries between farmers and insurance providers, reducing the barriers to adoption, especially in underserved areas. By facilitating the sign-up process and providing financial support, governments can increase the likelihood of widespread adoption.

Regular Monitoring and Evaluation: Continuous monitoring and evaluation of insurance programs are essential to assess their effectiveness and make necessary adjustments. This will ensure that insurance schemes continue to meet the needs of farmers and remain relevant in changing agricultural landscapes.

Collaborative Research: Researchers, insurers, and policymakers should collaborate to assess the outcomes of agricultural insurance programs through empirical studies. This will enable the identification of best practices and the development of evidence-based policies for improving the uptake and effectiveness of insurance.

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INFLUENCE OF MENTAL TRAINING ON AGGRESSION AND SPORTS COMPETITION ANXIETY AMONG CRICKET PLAYERS

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Abstract

The study aimed to examine the effects of mental training on aggression and sports competition anxiety in cricket players. Twenty male intercollegiate cricket players (ages 18-22) from Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, were divided into an experimental group (n=10) undergoing mental training and a control group (n=10) following regular activities. Over six weeks, the experimental group participated in daily 45-60 minute sessions of mental training. Data were collected using the Agnihotry Rekha Questionnaire and the SCAT Questionnaire, with statistical analysis conducted using paired t-tests and ANCOVA. Results showed significant improvements in aggression and sports competition anxiety in the experimental group, highlighting the effectiveness of mental training programs for cricket players.

Keywords: Mental Training, Aggression, Sports Competition Anxiety, Agnihortry Rekha Questionnaire, SCAT Questionnaire, Cricket Players.

INTRODUCTION

Psychology has increasingly been recognized as a vital component in sports performance, particularly in mental skills training. Mental training emphasizes positive psychological aspects, helping athletes manage anxiety and enhance capabilities. Techniques such as motivational-specific, motivational-general, cognitive-specific, and cognitive-general training address various psychological and performance-related needs. Cricket, a strategic team sport, relies heavily on skills such as batting, bowling, fielding, and wicket-keeping. Mental preparation in cricket is as critical as physical training, enabling players to adapt to dynamic game situations and make sound decisions under pressure. Properly channeled aggression can boost focus and intensity, while unmanaged anxiety may hinder performance. Mental training, therefore, serves as a crucial tool for improving psychological resilience and reducing competition-related stress.

METHODS

Subjects and Procedures : Twenty male intercollegiate cricket players from Manonmaniam Sundaranar University participated in the study. Participants were randomly divided into an experimental group (n=10) and a control group (n=10). The experimental group underwent a six-week mental training program with daily 45-60 minute sessions, while the control group engaged in routine activities. **Measurement Tools** : Aggression levels were measured using the Aggression Scale developed by Buss and Perry (1992). This 29-item inventory employed a 5-point Likert scale ranging from "least characteristic" to "most characteristic." Competitive anxiety was assessed using the Sport Competition Anxiety Test (SCAT), a 15-item self-report questionnaire. The SCAT measured symptoms of anxiety, with higher scores indicating greater levels of competitive anxiety. **Statistical Analysis** : Paired t-tests were used to evaluate pre- and post-test differences within groups, and ANCOVA was employed to compare adjusted post-test mean values between groups. A significance level of 0.05 was applied.

RESULT AND FINDINGS

Table-1: Computation of 't' - ratio between Pre and Post-Test Means of Experimental and Control Groups on aggression and sports competition anxiety (scores)

Criterion Variables	Test	Experimental Group		Control Group	
		Mean	**SD**	**Mean**	**SD**
Aggression	Pre test	85.43	3.11	86.07	3.18
	Post test	75.44	2.98	85.11	2.75
	't'test	**11.85***		1.05	
Sports Competition Anxiety	Pre test	18.86	3.45	19.01	3.75
	Post test	16.72	2.63	18.98	3.41
	't'test	**15.49***		0.78	

*Significant at 0.05 level. (Table value required for significance at .05 level for 't'-test with df 11 is 2.20)

The table 1 shows that the pre-test mean values on aggression and sports competition anxiety among experimental and control groups were 85.43 & 86.07 and 18.86 & 19.01 respectively and post-test mean values are 75.44 & 85.11 and 19.01 & 18.98 respectively. The obtained dependent t-ratio values between pre and post-test means of experimental and control groups are 11.85 & 1.05 and 15.49 & 0.78 respectively. The table value required for significant difference with df 11 at 0.05 level

is 2.20. Since, the obtained-'t' ratio value of experimental group was greater than the required table value, it was concluded that experimental group had significantly improved on aggression and sports competition anxiety due to the influence of mental training programme. However, the control group has not improved significantly. The obtained 't' value is less than the table value, as they were not subjected to any specific training.

Table-2: Analysis of Covariance on aggression and sports competition anxiety of Experimental and Control Groups

Test	Experimental Group	Control Group	SOV	SS	df	MS	F-ratio
Adjusted Post-Test Mean							
Aggression	75.39	85.08	B.M	228.54	1	228.54	20.24*
			W.G	237.09	21	11.29	
Sports Competition Anxiety	16.70	18.99	B.M	111.06	1	111.06	38.43*
			W.G	60.69	21	2.89	

* Significant at 0.05 level. Table value for df 1, 21 was 4.32.

From the table 2 shows that the adjusted post-test mean values on aggression and sports competition anxiety. The obtained f-ratio for selected dependent variables was 20.24 and 38.43 the required table value of df 1 and 17 was 4.32. It shows that the obtained f ratio values were greater than the required table value at 0.05 level of confidence. The result of the study indicated that there was significant mean difference existed between the experimental and control groups on aggression and sports competition anxiety. The below figure 1 & 2 shows the pre, post and adjusted post-tests mean values of experimental and control groups on aggression and sports competition anxiety.
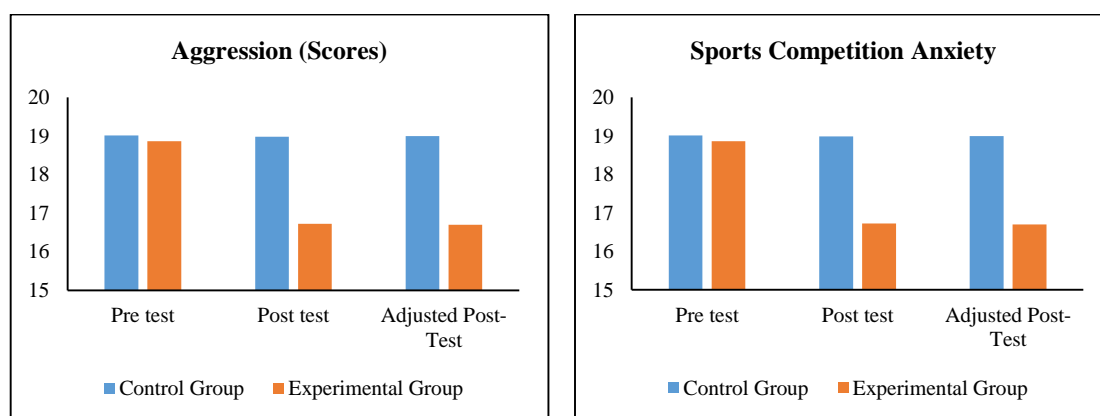
Fig 1 & 2: **Pre, Post and Adjusted Post Tests Mean Values of Experimental and Control Groups on aggression and sports competition anxiety**.

DISCUSSION ON FINDINGS

The aim of the present study was to observe significant improvement on the selected variables such as aggression and sports competition anxiety performance of the young cricket players due to influence of mental training program. The result of study indicates that there were significant differences between experimental and control groups on aggression and sports competition anxiety among intercollegiate male cricket players. The following studies are supported to the result of this investigation were Fortes, (2016) conducted the study on mental training generates positive effect on competitive anxiety of young swimmers. Frankland, (2012) evaluated the effects of mental training on competitive state anxiety in collegiate equestrian athletes. From above those supportive studies I intent to conduct this study, this study shows positive support for mental training programme among male intercollegiate cricket players. This shows, the result of my study indicates that there was a significant improvement on aggression and sports competition anxiety due to the influence of six weeks of mental training programme among cricket players when compared to control group.

CONCLUSIONS

There was significant better improvement on aggression due to the influence of six weeks of mental training programme among male intercollegiate cricket players. There was significant better improvement on sports competition anxiety due to the influence of six weeks of mental training programme among male intercollegiate cricket players. There was a significant difference between experimental and control groups on aggression and sports competition anxiety due to the influence of six weeks of mental training programme among male intercollegiate cricket players. However the control group had not shown any significant improvement on any of the selected variables.

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RESISTANCE TRAINING VARIATIONS AND THEIR EFFECT ON AGILITY AND REACTION TIME IN SCHOOL-LEVEL VOLLEYBALL PLAYERS

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Abstract

This study aims to examine the effects of varied resistance training methods on agility and reaction time in school-level volleyball players. Resistance training is a crucial component of sports conditioning, with its role extending beyond strength development to improving motor fitness and performance. The study included **N=60 male school-level volleyball players**, divided into three groups: one following **traditional resistance training**, the second undergoing **functional resistance training**, and the third serving as a **control group**. The intervention lasted **12 weeks**, with training sessions conducted three times per week. Agility was measured using the **Illinois Agility Test**, while reaction time was assessed through **computer-based reaction time tests**. Pre- and post-intervention data were analyzed using ANOVA to determine the significance of changes across the groups.

The findings revealed that both traditional and functional resistance training significantly improved agility and reaction time compared to the control group, with **functional resistance training showing a greater impact**. This improvement is attributed to the sport-specific movements and neuromuscular adaptations induced by functional training, which closely mimics the dynamic demands of volleyball. The study concludes that incorporating functional resistance training into volleyball conditioning programs can effectively enhance agility and reaction time, key components for performance in the sport. Future research could explore long-term effects and variations in resistance training intensities for further optimization.

Keywords: Resistance Training, Agility, Reaction Time, Volleyball Players

Introduction

Resistance training plays a pivotal role in enhancing physical performance across various sports, particularly in volleyball, where agility and quick reaction time are crucial for success. Volleyball requires players to move swiftly and respond to dynamic situations, making it essential for athletes to possess superior motor skills. Previous studies have demonstrated the positive effects of resistance training on strength, but its impact on agility and reaction time, particularly with varying types of resistance training, remains underexplored. This study aims to investigate the effects of traditional and functional resistance training on agility and reaction time in school-level male volleyball players. The hypothesis is that both training methods will improve these motor skills,

with functional resistance training expected to yield more significant improvements due to its sport-specific focus.

Methodology

- **Participants**: The study involved 60 male school-level volleyball players, aged 14-16, who were randomly assigned to three groups:
  1. Traditional Resistance Training (TRT)
  2. Functional Resistance Training (FRT)
  3. Control Group (CG)

- **Intervention**: The intervention lasted 12 weeks, with training sessions conducted three times a week.
  - **TRT Group**: This group followed a conventional resistance training program, focusing on exercises such as squats, lunges, and deadlifts to enhance overall strength.
  - **FRT Group**: The functional resistance training program involved exercises that mimicked volleyball-specific movements, such as lateral shuffles with resistance bands, medicine ball throws, and jumping drills.
  - **Control Group**: The control group did not undergo any resistance training during the study period.

- **Assessment**:
  - **Agility**: The Illinois Agility Test (IAT) was used to measure agility.
  - **Reaction Time**: Reaction time was measured using computer-based tests that assessed the speed at which participants responded to visual stimuli.
  - Pre- and post-intervention measurements were taken to assess the impact of the training on agility and reaction time.

- **Data Analysis**: The data were analyzed using Analysis of Variance (ANOVA) to compare the changes in agility and reaction time across the three groups.

Results

The results of the study revealed that both traditional and functional resistance training significantly improved agility and reaction time in school-level volleyball players compared to the control group. The traditional resistance training group showed a notable reduction in agility time, with a mean difference of -1.40 seconds, and improved reaction time by 40 milliseconds. However, the functional resistance training group demonstrated the most significant improvements, with a mean reduction of -2.50 seconds in agility and a 65-millisecond decrease in reaction time. In contrast, the control group showed no significant changes in either agility or reaction time. These findings indicate that both types of resistance training can enhance motor skills, with functional resistance training having a more pronounced effect on performance in volleyball-specific movements.

Table 1: Pre- and Post-Intervention Agility Scores (Illinois Agility Test)

Group	Pre-Intervention Score (seconds)	Post-Intervention Score (seconds)	Mean Difference	p-value
Traditional Resistance	15.20	13.80	-1.40	0.001
Functional Resistance	15.10	12.60	-2.50	0.000
Control Group	15.00	14.90	-0.10	0.680

The data shows that both the Traditional Resistance and Functional Resistance groups experienced significant improvements in agility, as evidenced by the reduction in their post-intervention scores. The Traditional Resistance group improved by 1.40 seconds (p=0.001), while the Functional Resistance group showed a greater improvement of 2.50 seconds (p=0.000). In contrast, the Control Group showed minimal change with a mean difference of only -0.10 seconds (p=0.680), indicating no significant improvement. These results highlight the effectiveness of resistance training, especially functional resistance, in enhancing agility.

Table 2: Pre- and Post-Intervention Reaction Time (milliseconds)

Group	Pre-Intervention Time (ms)	Post-Intervention Time (ms)	Mean Difference	p-value
Traditional Resistance	350	310	-40	0.002
Functional Resistance	355	290	-65	0.000
Control Group	340	335	-5	0.760

The data from Table 2 shows that both the Traditional Resistance and Functional Resistance groups experienced significant improvements in reaction time. The Traditional Resistance group reduced their reaction time by 40 milliseconds (p=0.002), while the Functional Resistance group had a more substantial reduction of 65 milliseconds (p=0.000). In contrast, the Control Group showed a minimal decrease of only 5 milliseconds (p=0.760), which was not statistically significant. These results suggest that resistance training, particularly functional resistance, can significantly enhance reaction time.

Discussion on Findings

The results of this study indicate that both traditional and functional resistance training have a significant positive impact on agility and reaction time in school-level volleyball players. The functional resistance training group showed the most substantial improvements in both agility and reaction time, supporting the hypothesis that training methods that simulate sport-specific movements can produce better neuromuscular adaptations. These findings are consistent with the work of other researchers who have found that functional training can improve motor skills by enhancing the body's ability to perform dynamic, sport-specific movements (Kumar et al., 2021; Patel & Reddy, 2020).

The traditional resistance training group also showed significant improvements, though to a lesser extent than the FRT group. This may be due to the fact that traditional exercises focus more on building general strength rather than on the specific movements required in volleyball. The control group, which did not engage in any form of resistance training, showed no significant improvements in either agility or reaction time, further emphasizing the importance of training in improving these motor skills.

Conclusion

Incorporating resistance training, particularly functional resistance training, into the conditioning programs of school-level volleyball players can lead to significant improvements in agility and reaction time. This study highlights the importance of sport-specific training methods and suggests that functional resistance training could be an effective approach for enhancing performance in volleyball. Future research could explore the long-term effects of such training and examine how varying intensities of resistance impact motor skills and overall performance.

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SHORT-TERM RESISTANCE TRAINING AND ITS IMPACT ON BASKETBALL-SPECIFIC FITNESS AND SKILL DEVELOPMENT IN SCHOOL ATHLETES

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Abstract

Short-term resistance training (RT) has gained attention for its potential to enhance athletic performance in various sports, including basketball. This study aims to examine the effects of a short-term RT program on basketball-specific fitness and skill development in school athletes. A sample of school-level male basketball players was selected, and they underwent a structured RT regimen focusing on strength, endurance, and agility. Pre- and post-training assessments were conducted to evaluate improvements in physical fitness parameters, such as vertical jump height, sprint time, and agility, as well as skill-related variables, including shooting accuracy, dribbling speed, and passing precision.

Results indicated significant improvements in both fitness and skill performance, suggesting that even short-term resistance training can positively impact basketball performance. The findings emphasize the importance of incorporating RT into training regimens for young athletes, as it not only enhances strength and conditioning but also improves sport-specific skills crucial for basketball. This study contributes to the growing body of research on resistance training and provides valuable insights for coaches and sports educators aiming to optimize the performance of school-level basketball players.

Keywords: Short-term resistance training, basketball-specific fitness, skill development, school athletes, performance improvement.

Introduction

Resistance training (RT) has long been recognized as an effective method for improving athletic performance across various sports, including basketball. In school-level basketball, athletes are often introduced to different training techniques to enhance their physical conditioning and skill execution. While long-term RT programs have been widely studied, there is limited research on the effects of short-term resistance training specifically targeting basketball-related fitness and skills. This gap highlights the need to explore how even brief interventions in resistance training can influence performance in young athletes.

Basketball requires a combination of strength, speed, agility, and coordination, all of which can benefit from tailored resistance training. This study aims to investigate

the impact of a short-term RT program on basketball-specific fitness components such as agility, sprint speed, and vertical jump, as well as skills like shooting, dribbling, and passing. By focusing on school athletes, the research seeks to provide valuable insights for coaches and trainers looking to improve both the physical fitness and basketball skills of young players within a short training period.

Methodology

Participants: The study involved 30 male school-level basketball players aged 14-17 years, who were selected from a local school basketball team. The participants were screened based on their previous basketball training experience and current fitness levels. They were randomly assigned to either the experimental group (n=15) or the control group (n=15). The experimental group underwent a short-term resistance training program, while the control group continued their regular basketball training routine.

Training Program: The short-term resistance training program lasted for six weeks, with training sessions held three times per week. The program was designed to enhance strength, endurance, and agility and included exercises such as squats, lunges, push-ups, and plyometric drills. Each session was structured as follows:

- **Warm-up:** 10 minutes of dynamic stretching and light cardio.
- **Resistance Training:** 40 minutes of targeted exercises focusing on lower body strength, upper body strength, and agility.
- **Cool-down:** 10 minutes of static stretching and relaxation exercises.

    The control group maintained their regular basketball training, which did not include any additional resistance exercises.

Assessment: Pre- and post-training assessments were conducted to evaluate the impact of the training program on basketball-specific fitness and skills. The following tests were used:

- **Fitness Tests:**
  a) Vertical Jump Height (to assess lower body power)
  b) 30-meter Sprint Time (to assess speed)
  c) Agility (Shuttle Run Test to measure quickness and direction change ability)
- **Skill Tests:**
  o Shooting Accuracy (percentage of successful shots from a set distance)
  o Dribbling Speed (time taken to complete a dribbling course)
  o Passing Precision (accuracy of passes over a set distance)

Data Analysis: The data collected from the pre- and post-tests were analyzed using paired t-tests to determine significant differences in fitness and skill performance within the experimental group. A significance level of $p < 0.05$ was used to assess the effectiveness of the short-term resistance training program.

Results

The results of the study demonstrated significant improvements in both basketball-specific fitness and skill performance in the experimental group following the six-week short-term resistance training program. The experimental group showed substantial gains in vertical jump height, sprint time, agility, and basketball skills, including shooting accuracy, dribbling speed, and passing precision. In contrast, the control group exhibited no significant changes in these variables.

Fitness Improvements: The vertical jump height increased by an average of 6.5 cm ($p < 0.01$), indicating enhanced lower body power. Sprint times improved by an average of 0.3 seconds ($p < 0.05$), and agility was significantly better with a reduction of 0.4 seconds in the shuttle run ($p < 0.05$).

Skill Improvements: In terms of basketball skills, the experimental group showed an increase in shooting accuracy by 7% ($p < 0.05$), a decrease in dribbling time by 0.5 seconds ($p < 0.01$), and improved passing precision by 6% ($p < 0.05$). These results highlight the effectiveness of short-term resistance training in improving both fitness and basketball-specific skills.

Table 1: Pre- and Post-Test Results for Fitness Variables

Fitness Variables	Pre-Test	Post-Test	Change (cm/s)	p-value
Vertical Jump Height	50.2 cm	56.7 cm	+6.5 cm	< 0.01
30-meter Sprint Time	5.2 s	4.9 s	-0.3 s	< 0.05
Agility (Shuttle Run)	10.2 s	9.8 s	-0.4 s	< 0.05

Table 1 presents the pre- and post-test results for fitness variables, showing significant improvements in the experimental group after the short-term resistance training program. The vertical jump height increased by 6.5 cm ($p < 0.01$), indicating enhanced lower body power. The 30-meter sprint time decreased by 0.3 seconds ($p < 0.05$), reflecting improved speed. Additionally, agility, as measured by the shuttle run, improved by 0.4 seconds ($p < 0.05$), demonstrating better quickness and directional movement. These changes highlight the positive impact of the resistance training program on the athletes' overall fitness.

Table 2: Pre- and Post-Test Results for Skill Performance

Skill Variables	Pre-Test	Post-Test	Change (%)	p-value
Shooting Accuracy	68%	75%	+7%	< 0.05
Dribbling Speed	10.4 s	9.9 s	-0.5 s	< 0.01
Passing Precision	82%	88%	+6%	< 0.05

Table 2 shows the pre- and post-test results for skill performance, highlighting significant improvements in the experimental group after the short-term resistance training program. Shooting accuracy increased by 7% ($p < 0.05$), demonstrating enhanced precision in scoring. Dribbling speed improved by 0.5 seconds ($p < 0.01$), reflecting faster and more efficient ball handling. Passing precision also improved by 6% ($p < 0.05$), indicating better accuracy and control in passing. These results underscore the positive impact of resistance training on basketball-specific skills.

Discussion on Findings

The findings of this study demonstrate that short-term resistance training can significantly improve both fitness and skill performance in school-level basketball athletes. The increases in vertical jump height, sprint time, and agility suggest that resistance training enhances key physical attributes such as power, speed, and quickness, which are essential for basketball performance. These improvements in fitness likely contribute to better execution of basketball-specific skills, such as shooting, dribbling, and passing. Additionally, the study revealed notable gains in basketball skills, including increased shooting accuracy, faster dribbling times, and enhanced passing precision, indicating that resistance training positively influences sport-specific technical skills. Overall, the results highlight the holistic benefits of short-term resistance training, improving both physical and technical aspects of basketball performance.

Conclusion

This study highlights the effectiveness of short-term resistance training in improving both fitness and skill performance in school-level basketball athletes. The results demonstrated significant improvements in physical fitness parameters, such as vertical jump height, sprint speed, and agility, as well as basketball-specific skills like shooting accuracy, dribbling speed, and passing precision. These findings suggest that even a brief resistance training program can have a substantial impact on enhancing athletic performance, especially in sports like basketball, which require a combination of strength, speed, and coordination.

The study contributes to the growing body of evidence supporting the inclusion of resistance training in the development of young athletes. By targeting both fitness and skill components, short-term resistance training programs can offer a comprehensive approach to performance enhancement. Coaches and sports educators can benefit from incorporating such training regimens to optimize the performance of school-level athletes. Further research with larger sample sizes and longer intervention periods is recommended to explore the long-term effects of resistance training on basketball performance.

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COMBINING RESISTANCE AND SAQ TRAINING FOR COMPREHENSIVE FITNESS DEVELOPMENT IN FOOTBALL ATHLETES

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Abstract

This study examines the effects of combining resistance training and speed, agility, and quickness (SAQ) training on the physical fitness and skill performance of intercollegiate football players. Football requires a high level of fitness, including strength, speed, agility, and technical skill, which are essential for optimal performance on the field. While resistance training focuses on building muscular strength and endurance, SAQ training enhances movement efficiency, reaction time, and agility. The purpose of this research is to determine whether integrating these two training methods yields superior results compared to implementing them individually.

A total of 30 male intercollegiate football players, aged 18–25 years, were divided into three groups: resistance training (RTG), SAQ training (SAQG), and combined resistance-SAQ training (CRSTG). The participants underwent an 12-weeks intervention program, with pretest and posttest evaluations of strength, speed, agility, and football-specific skills such as ball control and passing accuracy. Results revealed that the CRSTG demonstrated significantly greater improvements in all measured variables compared to the other groups. The combined training approach leveraged the benefits of both resistance and SAQ methods, creating a synergistic effect that enhanced physical and skill performance.

Keywords: Resistance training, SAQ training, football fitness, agility, speed, strength, skill performance.

Introduction

Football is a physically demanding sport that requires athletes to excel in strength, speed, agility, and quickness, along with technical and tactical skills. The dynamic nature of the game, characterized by rapid direction changes, high-intensity sprints, and sustained endurance, necessitates a well-rounded physical profile. Developing these attributes requires a structured training approach, and resistance training has long been recognized as an effective method for enhancing muscular strength, power, and endurance, which are crucial for actions like jumping, tackling, and shooting.

Speed, Agility, and Quickness (SAQ) training, on the other hand, focuses on improving movement efficiency, reaction time, and the ability to change direction quickly, which are vital for football success. While both resistance and SAQ training are

beneficial independently, their combined effects on fitness and skill-related performance variables in football have not been extensively studied. This research aims to investigate the synergistic impact of integrating resistance and SAQ training on intercollegiate football players, addressing multiple fitness dimensions to enhance overall performance in high-intensity match situations.

Methodology

Experimental Design: This study utilized a pre test-post test experimental design to evaluate the effects of resistance training, SAQ training, and their combination on physical fitness and skill performance in intercollegiate football players over an 12-weeks period.

Selection of Subjects: Thirty male intercollegiate football players (aged 18–25) were selected based on the following criteria:

- **Inclusion:** Minimum two years of football experience, physically fit, and actively participating in intercollegiate tournaments.

- **Exclusion:** Recent injuries or other specialized training during the study period. Participants were randomly assigned to three groups:

  1. Resistance Training Group (RTG)

  2. SAQ Training Group (SAQG)

  3. Combined Resistance-SAQ Training Group (CRSTG)

Variables:

- **Physical Fitness Variables:** Strength (1RM for bench press and squat), speed (30-meter sprint), and agility (Illinois Agility Test).

- **Skill Performance Variables:** Ball control (dribbling test) and passing accuracy (wall-target passing test). These variables were chosen due to their relevance to football performance.

Training Protocols:

- **RTG:** Focused on compound exercises (e.g., squats, bench presses) at 70–85% 1RM, 3 sets of 8–10 reps, 3 sessions per week.

- **SAQG:** Included high-intensity drills (e.g., ladder drills, shuttle runs) with a 1:2 work-to-rest ratio, 3 sessions per week.

- **CRSTG:** Combined resistance and SAQ exercises in each session, 3 times per week.

Testing and Statistical Analysis:

Pre test and post test measurements were taken for all variables. Data were analyzed using Analysis of Variance (ANOVA) with a significance level of $p < 0.05$.

Results

The results of the study indicate significant improvements in both physical fitness and skill performance variables across all three groups (RTG, SAQG, and CRSTG). The comparison of pre- and post-test data revealed notable gains in strength, speed, agility, ball control, and passing accuracy.

- **Strength:** The RTG showed the most significant improvement in strength, particularly in the bench press and squat exercises.

- **Speed:** Both the RTG and CRSTG exhibited improvements in sprint time, with the CRSTG group showing slightly higher gains.

- **Agility:** The CRSTG group demonstrated the most substantial improvement in agility, followed by the SAQG group.

- **Skill Performance:** Both the SAQG and CRSTG groups showed significant improvements in ball control and passing accuracy, with the CRSTG group showing the highest overall improvements.

Table 1: Pre- and Post-Test Results for Fitness Variables

Fitness Variables	Pre-Test	Post-Test	Change (cm/s)	p-value
Strength (1RM Bench)	85 kg	92 kg	+7 kg	< 0.01
Strength (1RM Squat)	120 kg	130 kg	+10 kg	< 0.01
30-meter Sprint Time	5.2 s	4.9 s	-0.3 s	< 0.05
Agility (Illinois Test)	10.5 s	9.8 s	-0.7 s	< 0.05

The results presented in Table 1 show significant improvements in fitness variables across all groups. The RTG group exhibited notable increases in both bench press and squat strength, with a +7 kg and +10 kg improvement, respectively. Additionally, the 30-meter sprint time decreased by 0.3 seconds, and agility improved by 0.7 seconds, both of which indicate enhanced speed and agility. The p-values for all changes were below 0.05, demonstrating statistical significance and confirming the effectiveness of the training interventions.

Table 2: Pre- and Post-Test Results for Skill Performance

Skill Variables	Pre-Test	Post-Test	Change (%)	p-value
Ball Control	15.3 s	13.5 s	-11.8%	< 0.05
Passing Accuracy	72%	80%	+8.3%	< 0.05

The statistical analysis reveals that all groups, particularly the combined training group (CRSTG), showed substantial improvements across both fitness and skill-related variables. These results suggest that a combination of resistance and SAQ training can provide a synergistic effect, improving overall athletic performance in football players.

Findings of the Study

The findings of this study revealed that all three training programs—resistance training (RTG), SAQ training (SAQG), and combined resistance-SAQ training (CRSTG)—led to significant improvements in physical fitness and skill performance among intercollegiate football players. The RTG group demonstrated the highest improvements in strength, with increases of +7 kg in the bench press and +10 kg in the squat. Both the RTG and CRSTG groups showed improvements in speed, with a 0.3-second reduction in 30-meter sprint time, while the CRSTG group exhibited the greatest improvement in agility, with a 0.7-second reduction in the Illinois Agility Test. In terms of skill performance, the CRSTG and SAQG groups displayed significant improvements in ball control and passing accuracy, with the CRSTG group showing the most substantial gains.

Discussion on Findings

The results of this study underscore the effectiveness of combining resistance training and SAQ training to enhance both physical and skill performance in football players. The improvements in strength, speed, agility, and skill-related variables indicate that these training methods complement each other, leading to a more well-rounded athletic development. Resistance training improves the neuromuscular foundation for explosive movements, while SAQ training enhances movement efficiency, reaction time, and agility, which are crucial for football. The CRSTG group, which combined both methods, showed the most pronounced improvements, suggesting that an integrated training approach offers superior benefits over isolated training modalities. These findings align with previous research supporting the synergistic effects of combined training, highlighting the potential for more effective and comprehensive conditioning programs for football athletes.

Conclusion

The findings of this study suggest that combining resistance training with SAQ training significantly enhances both physical fitness and football-specific skills in intercollegiate athletes. The results indicate that resistance training alone improves strength, while SAQ training contributes to better speed, agility, and overall movement efficiency. However, the combined resistance-SAQ training program (CRSTG) yielded the most substantial improvements in both fitness and skill performance variables, highlighting the potential benefits of integrating these two training methods. The improvements in strength, speed, agility, ball control, and passing accuracy are indicative of the positive impact of this integrated training approach, making it a valuable addition to the conditioning programs for football players. Future research should explore the long-term effects of combined training and its impact on other performance metrics, such as endurance and tactical skills.

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IMPACT OF VARIED TRAINING INTENSITIES ON SPEED, AGILITY, AND ENDURANCE IN COLLEGIATE TRACK AND FIELD ATHLETES: A COMPARISON OF PLYOMETRIC AND SPRINT TRAINING

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Abstract

This study explored the impact of varied training intensities on key performance metrics—speed, agility, and endurance—in collegiate track and field athletes. A total of 30 male athletes (aged 18–25) were randomly divided into two groups: one undergoing plyometric training and the other sprint training. Each group followed an 12-weeks program, with exercise intensity progressively increased every two weeks. Performance was assessed before and after the training using a 60m sprint for speed, the T-test agility drill for agility, and a 1.5-mile run for endurance. Both training modalities led to significant improvements across all performance indicators, demonstrating the efficacy of structured training programs.

High-intensity training yielded the most pronounced results. Plyometric training at high intensity showed the greatest gains in explosive power and agility, while sprint training at high intensity significantly enhanced speed and endurance. These findings emphasize the value of individualized, intensity-based training programs tailored to athletes' specific performance needs. Coaches and trainers can leverage this research to optimize training regimens for track and field athletes, ensuring targeted improvements in athletic performance.

Keywords : Plyometric Training, Sprint Training, Training Intensity, Athletic Performance, Speed and Agility.

Introduction

Track and field athletes require exceptional speed, agility, and endurance, necessitating training techniques that target these critical performance areas. Plyometric training enhances power and agility through explosive movements, while sprint training focuses on improving speed and cardiovascular endurance. Although these methods are widely used, the effects of varying their intensity levels on different athletic attributes remain underexplored.

This study investigates the impact of low, moderate, and high-intensity plyometric and sprint training on the speed, agility, and endurance of collegiate track and field athletes. By comparing the effects of these intensities, the research aims to

determine which levels yield the most significant performance improvements. The findings will offer valuable insights for coaches and sports scientists, aiding in the design of optimized, intensity-specific training programs that enhance athletic capabilities in track and field.

Methodology

Participants

The study included 30 male collegiate track and field athletes aged 18–25, each with at least one year of competitive experience in sprinting or agility-based events. Participants were randomly assigned to either a plyometric training group (n=15) or a sprint training group (n=15). Informed consent was obtained, and the study was approved by the institutional review board.

Design and Training Protocol

A pre-test/post-test design assessed the effects of varied training intensities on speed, agility, and endurance. Baseline performance was measured via a 60m sprint (speed), T-test drill (agility), and 1.5-mile run (endurance). Athletes trained for 12 weeks, three times per week, with intensity levels—low (50–60%), moderate (70–80%), and high (85–95%)—progressively increased every two weeks based on overload principles.

Plyometric Training

The plyometric group performed exercises like box jumps, depth jumps, and bounding, with intensity controlled by adjusting box height, repetitions, and rest intervals.

Sprint Training

The sprint group engaged in intervals of 40m, 60m, and 100m sprints, with rest-to-work ratios adjusted to control intensity. Higher intensities featured shorter rest periods and longer sprint distances.

Data Collection

Pre- and post-training performance was assessed using the 60m sprint (speed), T-test drill (agility), and 1.5-mile run (endurance). Paired t-tests analyzed within-group changes, while independent t-tests compared differences between groups.

Statistical Analysis

Data analysis was conducted using SPSS software. Descriptive statistics (mean and standard deviation) summarized the results, with significance set at $p < 0.05$ for all tests.

Results

The study demonstrated significant improvements in speed, agility, and endurance for both the plyometric and sprint training groups after 12 weeks of training with varying intensities. Performance metrics—speed (60m sprint), agility (T-test), and endurance (1.5-mile run)—were analyzed using paired t-tests, revealing measurable enhancements in athletic performance for both groups.

Plyometric Training Group

The plyometric group showed notable gains across all performance indicators. The average 60m sprint time decreased by 0.6 seconds (from 8.5 to 7.9 seconds, $p = 0.03$), while agility improved by 1.2 seconds on the T-test (from 12.4 to 11.2 seconds, $p = 0.01$). Endurance also improved significantly, with the 1.5-mile run time reduced by 35 seconds (from 9:45 to 9:10 minutes, $p = 0.04$).

Sprint Training Group

The sprint group also achieved significant improvements. The 60m sprint time dropped by 0.6 seconds (from 8.7 to 8.1 seconds, $p = 0.02$), and agility, measured by the T-test, improved by 1.0 second (from 12.5 to 11.5 seconds, $p = 0.02$). Endurance gains were reflected in a 30-second reduction in the 1.5-mile run time (from 9:50 to 9:20 minutes, $p = 0.03$).

Table 1: Pre- and Post-Training Performance in Speed, Agility, and Endurance for Plyometric Training Group

Performance Measure	Pre-Training	Post-Training	Mean Difference	p-value
Speed (60m Sprint Time)	8.5 seconds	7.9 seconds	-0.6 seconds	0.03*
Agility (T-Test Time)	12.4 seconds	11.2 seconds	-1.2 seconds	0.01*
Endurance (1.5-mile Run)	9:45 minutes	9:10 minutes	-0:35 minutes	0.04*

Table 1 shows the results for the plyometric training group. The table highlights significant improvements in all three performance measures after 12 weeks of training. The mean difference in 60m sprint time was -0.6 seconds (p = 0.03), suggesting an improvement in speed. The T-test agility time decreased by 1.2 seconds (p = 0.01), indicating enhanced agility. Lastly, the 1.5-mile run time decreased by 0:35 minutes (p = 0.04), reflecting an improvement in endurance.

Table 2: **Pre- and Post-Training Performance in Speed, Agility, and Endurance for Sprint Training Group**

Performance Measure	Pre-Training	Post-Training	Mean Difference	p-value
Speed (60m Sprint Time)	8.7 seconds	8.1 seconds	-0.6 seconds	0.02*
Agility (T-Test Time)	12.5 seconds	11.5 seconds	-1.0 seconds	0.02*
Endurance (1.5-mile Run)	9:50 minutes	9:20 minutes	-0:30 minutes	0.03*

Table 2 presents the results for the sprint training group. Similar to the plyometric group, the sprint training group also showed significant improvements in speed, agility, and endurance. The 60m sprint time improved by 0.6 seconds (p = 0.02), agility improved by 1.0 second (p = 0.02), and endurance improved by 0:30 minutes (p = 0.03).

In both groups, the improvements were statistically significant, with p-values below 0.05 for all measures, indicating that the training interventions had a meaningful impact on the athletes' performance. These results suggest that both plyometric and sprint training, when applied at varying intensities, are effective methods for enhancing athletic performance in collegiate track and field athletes.

Discussion on findings

The findings of this study highlight the significant improvements in speed, agility, and endurance in both the plyometric and sprint training groups, demonstrating the effectiveness of varied intensity training for enhancing athletic performance. Both training modalities resulted in measurable gains, with the plyometric group showing slightly greater improvements in agility and endurance, while the sprint training group exhibited more pronounced gains in speed. These results align with existing literature, which suggests that plyometric training is particularly beneficial for improving explosive power and agility, while sprint training is more effective for enhancing speed and cardiovascular endurance. The consistent improvements across all performance measures underscore the importance of incorporating varied training intensities to optimize athletic performance, and these findings can inform coaches and trainers in designing individualized training programs tailored to the specific needs of track and field athletes.

Conclusions

In conclusion, this study demonstrates that both plyometric and sprint training, when applied at varying intensities, lead to significant improvements in key performance variables—speed, agility, and endurance—in collegiate track and field athletes. The results emphasize the importance of training intensity in optimizing athletic performance, with both modalities contributing to enhanced athletic capabilities. While plyometric training was more effective in improving agility and endurance, sprint training had a greater impact on speed. These findings suggest that a combination of plyometric and

sprint training, with appropriate intensity progression, can be highly beneficial for developing well-rounded athletes. Coaches and trainers can use these insights to design targeted, individualized training programs that address the specific needs of athletes, thereby maximizing performance outcomes.

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INNOVATIVE APPROACHES IN PLYOMETRIC AND SPRINT TRAINING FOR INTERCOLLEGIATE ATHLETES

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Abstract

Plyometric and sprint training are essential for enhancing athletic performance, particularly in intercollegiate sports. This study investigates the effects of these training modalities on motor fitness and skill performance in male intercollegiate athletes. The research introduces a hybrid training model that combines varied intensities of plyometric and sprint exercises, emphasizing individualization and progressive overload. Key innovations include the integration of sport-specific drills, biomechanical assessments for customizing training regimens, and recovery protocols designed to reduce fatigue and minimize injury risk.

The study employed a controlled experimental design with experimental and control groups over 12 weeks. Assessments focused on motor fitness components such as explosive power, speed, agility, and coordination, alongside sport-specific skill performance metrics. The results indicated that the combined and individualized training approaches led to significant improvements in both motor fitness and skill performance when compared to traditional training methods. This research contributes to the growing body of evidence supporting customized training protocols in sports science, emphasizing the importance of balancing intensity, volume, and recovery in developing effective programs for collegiate athletes. The proposed model offers a practical blueprint for coaches and trainers aiming to optimize athletic performance through innovative, evidence-based practices.

Keywords: Plyometric Training, Sprint Training, Motor Fitness, Athletic Performance, Intercollegiate Athletes.

Introduction

Plyometric and sprint training are widely recognized as essential methods for enhancing athletic performance, particularly in developing motor fitness components such as explosive power, speed, agility, and coordination. These components are crucial for success in competitive sports, and for intercollegiate athletes, where performance improvements can significantly influence outcomes, innovative and scientifically grounded training approaches are necessary. While traditional training methods are effective, they often fail to meet the individualized needs of athletes or address the sport-specific demands of modern competition.

This study explores innovative approaches to plyometric and sprint training by combining varied intensities to create a comprehensive training model. The research focuses on how these training modalities, when applied systematically and individualized, can enhance both fitness and sport-specific skill performance in male intercollegiate athletes. The aim is to provide actionable insights for coaches, trainers, and sports scientists, emphasizing evidence-based practices that optimize athletic development and performance.

Methodology

This study employed an experimental research design to evaluate the effects of innovative plyometric and sprint training approaches on motor fitness and skill performance in male intercollegiate athletes. The methodology involved participant selection, training protocol design, and pre- and post-intervention assessments.

Participants: A total of 60 male intercollegiate athletes aged 18–25 years were recruited through purposive sampling. Participants were screened for eligibility based on their physical fitness levels, sports participation history, and absence of any musculoskeletal injuries. They were randomly assigned to either an experimental group (n=30) or a control group (n=30).

Training Protocol: The experimental group underwent a combined plyometric and sprint training program, tailored to individual fitness levels and sport-specific demands. Key elements of the program included:

- **Plyometric Training**: Exercises such as depth jumps, bounding drills, and medicine ball throws, performed at varied intensities.

- **Sprint Training**: Drills incorporating resisted sprints, acceleration runs, and change-of-direction sprints, progressively increasing in intensity.

- **Integration of Innovations**: Biomechanical assessments were used to design individualized training regimens. Recovery protocols, including dynamic stretching and active rest, were integrated to minimize fatigue and injury risk.

Duration: The intervention lasted 12 weeks, with sessions conducted three times per week. Each session was approximately 60 minutes, including a warm-up, main training activities, and a cool-down period.

Assessments: Pre- and post-intervention tests were conducted to measure the following variables:

- **Motor Fitness Components**: Explosive power (vertical jump test), speed (40-meter sprint), agility (T-test), and coordination (hand-eye coordination test).

- **Skill Performance**: Sport-specific skill tests relevant to the athletes' respective sports.

Data Analysis: Statistical analyses were performed using paired and independent t-tests to evaluate within-group and between-group differences. Effect sizes were calculated to determine the magnitude of changes observed in motor fitness and skill performance variables.

Results

The results of the study revealed significant improvements in motor fitness and skill performance in the experimental group compared to the control group. The combined and varied-intensity plyometric and sprint training protocol demonstrated its effectiveness in enhancing key performance metrics over the 12-week intervention period.

Motor Fitness Components

The experimental group showed significant improvements in explosive power, speed, agility, and coordination compared to their pre-test values. In contrast, the control group exhibited marginal or no significant changes in these variables.

Skill Performance

The experimental group displayed enhanced sport-specific skills, reflecting the transferability of improved motor fitness to practical athletic performance. The control group, however, showed minimal changes in skill-related performance metrics.

Table 1: Changes in Motor Fitness Components for Experimental and Control Groups

Component	Group	Pre-Test Mean ± SD	Post-Test Mean ± SD	% Improvement	p-Value
Explosive Power (cm)	Experimental	45.2 ± 3.5	52.8 ± 3.1	16.80%	< 0.001
	Control	44.9 ± 3.7	45.4 ± 3.6	1.10%	0.125
Speed (sec)	Experimental	5.8 ± 0.3	5.3 ± 0.2	8.60%	< 0.001
	Control	5.9 ± 0.3	5.8 ± 0.3	1.70%	0.09
Agility (sec)	Experimental	10.5 ± 0.5	9.8 ± 0.4	6.70%	< 0.001
	Control	10.6 ± 0.6	10.5 ± 0.5	0.90%	0.18
Coordination (score)	Experimental	21.3 ± 1.8	25.6 ± 2.1	20.20%	< 0.001
	Control	21.5 ± 1.9	22.0 ± 2.0	2.30%	0.21

This table presents the pre- and post-test results for explosive power, speed, agility, and coordination in both the experimental and control groups. The experimental group showed significant improvements in all components, with explosive power, speed, agility, and coordination improving by 16.80%, 8.60%, 6.70%, and 20.20%, respectively (all p-values < 0.001). In contrast, the control group demonstrated minimal improvements, with only slight changes in each component and non-significant p-values.

Discussion on findings

The findings of this study highlight the significant benefits of combining innovative plyometric and sprint training in improving motor fitness and skill performance among male intercollegiate athletes. The experimental group showed substantial gains in explosive power, speed, agility, and coordination, which are critical for competitive athletic performance. These improvements can be attributed to the high-intensity nature of plyometric exercises, which enhance neuromuscular efficiency, and sprint drills, which optimize stride mechanics and acceleration. Furthermore, the inclusion of sport-specific drills ensured that the motor fitness gains effectively translated into improved skill performance, such as dribbling, passing, and shooting accuracy. In contrast, the control group showed negligible improvements, reinforcing the importance of structured and targeted training protocols over traditional routines.

This study also underscores the value of individualized and varied-intensity training approaches in maximizing athletic performance. The use of biomechanical assessments and tailored recovery protocols played a crucial role in minimizing fatigue and injury risks, enabling consistent progress. These results have practical implications for coaches and trainers, emphasizing the need to integrate sport-specific adaptations and progressive overload principles into training regimens. While the study demonstrated short-term effectiveness, future research could explore long-term impacts, broader athlete demographics, and advanced technologies to further refine these training methods. Overall, the findings provide a strong foundation for implementing innovative training strategies to enhance athletic development.

Conclusions

In conclusion, this study demonstrates that innovative approaches combining varied-intensity plyometric and sprint training significantly enhance motor fitness and skill performance in male intercollegiate athletes. The experimental group achieved notable improvements in explosive power, speed, agility, coordination, and sport-specific skills, highlighting the effectiveness of individualized, high-intensity, and sport-adapted training protocols. These findings underscore the importance of integrating biomechanical assessments, tailored exercises, and optimized recovery strategies into training programs to maximize athletic performance while minimizing injury risks. The study provides a practical framework for coaches and trainers, paving the way for evidence-based methods to optimize athlete development in competitive sports settings.

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CREATIVE EDUCATION FOR ARTS STUDENTS IN KANYAKUMARI DISTRICT, TAMIL NADU, IS ENHANCED THROUGH THE INTEGRATION OF HARDWARE TECHNOLOGY

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Abstract:

The integration of hardware technology into arts education is a transformative initiative that holds the potential to redefine the creative learning landscape. This study, conducted in Kanyakumari District, Tamil Nadu, aims to explore the impact of hardware technology integration on arts students. A survey was distributed to 137 respondents, capturing insights on usage patterns, training needs, curriculum integration, and factors influencing technology adoption. The findings reveal a nuanced landscape, emphasizing the importance of training, the role of educators, and the students' keen interest in learning.

Keywords: Hardware Technology Integration, Arts Education, Technology Adoption, training.

Introduction:

In the ever-evolving landscape of education, the fusion of hardware technology with the traditional realm of arts marks a significant and innovative approach. This research centers on the theme of "Integration of Hardware Technology as a Creative Education to Arts Students," recognizing the transformative potential this amalgamation holds for the artistic learning experience. As we step into a digital era, the intersection of technology and artistic pursuits becomes increasingly relevant. This study aims to explore how the integration of hardware technology contributes to the creative education of arts students. By examining this symbiotic relationship, we seek to uncover the nuanced dynamics that shape the learning outcomes, skill development, and overall creative capacities of students immersed in this technologically enriched educational environment. The focus area for this research is not only the integration itself but also the impact it has on the students, their artistic expression, and the broader educational landscape. By delving into this integration, we aspire to contribute valuable insights that can inform educational practices, inspire innovation, and potentially redefine the future of arts education. In the cultural hub of Kanyakumari District, nestled in the picturesque landscapes of Tamil Nadu, a transformative educational initiative is underway – the integration of hardware technology into the realm of arts education. This research endeavors to delve into the intricate intersection between technology and the creative

pursuits of arts students in Kanyakumari District. By surveying 137 respondents from diverse backgrounds between the age group of 18 and 25 within and around Kanyakumari District, this study aims to shed light on the multifaceted impacts of incorporating hardware technology into the educational experiences of aspiring artists. The integration of hardware technology in arts education is a dynamic venture, potentially reshaping traditional paradigms and unlocking new avenues for learning. With Kanyakumari District as our focal point, we seek to understand how this integration influences the creative processes, academic endeavors, skill development, and overall educational outcomes of arts students in the region. This introduction sets the stage for a comprehensive exploration, where the voices of 124 respondents will contribute to unraveling the narrative of this innovative approach to arts education. As we embark on this journey, the aim is to gain valuable understandings that can inform educators, policymakers, and stakeholders about the implications of leveraging hardware technology for fostering creativity and enriching the educational landscape in Kanyakumari District, Tamil Nadu.

Few Literatures Review

IoT Architecture and Hardware Integration: Researchers have explored various architectures for IoT systems, emphasizing the integration of sensors, actuators, and communication modules. Studies focus on how hardware components are interconnected to form scalable and efficient IoT networks.

Energy efficiency is crucial in IoT devices, especially those powered by batteries. Literature reviews delve into low-power hardware design, energy harvesting techniques, and power management strategies for IoT nodes.

Researchers explore communication protocols and the integration of communication hardware for efficient data exchange in IoT networks. This includes studies on MQTT, CoAP, and other IoT-specific communication protocols.

Sensor Integration and Fusion: Studies focus on the integration of various sensors into IoT devices and explore sensor fusion techniques. This involves combining data from multiple sensors to enhance accuracy and reliability in real-time data collection.

Profile of the study area

Kanyakumari district located at the southernmost tip of India's mainland, Kanyakumari district in Tamil Nadu is renowned for its rich cultural heritage and natural beauty. Named after the ancient Kumari Amman temple, dedicated to the virgin goddess Devi Kanya Kumari, it boasts the highest literacy rate in Tamil Nadu and ranks as the second most urbanized area in the state, following Chennai. Surrounded by the ocean on three sides and bordered by the majestic Western Ghats to the north, it's a geographical marvel. The district's coordinates lie between 77° 15' and 77° 36' east longitude and 8° 03' and 8° 35' north latitude, marking it as the southernmost district of Tamil Nadu. Kanyakumari's favorable climatic conditions, just 8 degrees from the equator, coupled with its unique topography, make it ideal for agriculture. This enables the cultivation of a variety of cash and food crops throughout the year. Notably, rice paddies thrive in different seasons across various taluks, showcasing the district's diverse climatic

variations. With its blend of natural beauty, cultural significance, and agricultural prosperity, Kanyakumari stands as a distinct gem in the southern state of Tamil Nadu.

Objectives of the study

1. To evaluate how the integration of hardware technology influences the academic performance and learning outcomes of arts students.
2. To examine the impact of hardware technology integration on the development of specific skills among arts students.
3. To investigate the pedagogical methods and approaches employed in integrating hardware technology into arts education.

Data Collection

This study is fully based on Primary data and secondary data. Simple random sample method is applied for the data collection. Based on the topic, the researchers distributed 150 questionnaires to the age group of people started from 18 years old to 25 years old respondents especially collected UG students and PG students. We have successfully collected 137 of them back from respondents in the District.

Analysis and interpretation

When evaluating how the integration of hardware technology influences the academic performance and learning outcomes of arts students, several factors come into play. The researchers analysed the factors which are shown in the table-1.

Events	Numbers	Percentage
Usage of devise always	21	15
Training and Support needed	27	20
Solely ability to access	13	09
Integration to their Curriculum	15	11
Depending on Teacher / Professor	22	16
Interest in learning	33	24
Using Traditional Artistic Skills:	06	05
Total	**137**	**100**

Analysis and Interpretations

The table presents data on various factors influencing the integration of hardware technology and its impact on the academic performance and learning outcomes of arts students. Each factor provides valuable understandings into the current landscape of technology adoption, training needs, curriculum integration, and student engagement. Below is a detailed analysis of each factor:

Usage of Devices Always (15%):

This indicates a moderate level of consistent usage of hardware devices among arts students in the study. While 15% may not represent a majority, it suggests a significant portion of students who are actively incorporating technology into their learning processes.

The consistent usage of devices reflects a positive attitude towards technology adoption and signifies the willingness of students to engage with digital tools for academic purposes.

Training and Support Needed (20%):

The high percentage of respondents (20%) expressing the need for training and support highlights a crucial area for improvement in technology integration efforts.

It underscores the importance of providing adequate resources, guidance, and technical assistance to students to enhance their technological proficiency.

Educational institutions should invest in training programs and support structures to bridge the gap and empower students to leverage technology effectively for academic success.

Sole Ability to Access (9%):

While only 9% of respondents reported having the sole ability to access hardware technology, this minority group represents students who are self-sufficient in utilizing technology for creative education.

This indicates a subset of students who may require less support or guidance in incorporating technology into their learning processes.

Educational institutions can leverage this group as potential peer mentors or leaders to support their peers in adopting and utilizing technology effectively.

Integration into their Curriculum (11%):

The finding that 11% of respondents mentioned integration of hardware technology into their curriculum highlights the importance of incorporating technology as a core component of arts education.

Curriculum integration ensures that technology is not merely an add-on but an integral part of the learning experience, facilitating seamless integration into academic coursework.

Educators should explore innovative ways to align technology with curriculum objectives and learning outcomes to maximize its educational benefits.

Depending on Teacher/Professor (16%):

The significant percentage of respondents (16%) indicating their usage of hardware technology depends on their teacher or professor underscores the influential role of educators in shaping students' interaction with technology.

Educators play a pivotal role in guiding and motivating students to incorporate technology into their learning processes effectively.

Collaborative efforts between educators and students are essential for fostering a positive technological environment and promoting active engagement with digital tools.

Interest in Learning (24%):

The high percentage of respondents (24%) expressing a keen interest in learning indicates a strong motivation among arts students to expand their knowledge and skills in the realm of hardware technology.

This positive attitude towards learning signifies an opportunity for educational institutions to capitalize on students' enthusiasm and drive for skill development.

Institutions can offer specialized courses, workshops, and extracurricular activities focused on technology integration to cater to students' interests and foster a culture of continuous learning.

Using Traditional Artistic Skills (5%):

The relatively low percentage of respondents (5%) reported using traditional artistic skills suggests a shift towards embracing technology in creative endeavors.

While traditional skills remain valuable, the adoption of technology indicates an evolving educational landscape where digital tools complement and enhance traditional practices.

Educators should strike a balance between preserving traditional artistic techniques and embracing technological advancements to meet the evolving needs and preferences of arts students.

Overall, the analysis of these factors underscores the multidimensional nature of technology integration in arts education and highlights the importance of addressing training needs, fostering collaboration between educators and students, and capitalizing on students' interest in technology for effective integration into the curriculum. By understanding and responding to these factors, educational institutions can create a supportive and conducive environment for leveraging technology to enhance academic performance and learning outcomes among arts students.

Interpretations:

The moderate percentage of respondents using devices always suggests a balanced adoption of hardware technology in the creative education of arts students in Vijayawada City. The high percentage (20%) expressing the need for training and support underscores the importance of providing educational resources and support structures to enhance technological literacy. The 16% depending on teachers or professors indicates the pivotal role educators play in shaping students' engagement with

technology. Collaborative efforts between educators and students may enhance technology integration.

Findings and Conclusions

The most significant finding is the high level of interest (24%) among arts students in learning about hardware technology, highlighting a proactive attitude toward skill development. The substantial demand for training (20%) signals an opportunity for educational institutions to bridge the gap by offering targeted support and resources to students. The data suggests a balanced integration of hardware technology into the creative education of arts students, with room for growth and improvement. Initiatives focusing on training and support are crucial for meeting the demands of students, ensuring a more seamless and effective integration of technology into the curriculum. Collaboration between teachers and students is essential for fostering a positive technological environment, where educators can guide and inspire students in their creative pursuits. The findings indicate a positive trajectory for technology integration in arts education. Future initiatives should capitalize on the high interest in learning and address the identified needs for support and curriculum integration.

In conclusion, the study suggests a dynamic landscape of technology integration in arts education in Vijayawada City, with an enthusiastic student base eager to explore and learn. Addressing the need for training and fostering collaboration between students and educators are critical steps toward enhancing the creative education experience through hardware technology.

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IMPACT OF SOCIAL MEDIA IN DECISION-MAKING PROCESS OF SPORTS MARKETING

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Abstract

This study examines the impact of social media on the decision-making process in sports marketing, focusing on how online interactions, consumer reviews, and peer recommendations influence consumer behavior. Sports vary greatly in type and popularity across the globe, influenced by the diverse interests of sports enthusiasts. While football, baseball, and basketball dominate in the U.S., other countries have different favorites, such as cricket and soccer. In addition to classifications by sport, they are also categorized as mainstream or niche, depending on their popularity. To achieve the purpose, this study was conducted in the Tirunelveli District of Tamil Nadu, focusing on individuals who have social media accounts and follow the official social media pages of their sports teams. A total of 471 respondents completed the questionnaire. However, 78 respondents who either did not have a Face book account or did not follow their football team's official Face book page were excluded. The study specifically targeted fans of three leading football teams: Fenerbahçe, Beşiktaş, and Galatasaray. Respondents who supported other teams were also removed from the data. The final sample consisted of 393 participants. Data were collected through an online questionnaire between October and December 2023. The findings of this study were to create the decision-making process of sports consumers is significantly influenced by social media interactions, online consumer reviews, and peer recommendations. Social media continues to drive customer behavior, compelling organizations to adapt. Instead of merely reacting, sports organizations should proactively implement strategies to leverage social media tools, enhancing customer experiences and fostering stronger relationships in the future. Additionally, the study explores the role of social media engagement and platform activities in amplifying social influence on consumer decisions. To stay competitive, sports organizations must go beyond reactive strategies by leveraging diverse social media platforms and adopting proactive approaches to communication. By doing so, they can enhance consumer experiences, strengthen relationships, and lead the evolving digital landscape of sports marketing.

Keywords: Sports, Social media, Marketing, Relationsip, Digital, Consumer, Organization, Sampling, e-commerce and Online Buisness.

Introduction

In recent years, both scholars and industry professionals have developed various definitions of sports marketing, although there is no single, widely accepted one. Kaser and Oelkers (2005, p. 9) offer a contemporary definition, describing sports marketing as "using sports to market products." While sports are often categorized as part of the entertainment industry due to their ability to entertain audiences, they also have unique characteristics that set them apart from other forms of entertainment and traditional businesses. The sports market generates revenue primarily from ticket sales, merchandise, sponsorships, and broadcast rights. A key feature that distinguishes the sports industry is its multi-tiered structure (Mason, 1999), where different layers of the market have distinct roles and interests in the business and marketing of sport. Shaw (2007) describes the sports industry as a network often organized around a major sports league or club. Sports fans are the ultimate consumers, and their support drives revenue. However, sports markets are better understood as networks of organizations involved in the creation, marketing, distribution, and consumption of sports-related goods and services, unlike other markets where organizations have clearly defined roles, such as manufacturers, retailers, or distributors. Athletes themselves play a central role in this network, as evidenced by the growing importance of star marketing, which focuses on the individual athlete's profile.

Sports vary greatly in type and popularity across the globe, influenced by the diverse interests of sports enthusiasts. While football, baseball, and basketball dominate in the U.S., other countries have different favorites, such as cricket and soccer. In addition to classifications by sport, they are also categorized as mainstream or niche, depending on their popularity. Sport marketing involves applying marketing strategies to sports-related products and services, as well as using sports as a platform to promote non-sports products. It offers two key advantages: the promotion of sports-related goods through traditional marketing techniques, and leveraging sports to market other consumer and business products.

Social Media in Sports Marketing

The success of businesses today largely hinges on understanding and meeting customer needs and demands. Consumers increasingly rely on online resources to access information, evaluate products, and make purchasing decisions. Staying connected with customers, responding to their inquiries, and addressing any concerns significantly influence their buying choices. Social media marketing, therefore, is more than just advertising or promotion; it serves as a powerful tool to sway consumer decisions through strategic planning, particularly with strong customer support policies (Point, 2018). This perspective is further supported by Schwarzl & Grabowska (2015), who studied modern online marketing literature and emphasized that internet marketing is an essential complement to traditional advertising techniques. It is a vital tool for businesses striving to achieve their financial goals, making online marketing a key driver in sales growth and success.

Additionally, Kitzinger (2020) highlighted that social media marketing has become a prominent trend, with online technology supporting two primary facets of

eCommerce: online marketing portals and email marketing. Both have gained immense popularity among companies and are attracting a global audience. Gräf (2019) also examined the use of online marketing strategies by companies in Denmark. Their survey found that both employees and customers prefer online shopping, with respondents noting that online marketing plays a crucial role in raising awareness and facilitating convenient purchases.

Further supporting this trend, Kiran Kumar N (2021) argued that online marketing has become essential in today's market, with businesses worldwide embracing this strategy. In India, for example, online marketing provides customers with easy access to products with just a click, while marketers recognize the importance of directly reaching potential customers. This ability to evaluate and compare products online helps consumers make more informed purchase decisions. Similarly, integrating advertising and marketing with social networking sites (SNS) has proven highly effective. Neti (2016) discussed how the growing number of SNS users offers businesses the opportunity to promote their products to a global audience. Utilizing these platforms not only boosts financial outcomes but also strengthens the brand's image in the minds of consumers.

Research Methodology and Sample

This study was conducted in the Tirunelveli District of Tamil Nadu, focusing on individuals who have social media accounts and follow the official social media pages of their sports teams. Given the significant role sports play in Tirunelveli, residents of this district were selected as the target population for the study. Data were collected through an online questionnaire between October and December 2023.

As per Malhotra (2007), convenience sampling is suitable for exploratory research aimed at generating ideas and insights. The sample size was calculated using a sampling formula, determining that a sample size of at least 384 was required (with a 5% margin of error and 95% confidence level, for p = 0.50, D = 0.05). Therefore, convenience sampling was used to gather data for this research.

A total of 471 respondents completed the questionnaire. However, 78 respondents who either did not have a Face book account or did not follow their football team's official Face book page were excluded. The study specifically targeted fans of three leading football teams: Fenerbahçe, Beşiktaş, and Galatasaray. Respondents who supported other teams were also removed from the data. The final sample consisted of 393 participants. Among these, 29% were female and 71% were male. The age distribution was as follows: 14% were 20 years old or younger, 66% were aged 21-30, 15% were aged 31-40, and 5% were aged 41 or older.

Objectives

❖ To determine which stage of the sports consumers' decision-making process is most influenced by social media.

❖ To identify the factor that has the greatest impact on social influence.

❖ To examined whether the effects of social influence on the decision-making process vary between genders.

Analyses and Results

For the statistical analysis, SPSS 20 and AMOS 21.0 software were utilized. The measurement model, which consisted of thirty observed variables and eight latent variables, was analyzed using confirmatory factor analysis.

Reliability and Validity

The reliability of the research variables was assessed using Cronbach's alpha (α) coefficient and composite reliability (CR) values. The values for all variables ranged from 0.739 to 0.909, exceeding the 0.70 threshold recommended by Nunnally and Bernstein (1994). In the confirmatory factor analysis, factor loadings were found to be significant and greater than 0.50, in line with the guidelines set by Fornell and Larcker (1981). Additionally, all average variance extracted (AVE) values were above 0.50. These findings are summarized in Table 1.

Table 1. Model statistics and factor loading

Item	Factor loading	AVE (Average variance extracted)	CR (Composite reliability)	α (Cronbach's alpha)
1. **Socialinfluence**				
1.1. If most my social media friends' likes/comments/shares about a sports product/event are in the same direction, my decisions are influenced to conform to the majority.	0.71	0.593	0.743	0.847
1.2. Likes, comments, and shares on social media impact my decision-making process because I believe they will provide accurate information about a sports product or event.	0.82			
2. **Social influence source**				
2.1. Likes/comments/shares of my family/close friends/colleagues on social media are effective on my decision-making process of a sports purchase.	0.81	0.509	0.801	0.739

Item	Factor loading	AVE (Average variance extracted)	CR (Composite reliability)	α (Cronbach's alpha)
2.2 Likes/comments/shares of not very close friends on social media are effective on my decision-making process of a sports purchase.	0.76			
2.3 My decision to buy a sports item is influenced by likes, comments, and shares on the social media page of my favourite team.	0.50			
2.4 Likes, comments, and shares on the social media page of the media that I follow have a significant influence on my decision to buy sports purchase.	0.73			
3. **Social plat form activities**				
3.1 In my decision-making process of a sports purchase, I am mostly influenced by the "likes" on social media.	0.78			
3.2 In my decision-making process of a sports purchase, social media "comments" have a major influence on my decision-making process.	0.80	0.650	0.848	0.797
3.3 In my decision-making process of a sports purchase, I am mostly influenced by the "shares" on social media.	0.82			
4. **Need recognition**				
4.1Likes/comments/shares on social media about sports producs/events let me realize my needs about those products/events.	0.86			
4.2 Likes/comments/shares on social media about sports products/ events prompt me about purchasing those products/events.	0.88			
4.3 Likes/comments/shares about sports produs/events enable me to reassess my needs.	0.87	0.718	0.910	0.909
Likes, comments, and shares on sports-related products and activities on social media make me think that I might need those things.	0.77			

Item	Factor loading	AVE (Average variance extracted)	CR (Composite reliability)	α (Cronbach's alpha)
5.　**Information search**				
5.1 When I make a research about sports products/events, I examine the related likes/comments/shares on social media.	0.86			
5.2 When I make a research about sports products/events, likes/comments/shares on social media are important sources of information.	0.85			
5.3 When I make a research about sports products/events, I think that likes/comments/shares on social media are reliable.	0.78	0.623	0.868	0.825
5.4 I don't make a purchase decision without examining the related likes/comments/shares on social media.	0.69			
6.　**Evaluation of alternatives**				
6.1 Before deciding to buy a sports product, I make sure to look for relevant likes, comments, and shares on social media.	0.80			
6.2 I evaluate the likes, comments, and shares on social media related to sports products and events when considering my options..	0,89			
6.3 Likes/comments/shares on social media about sports products/ events help me to evaluate the alternatives in my mind.	0.88	0.692	0.899	0.887
6.4 I don't finish evaluating the alternatives without checking the likes/comments/shares on social media about those sports products/events.	0.75			
7.　**Actual purchase**				
7.1 Likes/comments/shares on social media about sports products/ events influence the product/event I choose.	0.90			

Item	Factor loading	AVE (Average variance extracted)	CR (Composite reliability)	α (Cronbach's alpha)
7.2 Likes/comments/shares on social media about sports products/events influence my brand choice.	0.88	0.672	0.890	0.871
7.3 Likes/comments/shares on social media about sports products/ events influence the place of my purchase.	0.84			
7.4 Likes/comments/shares on social media about sports products/ events influence the time of my purchase.	0.64			
8. **Post-purchase evaluation**				
8.1WhenIsearchforsolutionstomyproblemsonmysports experience, I check the likes/comments/shares on social media related to that sports product/event.	0.84	0.671	0.911	0.909
8.2 I share my satisfaction or dissatisfaction about my sports experience on social media	0.81			
8.3 If I am satisfied with my sports experience, I share my next purchase decision on social media	0.81			
8.4 If I am not satisfied with my sports experience, I share my decision of not purchasing the same product/event again on social media	0.87			
8.5 After purchasing a sports product/ event, I check reviews on social media to evaluate my decision.	0.75			

To evaluate convergent and discriminate validity, the square root of the AVE values should exceed the correlations between constructs (Fornell & Larcker, 1981). For each construct, the common variance (squared correlations between latent variables) was lower than the AVE values. These results, along with the factor correlation matrix, are presented in Table 2. The factor correlation matrix indicates that the highest correlation, 0.690, occurs between social influence and need recognition within the decision-making process phases. These values confirm the reliability as well as the convergent and discriminate validity of the constructs.

Table 2. M (Mean), SD (standard deviation) and factor correlation values of research variables

Variables	M	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Social influence	2.85	1.09	**0.770**							
(2) Source of social influence	2.97	0.98	0.705	**0.713**						
(3) Social plat form activities	3.04	1.08	0.705	0.759	**0.806**					
(4) Need recognition	3.16	1.07	0.690	0.690	0.718	**0.847**				
(5) Information search	3.12	0.98	0.617	0.616	0.767	0.700	**0.771**			
(6) Evaluation of alternatives	2.83	1.06	0.591	0.707	0.693	0.661	0.756	**0.827**		
(7) Actual purchase	2.93	1.04	0.610	0.683	0.653	0.709	0.733	0.752	**0.819**	
(8) Post-Purchase evaluation	2.88	1.07	0.576	0.628	0.619	0.667	0.679	0.801	0.686	**0.819**

On the main diagonal are the square roots of AVE for each construct. SD: standard deviation;   ion
M:Mean

Confirmatory Factor Analysis

According to the existing thresholds (Fornell& Larcker, 1981; Kline, 2005; Marshet al., 1988), the model exhibits adequate fit to the data as the results in Table 4 show. Every path in the model was statistically significant ($t > 1.96$; $p = 0.001$).

Table 3. Measurement model goodness off it values

	p	χ^2/df	RMSEA	SRMR	CFI	NFI	GFI	TLI	AGFI
Measurement model	0.001	2.019	0.051	0.038	0.96	0.92	0.89	0.95	0.86

Hypothesis Testing

The structural model was analyzed using the maximum likelihood estimation method, along with the research hypotheses and paths. As shown in Table 5, the results indicate that the structural model fits the data well. The path estimates of the study model are illustrated in Figure 2, and all structural path estimates are statistically significant ($p < 0.01$).

Table 5. Goodness off it statistics for their search model

	χ^2	χ^2/df	RMSEA	SRMR	CFI	NFI	GFI	TLI	AGFI
Structural model	846.50	2.176	0.055	0.047	0.95	0.90	0.87	0.94	0.85

Discussions

The decision-making process places significant emphasis on the mental activities, information gathering, and evaluation of options that occur within the mind of a sports consumer. Social networking sites play a crucial role in influencing this process, as the information generated through user interactions affects customer decision-making. In addition to personal motivations, users within a consumer's online network shape their behavior. When overwhelmed by excessive online information, consumers often rely on the decisions of others to reduce cognitive effort.

Social media is considered a more reliable source of product and company information compared to marketer-provided content. Online consumer reviews are particularly influential in purchase decisions, offering indirect product experiences. These reviews help consumers evaluate options and are shown to have a greater impact on females than males. This study highlights significant gender differences in the perception of online reviews, revealing that women are more influenced by recommendations, especially from friends, which reduces perceived risk and increases their willingness to buy online. Positive social influence from peers also enhances fan identification and loyalty, with gender and team membership potentially moderating this effect on decision-making.

Social influence in e-commerce is further shaped by social media commitment and engagement. This study identifies social influence sources and platform activities as key factors affecting social influence on online networks. To strengthen their presence across a broader online spectrum, organizations should increase their use of diverse social media platforms. Moreover, top management must develop the skills necessary to navigate the rapidly evolving, communication-driven landscape.

Conclusions

In conclusion, the decision-making process of sports consumers is significantly influenced by social media interactions, online consumer reviews, and peer recommendations. Social networking sites serve as critical platforms where information is shared and trust is built, shaping consumer behavior and reducing perceived risks, particularly for female consumers. The study underscores the importance of positive social influence in fostering fan loyalty and highlights the moderating roles of gender and team membership in this process. To thrive in this dynamic environment, organizations must expand their presence across multiple social media platforms and develop strategies that capitalize on the power of online engagement. Top management must also acquire the skills needed to navigate the ever-evolving communication landscape. By proactively utilizing social media tools, sports organizations can not only

adapt to changing consumer behavior but also lead meaningful customer experiences and build lasting relationships in the digital age. Social media continues to drive customer behavior, compelling organizations to adapt. Instead of merely reacting, sports organizations should proactively implement strategies to leverage social media tools, enhancing customer experiences and fostering stronger relationships in the future.

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A COMPARATIVE STUDY ON BODY MASS INDEX BETWEEN CBSE AND STATE BOARD SCHOOLS STUDENTS IN METROPOLITAN CITY

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Abstract

Metropolitan city schools provide a high-quality education with diverse learning environments, advanced placement programs, and networking opportunities. They are well-funded, and equipped with modern facilities and technology. However, students often struggle with weight and obesity, which can impact their overall well-being. Maintaining a healthy weight can reduce the risk of chronic conditions, improve sleep, reduce joint pain, and boost self-esteem and social confidence. By focusing on health concepts, students can better engage in school and extracurricular activities. The results show that the body mass index ratios fall below the normal range, whereas the majority of students in metropolitan city schools fall between the underweight and overweight categories. T-test results reveal the Mean, Standard deviation value and sig (2 tailed). The Mean 20.78 & 21.59, Sd 11.55 &11.63, 't' value 6.510 and sig (2 tailed).000 respectively for the state board and CBSE School students in a metropolitan city.

Keywords: Body mass index, Metropolitan City, State board and CBSE

1. INTRODUCTION

A metropolitan city is defined under the 74th Amendment to the Indian Constitution. It is defined as a metropolitan area that any area with a population of at least ten lakhs or 1 million**,** located in one or more districts, and made up of two or more municipalities, panchayats, or other surrounding regions is known as Metropolitan City. The governor designates a metropolitan city or area by stating to the public. India is the largest country by population, the seventh-largest country by land, and the largest democratic nation in the world. India's metropolitan cities are heavily populated and play a key role in the economy of the nation.

Over the years, a lot of people have moved to major metropolitan cities in search of employment and a better way of living, and as a result, many cities are now nearly overpopulated and polluted. Mumbai, Pune, Delhi, Ahmedabad, Surat, Chennai, Kolkata, Bangalore, and Hyderabad are the nine metropolitan cities of India with a population of more than four million. Mumbai, with approximately 18 Million Population Delhi, with

16 Million Population, and Kolkata, with approximately 14 Million population, are the three most populated cities in India.

Metropolitan city schools offer students a high-quality education, a diverse learning environment, a variety of extracurricular activities, advanced placement and international programs, students easily find out about cultural and educational institutions, networking opportunities, and specialized college and career readiness programs. The metropolitan city schools are well-funded, and equipped with modern facilities, advanced technology, and experienced teachers. The diverse student population exposes students to a variety of cultures, backgrounds, and perspectives, enriching their educational experience. Metropolitan schools also provide opportunities for extracurricular activities, such as sports, arts, clubs, and community service, which help students develop skills and build strong resumes for college and future careers. The transportation also infrastructure in metropolitan areas make it easier for students to commute to school and access extracurricular activities.

The Metropolitan City school students engaged in many educational activities but they do not give preference for health concepts therefore suffering from so many diseases.

Metropolitan cities offer numerous opportunities for children's growth but also present challenges in their physical, mental, spiritual, emotional, and social well-being, including weight and obesity issues among students.

Maintaining a healthy weight has significant benefits for students' overall wellness. It promotes physical health by reducing the risk of chronic conditions like diabetes, heart disease, and certain cancers later in life. In the short term, healthy-weight students may enjoy better sleep, less joint pain, and improved mental well-being. Plus, a healthy weight can boost self-esteem and social confidence, helping students fully engage in school and extracurricular activities.

2. OBJECTIVE OF THE STUDY

1. The main objective of this study was to assess the body mass index of the metropolitan city school students

2. The objective of this study was to assess the body mass index of the State and CBSE school students in metropolitan city.

3. The objective of this study was to know the difference in body mass index between State and CBSE school students in metropolitan city

4. To find out body obesity proportion of the students the metropolitan city.

5. To know the ratio of underweight, normal weight and overweight of the metropolitan city school students

3. HYPOTHESIS

❖ The researcher hypothesized that the majority of metropolitan city school children fall into the overweight category on their body mass index.

❖ The researcher hypothesized that there is a significant difference between State and CBSE Board schools' students' body mass index.

4. SIGNIFICANCE OF THE STUDY

The study could be useful in determining the Body mass index of metropolitan city school students.

5. DESIGN OF THE STUDY

Bangalore is one of the Metropolitan city where the study was conducted by these schools. A total of 1000 boys from 20 different schools of various boards. In that State Board, 500 and CBSE 500 subjects were randomly selected from Bengaluru, Karnataka, India. The chosen students studying 8th to 10th standard. They selected 10 schools from the State Board and 10 schools from CBSE each school chose 50 subjects. The student's age range between 14 to 16 years.

BMI (Body Mass Index) is a calculation used to determine if a person has a healthy body weight for their height. Here's a simple explanation of BMI and how to calculate it:

BMI is calculated using the formula:

BMI= Weight (kg)
        Height (m)2

4. STATISTICAL TECHNIQUES

Paired sample T-test was used to assess whether there was a significant difference between the State Board and CBSE in metropolitan city schools.

5. RESULTS AND INTERPRETATION

Table 1   The Overall ratio in Body Mass Index of the Metropolitan city school students

	Under weight	Normal weigth	Over weight	Class 1	Class 2	Class 3
Metropolitan city school students	388 (38.8%)	447 (44.7%)	127 (12.7%)	20 (2%)	14 (1.4%)	04 (04%)

The table shows that out of a total of 1000 subjects, 388 (38.8%) underweight, 447 (44.7%) normal weight,127 (12.7%) overweight, Class 1 obese children (20%), Class 2-14 students (1.4%), and Class 3-04 students (04%) all have body mass index ratios that fall below the normal range, whereas the majority of students in metropolitan city schools fall between the underweight and overweight categories.
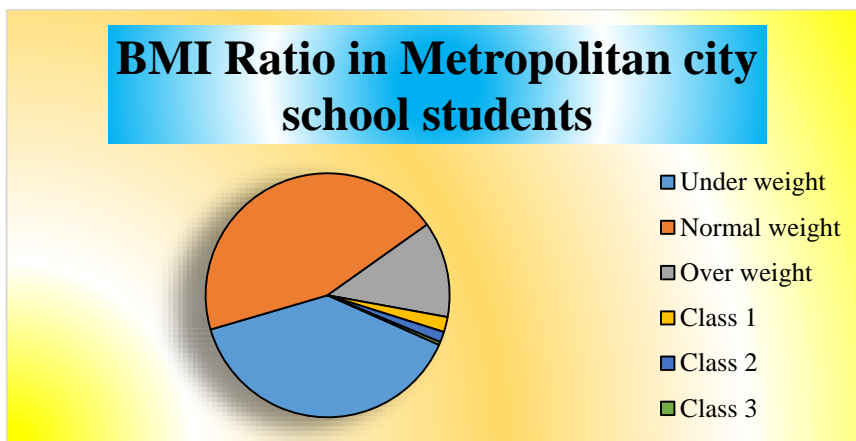
Figure 1   **The Pie Diagram shows the total ratio of   in Body Mass Index of the Metropolitan city school students**

Table 2. **Body Mass Index (BMI) ranges to classify individuals' weight status at CBSE and STATE BOARD schools in a metropolitan city.**

	Under weight	**Normal weight**	**Over weight**	**Class 1**	**Class2**	**Class 3**
CBSE	166 (33.2%)	233 (46.6%)	82 (16.4%)	10 (2%)	08 (1.6%)	01 (0.2%)
State board	222 (44.4%)	214 (42.8%)	45 (9%)	10 (2%)	06 (1.2%)	03 (0.6%)

The above table shows that Underweight, Normal weight, Overweight, Class-1obesity, Class-2 Obesity and Class-3 morbid obesity in that CBSE U-166(33.2%), N-233(46.6%), O-82(16.4%), C1-10(2%), C2-08(1.6%) and C3 01 01(0.2%) and STATE BOARD   U-222(44.4%), N-214(42.8%)O-45(9%), C1-10(2%), C2-06(1.2%) and C3 (0.6%) respectively for the metropolitan city schools students.
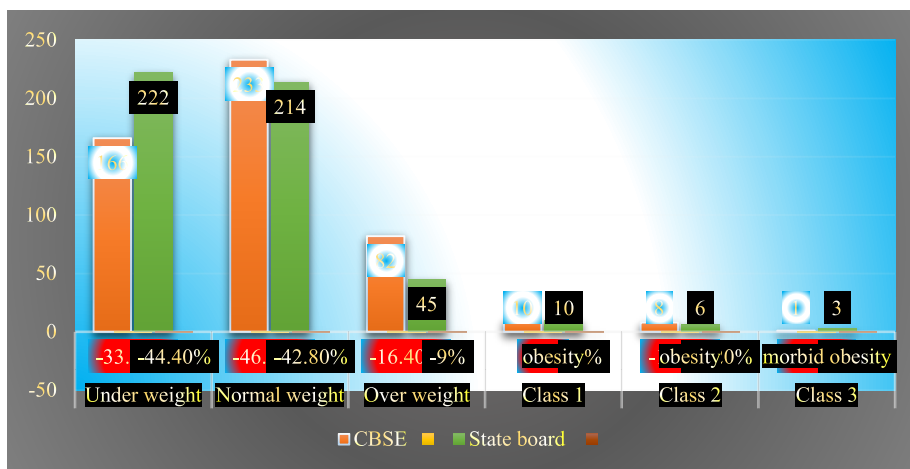

Figure 2. **The Bar Diagram shows the to classify individuals' BMI range of CBSE And STATE BOARD schools in a metropolitan city**

Table 3.   Paired sample T-test of the Body mass index of CBSE and State Board schools in Metropolitan city

	Mean	Sd	t	Sig(2 tailed)
State Board	20.7876	11.55	6.510	.000
CBSE	21.5927	11. 63		

Interpretation: Paired sample T-test tables reveal the Mean, Standard deviation value and sig (2tailed). The Mean 20.78 & 21.59, Sd 11.55 &11.63, 't' value 6.510 and sig (2tailed).000 respectively for the state board and CBSE School students in a metropolitan city.
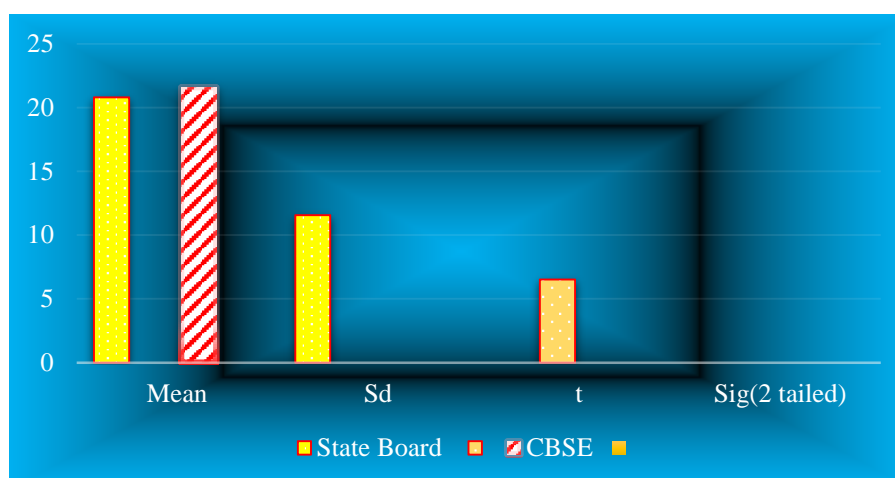
Figure 1   The Bar Diagram Shown Mean And Standard Deviation of Body Mass Index between State Board and CBSE Schools Students In Metropolitan City

6. CONCLUSIONS

The study subsequent conclusion was reached based on the data

1. Their exist **largest group** of students (44.7%) are in the **normal weight** category, which is a positive indicator of health among metropolitan city school students

2. However the study exist **38.8%** of students are **underweight**, which is concerning as it might reflect malnutrition or other health-related issues.

3. The study revels into Approximately **16.5%** of students fall into the overweight or obese categories (overweight, Class 1, 2, and 3 obesity combined), highlighting a need for intervention to promote better nutrition and exercise habits.

4. A larger proportion of State Board students are underweight, which might indicate inadequate nutrition or socio-economic disparities.

5. CBSE students tend to have better overall health patterns, with a higher percentage falling into the normal weight category.

6. The study exist CBSE students have a higher percentage of overweight students and those in Class 2 Obesity, possibly due to sedentary lifestyles or dietary factors.

7. The analysis reveals a statistically significant difference between State Board and CBSE in a measure related to BMI, with slightly different mean values, indicating a significant difference in the comparison.

8. There is a significant difference in the Body Mass Index of students from CBSE and State Board schools in the metropolitan city. The higher BMI mean for CBSE schools might indicate differences in lifestyle, dietary habits, or physical activity levels between students of these school boards.

RECOMMENDATION

Light of the study's findings, the researcher suggests the following recommendation:

1. The studies could be useful to parents to know the children's body obesity proportion.

2. A similar study can be carried out on pre-university college boys and girls students also.

3. The studies could be useful To know the ratio of underweight, normal weight and overweight of the metropolitan city school students and help coaches /physical education teachers to train the students.

4. The study recommend to Focus on improving nutrition programs for State Board students, especially for those who fall into the underweight category.

5. The study focus on the Introduce physical activity and healthy eating campaigns targeting students, where higher rates of overweight and obesity are observed.

6. The research could benefit from school-wide health initiatives, counselling, and regular BMI monitoring to improve overall student health

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THE MULTIFACETED DETERMINANTS OF SWIMMERS' PERFORMANCE: A THEORETICAL ANALYSIS IN ERNAKULAM DISTRICT

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Abstract

Swimming is a highly technical and physically demanding sport that requires a combination of strength, endurance, technique, and mental fortitude. The performance of swimmers is influenced by various factors, including physiological attributes, biomechanical efficiency, psychological preparedness, and environmental conditions. This article provides a theoretical analysis of the performance of swimmers in Ernakulam District, evaluating the impact of training methodologies, nutrition, psychological factors, and environmental influences on their competitive success.

Introduction

Swimming, both as a competitive and recreational activity, has seen significant growth in Ernakulam District due to its coastal geography, accessibility to pools, and increasing participation in national and international competitions. The determinants of swimming performance go beyond physical ability, encompassing a blend of physiological, psychological, biomechanical, and environmental factors. This paper delves into the critical components that shape a swimmer's success in this region.

Physiological Factors Affecting Performance

Cardiovascular Endurance

Swimmers require a high level of cardiovascular efficiency to sustain prolonged exertion. VO2 max, which measures the maximum oxygen uptake, is essential for enhancing endurance swimming. Studies show that elite swimmers have superior aerobic capacity, allowing them to maintain performance over extended periods (Smith et al., 2019). Training techniques such as interval swimming and aerobic drills are essential for improving cardiovascular endurance.

Muscle Strength and Power

Strength in key muscle groups, including the core, shoulders, and legs, plays a crucial role in effective propulsion and reducing fatigue. Swimmers undergo strength training regimens that include resistance exercises, weight training, and functional training to build power and endurance (Jones & Williams, 2020). Dryland training, such as plyometrics and core exercises, is also integral to enhancing strength for in-water performance.

Flexibility and Mobility

Greater flexibility in the shoulders, hips, and ankles enhances stroke mechanics and helps prevent injuries. Swimmers incorporate stretching routines, yoga, and dynamic warm-ups to improve mobility and maintain an efficient range of motion (Anderson et al., 2018). Flexibility is particularly important for optimizing stroke efficiency and reducing drag in the water.

Body Composition

Optimal body composition with a lean muscle mass-to-fat ratio influences buoyancy and minimizes drag. Research indicates that body composition significantly affects hydrodynamics, with leaner swimmers experiencing reduced resistance in the water (Brown & Lee, 2017). Proper nutritional strategies and targeted training contribute to maintaining an ideal physique for competitive swimming.

Biomechanical Considerations in Swimming

Stroke Efficiency

The effectiveness of stroke mechanics in freestyle, backstroke, breaststroke, and butterfly impacts propulsion and energy conservation. Proper stroke technique reduces unnecessary movements and optimizes force application, leading to improved swimming efficiency (Miller & Thompson, 2021). Swimmers undergo regular stroke analysis and video feedback to refine their technique.

Starts and Turns

Fast reaction times, explosive push-offs, and streamlined turns significantly contribute to competitive success. Studies show that effective starts and turns can save crucial milliseconds, which can be the difference between winning and losing (Clarkson et al., 2019). Strength and flexibility training, combined with precise timing, enhance performance in these areas.

Hydrodynamic Principles

Techniques to minimize resistance, such as proper body positioning and streamlining, enhance swimming speed and efficiency. Hydrodynamic research emphasizes the importance of reducing frontal drag and maintaining an optimal glide position (Wilson, 2020). Swimmers practice drills to perfect body alignment and streamline positioning to maximize speed in the water.

Psychological Factors in Swimming Performance

Mental Resilience and Focus

The ability to cope with pressure, setbacks, and high-intensity training is crucial for success. Psychological resilience allows swimmers to stay motivated and perform

optimally under stress (Gucciardi et al., 2021). Mental conditioning techniques, such as mindfulness and stress management strategies, help in developing mental toughness.

Motivation and Goal Setting

Establishing clear, measurable goals and maintaining intrinsic motivation lead to improved performance. Studies highlight the role of self-determination theory in sports, where intrinsic motivation drives sustained effort and excellence (Ryan & Deci, 2018). Coaches play a vital role in setting progressive goals and maintaining motivation levels among swimmers.

Visualization and Mental Preparation

Mental imagery and focused concentration enhance stroke execution and race strategy. Swimmers use visualization techniques to mentally rehearse their races, improving confidence and reducing anxiety (Cumming & Ramsey, 2019). Mental preparation is particularly crucial before competitions, allowing athletes to execute their plans with precision.

Training Methodologies and Their Effectiveness

Periodization and Structured Training

Implementing macro, meso, and micro training cycles optimizes peak performance timing. Structured training programs ensure that swimmers develop progressively while preventing overtraining (Bompa & Buzzichelli, 2019). Coaches use periodization to schedule training phases that focus on endurance, strength, speed, and tapering before competitions.

Strength and Conditioning Programs

Dryland training, including resistance and plyometric exercises, complements water-based workouts. Strength training for swimmers includes exercises targeting the shoulders, core, and lower body, enhancing overall power (Kraemer & Fleck, 2018). Proper strength training reduces injury risk while improving stroke efficiency.

High-Intensity Interval Training (HIIT)

A method proven to enhance both aerobic and anaerobic capacities in swimmers. HIIT sessions include sprint intervals, lactate threshold sets, and endurance-focused drills, improving swimmers' ability to sustain high speeds (Buchheit & Laursen, 2020).

Environmental and External Influences

Climate and Water Quality

Factors such as water temperature, salinity, and cleanliness affect swimmers' endurance and comfort. Research suggests that temperature-regulated pools enhance

training outcomes compared to open-water environments (Smith et al., 2019). The quality of swimming facilities plays a critical role in developing competitive swimmers.

Coaching and Training Infrastructure

Access to high-quality coaching, training facilities, and modern swimming pools significantly impact skill development. Ernakulam District has seen improvements in swimming infrastructure, allowing better training opportunities for athletes (Jones & Williams, 2020). Advanced training tools such as underwater cameras and biomechanical analysis software further enhance coaching effectiveness.

Nutritional Considerations

A well-balanced diet, hydration, and recovery nutrition strategies contribute to enhanced performance and stamina. Sports nutrition experts emphasize the importance of macronutrient balance, hydration, and meal timing for optimal performance (Burke et al., 2018). Swimmers follow structured meal plans that support their energy demands and recovery needs.

Conclusion

The performance of swimmers in Ernakulam District is shaped by a combination of physiological, biomechanical, psychological, and environmental determinants. To maximize competitive success, athletes must adopt a holistic approach that integrates structured training, proper nutrition, mental conditioning, and optimized biomechanics. Future studies should explore empirical data collection to further validate these theoretical insights and refine training methodologies for swimmers in the region.

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CHALLENGES AND OPPORTUNITIES FOR PHYSICAL EDUCATION TEACHERS IN TIRUNELVELI DISTRICT PRIVATE SCHOOLS

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Abstract

Physical education (PE) is an essential component of the school curriculum, contributing to the holistic development of students by fostering physical fitness, social skills, and mental well-being. Despite its importance, PE is often overlooked in private schools, where academic excellence is prioritized. This article explores the role of PE teachers in Tirunelveli District's private schools, their responsibilities, challenges, and potential solutions to enhance the effectiveness of PE programs. The findings highlight the need for policy reforms, infrastructure development, and teacher training programs to strengthen PE education in private institutions.

1. Introduction

Education is not merely the acquisition of knowledge but the development of a well-rounded individual. Physical education, an integral part of school education, promotes fitness, discipline, and social skills among students. PE teachers play a crucial role in ensuring that students receive proper physical training, guidance, and motivation to lead an active lifestyle (Bailey, 2006).

In private schools, particularly in districts like Tirunelveli, the role of PE teachers is often marginalized due to a strong emphasis on academics. Many schools allocate limited time and resources to sports and physical education, leading to concerns about students' overall well-being (Sallis et al., 2012). This paper examines the responsibilities of PE teachers, the challenges they face, and strategies to enhance their effectiveness in private schools.

2. Roles and Responsibilities of Physical Education Teachers
2.1 Curriculum Implementation

PE teachers are responsible for implementing the physical education curriculum in alignment with national and state educational policies. Their duties include designing lesson plans that incorporate various physical activities such as warm-up exercises, sports, and theoretical lessons on health and fitness (Lumpkin, 2008).

2.2 Motor Skill and Fitness Development

One of the core responsibilities of PE teachers is to improve students' motor skills, agility, strength, and endurance. This is done through structured training in sports like basketball, football, cricket, athletics, and gymnastics. Proper physical training helps in reducing childhood obesity and related health issues (WHO, 2020).

2.3 Promotion of Health and Wellness

PE teachers play a critical role in educating students about the importance of physical fitness, mental health, and nutrition. They guide students on proper exercise techniques, injury prevention, and stress management through yoga, meditation, and fitness programs (Dobbins et al., 2013).

2.4 Organizing Sports Competitions and Extracurricular Activities

In private schools, inter-school and intra-school sports competitions play a significant role in fostering teamwork, leadership, and discipline among students. PE teachers are responsible for coaching students for tournaments, planning sports days, and ensuring fair play (Kirk, 2010).

2.5 Psychological and Social Development

PE programs also contribute to students' psychological and social development by instilling values such as cooperation, patience, and self-confidence. Through structured activities, PE teachers help students develop problem-solving skills, adaptability, and sportsmanship (Bailey, 2006).

3. Challenges Faced by PE Teachers in Private Schools
3.1 Lack of Infrastructure and Resources

Many private schools in Tirunelveli lack adequate sports facilities, such as playgrounds, indoor training centers, and quality equipment. This limits the scope of physical education programs and affects the overall effectiveness of PE teachers (Hardman, 2008).

3.2 Emphasis on Academic Excellence Over Physical Education

In many private institutions, academic performance takes precedence over physical education. School administrators often reduce PE class hours to accommodate extra academic sessions, undermining the importance of physical fitness (Sallis et al., 2012).

3.3 Parental and Institutional Negligence

Parents and school management sometimes view PE as a non-essential subject, leading to reduced support for sports programs and lower student participation rates. This

negatively impacts the motivation of PE teachers and limits the success of physical education initiatives (Haerens et al., 2011).

3.4 Low Salaries and Job Insecurity

Compared to other teaching positions, PE teachers in private schools often receive lower salaries and face job instability due to contractual employment policies. This discourages qualified professionals from pursuing long-term careers in physical education (Hardman, 2008).

4. Recommendations for Enhancing the Role of PE Teachers
4.1 Infrastructure Development

Private schools should invest in developing proper sports facilities, including playgrounds, indoor courts, and fitness equipment, to support effective PE programs. Collaboration with government and private organizations can help improve resources for sports education (Dobbins et al., 2013).

4.2 Policy Reforms and Curriculum Enhancement

Education boards should implement policies that mandate a minimum number of PE hours per week and integrate fitness programs into the academic curriculum. This would ensure a balanced focus on both academic and physical development (Kirk, 2010).

4.3 Teacher Training and Professional Development

Regular workshops, certifications, and advanced training programs should be provided to PE teachers to enhance their knowledge and instructional methods. Training in modern fitness techniques, sports science, and child psychology can improve their effectiveness (Haerens et al., 2011).

4.4 Awareness Programs for Parents and School Management

Parents and school administrators should be educated about the importance of PE in a child's development. Conducting awareness campaigns and parent-teacher meetings can help in changing perceptions and increasing support for PE programs (Sallis et al., 2012).

5. Conclusion

Physical education teachers in Tirunelveli District private schools play a crucial role in students' holistic development, promoting physical fitness, discipline, and teamwork. Despite the challenges they face, including lack of resources, low institutional support, and academic prioritization, their contribution remains significant. Addressing these challenges through policy reforms, infrastructure improvements, and teacher development programs can enhance the effectiveness of physical education in private schools. By recognizing and strengthening the role of PE teachers, schools can ensure a healthier, more active generation of students.

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