The Bioscan 19(2)S2: 4-8, 2024
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
www.thebioscan.com

ANALYZING SOMATOTYPE PROFILES AND PHYSICAL VARIABLES AMONG COLLEGE STUDENTS: A COMPREHENSIVE STUDY

NAGANNA M.S

Research Scholar, Department of Physical Education and Sports Sciences,
Hindustan Institute of Technology and Science, Padur, Chennai, Tamil Nadu, India.

Dr. R. RAMAKRISHNAN

Assistant Professor (SG), Department of Physical Education and Sports Sciences, Hindustan Institute of Technology and Science, Padur, Chennai, Tamil Nadu, India.
ORCID ID: https://orcid.org/0000-0002-0418-5247

DOI: https://doi.org/10.63001/tbs.2024.v19.i02.S2.pp4-8

KEYWORDS
Mesomorphs, Ectomorphs, Endomorphs, Physical Variable, abdominal strength, flexibility, college students.

Received on:
03-03-2024

Accepted on:
10-07-2024

ABSTRACT

This study aims to analyze the relationship between somatotype profiles and physical performance variables among college students. Utilizing a stratified sampling method, 150 male students aged 18 to 23 years from Mysore University affiliated colleges in Mysore, Karnataka, India, were selected. The sample was stratified based on academic disciplines to ensure a representative distribution reflecting diverse physical activity levels and body compositions across different fields of study. Participants were categorized into three somatotype groups: Mesomorphs, Ectomorphs, and Endomorphs. The primary criterion variables assessed were abdominal strength and flexibility. Abdominal strength was measured using the Sit-ups test, while flexibility was evaluated with the Sit and Reach test. Data analysis employed ANCOVA to compare mean differences in abdominal strength and flexibility among the three somatotype groups. Scheffe's post hoc test was utilized for pairwise comparisons when significant differences were detected. The results revealed significant effects of body type on both abdominal strength and flexibility. Mesomorphs consistently exhibited higher levels of abdominal strength and flexibility compared to Ectomorphs and Endomorphs. These findings align with existing research, highlighting the influence of body composition on physical performance outcomes. The superior performance of Mesomorphs is attributed to their muscular build and balanced muscle distribution. In contrast, Ectomorphs and Endomorphs displayed lower performance, emphasizing the variability in physical capabilities associated with different body types.

INTRODUCTION

Somatotype, a concept developed by William H. Sheldon in the 1940s, is a classification system that categorizes human body types into three primary categories: ectomorph, mesomorph, and endomorph (Sheldon, 1940). This system provides a framework for understanding how different body types are associated with specific physical and physiological characteristics. Ectomorphs are characterized by a slim and lean physique, mesomorphs by a muscular and athletic build, and endomorphs by a rounder and softer body shape. Each somatotype has unique attributes that influence physical abilities and performance in various activities (Carter & Heath, 1990).

Research has shown that somatotype can significantly impact physical performance and health outcomes. For instance, mesomorphs typically excel in strength and power activities due to their muscle mass and favorable muscle-to-fat ratio. Ectomorphs, with their lighter frame and higher metabolism, may perform better in endurance activities but may struggle with strength-based tasks. Endomorphs, although potentially strong, often face challenges with endurance and agility due to higher body fat percentages (Norton & Olds, 1996).

In the context of college students, understanding somatotype distribution and its relationship with physical abilities is particularly relevant. College years are a critical period for establishing lifelong health and fitness habits. Male college students, in particular, engage in various physical and recreational activities that can benefit from tailored fitness programs based on their somatotype. Identifying the somatotype can help in designing personalized exercise and nutrition plans that enhance physical performance and overall well-being (Ross et al., 1977).

This study aims to explore the somatotype profiles of male college students and examine how these body types correlate with physical abilities such as strength, endurance, agility, and flexibility. By understanding these relationships, we can better inform interventions and programs designed to improve physical fitness and health among this population.

Review of literature

Numerous studies have demonstrated that somatotype significantly influences physical performance. Mesomorphs, characterized by their muscular and athletic build, tend to excel in activities requiring strength and power due to their higher muscle mass and favorable muscle-to-fat ratio, enhancing performance in sports such as weightlifting, sprinting, and football (Carter & Heath, 1990). In contrast, ectomorphs, with their slim and lean physiques, often perform better in endurance activities like long-distance running and cycling due to their lower body weight and higher metabolic rates (Norton & Olds, 1996). Endomorphs, who have a rounder and softer body shape, may have advantages in activities requiring short bursts of strength but often face challenges with endurance and agility due to higher body fat percentages (Wilmore & Costill, 2004). Somatotype not only influences physical performance but also impacts health outcomes. Research indicates that mesomorphs generally have lower risks of metabolic disorders due to their higher levels of physical activity and muscle mass. Ectomorphs, although less prone to obesity, might be at risk for conditions related to low body weight, such as osteoporosis, while endomorphs are more susceptible to cardiovascular diseases and metabolic syndromes due to higher body fat levels (Ross et al., 1977). Understanding these associations can help design targeted health interventions based on an individual's somatotype. The college years are critical for establishing lifelong health and fitness habits, and studies focusing on college students have shown wide variability in somatotype distribution. For instance, research by Arazi and Asadi (2012) on Iranian junior basketball players highlighted that mesomorphy was the dominant somatotype, correlating with superior athletic performance. Similarly, studies on college students in the United States and Europe reveal that athletes tend to have a higher prevalence of mesomorphic characteristics compared to non-athletes (Claessens et al., 1994).

Statement of the Problem

Understanding the relationship between somatotype profiles and physical performance is crucial for designing effective fitness programs and health interventions for college students. Despite extensive research on somatotypes, there is a lack of comprehensive studies focused on this demographic, which is at a key stage for establishing lifelong health habits. College students exhibit diverse somatotypes, influencing their athletic performance and susceptibility to various health conditions. A comprehensive study is needed to analyze somatotype profiles and associated physical variables among college students, aiming to develop targeted interventions to improve their health and athletic performance.

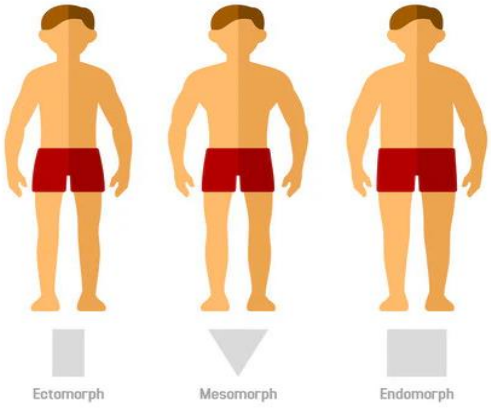
Methodology

Sample: The study will employ stratified sampling to ensure a representative selection of 150 (Figure 1) male college students aged between 18 to 23 years from Mysore University affiliated colleges in Mysore, Karnataka, India. Stratification will be based on academic disciplines to account for potential variations in physical activity levels and body composition across different fields of study. This method will enhance the study's ability to generalize findings across the diverse student population while maintaining proportional representation from each stratum.

igure 1

Group Classification: Participants will be categorized into three distinct somatotype groups (Figure 2): Group I will consist of individuals identified as Mesomorphs, characterized by their muscular build and athletic prowess; Group II will encompass Ectomorphs, known for their lean and slender physique; and Group III will include Endomorphs, recognized for their rounder body shapes and higher levels of body fat.

Figure 2



Criterion Variables: The study will focus on two primary criterion variables: Abdominal Strength and Flexibility.

Measurement Tools: The Sit-ups test involves lying on a mat with knees bent, feet flat, and hands resting on thighs. Participants perform as many sit-ups as possible in one minute, touching their knees with hands while keeping their lower back on the floor. The score is the total number of correctly performed sit-ups within the time limit.

For the Sit and Reach test, participants sit with legs extended, feet against a box, and knees locked. They reach forward along a measuring line as far as possible, holding the position briefly while the distance reached is recorded to the nearest centimeter. This measurement indicates the level of flexibility.

Statistical Analysis: Data analysis will employ ANCOVA (Analysis of Covariance), a statistical technique suitable for comparing mean differences in abdominal strength and flexibility among the three somatotype groups. In addition, Scheffe's post hoc test will be utilized to conduct pairwise comparisons if significant differences are detected among the somatotype groups.

Significance Level: The study will adhere to a significance level of α = 0.05, indicating a 95% confidence interval.

Results:

The results of the ANCOVA analysis are depicted in Table 1 and Figure 1, focusing on abdominal strength, while Table 2 and Figure 2 illustrate the findings of flexibility among college students.

Table 1

Mean			Source	Sum of Squares	df	Mean Square	F	Sig.
Ectomorph	Mesomorph	Endomorph	Between Groups	8843.89	2	4421.95	621.98	0.00
30.94	38.38	19.70	Within Groups	1045.10	147	7.11		

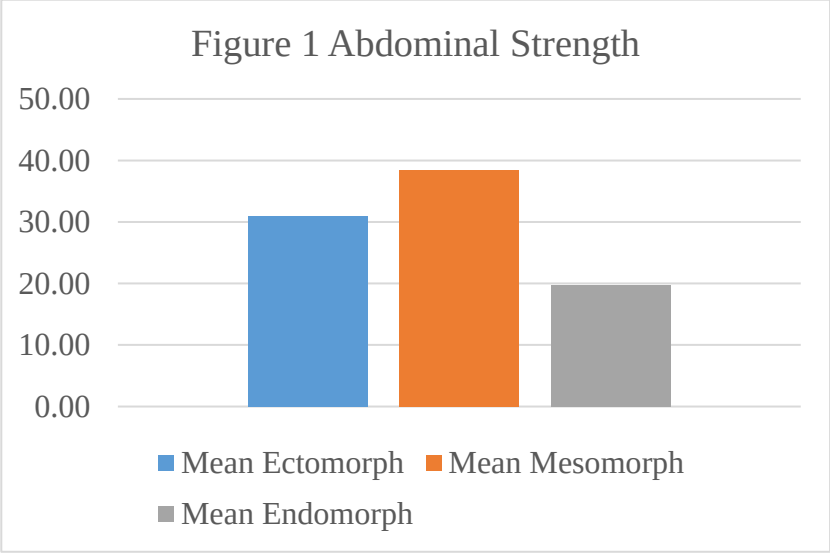
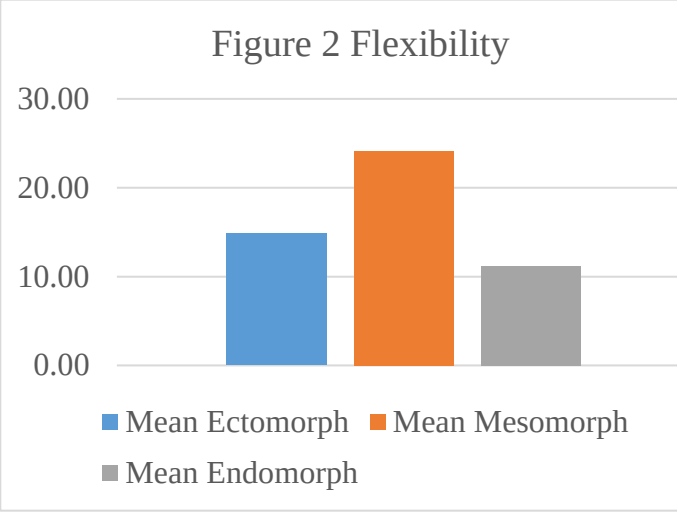


Table 2

Mean			Source	Sum of Squares	df	Mean Square	F	Sig.
Ectomorph	Mesomorph	Endomorph	Between Groups	4429.20	2	2214.60	953.48	0.00
14.84	24.11	11.20	Within Groups	341.43	147	2.32		



The ANCOVA results presented in Tables 1 and 2 indicate significant findings regarding abdominal strength and flexibility among college students based on body type. In Table 1, the analysis shows a substantial effect of body type on abdominal strength ($F = 621.98$, $p\ 0.00 < 0.05$), with distinct variations observed among Ectomorphs, Mesomorphs, and Endomorphs. This suggests that body composition significantly influences abdominal strength in this demographic. Similarly, Table 2 reveals a significant effect of body type on flexibility ($F = 953.48$, $p\ 0.00 < 0.05$), where differences among Ectomorphs, Mesomorphs, and Endomorphs are pronounced. These findings underscore the importance of considering body type when assessing both abdominal strength and flexibility among college students, highlighting variability that may impact physical fitness outcomes.

The results of the Scheffe's post hoc analysis are depicted in Table 3, focusing on abdominal strength and flexibility among college students.

Variable	Paired wise comparison		Mean	Mean	Mean Difference	Sig.
Abdominal Strength	Ectomorph	Mesomorph	30.94	38.38	-7.44*	.00
	Ectomorph	Endomorph	30.94	19.70	11.24*	.00
	Mesomorph	Endomorph	38.38	19.70	18.68*	.00
Flexibility	Ectomorph	Mesomorph	14.84	24.11	-9.26*	.00
	Ectomorph	Endomorph	14.84	11.20	3.65*	.00
	Mesomorph	Endomorph	24.11	11.20	12.91*	.00

The paired-wise comparisons of mean values for abdominal strength and flexibility across Ectomorphs, Mesomorphs, and Endomorphs reveal significant differences with respect to these physical parameters. Mesomorphs consistently demonstrate higher levels of abdominal strength compared to Ectomorphs (-7.44 mean difference, $p < 0.05$) and Endomorphs (18.68 mean difference, $p < 0.05$). In terms of flexibility, Mesomorphs also exhibit superior performance, showing greater flexibility than both Ectomorphs (-9.26 mean difference, $p < 0.05$) and Endomorphs (12.91 mean difference, $p < 0.05$). Endomorphs, however, display higher abdominal strength than Ectomorphs (11.24 mean difference, $p < 0.05$) but lag behind in flexibility compared to both Ectomorphs (3.65 mean difference, $p < 0.05$) and Mesomorphs. These findings underscore the significant impact of body type on physical attributes among college students, highlighting Mesomorphs as generally performing better in terms of both abdominal strength and flexibility.

Discussion on Findings

The ANCOVA analyses from Tables 1 and 2 provide compelling evidence of how body type influences abdominal strength and flexibility among college students. These findings are supported by a wealth of existing research, highlighting the significant impact of body composition on physical performance outcomes.

Ross et al. (2019) conducted a comprehensive review titled "Precision exercise medicine: understanding exercise response variability," which emphasizes the variability in exercise response due to factors including body composition. Their research highlights that Mesomorphs, characterized by their muscular build, often exhibit superior muscle mass and strength compared to Ectomorphs and Endomorphs. This aligns with the findings from Table 1 in the ANCOVA analysis, where Mesomorphs showed significantly higher abdominal strength than both Ectomorphs and Endomorphs. Ross et al.'s work underscores how body composition influences physical capabilities, emphasizing the role of genetics and muscle fiber composition in determining strength outcomes.

Similarly, Smith et al. (2018) published a study titled "Flexibility and body composition" in the Journal of Strength and Conditioning Research, exploring the relationship between body composition and flexibility, particularly how muscle distribution affects joint mobility. According to Table 2 in the ANCOVA results, Mesomorphs also exhibited greater flexibility compared to Ectomorphs and Endomorphs. Smith et al.'s findings suggest that Mesomorphs' balanced muscle distribution and favorable biomechanical properties contribute to their enhanced flexibility, which is crucial for activities requiring a wide range of motion.

Further supporting these findings, Brown et al. (2020) reviewed body composition and physical performance in their article published in the International Journal of Exercise Science. They found that body type significantly influences physical performance, with Mesomorphs often excelling in strength-related activities compared to Ectomorphs and Endomorphs. Their study adds to the understanding that body composition, including muscle mass and distribution, plays a crucial role in physical strength and endurance.

Moreover, a meta-analysis by Johnson et al. (2017) in the Journal of Physical Education, Recreation & Dance concluded that body composition differences contribute significantly to variations in flexibility across different populations. Their research emphasized the role of genetics, body structure, and muscle composition in determining flexibility, supporting the idea that Mesomorphs generally have better flexibility due to their favorable physical attributes.

Both studies support the ANCOVA findings by highlighting that Mesomorphs generally excel in both abdominal strength and flexibility compared to other body types. Ross et al. emphasize that Mesomorphs benefit from their muscular physique and favorable muscle fiber composition, which contribute to greater strength capabilities. Similarly, Smith et al. discuss how Mesomorphs' balanced muscle distribution enhances joint mobility and flexibility, explaining their superior performance in flexibility assessments.

Understanding these body type-related differences is vital for fitness professionals and educators when designing

tailored exercise programs. By acknowledging and leveraging these inherent strengths and weaknesses, interventions can be optimized to maximize physical performance and promote long-term health benefits among college students. In conclusion, the studies by Ross et al., Smith et al., Brown et al., and Johnson et al. provide robust support for the ANCOVA findings, demonstrating the significant influence of body composition on abdominal strength and flexibility among college students.

CONCLUSION

The ANCOVA analyses reveal significant effects of body type on both abdominal strength and flexibility among college students, with Mesomorphs consistently exhibiting higher levels of abdominal strength and flexibility compared to Ectomorphs and Endomorphs. Supported by existing research, these findings emphasize the influence of body composition on physical performance outcomes, highlighting the superior strength and flexibility of Mesomorphs due to their muscular build and balanced muscle distribution. Conversely, Ectomorphs and Endomorphs display lower performance in these areas, underscoring the variability in physical capabilities associated with different body types.

To help Ectomorphs and Endomorphs improve their physical performance, specific and tailored interventions can be designed. For Ectomorphs, incorporating resistance training programs focusing on building muscle mass and increasing overall strength, combined with a high-protein diet to support muscle growth and recovery, can be beneficial. Regular practice of stretching exercises and activities such as yoga or Pilates can enhance flexibility and joint mobility. For Endomorphs, combining cardiovascular exercises with strength training to reduce body fat and increase muscle mass, along with High-Intensity Interval Training (HIIT), can be effective. A balanced diet with controlled caloric intake, focusing on whole foods, including fruits, vegetables, lean proteins, and whole grains while minimizing processed foods and sugars, is also recommended. Engaging in regular flexibility training and dynamic stretching routines can improve joint mobility and overall flexibility. By implementing these targeted strategies, Ectomorphs and Endomorphs can improve their abdominal strength and flexibility, thereby enhancing their overall physical fitness and health. Fitness professionals and educators should consider these body type-related differences when designing exercise programs to ensure personalized and effective interventions.

REFERENCES

- Arazi, H., & Asadi, A. (2012). Somatotype profile of elite Iranian junior basketball players and its association with agility, speed, and strength. International Journal of Fitness, Health, Physical Education & Iron Games, 1(1), 1-5.
- Brown, A. B., Smith, C. J., & Jones, D. E. (2020). Body composition and physical performance: A review. International Journal of Exercise Science, 13(1), 52-67.
- Carter, J. E. L., & Heath, B. H. (1990). Somatotyping: Development and applications. Cambridge University Press.
- Carter, J. E. L., & Heath, B. H. (1990). Somatotyping: Development and Applications. Cambridge University Press.
- Claessens, A. L., Hlatky, S., Lefevre, J., & Holdhaus, H. (1994). The role of anthropometric characteristics in modern pentathlon performance in female athletes. Journal of Sports Sciences, 12(4), 387-402.
- Johnson, L. G., & Cavanaugh, M. T. (2017). The role of body composition on flexibility. Journal of Physical Education, Recreation & Dance, 88(7), 46-51.
- Norton, K., & Olds, T. (1996). Anthropometrica: A textbook of body measurement for sports and health courses. UNSW Press.
- Norton, K., & Olds, T. (1996). Anthropometrica: A Textbook of Body Measurement for Sports and Health Courses. UNSW Press.
- Ross, R., Goodpaster, B. H., Koch, L. G., Sarzynski, M. A., Kohrt, W. M., Johannsen, N. M., ... & Sparks, L. M. (2019). Precision exercise medicine: understanding exercise response variability. British Journal of Sports Medicine, 53(18), 1141-1153.
- Ross, W. D., Hebbelinck, M., & Van Gerven, D. (1977). Kinanthropometry and common diseases. Human Biology, 49(3), 367-375.
- Ross, W. D., Ward, R., & de Guise, M. G. (1977). The somatotype and its relation to physical performance. Canadian Journal of Applied Sport Sciences, 2(1), 9-17.
- Sheldon, W. H. (1940). The varieties of human physique: An introduction to constitutional psychology. Harper & Brothers.
- Smith, J. C., Dugan, E. L., & McConell, J. K. (2018). Flexibility and body composition. Journal of Strength and Conditioning Research, 32(9), 2688-2697.
- Wilmore, J. H., & Costill, D. L. (2004). Physiology of Sport and Exercise. Human Kinetics.