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THE INTERSECTION OF PHYSICAL FORM AND WELL-BEING: PREDICTING HRQOL IN COLLEGE ATHLETES THROUGH MORPHOLOGICAL ANALYSIS

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Abstract:
In the world of sports science and physical fitness, exploring the morphological profiles of athletes unlocks a deeper understanding of how body composition shapes performance, resilience, and long-term health outcomes, offering a fascinating glimpse into the human body's adaptation to intense physical demands. This research explores the morphological traits and their relation to the quality of life among college-level athletes and non-athletes in India, shedding light on the intricate interplay between physical attributes and overall well-being. The study, conducted at the National Institute of Medical Science (NIMS), Rajasthan, involves 120 male volunteers and employs a comprehensive set of anthropometric measurements and the SF-36 Health Survey for Health-Related Quality of Life (HRQoL) analysis. The findings reveal notable differences in morphological characteristics between athletes and non-athletes, emphasizing lower body fat percentages and distinct body compositions in athletes. The HRQoL analysis indicates positive perceptions of health among athletes, with 60% reporting good health

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and 31.4% describing their health as excellent. However, challenges such as limited access to certain physical activities are identified. The study contributes valuable insights into the potential impact of diverse lifestyles on physical health, emphasizing the significance of active interventions by health professionals, coaches, and physiotherapists to improve the well-being of college athletes. This research not only holds significance within the sports community but also has broader implications for public health and wellness. By recognizing the long-term effects of sports participation on HRQoL and linking morphological characteristics to life quality, the study provides a foundation for tailoring interventions and support systems to address the unique needs of athletes and promote their overall well-being throughout and beyond their athletic careers.

Keywords: anthropometry, HRQoL, morphological characteristics, body composition, college athletes

1. Introduction

The study of morphological characteristics is paramount. It sheds light on the intricate interplay between an individual's physical attributes and their athletic performance or overall health.

The relationship between body composition, physical activity, and athletic performance has been a key focus in sports science. A study by Hermassi (2021) on young male handball players found that lower body fat percentage (%BF) significantly improved sprint times and jumping ability, with %BF being a more impactful factor than BMI. This finding indicates that reducing body fat enhances performance in youth handball players, emphasizing the importance of body composition in athletic development.

Similarly, the role of maturation in athletic performance has been studied in volleyball players. Grigoletto (2023) analyzed the maturity status and anthropometric characteristics of 94 male adolescent volleyball players. The results showed that "early" maturing players, who had better height and muscle mass, performed better in tournaments, with some teams being composed mainly of early maturing players who ended up in top positions. This means maturity status plays a significant role in the performance of athletes, with far-reaching implications in talent selection. However, there is a need for more research to understand it fully.

Age-related decline in physical and mental health remains a significant concern for older adults, especially aging athletes. Senior Olympians, studied by researchers, demonstrated the persistence of high performance among elite athletes up to the age of 75 but, from then onwards, exhibited a more significant decrease in performance (Wright, 2008). A greater decrease was shown for female sprint events. The decline points toward an intervention time of age 75, which is critical in terms of musculoskeletal aging and functional capacity.

Mental health problems, such as anxiety, depression, and burnout, are common among professional footballers, both during and after their careers. A study on current and former footballers found that the prevalence of mental health problems ranged from 5% to 39%, with significant associations between poor mental health, low social support, and recent life events (V. Gouttebarge, 2015). This highlights the need for mental health support for athletes, both during their careers and in retirement, as they may face unique psychosocial challenges.

In terms of long-term health, elite athletes tend to have lower risks for chronic conditions such as metabolic syndrome (MS) and non-alcoholic fatty liver disease (NAFLD). A study by Gouttebarge (2015) proved that retired athletes have lower body fat percentages and lower risk for MS and NAFLD as compared to the general population. In addition, engaging in LTPA further into life maintains more benefits, including lesser body fat and reduced risk for such chronic diseases.

Finally, studies on the long-term health benefits of physical activity stress that former athletes report better self-rated health (SRH) in late adulthood than non-athletes. According to a cohort study by Laine (2015), 64% of former athletes rated their health as good or excellent compared with 48% of non-athletes. Besides, athletes were more active and had fewer smokers than non-athletes, which led to better SRH. These findings underscore the long-term benefits of an active lifestyle initiated during youth, which promotes healthier behaviors and a better quality of life in later years (Bäckmand, 2010). To evaluate overall mental and physical health HRQoL analysis is done with the help of a standard health survey tool known as SF-36 (Snyder, 2010; CDC, 2000),

HRQoL analysis among college athletes will help analyze and improve their life quality and will also help identify the gap in improving overall health in college athletes. Along with mental and physical life quality analysis, morphological characteristics are also reported in the present study. These characteristics encompass a range of observable traits, including body composition, somatotype, and anthropometry, which contribute significantly to an individual's overall physical makeup (Sindik, 2012).

Athletes, by nature, have long been recognized for their distinct physical attributes that align with the requirements of their chosen sports. Non-athletes, on the other hand, exhibit a diverse range of morphological features shaped by varying lifestyles and activities. India, with its rich cultural diversity and a burgeoning interest in sports, offers a fertile ground for investigating the morphological characteristics of college-level individuals. The interaction between morphological characteristics, academic commitments, physical activities, and the cultural backdrop shapes a distinctive landscape in which athletes and non-athletes alike navigate their physical development (Simon J. E., 2016).

Hence, by examining the morphological variations, valuable insight can be gained into the potential impact of various lifestyles on physical health and performance. This study aims to explore the morphological characteristics of college-level athletes and non-athletes in India. Ultimately, this investigation seeks to enhance the understanding of how morphological attributes influence the lives of college students, shaping their journey toward holistic well-being. From this point of view, the research not only holds significance within the sports community but also has broader implications for public health and wellness. Understanding the physical distinctions between athletes and non-athletes promotes active lifestyles and encourages individuals to regularly engage in physical activity to enhance their overall health and well-being. The present study also helped to identify the mental health issues among college athletes, such as aggression, depression, and anxiety. This study will also contribute to the promotion of active interventions in health professionals, coaches, and physiotherapists to improve the sport of college athletes, as no data has been reported concerning college athletes to date. This research article is an endeavor to report college athletes' health, life quality, and morphological features.

3. Material and Methods

A total of 120 male volunteers were randomly selected from the various departments of the National Institute of Medical Science (NIMS), Rajasthan. Before the measurement, a brief questionnaire (personal information and training history) and written consent were filled out by the participants, and they acknowledged the purpose, procedures, and benefits of the study. Due to missing values, the data of three volunteers was excluded from the study. The volunteers who were under 18 years; consents were duly signed by their parents. The data were collected under simulated environmental conditions in the morning (between 9:30 am to 12:30 pm) and afternoon (between 5:00 pm to 7:30 pm) session. Following the Declaration of Helsinki, the study was approved by the Institute’s Ethical Committee of the National Institute of Medical Science (NIMS), Rajasthan.

3.1 Procedure of data collection

All the anthropometric variables (Table 1) were measured by a Level 1 anthropometrist recognized by the International Society for the Advancement of Kinanthropometry (ISAK), by the ISAK guidelines (Ross, Carr & Carter, 1999). According to the standard protocol of data collection, all the variables were measured three times, and the mean value was taken for analysis. The Technical Errors of Measurement (TEM) Scores were within 5% for skinfolds and 1% for the remaining variables.

While analyzing HRQoL SF- 36 questionnaires were used. (Lins. L, 2016) This questionnaire was pre-validated for the Brazilian population. Hence, a pre-validated questionnaire was used in the present study. It includes 36 questions categories in 8 different divisions, covering physical and functional aspects, vitality, emotional health, mental health, capacity, and social functioning for estimating the health status of an individual. The response to each question was collected from all the individuals for HRQoL analysis in college athletes.

Table 1: Measuring parameters of college-level athletes and non-athletes

Variables	**Parameters**	**Test/procedure**	**Equipment**
Personal	Age (years)	Age proof certificate	-
Demographic	Height (cm)	Standing height	Anthropometric rod (Hopkins Road Rod Portable Stadiometer)
	Body mass (kg)	Body mass wearing minimum clothes	Digital Weighing Scale (Dual frequency body composition monitor, RD-545-SV Smart Bluetooth, Wireless)
Anthropometric	Biceps skin fold (mm)	According to the ISAK manual	Slim Caliper
	Triceps skin fold (mm)		
	Subscapular skin fold (mm)		
	Supraspinal skin fold (mm)		
	Bi-epicondyle humerus (cm)		Sliding Caliper
	Bi-epicondile femur (cm)		
	Arm girth (cm)		Anthropometric tape (CESCORF)
	Calf girth (cm)		

3.2 Statistical analysis

The normality and variance homogeneity hypotheses were analyzed via the Anderson-Darling test. According to the distribution pattern of the data set, parametric analysis was performed because most of the data were normally distributed. Descriptive statistics were employed to describe the data. Inferential statistics were performed to compare and correlate the dataset. The level of significance for this study was considered as $p \leq 0.05$. Statistical analysis graphical expression was performed using the Gnumeric spreadsheet (Ver: 1.12.48), Microsoft Excel, and SPSS software (Ver: 20).

4. Results and Discussion

Table 1 illustrates the contrast in fundamental and body measurement traits between college athletes and individuals who are not engaged in athletics at the college level. The table provides a range of parameters, each accompanied by corresponding values for both athlete and non-athlete groups. Additionally, the p-values are presented, serving as indicators of the statistical importance of the disparities identified between these two cohorts.

Table 1: Basic and anthropometric characteristics of college-level athletes and non-athletes

Parameters	Athletes	Non-athletes	p-value
Age (year)	20.6±1.8 (20.2-21.1)	22.6±2.2 (22.0-23.1)	1.03 e-06
Height (cm)	169.0±5.8 (167.4-170.6)	169.1±7.1 (167.3-170.9)	0.94
Body mass (kg)	61.0±8.2 (58.7-63.2)	65.1±10.8 (62.4-67.8)	0.02
BMI (kg/m²)	21.3±2.1 (20.7-21.9)	22.7±3.2 (21.9-23.6)	0.004
Biceps skinfold (mm)	5.2±2.1 (4.6-5.8)	7.9±4.2 (6.8-8.9)	2.18 e-05
Triceps skinfolds (mm)	8.5±3.3 (7.6-9.4)	13.4±5.0 (12.2-14.7)	6.59 e-09
Subscapular skinfolds (mm)	10.8±3.4 (9.9-11.7)	15.5±4.7 (14.3-16.7)	8.92 e-09
Supraspinal skinfolds (mm)	9.8±4.0 (8.7-10.9)	22.3±10.1 (19.7-24.8)	4.85 e-14
Medial calf skinfolds (mm)	9.7±4.1 (8.6-10.9)	11.6±4.5 (10.5-12.7)	0.02
Bi-epicondyle humerus (cm)	6.7±0.7 (6.5-6.9)	7.0±0.5 (6.9-7.1)	0.01
Bi-epicondyle femur (cm)	9.3±0.5 (9.1-9.4)	9.4±1.3 (9.1-9.7)	0.56
Arm girth flex (cm)	28.7±2.9 (27.9-29.5)	30.6±3.6 (29.6-31.5)	0.002
Max. calf girth (cm)	34.1±3.4 (33.2-35.0)	32.9±3.1 (32.1-33.7)	0.05

Note: Data were presented as mean±SD (95% CI).

Table 2: Morphological characteristics of college-level athletes and non-athletes

Parameters	Athletes (n=54)	Non-athletes (n=63)	p-value
Endomorphy	2.9±1.0 (2.7-3.2)	5.0±1.5 (4.6-5.4)	5.32 e-14
Mesomorphy	3.9±0.9 (3.7-4.2)	4.3±1.6 (3.9-4.7)	0.09
Ectomorphy	3.0±1.0 (2.7-3.3)	2.4±1.4 (2.1-2.8)	0.02
Body fat (%)	13.9±3.7 (12.9-14.9)	20.1±4.7 (18.9-21.3)	1.16 e-12
Fat free mass (kg)	52.3±6.1 (50.7-54.0)	51.7±6.8 (50.0-53.4)	0.57

Note: Data were presented as mean±SD (95% CI).

Table 2 presents a comparison of morphological characteristics between college-level athletes and individuals who are not involved in athletic activities. The investigation focuses on parameters such as Endomorphy (body roundness), Mesomorphy (muscularity), Ectomorphy (slenderness), Body fat percentage, and fat-free mass. The results emphasize significant differences between athletes and non-athletes regarding Endomorphy, Ectomorphy, Body fat percentage, and a minor difference in Mesomorphy ($p < 0.05$). Nevertheless, there is no considerable distinction in Fat-free mass between the two cohorts. These findings imply that athletes commonly exhibit lower body fat percentages and distinct morphological profiles compared to non-athletes, likely due to the physical demands associated with sports participation.

Figure 1 illustrates a comparative analysis between individuals at the college level who are engaged in sports and those who are not, utilizing Phantom Z Scores to assess various bodily measurements. The data highlights distinctions in physiological traits between these two groups. Each measurement includes values for both athletes and non-athletes. Negative Z scores among athletes indicate values that fall below the mean, while positive Z scores for non-athletes signify values surpassing the mean. The metrics encompass body mass, height, skinfold thickness at distinct sites (triceps, subscapular, biceps, supraspinal, and medial calf), flexed arm and calf girth, as well as widths of the Humerus and femur. The above-noted figure provides a quick overview of the divergences in these physical attributes between college-level athletes and their non-athlete counterparts.

Figure 1: Segmental comparison of college-level athletes and non-athletes with reference

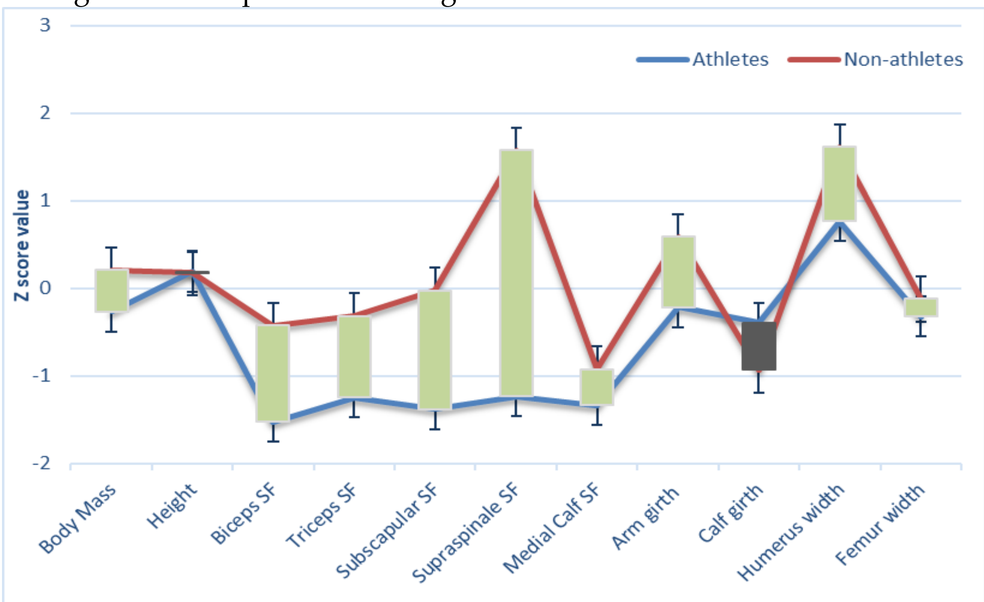
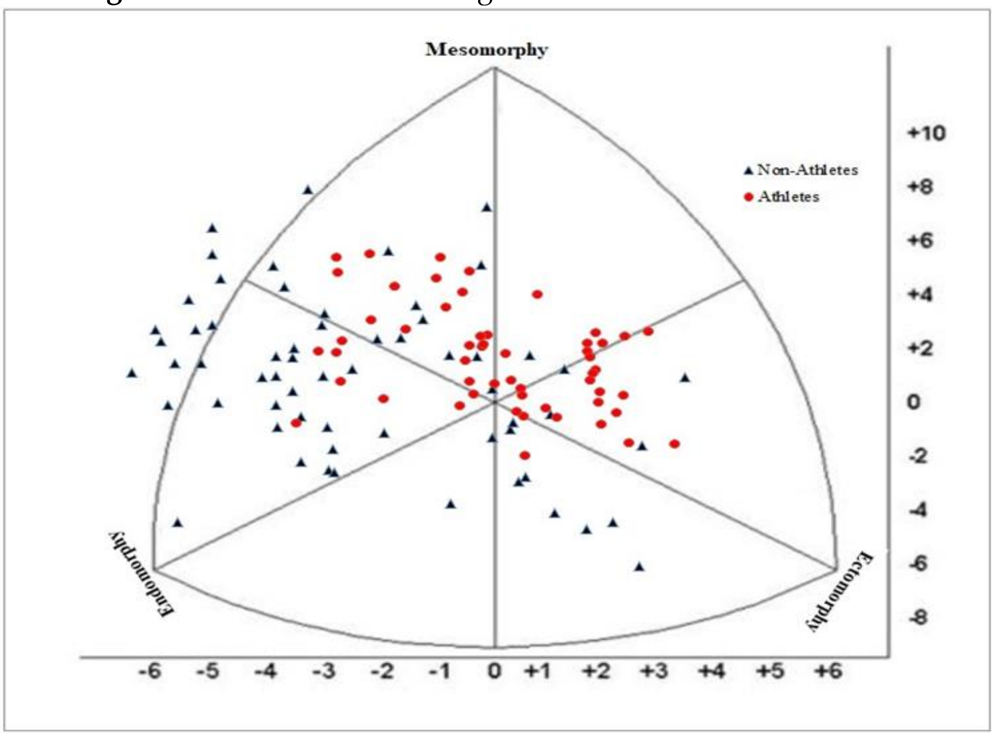
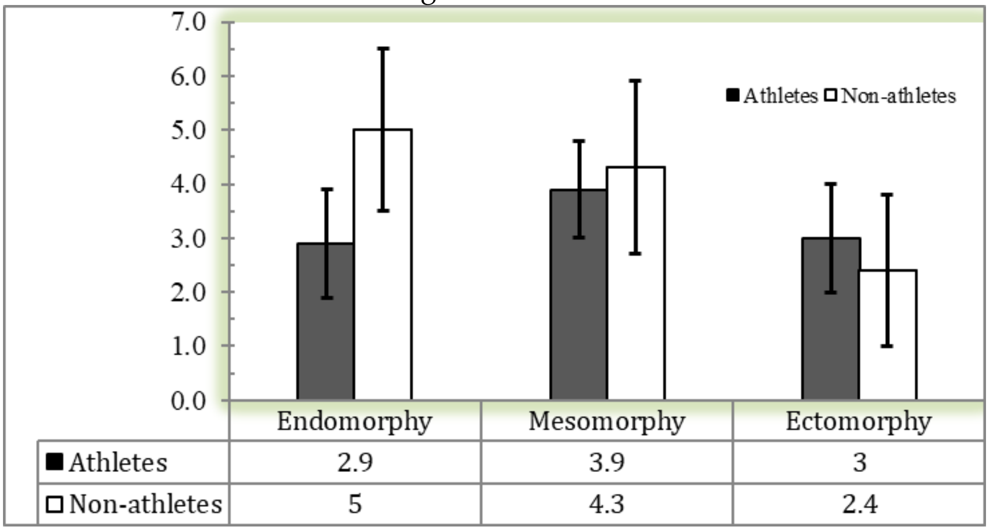


Figure 2: Somato-chart of college-level athletes and non-athletes



The graph (Figure 2) provides a visual representation of the morphological position of each individual on the somatochart. According to somatochart college-level athletes are found to be Ectomorphic mesomorph (2.9-3.9-3.0). On the other hand, non-athletes are Mesomorphic endomorphs (5.0-4.3-2.4).

Figure 3: Graphical comparison of morphological characteristics of college-level athletes and non-athletes



The above-noted figure (Figure 3) compares the morphological traits of collegiate athletes and non-athletes in a graphical format. Endomorphy is associated with body fat and softness, Mesomorphy with muscularity and body composition, and Ectomorphy with leanness and fragility. Athletes have lower Endomorphy (2.9) than non-athletes (5.0), greater Mesomorphy (3.9) than non-athletes (4.3), and somewhat higher Ectomorphy (3.0) than non-athletes (2.4). These findings emphasize potential body composition disparities between college-level players and non-athletes, showing that athletes had lower body fat, stronger muscularity, and somewhat higher leanness than non-athletes.

Figure 4: Graphical comparison of BMI, % of body fat and fat-free mass of college-level athletes and non-athletes

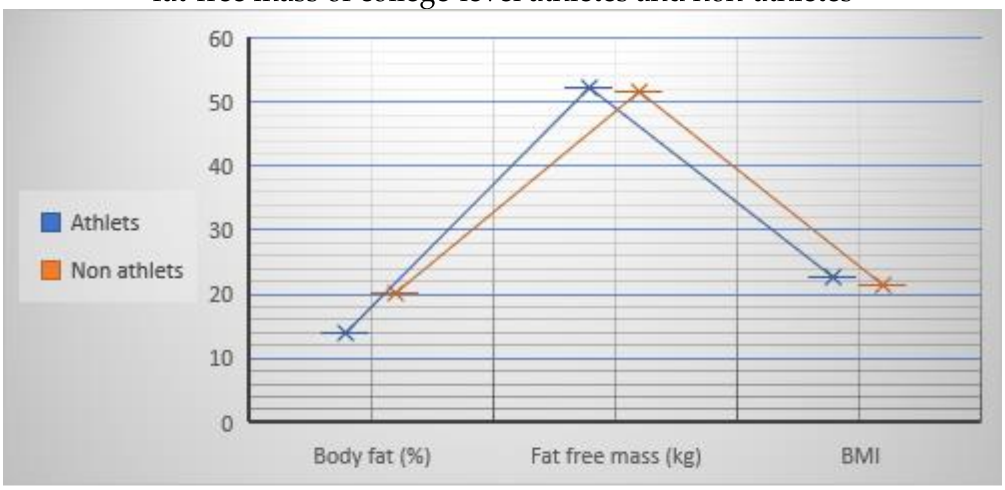


Figure 4 presents a visual representation that compares key body composition parameters to distinguish those who participate in college-level athletics from those who do not. The table presents a comparison of average values for BMI, body fat percentage, and fat-free mass between individuals who engage in athletic activities and those who do not. Athletes consistently have lower measures, as evidenced by their average BMI of 21.3 Kg/m^2, in contrast to the non-athletes' average BMI of 22.7 Kg/m^2. Additionally, it is worth noting that athletes have a lower body fat percentage of 13.9%, as opposed to the comparatively higher percentage of 20.1% noticed in individuals who do not engage in athletic activities. Concerning fat-free mass, athletes exhibit a modest superiority over non-athletes, with an average measurement of 52.3 kg compared to 51.7 kg. The results suggest that individuals in the athletic group generally have a leaner body composition compared to those who are not involved in sports.

Table 3: Percentile score of various anthropometric parameters of athletes

Parameters	10th	20th	30th	40th	50th	60th	70th	80th	90th
Age (Years)	19.0	19.0	20.0	20.0	20.0	21.0	22.0	22.0	23.0
Body Mass (kg)	51.3	53.5	55.3	58.4	60.3	62.6	64.0	66.8	68.1
Stature (cm)	162.0	164.3	166.2	167.4	169.0	170.4	172.0	173.0	177.3
Biceps (mm)	3.3	3.8	4.0	4.2	4.4	4.8	5.2	6.2	8.7
Triceps SF. (mm)	5.2	5.4	6.1	7.1	7.6	8.4	10.3	11.1	12.7
Subscapular SF. (mm)	7.1	8.1	9.0	9.4	10.2	11.0	11.3	12.4	15.3
Supraspinale SF. (mm)	5.8	6.3	6.9	7.7	8.8	9.9	11.3	13.2	15.7
Medial Calf SF. (mm)	5.8	6.5	7.0	8.1	9.0	10.0	11.0	12.8	14.8
Bi-epicondyle Humerus (cm)	6.2	6.3	6.4	6.6	6.6	6.7	6.7	6.8	7.2
Bi-epicondyle Femur (cm)	8.7	8.9	9.0	9.1	9.2	9.4	9.5	9.8	10.0
Arm Girth Flex (cm)	25.3	26.0	26.8	27.5	28.4	29.1	29.9	31.0	32.0
Calf Girth (max.) (cm)	31.2	32.0	32.2	33.1	33.6	34.2	34.9	36.0	37.6
Endomorphy	1.8	2.0	2.2	2.7	2.9	3.0	3.2	3.6	4.4
Mesomorphy	2.7	3.2	3.6	3.7	3.9	4.0	4.2	4.5	5.4
Ectomorphy	1.6	2.0	2.4	2.7	3.1	3.4	3.6	3.8	4.1
BMI (kg/m^2)	18.9	19.6	19.8	20.5	21.0	21.5	22.3	23.2	23.8
Body fat (%)	9.6	10.2	11.3	12.7	13.9	14.5	15.5	16.5	19.2
Fat free mass (kg)	44.7	47.4	48.1	49.7	52.8	54.1	54.8	57.0	59.0

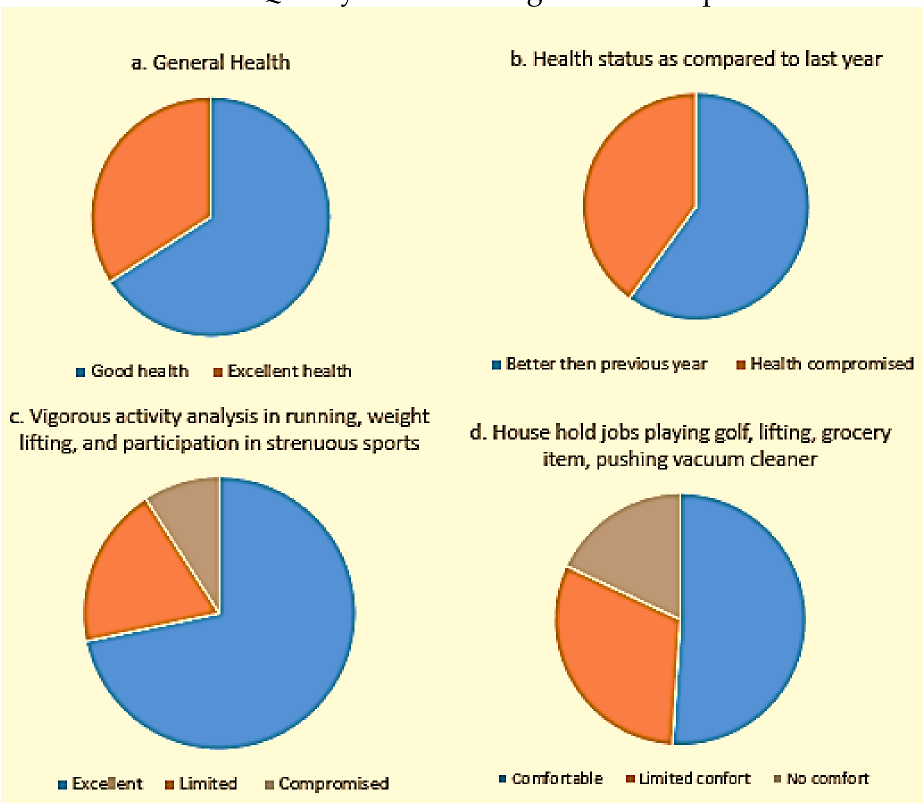
Table 4: Percentile score of various anthropometric parameters of non-athletes

Parameters	10th	20th	30th	40th	50th	60th	70th	80th	90th
Age (Years)	20.0	21.0	21.0	22.0	22.0	23.0	24.0	25.0	26.0
Body Mass (kg)	52.3	56.8	58.8	60.8	63.0	67.7	70.0	74.0	79.0
Stature (cm)	160.0	162.0	165.3	167.0	170.0	171.0	173.0	174.0	178.0
Biceps (mm)	3.0	4.0	5.0	6.0	7.0	8.0	9.4	11.0	14.0
Triceps Sf. (mm)	8.0	8.0	10.6	12.0	13.0	15.0	16.0	17.0	20.0
Subscapular Sf. (mm)	10.0	12.0	12.0	14.0	15.0	16.0	18.0	20.0	22.4
Supraspinale Sf. (mm)	10.1	13.4	15.0	17.0	20.0	25.0	28.8	31.6	36.3
Medial Calf Sf. (mm)	5.0	8.0	10.0	10.0	11.0	12.0	14.5	15.5	16.9
Bi-epicondylar Humerus (cm)	6.4	6.6	6.8	7.0	7.0	7.0	7.0	7.2	7.8
Bi-epicondylar Femur (cm)	8.6	8.9	9.0	9.5	9.6	9.8	9.9	10.0	10.2
Arm Girth Flex(cm)	27.0	27.0	28.6	30.0	31.0	31.0	32.4	33.0	35.8
Calf Gth (max.) (cm)	30.0	30.0	31.0	32.0	33.0	33.2	34.4	36.0	37.0
Endomorphy	3.1	3.7	3.9	4.6	5.2	5.7	6.1	6.4	6.8
Mesomorphy	1.9	3.1	3.7	4.1	4.5	5.0	5.1	5.5	6.1
Ectomorphy	0.7	1.1	1.7	1.9	2.2	2.6	3.0	3.7	4.4
BMI (kg/m2)	18.5	20.0	21.1	22.1	22.9	23.4	24.2	25.3	26.6
Body fat (%)	14.6	15.7	17.6	19.4	20.9	22.4	23.6	24.4	25.4
Fat free mass (kg)	43.9	46.2	48.1	49.5	50.4	52.5	54.1	57.6	61.1

Table 4 and Table 5 display percentile rankings for a range of anthropometric measures in college-level athletes and non-athletes, offering an understanding of how these metrics are spread across the population. The tables specify the measurements linked to the 10th through 90th percentiles, offering a thorough portrayal of the scope and dispersion of anthropometric traits in both athlete and non-athlete groups.

During the analysis of health-related quality-of-life features among athletes and non-athletes, we utilized the SF-36 questionnaire to evaluate their quality of life. This approach enabled us to explore the connection between participants' morphological characteristics and their HRQoL.

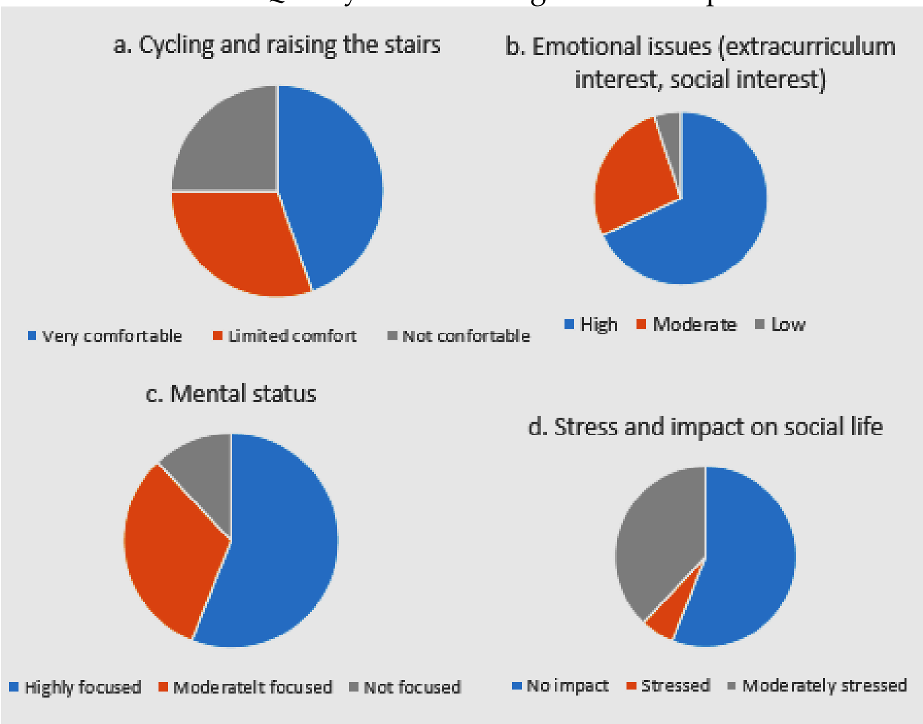
Graph 1: The physical criteria used to evaluate
Health-Related Quality of Life through the SF-36 questionnaire



In the examination of Health-Related Quality of Life (HRQoL) among athletes, notable findings emerged. A majority of athletes, specifically 60%, self-reported good health, with an additional 31.4% describing their health status as excellent. When assessing their health compared to the previous year, 33.3% perceived an improvement. Analysis of vigorous activities revealed that 51% of athletes participated, although some encountered limited access to activities such as running, weight lifting, and strenuous sports, as illustrated in Graph 1a. Subsequent inquiries focused on the frequency and feasibility of household tasks, including playing mild games like golf, pushing vacuum cleaners, and carrying groceries. Results indicated that 51% of participants felt comfortable, 31% experienced limited comfort, and 21% reported no limitations while managing both household tasks and sports commitments. In terms of cycling, 42%

expressed limited feasibility, 28% reported very limited feasibility, and 34% were entirely comfortable. Challenges were noted in climbing stairs and engaging in physical activities such as walking a mile, bathing, and other home-based exercises. Among the study participants, a significant 56% demonstrated a high focus on their sports and expressed satisfaction. Examining emotional well-being, 68% of college athletes reported positive responses regarding extracurricular interests and social interactions. They experienced minimal pain and interference in daily work due to bodily discomfort.

Graph 2: Describing the psychological components used to evaluate Health-Related Quality of Life through the SF-36 questionnaire



Regarding emotional aspects, 56% reported experiencing little to no mental stress or nervousness. They expressed a profound sense of calmness, enthusiasm, high energy levels, happiness, and minimal fatigue. Only a small percentage, specifically 6%, reported that mental stress impacted their social life, as illustrated in Graph 2b, c, and d.

5. Discussion

The findings presented in Table 1 and Table 2 highlight significant differences in various anthropometric parameters between college-level athletes and non-athletes, offering valuable insights into the relationship between morphological characteristics and Health-Related Quality of Life (HRQoL). Athletes tend to display a more favorable body composition, characterized by lower body fat percentages (13.9% vs. 20.1% in non-athletes) and higher muscularity (mesomorphy), contributing to a more efficient metabolic profile and better overall health status. These differences in body composition are likely to be reflected in the HRQoL assessments, as physical fitness and body composition are strongly correlated with self-reported health outcomes.

The SF-36 questionnaire used to evaluate HRQoL indicated that athletes report better health status, with 60% describing their health as "good" and 31.4% as "excellent." This is consistent with the physical characteristics observed in the morphological analysis, where athletes show more favorable measurements in terms of BMI, body fat percentage, and muscularity. Furthermore, athletes also showed higher participation rates in vigorous activities (51%) and reported fewer physical limitations when performing daily tasks such as household chores and recreational activities. This reflects the positive impact of regular physical activity and sports participation on physical functioning and overall quality of life.

In terms of emotional well-being, athletes displayed higher levels of satisfaction with their extracurricular interests and social interactions, with 68% reporting positive mental health responses. This is further supported by the psychological components of the SF-36, where 56% of athletes reported minimal mental stress, suggesting that their physical fitness and active lifestyle contribute not only to physical health but also to mental resilience and emotional stability. This study highlights the impact of athletic training on body composition, with athletes showing lower body fat, BMI, and skinfold measurements, consistent with regular physical activity. The younger age of athletes aligns with typical college-level sports participants, while height differences between athletes and non-athletes were minimal, possibly influenced by genetics, early nutrition, and socioeconomic factors. Previous research, such as Koley's 2011 study on university cricket players, also supports the finding that athletes have lower body fat and higher lean mass. Overall, athletes' leaner body composition and higher mesomorphy scores reflect the physical demands of sports, emphasizing the role of consistent training in shaping optimal physical traits for performance.

Overall, the results underscore the strong relationship between HRQoL and morphological characteristics in college-level athletes. The lower body fat percentage, higher muscle mass, and improved physical function found in athletes are closely associated with better health outcomes, enhanced physical well-being, and greater emotional stability compared to their non-athlete counterparts. The analysis indicates that participation in sports may offer significant advantages not only in terms of physical health but also in terms of psychological and emotional quality of life, further emphasizing the benefits of regular physical activity.

6. Recommendations

We highly recommend this research work for analyzing the morphological status of any kind of athletes or general people in the field of sports talent identification and body structure analysis for better performance as well as developing the quality of life of athletes for maintaining good mental and physical fitness.

7. Conclusion

This study highlights the vital role of assessing Health-Related Quality of Life (HRQoL) through comprehensive questionnaires that encompass mental, physical, environmental, and social health domains. The findings underscore the significant relationship between morphological characteristics and HRQoL, with active individuals engaged in physical activity and sports showing markedly better HRQoL scores compared to their inactive counterparts. This emphasizes the long-term, holistic benefits of sports participation, not just on physical fitness but also on mental and social well-being. In comparing collegiate athletes to non-athletes, the results align with existing research, revealing that consistent engagement in athletic training leads to noticeable changes in body composition. Athletes exhibited lower body mass, BMI, and skinfold thicknesses, which can be attributed to their regular physical training and the demands of their sports. While these differences are clear, the study also acknowledges the complexities of physical traits, where genetic factors, childhood nutrition, socioeconomic conditions, and sport-specific training regimens play crucial roles in shaping outcomes. The analysis further highlights the influence of sport-specific training on body morphology, showing that athletes from different disciplines may exhibit varied physical characteristics based on the demands of their respective sports. Genetic predisposition, dietary practices, and the intensity of training all contribute to the observed physical differences. Recognizing these factors is crucial for designing tailored interventions and support systems to address the unique needs of athletes, enhancing their overall health and performance, both during and after their athletic careers.

Ultimately, this study reinforces the value of integrating physical, mental, and social health dimensions into the assessment of athletes' quality of life, offering insights that can guide future research and improve athlete well-being across all stages of life.

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Conflict of Interest Statement
The authors declare no conflicts of interest.

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