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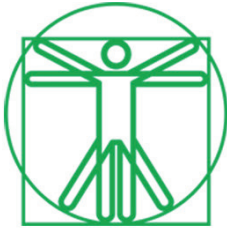
2nd Annual Scientific Conference of Physical Activity and Sports Tech for Healthy Lifestyles

"Shaping the Future of Sports & Health Monitoring Systems"



16 - 19 October 2025, Podgorica – Montenegro

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The Role of Stretching in Improving Physical Health and Preventing Injuries in Volleyball Training Sessions

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Abstract

Stretching is a fundamental component of athletic preparation that enhances muscle elasticity, joint flexibility, and recovery efficiency while reducing the risk of injuries. This study examined the effects of stretching on injury prevention and rehabilitation among volleyball players by comparing athletes who incorporated stretching into their training routines with those who did not. A total of 32 volleyball players (13 males and 19 females), including 10 beginners and 22 professionals, participated over a three-month competitive period. Data were collected through structured questionnaires, direct observation, and analysis of medical records. Results demonstrated that athletes who regularly practiced stretching reported fewer injuries, particularly muscle strains and sprains, and required shorter rehabilitation times than those who did not. Female athletes exhibited a slightly higher injury frequency and longer recovery durations compared to males, especially at the professional level. Active rehabilitation methods involving stretching and gradual loading were associated with faster recovery and fewer recurring injuries than passive methods such as rest. Overall, the findings confirm that consistent stretching - both dynamic and static - plays a crucial preventive and rehabilitative role in volleyball training, supporting athlete health, performance continuity, and long-term physical well-being.

Keywords: *stretching, volleyball, injuries, flexibility, rehabilitation, athletes, injury prevention*

Introduction

Stretching is a fundamental component of physical preparation that contributes significantly to athletes' overall health, performance, and injury prevention. It enhances muscle elasticity, improves joint mobility, and promotes blood circulation, thereby preparing the body for the physical and biomechanical demands of sport (Walker, 2011). Despite its recognized importance, stretching is often neglected by athletes and coaches, particularly in sports that emphasize technical skill and power, such as volleyball. The lack of consistent stretching routines can increase susceptibility to muscle strain, fatigue, and overuse injuries, which negatively impact both training continuity and competitive performance (Shellock & Prentice, 1985; Fradkin et al., 2010). Volleyball is characterized

by high-intensity actions—jumps, spikes, rapid lateral movements, and frequent changes of direction—that require optimal muscular flexibility and coordination. The sport involves repetitive use of the shoulders, knees, ankles, and lower back, making these regions particularly vulnerable to overuse and acute injuries (Verhagen, Visnes, & Bahr, 2017; Lehnert et al., 2017). Proper stretching before and after training sessions plays a critical role in preparing these muscle groups for explosive activity and assisting post-exercise recovery. Insufficient flexibility or inadequate muscle preparation has been linked to reduced movement efficiency and an increased risk of strains, sprains, and contusions (Rezende et al., 2016). The literature distinguishes between static and dynamic stretching, both of which have specific applications in volleyball training. Dy-

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dynamic stretching is primarily used during the warm-up phase to activate muscles and increase temperature, while static stretching is incorporated post-training to promote relaxation and recovery (Kokkonen et al., 2007). Studies have shown that integrating both types of stretching enhances range of motion and reduces delayed-onset muscle soreness, leading to better overall performance and faster rehabilitation following injuries (Gouttebarga et al., 2017). Despite substantial international evidence on the benefits of stretching, limited empirical research has been conducted on volleyball athletes in Albania, particularly in comparing those who systematically incorporate stretching into their routines with those who do not. Understanding these effects is essential to guide coaches, physical trainers, and sports medicine specialists in designing evidence-based prevention and recovery programs tailored to volleyball players of different levels and genders.

Therefore, this study aims to analyze the role of stretching in improving physical health and preventing injuries among volleyball athletes in Tirana. Specifically, it compares performance and recovery outcomes between athletes who regularly perform stretching exercises and those who do not. The research also seeks to identify gender and experience-level differences in injury frequency, affected muscle groups, and rehabilitation duration. By highlighting the preventive and restorative benefits of stretching, the study contributes to improving athlete health, optimizing training efficiency, and promoting long-term performance sustainability in volleyball.

Methodology

This study employed a comparative cross-sectional design to evaluate the role of stretching in improving physical health and preventing injuries among volleyball players. The investigation focused on analysing differences in injury frequency, rehabilitation duration, and recovery approaches between athletes who systematically incorporated stretching exercises into their training sessions and those who did not.

A total of 32 volleyball players (13 males and 19 females) from sports clubs and university teams in Tirana, Albania participated in the study. Participants were divided according to experience level into two groups: beginners (n = 10) and professionals (n = 22). All athletes were actively engaged in regular volleyball training and competition during the study period. Inclusion criteria required that participants be aged 16 years or older, free from major musculoskeletal injuries in the three months preceding data collection, and currently partic-

ipating in structured volleyball training. Exclusion criteria included chronic illness, recent surgery, or refusal to participate. All participants (and guardians, where applicable) provided informed consent prior to inclusion.

The study was conducted over a three-month period during the competitive volleyball season. Data were collected through a two-phase observation process: Training sessions without stretching (baseline). Training and matches including stretching as part of warm-up and cool-down routines.

Researchers directly observed athletes during training and competitions to record injury occurrences, affected muscle groups, and rehabilitation duration. Each athlete also completed a self-reported questionnaire, which collected data on: Use and frequency of stretching exercises; Type and severity of injuries sustained; Rehabilitation time and treatment method (active or passive); Perceived effectiveness of stretching in recovery and performance.

The questionnaire and observation forms were developed in accordance with prior research in sports medicine and volleyball injury prevention (Fradkin et al., 2010; Rezende et al., 2016; Verhagen et al., 2017). Injury data were categorized by type (strain, sprain, contusion, or overuse) and by location (shoulders, arms, knees, ankles, or lower back). Rehabilitation time was measured in days from injury occurrence to full return to play. Stretching routines were classified into two categories: Dynamic stretching: Performed during warm-up, involving gradual, controlled movements to increase joint mobility and muscle temperature. Static stretching: Performed during cool-down, involving sustained muscle elongation for 15–30 seconds to enhance flexibility and relaxation (Kokkonen et al., 2007).

Data were analysed using SPSS version 26.0 (IBM Corp., Armonk, NY). Descriptive statistics, including means and standard deviations, were used to summarize injury frequencies and rehabilitation durations by gender and experience level. Comparative analyses between groups (with and without stretching) were conducted using independent-samples t-tests and cross-tabulations. The significance level was set at $p < .05$.

Results

Table 1 presents the distribution of volleyball players according to their playing level and gender. It provides an overview of how male and female players are represented across different skill levels, offering insights into participation patterns within the sport.

Table 1. Distribution of Volleyball Players by Level and Gender

Level	Males (n)	Females (n)	Total (n)
Beginners	4	6	10
Professionals	9	13	22
Total	13	19	32

Note. The study included 32 volleyball players (10 beginners and 22 professionals), with 13 males and 19 females participating in the analysis.

Table 2. Average Number of Injuries per Athlete by Level and Gender

Level	Males (M)	Females (M)
Beginners	1.75	2.00
Professionals	1.66	2.38

Note. Female athletes reported a slightly higher mean number of injuries compared to males in both beginner and professional groups.

Table 2 shows the average number of injuries sustained per athlete, categorized by playing level and gender. This table highlights potential differences in injury incidence between male and female players across various levels of play.

Table 3 presents the average rehabilitation time, measured in days, for volleyball players according to their playing level and gender. It illustrates how recovery duration from injuries may vary based on both skill level and gender.

Table 3. Average Rehabilitation Time (in Days) by Level and Gender

Level	Males (Days)	Females (Days)
Beginners	5.0	5.6
Professionals	5.0	6.69

Note. Rehabilitation time was generally longer for female athletes, particularly at the professional level.

Table 4. Most Common Types and Locations of Injuries Observed

Injury Type	Commonly Affected Muscle/Joint	Frequency Trend
Muscle strain	Deltoids, gastrocnemius	High
Sprain	Ankles, knees	High
Contusion	Arms, shoulders	Moderate
Overuse/fatigue pain	Lower back, legs	Moderate

Note. The most frequent injuries were muscle strains and ankle sprains, particularly among players who did not perform stretching exercises regularly.

Table 4 summarizes the most common types and locations of injuries observed among volleyball players. It identifies the commonly affected muscle/joint and frequency trend.

Table 5 presents the types of treatment and recovery methods used by volleyball players following injuries. It outlines the various description and usage trends.

Table 5. Type of Treatment and Recovery Method Used

Rehabilitation Type	Description	Usage Trend
Active	Rehabilitative exercises, gradual loading	More common among experienced males
Passive	Rest, ice, or non-active recovery methods	More common among females/beginners

Note. Active rehabilitation methods were associated with faster recovery and fewer recurring injuries.

Discussion

The purpose of this study was to evaluate the role of stretching in improving physical health and preventing injuries among volleyball athletes, with a focus on gender and experience-level differences. The results revealed that athletes who regularly incorporated stretching into their training routines experienced fewer injuries, shorter rehabilitation times, and faster recovery compared to those who did not. These findings support the hypothesis that stretching contributes significantly to muscular flexibility, recovery efficiency, and overall injury prevention in volleyball players. The study found that female volleyball players sustained a higher number of injuries than their male counterparts in both beginner and professional categories. This trend aligns with previous findings indicating that female athletes may be more susceptible to certain musculoskeletal injuries due to differences in joint laxity, hormonal influences, and biomechanical control (Lehnert et al., 2017; Verhagen, Visnes, & Bahr, 2017). Moreover, the greater injury frequency among females could be attributed to differences in muscle strength and rehabilitation strategies. The results also showed that female athletes tended to engage more in passive recovery methods, which may contribute to slower rehabilitation and prolonged recovery times. Rehabilitation time was shorter among athletes who performed regular stretching, particularly professional male players who consistently engaged in active recovery routines. These findings are consistent with previous studies suggesting that stretching improves muscle elasticity, joint range of motion, and circulatory efficiency, all of which facilitate faster

recovery following injury (Fradkin, Zazryn, & Smoliga, 2010; Shellock & Prentice, 1985). The longer rehabilitation times observed in female athletes and beginners may be explained by the lower adoption of structured stretching and active rehabilitation practices, as well as lower training experience and muscle conditioning. The majority of injuries recorded were muscle strains and ankle sprains, followed by contusions and fatigue-related pain. These injuries most commonly affected the shoulders, knees, and ankles, reflecting the biomechanical demands of volleyball, which involve frequent jumping, landing, and rapid directional changes. These findings are consistent with international data indicating that volleyball players frequently sustain lower-limb and shoulder-related injuries due to repetitive movement patterns and overuse (Rezende et al., 2016; Gouttebauge, Sluiter, & Backx, 2017). The strong association between inadequate stretching and a higher incidence of these injuries reinforces the preventive value of integrating stretching into both warm-up and cool-down routines.

Athletes who practiced active rehabilitation- including stretching, light exercise, and gradual loading - demonstrated faster recovery and fewer recurrent injuries compared to those relying on passive methods such as rest or ice therapy. These results are in agreement with Kokkonen, Nelson, Eldredge, and Winchester (2007), who found that regular static stretching after exercise improves muscular recovery and flexibility. Furthermore, dynamic stretching during warm-up enhances neuromuscular activation, preparing athletes for high-intensity performance while reducing the likelihood of strain and overuse injuries (Walker, 2011). Hence, structured stretching

routines should be emphasized as both a preventive and rehabilitative measure within volleyball training programs.

The findings of this study have practical implications for volleyball coaches, physiotherapists, and sports medicine professionals. Regular stretching should be systematically integrated into training cycles, not only as a warm-up or recovery component but as a central preventive practice. Coaches should encourage dynamic stretching before training and static stretching afterward to maintain muscle balance and flexibility. Educational interventions are also recommended to improve athletes' understanding of proper stretching techniques and recovery behaviours.

These recommendations are supported by recent literature highlighting the importance of stretching and flexibility in mitigating injury risks and enhancing athletic performance across various sports disciplines (Rezende et al., 2016; Verhagen et al., 2017).

Although this study provides valuable insights, several limitations should be noted. The sample size was relatively small and limited to athletes from Tirana, which may restrict the generalizability of the findings. Data were based on self-reported measures and observational analysis, which could introduce recall bias. Future research should include a larger and more diverse sample, integrate physiological testing of flexibility and muscle strength, and examine the long-term effects of structured stretching programs on injury recurrence and performance outcomes. Experimental designs could further clarify causal relationships between stretching routines and injury prevention in volleyball and other high-impact sports.

Conclusion

In conclusion, the study confirms that regular stretching plays a crucial role in reducing injury incidence and improving recovery among volleyball players. The combination of dynamic stretching before training and static stretching after sessions enhances flexibility, supports muscle health, and minimizes rehabilitation time. These outcomes reinforce the importance of structured stretching programs as an integral component of athlete preparation and recovery. Future efforts should prioritize education and consistent implementation of stretching protocols to ensure sustainable athlete health and performance.

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Anthropometric Characteristics and Their Relationship with Physical Performance in Youth Female Football Players in Tirana

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Abstract

This study aimed to investigate the relationships between anthropometric characteristics and various components of physical performance in youth female football players in Tirana, Albania. Methods for this study included a sample of 36 female football players (mean age = 15.73 ± 2.87 years) underwent anthropometric assessments including body height, body weight, and waist circumference. Physical performance tests included upper-body endurance (30-second push-ups), core endurance (30-second curl-ups), lower-body power (standing long jump, countermovement jump, and vertical jump with run-up), speed (20-meter sprint), and agility (10x5m shuttle run and T-test). Pearson correlation analysis was conducted to explore relationships between anthropometric variables and performance measures. Results showed that no significant correlations were found between anthropometric variables and upper-body or core endurance. In contrast, body height and weight showed significant moderate positive correlations with lower-body power tests ($r = 0.387$ to 0.503 , $p < 0.05$). Height was also negatively correlated with agility (10x5m test, $r = -0.492$, $p = 0.007$), indicating better performance among taller players. No significant correlations were observed between anthropometric variables and speed or T-test performance. In conclusion this cohort of youth female football players, anthropometric characteristics, particularly height and weight, appear to be associated with lower-body power but not with muscular endurance or linear speed. These findings highlight the relevance of body dimensions in power-related performance and may inform talent identification and training approaches in female youth football.

Keywords: youth female athletes, football, anthropometry, physical performance, agility, jump performance

Introduction

Haywood Women's football has undergone a dramatic expansion across Europe, both in popularity and professional structure. According to UEFA's "Time for Action" strategy (UEFA, 2019), the number of registered female players in Europe exceeded 1.3 million, with national federations investing increasingly in youth development, infrastructure, and visibility of the women's game. In parallel, initiatives such as the UEFA Women's Football Development Programme's have facilitated the growth of grassroots and elite competitions.

The Albanian Football Association (Federata Shqiptare e Futbollit – FSHF) has followed this continental trend. Since the formal introduction of the Albanian Women's National Championship in 2009, and the subsequent establishment of U-19 and U-17 competitions, increasing numbers of young girls have engaged in organized football. However, empirical research assessing the physiological and anthropometric profiles of these athletes remains scarce.

Anthropometric profiling, measuring physical dimensions such as height, weight, and body composition alongside standardized fitness assessments, is widely used

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to evaluate athletic potential, identify training needs, and monitor development. Prior research conducted in Spain (Ramírez-Munera et al., 2025), the UK (Morris et al., 2018), and the United States (Peart et al., 2018) indicates that body size and composition have a significant effect on youth female players' speed, strength, and agility. However, these relationships are shaped by genetic, environmental, and training-related factors, underscoring the need for context-specific data.

Aim and Objectives

Study aims to examine the interrelation between anthropometric characteristics and physical performance in female youth footballers in Tirana, with a focus on identifying patterns that may inform local talent development strategies and training regimes. To achieve this objective, the following main tasks were set: [1] Conduct a literature review on the topic; [2] Implement testing procedures; and [3] Process and analyze the collected data.

Methodology

Thirty-six adolescent female football players (mean age = 15.73 ± 2.87 years) from two football teams were selected to participate for our study. All participants trained a minimum of three times per week for at least 90 minutes and had at least one year of structured football experience. Athletes were clinically healthy and free from injury at the time of testing. Written informed consent was obtained from legal guardians, and ethical approval was granted by the university's sports science research committee, in line with the Declaration of Helsinki. The study was held in January 2025. All subjects included underwent anthropometric assessments including body height, body weight, and waist circumference. Physical performance tests included upper-body endurance (30-second push-ups), core endurance (30-second curl-ups), lower-body power (standing long

jump, countermovement jump, and vertical jump with run-up), speed (20-meter sprint), and agility (10x5m shuttle run and T-test).

To collect data, we used the protocol tests that were to evaluate the purpose of our study, subjects performed a warm-up of 10 min before the beginning of the tests.

All statistical analyses were performed using IBM SPSS Statistics (Version 26.0; IBM Corp., Armonk, NY, USA). Descriptive statistics (mean and standard deviation) were calculated for all anthropometric and physical performance variables to summarize the central tendency and dispersion of the data. Pearson product-moment correlation coefficients (r) were computed to examine the relationships between anthropometric variables (body height, body weight, and waist circumference) and the following physical performance outcomes used in this study. Correlation values were interpreted using Cohen's (1988) guidelines, with r = 0.10–0.29 considered small, r = 0.30–0.49 moderate, and r ≥ 0.50 large. The level of statistical significance was set at p < .05 for all analyses. Two-tailed tests were applied given the exploratory nature of the study. Normality of distribution for each variable was verified through Shapiro–Wilk tests.

Results

As explained in Table 1 descriptive statistics for the sample indicate that the participants (N = 36) had an average age of 15.73 years (SD = 2.87), reflecting a mid-adolescent cohort. The mean body height was 158.03 cm (SD = 8.08) based on the subsample of 29 athletes with complete data, and the corresponding average for height expressed in meters was 1.27 m (SD = 0.64), though the relatively large standard deviation suggests a possible data entry or coding issue in this variable. The mean body weight was 54.60 kg (SD = 8.93), while the average waist circumference was 73.97 cm (SD = 10.59), based on the full sample of 36 players.

Table 1. Descriptive statistics for the sample

Variable	N	Mean	Standard Deviation
Age (years)	36	15.73	2.87
Body Height (cm)	29	158.03	8.08
Body Height (m)*	36	1.27	0.64
Body Weight (kg)	29	54.60	8.93
Waist Circumference (cm)	36	73.97	10.59

The descriptive statistics in Table 2 provide insight into the physical performance characteristics of the participants. Upper body muscular endurance, assessed via the number of push-ups completed in 30 seconds, showed a mean of 11.10 repetitions (SD = 5.36), while core endurance, measured by curl-ups in 30 seconds, had a mean of 25.29 repetitions (SD

= 9.94). Lower body power was evaluated through the standing long jump, with an average jump distance of 167.08 cm (SD = 18.14). In terms of vertical jump performance, players achieved a mean of 249.86 cm (SD = 14.90) in the countermovement jump (CMJ), and 254.28 cm (SD = 14.80) in the vertical jump with a run-up.

Table 2. Descriptive statistics for Physical Performance Metrics

Variable	N	Mean	Standard Deviation
Upper Body Push-ups (30s)	31	11.10	5.36
Core Body Curl-ups (30s)	31	25.29	9.94
Standing Long Jump (cm)	36	167.08	18.14
Vertical Jump – CMJ (mm)	36	249.86	14.90
Vertical Jump – Run-up (mm)	36	254.28	14.80

Table 3. Descriptive Statistics for Speed and Agility Tests

Variable	N	Mean	Standard Deviation
Speed Sprint – 20 m (s)	36	3.71	0.21
Agility – 10 × 5 m (s)	36	19.88	1.28
Agility – T-test (s)	35	13.84	2.25

Note: Valid N (listwise) = 0 due to missing or incomplete overlapping cases across all variables.

The results of the speed and agility tests shown in Table 3 reveal the average performance levels within the group. The mean time for the 20-meter sprint was 3.71 seconds (SD = 0.21), indicating relatively fast acceleration and sprinting ability among the participants. Performance in the 10x5 meter shuttle run, a measure of change-of-direction agility, averaged 19.88 seconds (SD = 1.28), while the T-test, which assesses multidirectional agility and footwork, had a mean completion time of 13.84 seconds (SD = 2.25).

The results of the Pearson correlation analysis shown on Table 4 indicate that there were no statistically significant relationships between anthropometric characteristics and upper

body or core strength endurance, as measured by the number of push-ups and curl-ups completed in 30 seconds. Specifically, body height showed a weak positive correlation with push-up performance ($r = 0.138, p = 0.521$) and a negligible negative correlation with curl-up performance ($r = -0.026, p = 0.905$), neither of which reached statistical significance. Similarly, body weight demonstrated weak negative correlations with both push-ups ($r = -0.069, p = 0.750$) and curl-ups ($r = -0.091, p = 0.672$), also without statistical significance. Waist circumference exhibited a weak negative correlation with push-up performance ($r = -0.095, p = 0.609$) and a low positive correlation with curl-up performance ($r = 0.203, p = 0.274$), again with no significant results.

Table 4. Pearson correlation analysis for Upper Body PushUps and Core Body CurlUp

		Upper_Body_Push_ups_30s	CoreBody_Curl_up_30s
Body_Height_cm	Pearson Correlation	0.138	-0.026
	Sig. (2-tailed)	0.521	0.905
	N	24	24
Body_Weight	Pearson Correlation	-0.069	-0.091
	Sig.(2 tailed)	0.750	0.672
	N	24	24
Waist_Circumference	Pearson Correlation	-0.095	0.203
	Sig. (2-tailed)	0.609	0.274
	N	31	31

Note. ** - Correlation is significant at the 0.01 level (2-tailed).

The correlation analysis on Table 5 revealed several statistically significant relationships between anthropometric characteristics and lower-body power performance. Body height showed moderate positive correlations with all three jump tests: standing long jump ($r = 0.503, p = 0.005$), countermovement vertical jump (CMJ) ($r = 0.457, p = 0.013$), and vertical jump with run-up ($r = 0.425, p = 0.021$). These results suggest that taller players tend to perform better in lower-body explosive tasks. Similarly, body weight demonstrated significant moderate positive correlations with the

same tests—standing long jump ($r = 0.387, p = 0.038$), CMJ ($r = 0.412, p = 0.026$), and vertical jump with run-up ($r = 0.427, p = 0.021$)—indicating that heavier athletes, likely with greater muscle mass, may achieve better results in these power-based movements. Waist circumference was not significantly correlated with standing long jump or CMJ but showed a weak-to-moderate positive correlation with vertical jump with run-up ($r = 0.341, p = 0.042$), suggesting a possible link between core/trunk dimensions and jumping performance during dynamic movements.

Table 5. Pearson Correlation Long Jump, Vertical Jump CMJ, Vertical Jump run up

		Lower_Body_Standing_Long_Jump	Vertical_Jump_CMJ	Vertical_Jump_run_up
Body_Height_cm	Pearson Correlation	.503**	.457*	.425*
	Sig. (2-tailed)	0.005	0.013	0.021
	N	29	29	29
Body_Weight	Pearson Correlation	.387*	.412*	.427*
	Sig.(2 tailed)	0.038	0.026	0.021
	N	29	29	29
Waist_Circumference	Pearson Correlation	-0.289	0.266	.341*
	Sig. (2-tailed)	0.087	0.117	0.042
	N	36	36	36

Note. ** - Correlation is significant at the 0.01 level (2-tailed); * - Correlation is significant at the 0.05 level (2-tailed).

In Table 6 the correlation results show mixed and mostly non-significant relationships between anthropometric characteristics and performance in speed and agility tests. Body height demonstrated a statistically significant moderate negative correlation with the 10x5m agility test ($r = -0.492$, $p = 0.007$), indicating that taller players tend to perform better (i.e., faster) in this specific agility drill. There were also non-significant negative correlations between height and the 20-meter sprint ($r = -0.325$, $p = 0.085$) as well as the T-test ($r = -0.349$,

$p = 0.069$), suggesting a possible trend where taller players may have an advantage in both linear and change-of-direction speed, though these did not reach significance. Body weight showed no significant associations with any of the three tests, with weak negative correlations observed for the sprint ($r = -0.047$), 10x5m agility ($r = -0.299$), and T-test ($r = -0.271$). Waist circumference also did not significantly correlate with any of the performance measures, with correlation values close to zero.

Table 6. Pearson Correlation of Speed, Agility and T-test

		Speed_sprint_20m	Agility_10x5m	T-test
Body_Height_cm	Pearson Correlation	-0.325	-.492**	-0.349
	Sig. (2-tailed)	0.085	0.007	0.069
	N	29	29	28
Body_Weight	Pearson Correlation	-0.047	-0.229	-0.271
	Sig.(2 tailed)	0.810	0.115	0.163
	N	29	29	28
Waist_Circumference	Pearson Correlation	0.199	-0.088	0.032
	Sig. (2-tailed)	0.245	0.610	0.854
	N	36	36	35

Note. ** - Correlation is significant at the 0.01 level (2-tailed); * - Correlation is significant at the 0.05 level (2-tailed).

Discussion

The findings indicated no statistically significant relationships between anthropometric parameters and muscular endurance in both upper-body (push-ups) and core (curl-ups) assessments. These findings align with previous research indicating that endurance tasks, especially those requiring recurrent submaximal contractions, are more affected by neuromuscular efficiency, technique, and training history than by body size (Lesinski et al., 2017). Although height and weight may affect absolute strength, they seem to be less significant for endurance exercises in young athletes (Vescovi & McGuigan, 2008). This indicates that muscular endurance in this group can be efficiently enhanced irrespective of anthropometric characteristics, possibly owing to their dependence on conditioning rather than leverage or force generation.

Conversely, body height and weight exhibited substantial and moderate correlations with all three lower-body power assessments: Standing Long Jump, Vertical Jump (CMJ), and Vertical Jump with Run-Up. The results suggest that taller and heavier athletes generally excel in explosive tasks, corroborating earlier research in juvenile football and basketball demographics (Buchheit et al., 2014; Ramirez-Munera et al., 2025). Taller athletes gain advantages from elongated limbs and perhaps superior leverage in push-off mechanics, while augmented body mass provided it comprises lean tissue can improve the production of propulsive force (Padulo et al., 2024). The moderate positive correlation between waist circumference and vertical leap with run-up may also indicate the influence of trunk stability and mass during dynamic propulsion. This pattern indicates that anthropometric traits are a significant factor in assessing lower-body power potential in adolescent female athletes.

The correlation between anthropometric measurements and linear speed performance was poor and statistically insignificant. Although body height exhibited a tendency for a negative connection with 20 m sprint time ($r = -0.325$, $p =$

$.085$), this did not achieve statistical significance. These findings somewhat contradict literature indicating a biomechanical benefit of height in stride length and sprint acceleration (Vescovi & McGuigan, 2014; Buchheit, M., & Samozino et al., 2014). The absence of substantial correlations in this study may be attributed to the multifaceted nature of sprinting, which depends on neuromuscular coordination, technique, and ground response force efficiency—all characteristics that evolve with training and maturation (Stanković et al., 2023). The diversity in maturation status across this adolescent group may have weakened possible correlations between anthropometry and sprint performance.

The findings of agility performance were inconsistent. A statistically significant moderate negative correlation was identified between body height and the 10x5 m shuttle run ($r = -0.492$, $p = .007$), indicating that taller individuals performed the test more rapidly. This is rather unexpected, given agility particularly change-of-direction (COD) capability is frequently linked to a lower center of gravity, which is generally beneficial for shorter athletes (Alexe et al., 2024; Sellami et al., 2024). A plausible reason is that the taller athletes in this study exhibited comparatively enhanced strength-to-weight ratios or stronger movement mechanics, mitigating potential disadvantages. No substantial correlations were identified regarding agility performance in the T-test, perhaps attributable to the intricate movement patterns and technical heterogeneity inherent in this assessment (Villaseca-Vicuña et al., 2021). Body weight and waist size had no significant relationships with either agility assessment.

The findings highlight the necessity of customizing training and talent identification programs in young football based not just on anthropometric characteristics but also on functional performance results. Although height and weight may enhance explosive activities such as jumping, these characteristics are less indicative of speed or endurance potential. A comprehensive strategy to player development that integrates

physical, technical, and tactical advancement is vital. Strength and conditioning programs must take individual anthropometric profiles into account to enhance movement efficiency and power output.

Conclusion

In summary, anthropometric characteristics particularly body height and weight exhibit a moderate correlation with lower-body power in young female football players, while demonstrating minimal or negligible impact on muscular endurance, linear speed, or agility. These findings underscore the need of using anthropometric evaluations in assessing athletic potential, especially for activities necessitating explosive force generation. Nonetheless, physical performance in football is multifaceted, and talent development plans must prioritize holistic training and assessment beyond mere physical metrics.

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A Comparative Study of Motor Skills in Children in Some Sports Disciplines

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Abstract

For many years, martial arts have been used as a form of sport, as well as a recreational activity and self-defense. The increase in physical abilities comes as a result of the application of well-organized martial arts programs, however, the results are not very clear. This study aimed to examine and identify differences in anthropometric and motor characteristics among children aged 8–12 years participating in three sports disciplines—football, basketball, and karate—in Tirana, Albania. A total of 83 children participated in this study (football, N=36; basketball, N=25; karate, N=22). All participants trained regularly in sports clubs and were assessed for anthropometric and motor abilities using standardized test protocols. Measurements included body weight, height, body mass index (BMI), and waist circumference. Motor abilities were evaluated through tests of arm span (dominant hand), upper-limb strength (30-second push-up test), lower-limb power (standing long jump), flexibility (Sit and Reach test), and agility (10×5m shuttle run and T-test). Descriptive statistics (mean, standard deviation, minimum, and maximum) and one-way ANOVA were used to compare groups, with a significance level set at $p < .05$. The results revealed significant sport-specific differences in selected motor skills. Statistically significant differences were found for body weight ($p = .029$), arm span (dominant hand) ($p = .029$), lower-limb strength ($p = .001$), and agility (10×5 m test, $p = .002$; T-test, $p < .001$). Basketball players displayed higher mean values in body weight and arm span, football players showed superior performance in lower-limb power and agility, and karate participants demonstrated strong multidirectional coordination. These findings provide essential information for coaches and physical education teachers to design sport-specific and age-appropriate training programs. The study highlights that even at young ages, participation in different sports disciplines leads to specific adaptations in motor abilities. Future research should consider additional physiological parameters, particularly cardio-respiratory fitness, to provide a more comprehensive understanding of children's physical development.

Keywords: *basketball, football, karate, motor skills*

Introduction

Motor skill development during childhood is a critical component of overall growth and has profound implications for long-term physical health, psychosocial well-being, and athletic potential. Early participation in structured physical activity enhances not only physical capacities but also cognitive and emotional development, contributing to healthy lifestyle habits (Gallahue et al., 2012; Payne & Isaacs, 2017). The acquisition and refinement of motor skills during the ages of 8–12 years represent a sensitive period for neuromuscular coordination, balance, and agility, during which children's responsiveness to

training stimuli is particularly high (Lloyd et al., 2015). Sports participation at this age provides an ideal context for the development of both fundamental movement skills and sport-specific abilities. Different sports disciplines impose distinct physiological and biomechanical demands, leading to specific adaptations in motor performance (Malina et al., 2015; Bompa & Buzzichelli, 2019). For example, football (soccer) emphasizes speed, agility, and lower-limb strength due to its dynamic nature and continuous play; basketball requires coordination, upper-body power, and jumping ability for effective performance in offense and defense; while karate, as a martial art, focuses on balance,

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flexibility, reaction time, and control of movement precision (Franchini et al., 2013). Understanding these sport-specific adaptations in children is crucial for optimizing training processes and promoting long-term athlete development. Previous studies have demonstrated that participation in sports during childhood is associated with higher levels of physical fitness, coordination, and body composition control (Silva et al., 2019; Trecroci et al., 2020). However, limited research has compared motor profiles across different sports in Albanian youth populations, particularly within organized club settings. Identifying the distinctive characteristics of children engaged in various sports can inform teachers, coaches, and sports scientists in designing evidence-based, age-appropriate training programs. The purpose of this study was to examine and identify differences in anthropometric and motor characteristics among children aged 8–12 years participating in three distinct sports disciplines—football, basketball, and karate—in Tirana, Albania. It was hypothesized that there would be no significant differences in the measured variables (anthropometric and motor abilities) between children participating in these sport disciplines.

Methodology

A total of 83 children aged 8–12 years participated in this study. The sample included 36 football players, 25 basketball players, and 22 karate practitioners, all of whom trained regularly in local clubs in Tirana. Participants were healthy, free of injury, and involved in systematic sports training (2–3 sessions per week). Parental consent was obtained prior to participation.

Anthropometric and motor skill assessments were conducted following standardized protocols. The following measurements were collected: Body Height (cm and m) – measured using a stadiometer; Body Weight (kg) – measured with a calibrated digital scale; Body Mass Index (BMI) – calculated as weight (kg)/height (m²); Waist Circumference (cm) – measured at the midpoint between the lowest rib and iliac crest using a flexi-

ble measuring tape; Arm Span (Avenue Dominant Hand) – measured from fingertip to fingertip with arms fully extended; Upper-Limb Strength – assessed by the 30-second push-up test; Lower-Limb Power – measured by the standing long jump test; Flexibility – assessed using the Sit and Reach test; and Agility – measured with the 10×5 m shuttle run and T-test for multidirectional speed and change of direction.

All assessments were carried out indoors under similar environmental conditions. Participants performed a standardized 10-minute warm-up before testing. Each motor test was demonstrated by an instructor and performed twice, with the best score recorded. Data collection was supervised by experienced sport science professionals to ensure consistency and reliability.

Descriptive statistics (mean, standard deviation, minimum, and maximum values) were computed for all variables. Group comparisons across sport disciplines were conducted using one-way analysis of variance (ANOVA), with a significance threshold set at $p < .05$. When significant main effects were found, Bonferroni post hoc tests were applied to determine pairwise differences. All statistical analyses were performed using SPSS for Windows, Version 22.0 (IBM Corp., 2022).

Results

A comparative analysis between groups is presented in Table 1. The comparison for body height (cm) showed no statistically significant differences between groups ($F = 2.177, p = 0.118$). Similarly, when analysed in meters, body height did not differ significantly between groups ($F = 2.177, p = 0.118$). In contrast, body weight demonstrated a statistically significant difference between the groups ($F = 3.670, p = 0.029$), indicating that the intervention may have influenced body weight values. No significant differences were observed in Body Mass Index (BMI) ($F = 2.304, p = 0.104$) or waist circumference ($F = 2.474, p = 0.090$).

The comparative analysis for agility performance is presented in Table 2. The results show that there were statistically significant

Table 1. Comparative Analysis between Sport Disciplines Groups

Variable	Source of Variation	Mean Square	F	p (Sig.)
Body Height (cm)	Between Groups	143.484	2.177	0.118
	Within Groups	65.898		
Body Height (m)	Between Groups	0.014	2.177	0.118
	Within Groups	0.007		
Body Weight (kg)	Between Groups	327.619	3.670	0.029
	Within Groups	89.262		
BMI (kg/m ²)	Between Groups	22.994	2.304	0.104
	Within Groups	9.980		
Waist Circumference (cm)	Between Groups	259.483	2.474	0.090
	Within Groups	104.905		

Note. One-way ANOVA was used to compare anthropometric variables between Sport Disciplines groups. Statistical significance was set at $p < .05$. A significant difference was found only for body weight ($p = .029$).

Table 2. Comparative Analysis of Agility Performance between Sport Disciplines

Variable	Source of Variation	Mean Square	F	p (Sig.)
Agility (10×5 m Shuttle Run)	Between Groups	16.131	6.473	.002
	Within Groups	2.492		
Agility (T-test)	Between Groups	93.061	13.684	<.001
	Within Groups	6.801		

Note. One-way ANOVA was used to compare agility performance across basketball, football, and karate. Significant differences were observed for both agility tests ($p < .05$).

differences between sport disciplines for both agility tests. For the 10×5 m shuttle run, the difference was significant ($F = 6.473$, $p = .002$), indicating variation in short-distance acceleration and direction-change ability among sports. Similarly, for the T-test, the difference was highly significant ($F = 13.684$, $p < .001$), confirming that agility performance varied notably between groups.

A comparative analysis Sport Disciplines groups is presented

in Table 3. The analysis of upper-body strength (push-ups in 30 seconds) showed no statistically significant difference between the Sport Disciplines groups ($F = 1.007$, $p = .369$). In contrast, the analysis of lower-body power (standing long jump) revealed a statistically significant difference ($F = 7.834$, $p = .001$). The flexibility variable (Sit and Reach test) showed no significant difference between the Sport Disciplines groups ($F = 2.630$, $p = .078$).

Table 3. Comparative Analysis of Motor Ability Tests between Control and Intervention Groups

Variable	Source of Variation	Mean Square	F	p (Sig.)
Upper-Body Strength (Push-ups, 30 s)	Between Groups	129.791	1.007	.369
	Within Groups	128.829		
Lower-Body Power (Standing Long Jump)	Between Groups	4155.961	7.834	.001
	Within Groups	530.471		
Flexibility (Sit and Reach Test)	Between Groups	989.863	2.630	.078
	Within Groups	376.329		

Note. One-way ANOVA was used to compare performance outcomes between the control and intervention groups. A significant improvement was observed only for lower-body power ($p = .001$).

Post hoc comparisons between the three sport disciplines are summarized in Table 4. For agility (10×5 m shuttle run), basketball players performed significantly slower than football players ($p = .001$), while no significant differences were found between basketball and karate ($p = .199$) or between football

and karate ($p = .223$). Regarding the T-test of agility, significant differences were found between karate and both basketball ($p < .001$) and football ($p < .001$), indicating that karate athletes achieved better agility performance compared to participants from the other two sports.

Table 4. Post Hoc Comparison of Agility Performance between Sport Disciplines (Basketball, Football, Karate)

Dependent Variable	(I) Sport Discipline	(J) Sport Discipline	Mean Difference (I-J)	Std. Error	p (Sig.)
Agility (10×5 m Shuttle Run)	Basketball	Football	1.27*	0.36	.001
		Karate	0.69	0.54	.199
	Football	Basketball	-1.27*	0.36	.001
		Karate	-0.58	0.47	.223
	Karate	Basketball	-0.69	0.54	.199
		Football	0.58	0.47	.223
Agility (T-test)	Basketball	Football	-0.18	1.20	.884
		Karate	-6.45*	1.65	< .001
	Football	Basketball	0.18	1.20	.884
		Karate	-6.27*	1.20	< .001
	Karate	Basketball	6.45*	1.65	< .001
		Football	6.27*	1.20	< .001

Note. One-way ANOVA with Bonferroni post hoc analysis was used to compare agility performance across sport disciplines; Significant differences at $p < .05$ are marked with an asterisk *.

The post hoc comparison results between the three sport disciplines are presented in Table 5. For upper-body strength (push-ups in 30 seconds), no statistically significant differences were found between basketball, football, and karate ($p > .05$). In contrast, for lower-body power (standing long jump), signif-

icant differences were observed: football players outperformed both basketball ($p = .003$) and karate ($p = .003$) participants. Regarding flexibility (Sit and Reach test), a significant difference emerged between football and karate ($p = .035$), with karate athletes showing superior flexibility levels.

Table 5. Post Hoc Comparison of Motor Performance between Sport Disciplines (Basketball, Football, Karate)

Dependent Variable	(I) Sport Discipline	(J) Sport Discipline	Mean Difference (I-J)	Std. Error	p (Sig.)
Upper-Body Strength (Push-ups, 30 s)	Basketball	Football	-3.82	2.71	.162
		Karate	-3.88	6.15	.529
	Football	Basketball	3.82	2.71	.162
		Karate	-0.06	5.83	.992
	Karate	Basketball	3.88	6.15	.529
		Football	0.06	5.83	.992

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Table 5. Post Hoc Comparison of Motor Performance between Sport Disciplines (Basketball, Football, Karate)

Dependent Variable	(I) Sport Discipline	(J) Sport Discipline	Mean Difference (I-J)	Std. Error	p (Sig.)
Lower-Body Power (Standing Long Jump)	Basketball	Football	-16.40*	5.38	.003
		Karate	3.60	7.58	.636
	Football	Basketball	16.40*	5.38	.003
		Karate	20.01*	6.50	.003
	Karate	Basketball	-3.60	7.58	.636
		Football	-20.01*	6.50	.003
Flexibility (Sit and Reach Test)	Basketball	Football	-4.85	9.01	.592
		Karate	-16.83	10.02	.097
	Football	Basketball	4.85	9.01	.592
		Karate	-11.98*	5.57	.035
	Karate	Basketball	16.83	10.02	.097
		Football	11.98*	5.57	.035

Note. A one-way ANOVA followed by Bonferroni post hoc tests was performed to compare sport disciplines; Significant differences at $p < .05$ are marked with an asterisk *.

Discussion

The purpose of this study was to examine and compare the anthropometric and motor characteristics of children aged 8–12 years participating in football, basketball, and karate in Tirana. The findings revealed significant sport-specific differences in selected physical performance variables, particularly in lower-body power and agility, while no significant differences were observed in body height, BMI, or upper-body strength. These results provide valuable insight into how the specific demands of each sport discipline shape the motor and physical development of young athletes. The analysis of anthropometric parameters, including body height, body weight, BMI, and waist circumference, revealed no statistically significant differences among the groups. This suggests that the children from different sport disciplines were relatively homogeneous in terms of body composition and somatic development, which is expected at this prepubertal age (Malina et al., 2015). Nevertheless, basketball players tended to have slightly greater body height and arm span than football and karate athletes—an expected trend given that body linearity and reach are advantageous in basketball and often influence talent selection (Popović et al., 2019). The observed similarities across groups indicate that, during middle childhood, training volume and sport type may not yet produce marked anthropometric divergence.

The results from the 30-second push-up test showed no significant differences between the groups, suggesting similar levels of upper-body strength among children. This may be attributed to the relatively low emphasis on resistance training in preadolescent athletes across all three sports (Behm et al., 2017). Additionally, children’s muscular endurance and strength adaptations are primarily neural rather than hypertrophic at this age (Faigenbaum & Myer, 2010), which could explain the uniformity across sports.

In contrast, standing long jump performance demonstrated significant differences, with football players showing superior lower-limb explosive strength compared to basketball and karate participants ($p = .001$). This result aligns with prior studies highlighting that football’s repeated sprinting, kicking, and jumping actions contribute to enhanced leg power (Trecroci et al., 2020). Basketball players, who also perform frequent jumps, showed intermediate results, while karate practitioners

demonstrated lower average performance. The difference likely reflects the dynamic, high-impact nature of football training, which continuously engages the stretch-shortening cycle of the leg muscles. No significant differences were observed in the Sit and Reach test across the groups, although karate athletes displayed slightly higher mean scores, followed by basketball players. These findings are consistent with Franchini et al. (2013), who reported that flexibility is a critical component of karate training due to its emphasis on range of motion and technical execution. The lack of statistical significance may stem from overlapping flexibility levels across sports or from insufficient training volume to create larger between-group differences at this developmental stage. Agility, as assessed by both the 10×5 m shuttle run and T-test, showed significant differences between sports disciplines. Football players performed best on the 10×5 m test ($p = .002$), likely due to frequent direction changes and sprint patterns inherent to football training. Karate practitioners demonstrated superior results on the T-test ($p < .001$), highlighting their advantage in coordinated, multidirectional movements that require rapid postural adjustments and neuromuscular control. These results emphasize that agility development in children is sport-specific, depending on the movement patterns most frequently practiced in training (Paul et al., 2016).

The findings underscore the importance of diversified sport participation during childhood to promote balanced motor skill development. Coaches and physical educators should integrate a variety of agility, power, and flexibility exercises across training sessions to ensure comprehensive motor learning. While sport-specific adaptations are beneficial, excessive early specialization might limit general motor competence and increase the risk of overuse injuries (Côté et al., 2009). Therefore, combining structured sport practice with multidimensional physical activities can enhance both athletic performance and long-term participation in physical activity. This study has several limitations. The sample was limited to children from sports clubs in Tirana, which may restrict the generalizability of findings to broader populations. Additionally, biological maturation stages were not controlled, which may have influenced some physical performance outcomes. Future research should include larger, regionally diverse samples and longitudinal designs to examine how motor skills evolve with continued training and maturation.

tion. Incorporating physiological and biomechanical measures would also provide a deeper understanding of sport-specific adaptations.

Conclusion

In conclusion, the study confirms that while anthropometric characteristics remain relatively uniform across sports at ages 8–12, motor performance differences emerge according to sport-specific demands. Football players demonstrated superior leg power and short-distance agility, whereas karate practitioners excelled in multidirectional coordination. These findings highlight the unique developmental benefits of each sport and reinforce the importance of diversified motor experiences during childhood to foster well-rounded physical competence.

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Joint Health and Rheumatologic Symptoms among Athletes in Team Sports in Albania

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Abstract

Sports characterized by repetitive high-impact loading and multidirectional movements, such as football, volleyball, and basketball, may increase susceptibility to overuse syndromes, joint inflammation, and soft tissue injuries. Despite this, rheumatology-specific data on athletes remain limited, particularly in small-scale sport-specific samples. The aim of this study was to investigate the prevalence of rheumatology-related symptoms and their functional impact among athletes engaged in football, volleyball, and basketball. A cross-sectional assessment was conducted with 45 competitive athletes (football, volleyball, basketball). Data were collected through a structured questionnaire that included demographic characteristics, sport participation history, and rheumatology-related symptom screening. Outcomes included frequency and severity of joint pain, swelling, stiffness, and fatigue, as well as missed training sessions and functional limitations in sport-specific movements. Chronic rheumatological illnesses were uncommon, with 5.4% of athletes reporting a previous diagnosis and 3.1% reporting a family history of such diseases. In contrast, 48.5% reported previous muscle or joint injuries, and 34.2% stated that joint symptoms affected their sports performance. Female athletes reported a slightly higher injury rate (58.7%) and greater performance impact (43.5%) compared with males (46.3% and 32.2%, respectively). Across disciplines, prior rheumatological diagnoses were most frequent in basketball (15.2%), followed by volleyball (7.7%) and football (2.5%). Previous injuries were reported by 56.9% of volleyball players, 51.5% of basketball players, and 44.4% of football players, while perceived performance limitations were noted by 41.5%, 39.4%, and 30.2% of athletes in these sports, respectively. Although confirmed rheumatological diseases were rare, musculoskeletal injuries and functional joint symptoms were widespread among team-sport athletes, particularly in volleyball and basketball. These findings underscore the importance of early screening and preventive strategies to mitigate chronic joint stress and optimize athletic performance.

Keywords: *rheumatology, athletes, football, volleyball, basketball, joint health, sports medicine*

Introduction

Athletes in competitive and recreational sports are routinely exposed to physiological, mechanical, and environmental stressors that can influence both their acute and chronic health status. Among these, illness, musculoskeletal injury, and rheumatological symptoms represent important determinants of training continuity, performance outcomes, and long-term health (Mountjoy et al., 2022). The epidemiology of health problems in athletes has been widely documented across various disciplines, with respiratory and gastrointestinal infections, skin and soft-tissue conditions, and musculoskeletal disorders

ranking as the most common causes of time loss from sport (Engebretsen et al., 2013; Schwellnus et al., 2016). Monitoring these conditions through structured questionnaires allows for early identification of health risks and the implementation of preventive strategies at both individual and team levels.

Recent surveillance studies from the International Olympic Committee (IOC) and Fédération Internationale de Football Association (FIFA) have highlighted that respiratory illnesses—such as colds, influenza-like symptoms, and sore throat—constitute nearly half of all reported illnesses during major international tournaments (Derman et al., 2017; Junge et al., 2018). Gastroin-

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testinal disturbances, including vomiting and diarrhea, frequently accompany team travel and dietary changes, while skin and soft-tissue infections occur more often in contact or mat-based sports such as taekwondo and karate, where direct skin-to-skin or skin-to-mat transmission is common (Zinder & Basler, 2010; Llera & Levy, 2015). These acute illnesses, though transient, can significantly impair performance through missed training sessions, reduced recovery quality, and immune system suppression from heavy training loads (Pyne et al., 2015; Walsh et al., 2011).

Beyond short-term infectious conditions, chronic musculoskeletal and rheumatological problems are also prevalent among athletes, particularly in disciplines characterized by repetitive joint loading and high mechanical impact. Sports such as basketball, football, and volleyball involve frequent jumping, sudden direction changes, and collisions that predispose athletes to joint degeneration, tendinopathies, and bursitis (Raysmith & Drew, 2016). Combat sports, including karate and taekwondo, place repetitive stress on the lower limbs and spine, increasing the risk of overuse injuries and inflammatory joint disorders (Kim et al., 2019). Studies indicate that a history of joint injuries or rheumatological symptoms, such as arthritis, spondyloarthritis, or tendonitis, can lead to chronic pain, reduced range of motion, and diminished athletic performance (Soligard et al., 2016; Theodoropoulos et al., 2020). Moreover, family history of autoimmune or rheumatological diseases has been associated with higher susceptibility to similar disorders, particularly when combined with repetitive mechanical stress and inadequate recovery (Jones et al., 2019). Assessing the relationship between previous musculoskeletal problems, family rheumatological history, and self-reported functional impact provides a holistic understanding of athletes' health beyond acute injuries. Incorporating these elements into regular medical screening can help differentiate between temporary overload symptoms and early-onset chronic disease (Fagher & Lexell, 2020).

Given this context, the present research aims to synthesize evidence on illness and rheumatological health among athletes in different sport disciplines - specifically basketball, football, volleyball, karate, and taekwondo. It focuses on two major domains of health assessment: (a) recent health conditions over the previous eight weeks, including respiratory, gastrointestinal, and skin infections, and (b) medical and rheumatological history, encompassing prior diagnoses, family predisposition, musculoskeletal injuries, and the perceived impact of joint symptoms on sports performance. Understanding these interrelated health dimen-

sions may support evidence-based prevention, improve athlete monitoring, and guide interdisciplinary medical care in sport.

Methodology

The study included a total of 260 athletes (214 males and 46 females) aged between 18 and 35 years, representing three team sport disciplines: football (n = 162), volleyball (n = 65), and basketball (n = 33). All participants were actively competing at club or university level and had a minimum of two years of organized training experience. Athletes were free of acute illness at the time of data collection and voluntarily participated in the study.

Data were collected using a structured health questionnaire designed to assess medical and rheumatological history over the athletes' sporting careers. The instrument consisted of four key items: Previous diagnosis of joint or rheumatological diseases (arthritis, tendonitis, bursitis, spondyloarthritis, lupus, etc.), family history of rheumatological diseases, previous muscle or joint injuries and perceived impact of joint symptoms on sports performance. Each item was recorded as a binary response (Yes/No). The questionnaire was self-administered under supervision to ensure comprehension and completeness. Demographic data (age, gender, and sport discipline) were also collected. Data collection took place during scheduled training sessions between August and September 2025. Prior to completion of the questionnaire, all participants were briefed on the study purpose and assured of confidentiality. The questionnaires were completed in small groups and immediately checked for accuracy. Data were then entered into IBM SPSS Statistics (version 29.0) for analysis.

Descriptive statistics were used to summarize categorical variables, including frequency (n) and percentage (%) distributions for all questionnaire items. Comparisons between genders (male vs. female) and sport disciplines (football, volleyball, basketball) were performed using Pearson's chi-square (χ^2) test to identify statistically significant differences in the prevalence of medical or rheumatological conditions, injury history, and perceived performance impact. The level of statistical significance was set at $p < .05$. Results were organized in tabular form (Tables 1–6) to present distributions and comparisons across groups, allowing for a detailed overview of the patterns of rheumatological and musculoskeletal conditions among athletes.

Results

Table 1 demonstrates that chronic rheumatological illnesses were uncommon, with only 5.4% of athletes reporting a prior diagnosis of joint or rheumatological disease and 3.1%

Table 1. Medical and Rheumatological History

		Frequency	Percent
Have you had a previous diagnosis of joint problems or rheumatological diseases (arthritis, tendonitis, bursitis, spondyloarthritis, lupus, etc.)?	Yes	14	5.4
	No	246	94.6
	Total	260	100.0
Family history of rheumatological diseases	Yes	8	3.1
	No	252	96.9
	Total	260	100.0
Previous muscle or joint injuries	Yes	126	48.5
	No	134	51.5
	Total	260	100.0
Do you feel that your joint symptoms affect your sports performance?	Yes	89	34.2
	No	171	65.8
	Total	260	100.0

having a family history of such conditions. On the other hand, 48.5% of respondents had previously had joint or muscle problems, indicating the significant physical demands and risk of damage associated with sports involvement. Furthermore, 34.2% of respondents said their performance was impacted by joint problems, indicating that functional discomfort is rather widespread even in the absence of a formal diagnosis.

With just slight gender disparities, male and female athletes' health profiles were largely identical, as Table 2 illustrates. Comparable rates of chronic diseases were indicated by the fact that 5.6% of males and 4.3% of females reported

having a prior diagnosis of joint or rheumatological disease. However, females were more likely than males to have a family history of rheumatological disease (8.7% vs. 1.9%), indicating a significantly higher inherited propensity. Compared to 46.3% of male participants, 58.7% of female participants reported having previously sustained a muscle or joint injury, suggesting that female participants were more likely to have been exposed to or recollect such injuries. Similarly, 43.5% of women and 32.2% of men said that joint pain impacted their athletic performance, suggesting that women may perceive or feel a larger functional impact.

Table 2. Medical and Rheumatological History by Gender

		Male		Female	
		Frequency	Percent	Frequency	Percent
Have you had a previous diagnosis of joint problems or rheumatological diseases (arthritis, tendonitis, bursitis, spondyloarthritis, lupus, etc.)?	Yes	12	5.6	2	4.3
	No	202	94.4	44	95.7
	Total	214	100.0	46	100.0
Family history of rheumatological diseases	Yes	4	1.9	4	8.7
	No	210	98.1	42	91.3
	Total	214	100.0	46	100.0
Previous muscle or joint injuries	Yes	99	46.3	27	58.7
	No	115	53.7	19	41.3
	Total	214	100.0	46	100.0
Do you feel that your joint symptoms affect your sports performance?	Yes	69	32.2	20	43.5
	No	145	67.8	26	56.5
	Total	214	100.0	46	100.0

Table 3 shows that, in contrast to volleyball players (7.7%) and football players (2.5%), 15.2% of basketball players reported having a prior diagnosis of joint or rheumatological disease.

The majority of athletes across all sports, 84.8% in basketball, 92.3% in volleyball, and 97.5% in football, did not report receiving such a diagnosis.

Table 3. Have You Had a Previous Diagnosis of Joint Problems or Rheumatological Diseases (Arthritis, Tendonitis, Bursitis, Spondyloarthritis, Lupus, etc.)?

Sport discipline		Frequency	Percent
Basketball	Yes	5	15.2
	No	28	84.8
	Total	33	100.0
Football	Yes	4	2.5
	No	158	97.5
	Total	162	100.0
Volleyball	Yes	5	7.7
	No	60	92.3
	Total	65	100.0

Table 4. Family History of Rheumatological Diseases

Sport Discipline		Frequency	Percent
Basketball	Yes	2	6.1
	No	31	93.9
	Total	33	100.0
Football	Yes	1	0.6
	No	161	99.4
	Total	162	100.0
Volleyball	Yes	5	7.7
	No	60	92.3
	Total	65	100.0

According to Table 4, only 0.6% of football players, 7.7% of volleyball players, and 6.1% of basketball players reported having a family history of rheumatological disorders. 99.4% of football players, 92.3% of volleyball players, and 93.9% of basketball players said they had no family history.

Table 5 shows that whilst the percentage was lower among football players (44.4%), 56.9% of volleyball players and 51.5% of basketball players reported having previously suffered a

muscle or joint injury. The percentage of athletes who had never experienced an injury was 55.6% in football, 48.5% in basketball, and 43.1% in volleyball.

According to Table 6, compared to 30.2% of football players, 41.5% of volleyball players and 39.4% of basketball players said that joint problems impacted their ability to participate in sports. In football, 69.8% of participants reported feeling unaffected, compared to 60.6% in basketball and 58.5% in volleyball.

Table 5. Previous Muscle or Joint Injuries

Sport Discipline		Frequency	Percent
Basketball	Yes	17	51.5
	No	16	48.5
	Total	33	100.0
Football	Yes	72	44.4
	No	90	55.6
	Total	162	100.0
Volleyball	Yes	37	56.9
	No	28	43.1
	Total	65	100.0

Table 6. Do You Feel That Your Joint Symptoms Affect Your Sports Performance?

Sport Discipline		Frequency	Percent
Basketball	Yes	13	39.4
	No	20	60.6
	Total	33	100.0
Football	Yes	49	30.2
	No	113	69.8
	Total	162	100.0
Volleyball	Yes	27	41.5
	No	38	58.5
	Total	65	100.0

Discussion

With a focus on gender and sport-specific differences, the current study examined the prevalence of musculoskeletal and rheumatological disorders among athletes participating in various team sports. Overall, the findings indicated that although chronic rheumatological disorders were uncommon, injuries to the muscles and joints, as well as the perceived effect they had on performance, were somewhat common. Only a small percentage of athletes (5.4%) or those with a family history of chronic rheumatological disorders (3.1%) reported having such symptoms, as shown in Table 1, indicating that these illnesses are rare among young, active sports populations. Nonetheless, over one-third (34.2%) of the athletes believed that their athletic performance was impacted by these symptoms, and almost half (48.5%) of the athletes reported prior muscle or joint problems. This suggests that musculoskeletal strain and overuse symptoms are common and significant, despite the rarity of medically diagnosed rheumatological illnesses. These results are consistent with earlier studies that found a significant prevalence of chronic joint pain and overuse injuries in competitive athletes (Maffulli et al., 2011; Soligard et al., 2016).

According to gender-based comparisons (Table 2), male and female athletes' profiles with regard to detected joint problems were comparatively similar (5.6% vs. 4.3%). However,

the prevalence of prior injuries (58.7% vs. 46.3%) and family history of rheumatological disease (8.7% vs. 1.9%) was higher among females. Furthermore, a higher percentage of female athletes (43.5%) than male athletes (32.2%) said that joint pain had a detrimental effect on their performance. These findings are in line with earlier research that suggested biomechanical, hormonal, and neuromuscular variations may make female athletes more vulnerable to soft-tissue and overuse injuries (Hewett et al., 2006; Roos et al., 2015).

Comparisons amongst sports (Tables 3–6) revealed clear trends. Football players (2.5%), volleyball players (7.7%), and basketball players (15.2%) had the greatest rates of previously diagnosed joint or rheumatological diseases. Similarly, compared to football players (0.6%), volleyball (7.7%) and basketball (6.1%) athletes were more likely to have a family history of rheumatological disorders. In terms of injury history, basketball players (51.5%) and volleyball players (56.9%) once more reported greater rates of previous joint or muscle injuries than football players (44.4%). These results might be explained by the different mechanical loads placed on each sport: basketball and volleyball include repetitive jumping and landing, which increases joint stress, especially on the knees and ankles (Bahr & Krosshaug, 2005).

The pattern for perceived performance impact was similar. Compared to 30.2% of football players, 41.5% of volley-

ball players and 39.4% of basketball players experienced joint problems. This trend suggests that even if they are not officially diagnosed with rheumatological disease, athletes who participate in sports that include high-impact and explosive lower-limb activities are more likely to have persistent joint discomfort that impairs their performance.

When combined, these findings imply that overuse symptoms and musculoskeletal injuries provide a greater immediate threat to athlete health than long-term rheumatological conditions. The observed gender and sport-specific patterns highlight the necessity of preventive measures catered to the biomechanical requirements of individual sports. Structured rehabilitation programs, load control, and routine medical screening for early joint complaints may all assist slow the progression of acute injury to chronic musculoskeletal disease. Causal inference was limited by the descriptive and cross-sectional nature of this investigation. Recall bias regarding injury history or symptom intensity may potentially be introduced by depending too much on self-reported data. Clinical imaging, biomechanical evaluation, and longitudinal follow-up may be used in future research to monitor the development of chronic joint diseases following overuse injuries. A more comprehensive understanding of rheumatological health across sporting communities may also be obtained by extending the sample to include athletes from endurance and individual sports.

Conclusion

In conclusion, the results demonstrate that although athletes rarely suffer from chronic rheumatological disorders, they frequently sustain muscle and joint injuries and associated symptoms, which can hinder their performance. In order to preserve athletes' joint health and sustain long-term participation, sport-specific injury prevention and early management programs are crucial, as seen by the higher occurrence among female basketball and volleyball players.

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Infectious Diseases among Athletes in Tirana: A Cross-Sectional Questionnaire Study across Multiple Sports

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Abstract

Athletes face several infection pathways- sport-associated (skin/wound infections, overtraining-related susceptibility), lifestyle-associated (team housing), travel-associated exposure, and community-level illnesses. Hygiene routines, vaccination status, training load, and shared-equipment practices can influence risk and performance. To estimate recent infection prevalence and patterns among athletes in Tirana and identify modifiable risk and protective factors related to sport type, training load, hygiene practices, travel, and vaccination. Cross-sectional survey of competitive and recreational athletes (≥ 14 years) from team and individual sports in Tirana. The 8–10 minute questionnaire captures demographics, sport/training profile, recent infections (respiratory, gastrointestinal, skin/soft-tissue), STI awareness/testing, hepatitis/vaccination status, shared-equipment and hygiene practices, travel, and perceived performance impact. Descriptive statistics (prevalence, 95% CI) and logistic regression will explore associations between infection outcomes and exposures (e.g., high training load, shared gear, overnight travel). Ethical consent/assent obtained; responses anonymous. Higher prevalence among athletes in full-contact sports (e.g., wrestling, football) compared with non-contact sports. Poor hygiene practices, such as sharing personal items and irregular gear disinfection, correlate with increased infection rates. Athletes with heavier training loads and frequent team travel report more days missed and greater performance impact. Sports clubs and federations should prioritize preventive education, routine cleaning protocols, and access to medical consultation, ensuring athletes maintain both health and competitive readiness.

Keywords: *infectious diseases, athletes, sports disciplines, respiratory infections*

Introduction

Illness represents a significant factor affecting athletes' health, well-being, and performance across sport disciplines. Research in sports medicine has consistently demonstrated that episodes of respiratory, gastrointestinal, and skin infections are among the most frequent health problems reported in both elite and recreational athletes (Engebretsen et al., 2013; Mountjoy et al., 2022). These conditions can result in training interruptions, reduced performance capacity, and lost competition time (Schwellnus et al., 2016). The International Olympic Committee (IOC) and Fédération Internatio-

nale de Football Association (FIFA) surveillance studies have identified respiratory illnesses as the leading cause of medical consultations during major tournaments, followed by gastrointestinal and dermatological infections (Derman et al., 2017; Junge et al., 2018).

Athletes participating in team-based and contact sports, such as basketball, football (soccer), volleyball, karate, and taekwondo, are exposed to unique environmental and physiological stressors that increase their susceptibility to infection (Walsh et al., 2011). Factors such as high training loads, travel, shared facilities, psychological stress, and close physical contact

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contribute to transient immunosuppression and greater exposure to pathogens (Pyne et al., 2015). Indoor sports like basketball and volleyball often show a higher prevalence of respiratory tract infections due to limited ventilation and crowded conditions, whereas combat sports such as karate and taekwondo have a greater incidence of skin and soft-tissue infections caused by frequent skin-to-skin or skin-to-mat contact (Zinder & Basler, 2010; Llera & Levy, 2015). In contrast, football players often experience increased gastrointestinal and respiratory illnesses related to international travel, dietary changes, and climatic variation during tournaments (Dvorak et al., 2012).

Observing recent health symptoms offers significant understanding of infection trends within particular sporting groups. Questionnaires evaluating short-term health history, such as respiratory symptoms (cold, flu, fever), gastrointestinal disorders (vomiting, diarrhea), or dermatological infections (impetigo, athlete's foot, infected blisters), provide an effective and non-invasive method for detecting illness trends and identifying risk factors (Schwellnus et al., 2016). These systems also record medical use metrics, such as fever bouts, healthcare visits, and antibiotic consumption, aiding in the distinction between self-limiting viral infections and clinically relevant bacterial disorders (Walsh et al., 2011).

This research seeks to synthesize the current literature regarding the prevalence and types of illnesses among athletes across various sports, basketball, football, volleyball, karate, and taekwondo, considering recent health indicators assessed over the past eight weeks. Comprehending sport-specific sickness patterns can guide preventive measures, improve training administration, and bolster athlete health safeguarding in diverse performance settings.

Methodology

A cross-sectional questionnaire-based study was performed with 260 competitive and leisure athletes (aged ≥14 years) in Tirana, Albania. Participants were sourced from athletic clubs, academic institutions, and community training facilities. The sample encompassed three principal team sports: football (n=162), volleyball (n=65), and basketball (n=33). Athletes qualified if they had engaged in consistent training

for a minimum of six months before the survey and had given informed consent (or parental agreement for minors).

Data were collected utilizing a structured self-administered questionnaire lasting 8–10 minutes, developed in accordance with prior worldwide surveillance instruments in sports medicine (Engebretsen et al., 2013; Schwellnus et al., 2016). The instrument comprised parts on: Demographics: age, gender, and sporting discipline. Training profile: frequency of weekly sessions, duration of each session, and level of competition. Recent health symptoms include self-reported instances of respiratory illnesses (cold, flu, sore throat, cough, fever), gastrointestinal disorders (vomiting, diarrhea, abdominal pain), skin or soft tissue infections (athlete's foot, impetigo, acne, infected blisters), wound infections (cuts, burns, blisters), and episodes of elevated temperature (>38 °C) within the past eight weeks. Impact indicators: absences from training sessions, medical consultations, and self-assessed performance consequences. The survey guaranteed anonymity and secrecy. Prior to participation, all respondents were apprised of the study's objectives and procedures. Ethical approval was secured from the Ethics Committee of the University of Medicine of Tirana, and the study complied with the principles of the Declaration of Helsinki.

All data were entered into SPSS version 26.0 (IBM Corp., Armonk, NY) for processing. Descriptive statistics, including frequencies and percentages, were calculated to summarize the prevalence of illnesses across categories (gender and sport discipline). Cross-tabulations were performed to explore differences in reported symptoms between groups. Where applicable, Pearson's chi-square (χ^2) test was used to assess associations between categorical variables such as gender and illness type or sport discipline and infection prevalence. A p-value < 0.05 was considered statistically significant.

Results

Table 1 summarizes the frequency of recent health issues reported over the last eight weeks among 260 participants. The most common condition was respiratory illness (e.g., cold, flu, sore throat, cough, fever), affecting 20% of the sample, followed closely by elevated body temperature (>38 °C) at 19.6%. Wound infections after cuts, blisters, or field burns

Table 1. Recent Health (last 8 weeks)

		Frequency	Percent
Respiratory illness (cold/flu, sore throat, cough, fever)	Yes	52	20.0
	No	208	80.0
	Total	260	100.0
Gastrointestinal illness (diarrhea, vomiting, abdominal pain)	Yes	30	11.5
	No	230	88.5
	Total	260	100.0
Skin or soft tissue infections (e.g. athlete's foot, impetigo, acne, infected blisters)	Yes	26	10.0
	No	234	90.0
	Total	260	100.0
Wound infection after cut/blister or field burn	Yes	40	15.4
	No	220	84.6
	Total	260	100.0
Temperature >38 °C	Yes	51	19.6
	No	209	80.4
	Total	260	100.0

were reported by 15.4% of respondents, while gastrointestinal illnesses such as diarrhea, vomiting, or abdominal pain affected 11.5%. Skin or soft tissue infections (including athlete's foot, impetigo, or acne) were the least frequent, occurring in 10% of participants. Overall, the findings indicate that mild respiratory and fever-related conditions were the most

prevalent recent health issues, while dermatological and gastrointestinal illnesses were comparatively less common.

Table 2 illustrates the distribution of current health concerns during the past eight weeks categorized by gender. The prevalence of most illnesses was similar across males and females, with only little variances noted. Respiratory

Table 2. Recent Health (last 8 weeks) by gender

		Male		Female	
		Frequency	Percent	Frequency	Percent
Respiratory illness (cold/flu, sore throat, cough, fever)	Yes	43	20.1	9	19.6
	No	171	79.9	37	80.4
	Total	214	100	46	100
Gastrointestinal illness (diarrhea, vomiting, abdominal pain)	Yes	24	11.2	6	13.0
	No	190	88.8	40	87.0
	Total	214	100.0	46	100.0
Skin or soft tissue infections (e.g. athlete's foot, impetigo, acne, infected blisters)	Yes	23	10.7	3	6.5
	No	191	89.3	43	93.5
	Total	214	100.0	46	100.0
Wound infection after cut/blister or field burn	Yes	33	15.4	7	15.2
	No	181	84.6	39	84.8
	Total	214	100.0	46	100.0
Temperature >38 °C	Yes	43	20.1	8	17.4
	No	171	79.9	38	82.6
	Total	214	100.0	46	100.0

diseases were reported by 20.1% of males and 19.6% of females, demonstrating no significant gender disparity. Likewise, a raised body temperature (>38 °C) impacted 20.1% of males and 17.4% of females. Gastrointestinal disorders were marginally more prevalent in females (13.0%) than in men (11.2%), but skin or soft tissue infections were comparatively higher in males (10.7%) than in females (6.5%). Wound

infections resulting from cuts or field burns were reported by approximately same percentages of boys (15.4%) and females (15.2%). In summary, health complaints were largely consistent between genders; however, males had marginally elevated incidence of dermatological and febrile symptoms, whereas females reported a modest increase in gastrointestinal difficulties.

Table 3. Respiratory illness (cold/flu, sore throat, cough, fever) by sport discipline

Sport Discipline		Frequency	Percent
Basketball	Yes	11	33.3
	No	22	66.7
	Total	33	100.0
Football	Yes	26	16.0
	No	136	84.0
	Total	162	100.0
Volleyball	Yes	15	23.1
	No	50	76.9
	Total	65	100.0

Table 3 illustrates the prevalence of respiratory ailments (encompassing cold, flu, sore throat, cough, or fever) among various sports disciplines. Basketball players exhibited the highest incidence of respiratory disease, with 33.3% reporting symptoms in the preceding eight weeks. Volleyball players exhibited a prevalence of 23.1%, whereas football players demonstrated the lowest percentage at 16.0%.

Table 4 presents the distribution of gastrointestinal ill-

nesses (including diarrhea, vomiting, and abdominal pain) by sport discipline. The results indicate that basketball players experienced the highest prevalence of gastrointestinal issues, with 21.2% reporting symptoms in the last eight weeks. Volleyball players followed with a rate of 12.3%, while football players reported the lowest prevalence at 9.3%. These differences may reflect variations in training environments, nutritional routines, and recovery conditions among sports.

Table 4. Gastrointestinal illness (diarrhea, vomiting, abdominal pain) by sport discipline

Sport Discipline		Frequency	Percent
Basketball	Yes	7	21.2
	No	26	78.8
	Total	33	100.0
Football	Yes	15	9.3
	No	147	90.7
	Total	162	100.0
Volleyball	Yes	8	12.3
	No	57	87.7
	Total	65	100.0

Table 5 shows that skin or soft tissue infections were most common among basketball players (12.1%), followed by football players (10.5%) and volleyball players (7.7%). Overall, these

infections were relatively infrequent across all sport disciplines.

Table 6 indicates that wound infections after cuts, blisters, or field burns were most frequent among football players

Table 5. Skin or soft tissue infections (e.g. athlete's foot, impetigo, acne, infected blisters) by sport discipline

Sport Discipline		Frequency	Percent
Basketball	Yes	4	12.1
	No	29	87.9
	Total	33	100.0
Football	Yes	17	10.5
	No	145	89.5
	Total	162	100.0
Volleyball	Yes	5	7.7
	No	60	92.3
	Total	65	100.0

Table 6. Wound infection after cut/blister or field burn by sport discipline

Sport Discipline		Frequency	Percent
Basketball	Yes	1	3.0
	No	32	97.0
	Total	33	100.0
Football	Yes	33	20.4
	No	129	79.6
	Total	162	100.0
Volleyball	Yes	6	9.2
	No	59	90.8
	Total	65	100.0

Table 7. Temperature >38 °C by sport discipline

Sport Discipline		Frequency	Percent
Basketball	Yes	6	18.2
	No	27	81.8
	Total	33	100.0
Football	Yes	33	20.4
	No	129	79.6
	Total	162	100.0
Volleyball	Yes	12	18.5
	No	53	81.5
	Total	65	100.0

(20.4%), followed by volleyball players (9.2%), while basketball players reported the lowest rate (3.0%). These results suggest that the higher contact and outdoor nature of football may increase the risk of minor injuries leading to infections.

Table 7 shows that elevated body temperature (>38 °C) was reported at similar rates across sport disciplines, 20.4% in football, 18.5% in volleyball, and 18.2% in basketball. Overall, fever incidence was relatively consistent, indicating comparable exposure to infection or physical strain among athletes in all three sports.

Discussion

This study examined the prevalence and trends of recent diseases among athletes in Tirana, concentrating on respiratory, gastrointestinal, dermatological, and wound infections across several sports disciplines. The results indicated that respiratory ailments constituted the most commonly reported health issue (20%), followed closely by fever episodes (19.6%) and wound infections (15.4%). Conversely, gastrointestinal disorders (11.5%) and skin or soft tissue infections (10%) were less prevalent. These findings correspond with previous international studies demonstrating that respiratory tract infections are the predominant cause of illness-related medical consultations among both elite and recreational athletes (Derman et al., 2017; Engebretsen et al., 2013; Schweltnus et al., 2016).

Gender comparisons revealed minimal variation in illness prevalence, suggesting that both male and female athletes face similar infection risks when exposed to comparable training conditions and workloads. This finding supports previous literature demonstrating that infection incidence is more strongly influenced by training volume, environmental exposure, and hygiene behavior than by biological sex (Walsh et al., 2011; Pyne et al., 2015).

Upon analysis by athletic discipline, basketball players demonstrated the highest incidence of respiratory and gastrointestinal ailments, whereas football players displayed a greater prevalence of wound infections. These discrepancies presumably indicate variability in training contexts and exposure to touch. Indoor sports like basketball and volleyball entail close physical contact and restricted ventilation, heightening the risk of airborne transmission of respiratory infections (Zinder & Basler, 2010; Mountjoy et al., 2022). In contrast, football players, who primarily train outdoors and have regular physical contact and field abrasions, may be more susceptible to skin and wound infections (Llera & Levy, 2015).

The comparatively low incidence of gastrointestinal illness noted in this study aligns with findings from prominent sporting events, including the FIFA World Cup and Olympic Games, where gastrointestinal cases represent a lesser proportion of athlete illnesses relative to respiratory and dermatological conditions (Dvorak et al., 2012; Junge et al., 2018). The elevated rates seen among basketball players indicate possible associations with communal facilities or inadequate hygiene practices for nutrition and hydration, highlighting the necessity for preventive education and sanitation measures in indoor sports environments. From a preventive standpoint, these findings reinforce the importance of infection-control strategies within sports environments. Regular cleaning of shared

equipment, maintenance of personal hygiene, and monitoring of athletes with febrile or respiratory symptoms are crucial to limit transmission. Sports organizations should also encourage athletes to maintain balanced training loads and adequate recovery periods to prevent transient immunosuppression and minimize susceptibility to infections (Mountjoy et al., 2022; Pyne et al., 2015).

Conclusion

In summary, the study highlights that respiratory and febrile illnesses are the most prevalent health issues among athletes in Tirana, with patterns varying slightly by sport type. Preventive strategies should focus on hygiene education, environmental cleanliness, and training load management to safeguard athlete health and performance. Future studies should employ longitudinal monitoring and clinical confirmation of infections to strengthen causal inference and guide tailored interventions for specific sports.

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A correlation analysis of obesity parameters and motor coordination in early school-age children

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Abstract

Childhood obesity has emerged as a major public health challenge with implications for physical, cognitive, and psychosocial development. Understanding the relationship between obesity parameters and motor coordination at early school age is important for informing interventions in school and community settings. The purpose of this study was to investigate the associations between two anthropometric indicators of obesity (body weight and waist circumference) and four measures of motor coordination (jumping sideways, walking backwards, hooping height, and moving sideways) in first- and second-grade children. A cross-sectional study was conducted with 176 children aged 6–8 years. Body weight and waist circumference were measured following standardized protocols. Motor coordination was assessed using four subtests of the Körperkoordinationstest für Kinder (KTK). Pearson correlation coefficients were calculated to explore the associations between obesity indicators and coordination outcomes. Body weight showed weak and non-significant correlations with all coordination tasks: jumping sideways ($r = -0.035$, $p = .641$), walking backwards ($r = -0.140$, $p = .065$), hooping height ($r = .010$, $p = .896$), and moving sideways ($r = -0.066$, $p = .381$). In contrast, waist circumference demonstrated stronger negative correlations. A significant association was found with walking backwards ($r = -0.278$, $p < .001$), while correlations with moving sideways ($r = -0.146$, $p = .054$), jumping sideways ($r = -0.125$, $p = .099$), and hooping height ($r = -0.129$, $p = .088$) approached but did not reach statistical significance. Waist circumference appears to be a more sensitive predictor of reduced motor coordination than body weight in early school-age children, particularly with regard to dynamic balance. These findings emphasize the importance of monitoring central adiposity in childhood and suggest that preventive interventions should integrate both weight management and motor skill development strategies to promote overall health and functional movement competence.

Keywords: childhood obesity, waist circumference, body weight; motor coordination, KTK test, first grade, second grade, physical fitness, dynamic balance

Introduction

Childhood obesity has emerged as an escalating global public health issue, with enduring implications for children's physical, cognitive, and psychosocial development (World Health Organization [WHO], 2022). The early school-age years constitute a pivotal developmental phase during which lifestyle patterns, physical fitness, and movement proficiency are formed. Excess body fat in these developmental years is significantly associated with negative cardiometabolic profiles, reduced physical activity, and in-

ferior motor coordination (D'Hondt et al., 2013; Lopes et al., 2012). Given that motor coordination is fundamental to children's involvement in play and sports, its deterioration may restrict activity participation, establishing a detrimental feedback loop that perpetuates sedentary behavior and increased obesity (Cattuzzo et al., 2016). Motor coordination refers to the ability to execute controlled, efficient, and goal-directed movements, integrating perceptual, neuromuscular, and biomechanical processes (Kiphard & Schilling, 1974). The Körperkoordinationstest für Kinder (KTK)

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is a widely applied field test battery for assessing coordination in children aged 5 to 14 years, using subtests such as jumping sideways, walking backwards, moving sideways, and hopping for height (Vandorpe et al., 2011). These skills are considered foundational to functional movement and sports participation. Previous studies have consistently demonstrated that higher body mass index (BMI) or waist circumference is associated with poorer KTK performance, particularly in balance and locomotor control tasks (D’Hondt et al., 2009; Lopes et al., 2018).

Waist circumference is a more precise measure of central adiposity compared to total body weight and exhibits a stronger correlation with metabolic and neuromotor outcomes (Katzmarzyk et al., 2004). Elevated abdominal adiposity may impair biomechanical efficiency, restrict range of motion, and adversely impact children’s capacity to execute dynamic balance activities (Okely et al., 2004). Although many studies have examined BMI and coordination, fewer have explicitly contrasted various obesity metrics (such as body weight versus waist circumference) concerning specific motor coordination domains throughout early childhood education. This study investigated the relationships between two obesity indicators, body weight and waist circumference, and four KTK coordination activities (jumping sideways, walking backwards, hopping for height, and moving sideways) in children aged 6 to 8 years in the first and second grades. This research intends to elucidate which anthropometric measure most accurately predicts coordination deficiencies, particularly in activities necessitating dynamic balance and lateral movement, by concentrating on central adiposity instead of overall body mass. Comprehending these relationships can inform early interventions in educational institutions and community initiatives that combine weight management with motor skill development to promote healthier, more active childhood trajectories.

Methodology

A total of 176 children (92 boys and 84 girls) aged 6 to 8 years participated in this cross-sectional study. Participants were first- and second-grade pupils recruited from three public elementary schools in Tirana, Albania. All children were free from acute or chronic illnesses at the time of testing and attended regular physical-education classes. Children’s participation was voluntary and in accordance with the principles of the Declaration of Helsinki (2013).

Anthropometric Variables: Body weight (kg) was recorded to the nearest 0.1 kg utilizing an SECA 869 digital scale, with subjects barefoot and attired in light clothing. Waist circumference (cm) was assessed at the midpoint be-

tween the lowest rib and the iliac crest utilizing an SECA 203 flexible measuring tape. All measurements adhered to the International Society for the Advancement of Kinanthropometry (ISAK) criteria and were conducted in duplicate; the average result was utilized for analysis. Motor-Coordination Variables: Motor coordination was evaluated using the Körperkoordinationstest für Kinder (KTK) (Kiphard & Schilling, 1974). Four subtests were administered in a standardized order: Jumping Sideways (JS) – number of jumps in 15 s; Walking Backwards (WB) – number of successful steps along balance beams of decreasing width; Hopping for Height (HH) – maximum obstacle height cleared while hopping on one foot; Moving Sideways (MS) – number of relocations between boards in 20 s. Each task was demonstrated once, followed by one or two practice trials and two scored trials. Raw scores were used for statistical analyses rather than standardized KTK motor quotients, consistent with recent methodological recommendations (Vandorpe et al., 2011).

Data were collected in gymnasiums or sports halls under identical environmental conditions. Testing was performed by trained assessors experienced in pediatric motor testing. Anthropometric measurements were obtained first, followed by the four KTK subtests after a structured warm-up session. Children were encouraged to perform each test at maximum effort while maintaining correct form.

All analyses were conducted using IBM SPSS Statistics Version 29.0. Descriptive statistics (mean ± standard deviation) were computed for all variables. Associations between obesity indicators (body weight, waist circumference) and motor-coordination outcomes (JS, WB, HH, MS) were examined using Pearson’s correlation coefficients. Significance was set at $p < .05$ (two-tailed). Effect magnitudes were interpreted as small ($|r| = .10-.29$), moderate ($|r| = .30-.49$), and large ($|r| \geq .50$) according to Cohen (1988).

Results

Table 1 presents the descriptive statistics for anthropometric and motor coordination variables. The mean body weight of participants was 28.4 kg (SD = 6.35), and the mean waist circumference was 62.7 cm (SD = 8.24), based on a sample of 176 children. Regarding motor coordination abilities, measured among 265 participants, the mean scores indicate moderate performance levels across tasks: Jumping Sideways (M = 44.6, SD = 13.94), Walking Backwards (M = 32.5, SD = 12.53), Hopping on One Leg over an Obstacle (M = 11.15, SD = 3.36), and Moving Sideways (M = 12.99, SD = 2.63).

Table 2 shows the descriptive statistics for body weight, waist circumference, and motor coordination abilities by

Table 1. Descriptive statistics for body weight and waist circumference and motor coordination abilities

	N	Mean	Std. Deviation
Body Weight	176	28.4	6.35
Waist Circumference	176	62.7	8.24
Jumping Sideways- Total	265	44.6	13.94
Walking Backwards- Total	265	32.5	12.53
Hooping from Height- Total	265	11.15	3.36
Moving Sideways- Total	265	12.99	2.63

grade level. As expected, second-grade children demonstrated higher mean values for both anthropometric and motor coordination measures compared to first graders. Specifically, body weight increased from 26.11 kg (SD = 5.34) in Grade 1 to 30.05 kg (SD = 6.54) in Grade 2, while waist circumference rose slightly from 61.60 cm (SD = 7.80) to 63.55 cm (SD

= 8.50). Similarly, improvements were observed across all motor coordination tasks: Jumping Sideways increased from 39.48 to 49.42 repetitions, Walking Backwards from 28.67 to 36.11 steps, Hopping on One Leg over an Obstacle from 9.59 to 12.62 successful hops, and Moving Sideways from 12.25 to 13.69 points.

Table 2. Descriptive statistics for body weight and waist circumference and motor coordination abilities by grade level

Grade		Mean	Std. Deviation	N
1	Body Weight	26.11	5.34	73
	Waist Circumference	61.60	7.80	73
	Jumping Sideways- Total	39.48	13.21	128
	Walking Backwards- Total	28.67	12.11	128
	Hooping from Height- Total	9.59	3.00	128
	Moving Sideways- Total	12.25	2.26	128
2	Body Weight	30.05	6.54	103
	Waist Circumference	63.55	8.50	103
	Jumping Sideways- Total	49.42	12.89	137
	Walking Backwards- Total	36.11	11.87	137
	Hooping from Height- Total	12.62	3.02	137
	Moving Sideways- Total	13.69	2.76	137

Table 3 presents the correlation coefficients between anthropometric indicators (body weight and waist circumference) and motor coordination abilities. The results show generally weak and mostly non-significant relationships between body weight and coordination tasks. Body weight demonstrated small, negative correlations with Jumping Sideways ($r = -0.035$), Walking Backwards ($r = -0.140$, $p = 0.065$),

and Moving Sideways ($r = -0.066$), and a negligible positive correlation with Hopping on One Leg over an Obstacle ($r = 0.010$). In contrast, waist circumference showed slightly stronger negative associations, particularly with Walking Backwards ($r = -0.278$, $p < 0.01$), indicating that higher waist circumference is moderately related to lower balance and coordination performance in this task.

Table 3. Correlation for body weight and waist circumference with motor coordination abilities

		Jumping Sideways- Total	Walking Backwards- Total	Hooping Height- Total	Moving Sideways- Total
Body Weight (N=176)	Pearson Correlation	-0.035	-0.140	0.010	-0.066
	Sig. (2-tailed)	0.641	0.065	0.896	0.381
	Sum of Squares and Cross-products	-549.527	-2106.238	39.614	-181.176
	Covariance	-3.140	-12.036	0.226	-1.035
	Pearson Correlation	-0.125	-.278**	-0.129	-0.146
Waist Circumference (N=176)	Sig. (2-tailed)	0.099	0.000	0.088	0.054
	Sum of Squares and Cross-products	-2509.523	-5448.344	-670.239	-515.168
	Covariance	-14.340	-31.133	-3.830	-2.944

Note. ** - Correlation is significant at the 0.01 level (2-tailed); * - Correlation is significant at the 0.05 level (2-tailed).

Table 4 presents the correlation coefficients between body composition (body weight and waist circumference) and motor coordination abilities, analyzed separately by grade level. In Grade 1, weak to moderate negative correlations were observed, with significant associations between body weight and Walking Backwards ($r = -0.231$, $p < 0.05$), as well as between waist circumference and both Walking Backwards ($r = -0.298$, $p < 0.05$) and Hopping on One Leg over an Ob-

stacle ($r = -0.243$, $p < 0.05$). In Grade 2, the relationships became stronger and more consistent. Body weight showed significant negative correlations with Walking Backwards ($r = -0.317$, $p < 0.01$) and Hopping on One Leg over an Obstacle ($r = -0.220$, $p < 0.05$), while waist circumference was significantly related to Walking Backwards ($r = -0.381$, $p < 0.01$), Hopping on One Leg over an Obstacle ($r = -0.245$, $p < 0.05$), and Moving Sideways ($r = -0.203$, $p < 0.05$).

Table 4. Correlation for body weight and waist circumference with motor coordination abilities by grade level

Grade		Jumping Sideways- Total	Walking Backwards- Total	Hopping Height- Total	Moving Sideways- Total	
1	Body Weight (N=73)	Pearson Correlation	-0.186	-.231*	-0.218	-0.179
		Sig. (2-tailed)	0.114	0.049	0.064	0.129
		Sum of Squares and Cross-products	-1002.579	-1212.393	-238.642	-143.112
	Waist Circumference (N=73)	Covariance	-13.925	-16.839	-3.314	-1.988
		Pearson Correlation	-0.228	-.298*	-.243*	-0.181
		Sig. (2-tailed)	0.053	0.010	0.039	0.125
2	Body Weight (N=103)	Sum of Squares and Cross-products	-1788.740	-2284.247	-387.671	-211.356
		Covariance	-24.844	-31.726	-5.384	-2.936
		Pearson Correlation	-0.140	-.317**	-.220*	-0.187
	Waist Circumference (N=103)	Sig. (2-tailed)	0.159	0.001	0.026	0.059
		Sum of Squares and Cross-products	-1165.695	-2537.097	-437.490	-309.058
		Covariance	-11.428	-24.874	-4.289	-3.030
Waist Circumference (N=103)	Pearson Correlation	-0.140	-.381**	-.245*	-.203*	
	Sig. (2-tailed)	0.158	0.000	0.013	0.039	
	Sum of Squares and Cross-products	-1519.005	-3974.403	-635.510	-437.442	
	Covariance	-14.892	-38.965	-6.230	-4.289	

Note. ** - Correlation is significant at the 0.01 level (2-tailed); * - Correlation is significant at the 0.05 level (2-tailed).

Discussion

This study investigated the correlation between anthropometric measures of obesity—body weight and waist circumference—and motor coordination in early school-age children. The primary findings indicated that body weight exhibited a weak and non-significant association with all coordination tasks, whereas waist circumference had stronger negative associations, especially with the walking backwards subtest, which evaluates dynamic balance and postural control. The findings suggest that central adiposity may be a more accurate predictor of motor coordination issues than overall body mass in children aged 6 to 8 years. The notable inverse correlation between waist circumference and the backward walking task corroborates previous findings indicating that central adiposity hinders balance and movement regulation (D’Hondt et al., 2009; Lopes et al., 2018). Abdominal obesity elevates the moment of inertia and modifies biomechanical alignment, hindering children’s capacity to sustain stability during dynamic tasks necessitating fine motor changes (Okely et al., 2004). Total body weight, frequently utilized as an indicator of obesity, fails to consider fat distribution, elucidating the weak and non-significant associations between weight and coordination shown in the current study. Comparable results have been observed in various European school-age cohorts, indicating that waist circumference, rather than BMI, correlates with diminished performance in balance and agility assessments (D’Hondt et al., 2013; Lopes et al., 2012). The near-significant correlations observed between waist circumference and other coordination subtests (jumping sideways, moving sideways, and hopping for height) suggest a general trend toward impaired global motor performance with increasing central adiposity. Although these associations did not reach conventional sig-

nificance, their consistent direction reinforces the hypothesis that fat distribution exerts a subtle but cumulative influence on gross motor coordination. These findings are also in line with the Stodden et al. (2008) conceptual model, which proposes a reciprocal relationship between motor competence and physical activity, children with poorer coordination tend to be less active, promoting further fat accumulation and motor decline over time.

Numerous research have established that children with increased adiposity have reduced performance in fundamental movement skills, such as balance, coordination, and agility (Cattuzzo et al., 2016; D’Hondt et al., 2013). The current findings enhance this understanding by highlighting that waist circumference, rather than overall body mass, may more accurately reflect the particular mechanical limitations impacting coordination in young infants. The negative correlation with walking backwards parallels the findings of Gentier et al. (2013), which indicated that children with increased trunk fat demonstrated worse dynamic balance, even when accounting for age and sex. These convergent findings highlight the necessity of integrating waist measurement into pediatric health monitoring in conjunction with BMI or weight.

This study underscores the importance of integrated therapies that combine weight control and mobility skill development in young school-age children. Educational institutions and community initiatives have to prioritize activities that improve balance, coordination, and agility, while fostering healthy body composition through engaging, age-suitable physical play. Monitoring waist circumference can function as an effective screening method for the early detection of children predisposed to metabolic and motor deficits. Considering that dynamic balance was significantly impacted, the

consistent incorporation of balance-oriented games, hopping activities, and obstacle courses may enhance both neuromotor control and functional confidence in overweight children.

Several limitations should be noted. The cross-sectional design prevents causal inference regarding whether increased central adiposity leads to reduced motor coordination or vice versa. The sample was limited to urban Albanian schoolchildren, which may restrict generalizability to rural populations or other cultural contexts. Additionally, physical activity levels and dietary patterns were not directly measured and could moderate the observed relationships. Future research should adopt longitudinal or interventional designs to clarify causal pathways and to determine whether targeted training can mitigate the coordination deficits associated with central adiposity. Including more sensitive biomechanical or neuromuscular assessments could also elucidate mechanisms linking fat distribution to movement efficiency.

Although other correlations were weak and non-significant (first and second grade children), the trend suggests that increased body mass and central adiposity may negatively influence children's motor coordination, especially in tasks requiring balance and backward movement. These findings at first grade suggest that greater body mass and abdominal girth may negatively influence balance and coordination tasks. In grade, the pattern indicates that as children grow older, the negative impact of higher body weight and waist circumference on coordination skills becomes more evident, particularly in tasks demanding dynamic balance and whole-body control.

Conclusion

In summary, this study demonstrates that waist circumference, a marker of central adiposity, is more strongly associated with reduced motor coordination than total body weight in early school-age children. The findings underscore the importance of assessing central fat accumulation when evaluating children's functional movement competence. Promoting coordinated movement through active play, physical education, and balanced nutrition should remain a priority in preventive health strategies aimed at fostering both physical and motor development in childhood.

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A Comparison Study on Differences in Motor Abilities across Sports and Gender in Children

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Abstract

The assessment of motor abilities represents a critical dimension in understanding the physical development and sport-specific adaptation of children and adolescents. This study examined flexibility and sprint performance among Albanian children and adolescents (ages 7–18) across gender and sport participation. Motor abilities were assessed using the Sit-and-Reach test and the 20 m sprint test among students engaged in physical education (PE) and those training in organized sports (football, volleyball, basketball, taekwondo, karate). Data were collected through standardized motor tests, including the Sit-and-Reach (flexibility), and the 20m sprint (speed), administered to youth athletes in volleyball, basketball, and football. Percentile-based normative values were calculated separately for boys and girls, across multiple age groups, to provide an objective comparison of motor abilities. Results showed age-related improvements in both flexibility and speed. Boys consistently outperformed girls in sprinting, while girls demonstrated superior flexibility. Compared with PE participants, sport-trained youth achieved significantly higher results ($p < .05-.01$), with football and taekwondo athletes excelling in speed and volleyball players showing greater flexibility. These findings emphasize the importance of structured sport participation for enhancing motor development and provide reference data for youth fitness assessment in Albania. The results also support integrating gender-sensitive, sport-specific approaches in physical-education and training programs to promote balanced physical development and talent identification.

Keywords: motor abilities, flexibility, agility, speed, comparison

Introduction

Physical fitness throughout infancy and adolescence is a crucial factor influencing overall health, cognitive development, and well-being, and serves as a significant predictor of adult health outcomes (Ortega, Ruiz, Castillo, & Sjörström, 2008). Consistent physical activity enhances muscle strength, flexibility, coordination, and speed, essential elements of motor competence and sustained engagement in physical activity (Malina, Bouchard, & Bar-Or, 2004). In the educational environment, physical education (PE) is essential for providing children with physical activity; nevertheless, conventional PE programs frequently fall short in intensity and volume necessary for optimal physical development (Pate, Oria, & Pillsbury, 2019). Conversely, organized sports—such as football, volleyball, basketball, and martial

arts—offer systematic, repetitive, and skill-focused training that can improve children's physical abilities more effectively than general physical education (Beunen & Malina, 1988; Cejudo, Sainz de Baranda, Ayala, & Santonja, 2015). Flexibility and speed are two of the most critical measures of motor ability in youth. Flexibility, typically evaluated using the Sit & Reach test, denotes the flexibility and extensibility of the musculoskeletal system, impacted by growth, maturation, and training stimuli (Alter, 2004; Behm, Chaouachi, Lau, & Wong, 2011). Sprint speed, typically assessed using the 20 m sprint test, signifies neuromuscular efficiency and explosive force, which generally enhance with age and training experience (Philippaerts et al., 2006; Viru et al., 1999). Prior studies in European cohorts have demonstrated consistent enhancements in these capabilities throughout

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childhood and adolescence, revealing notable disparities between physically active and sedentary kids (Tomkinson, Lang, & Tremblay, 2018; Tambalis, Panagiotakos, Psarra, & Sidossis, 2021).

In Albania, national data about motor development are, however, limited. Current research has predominantly focused on children’s anthropometric status and general health metrics, resulting in a deficiency of standardized reference values for physical fitness and motor abilities (Jarani, 2015; Jarani & Ylli, 2020). Albania’s increasing involvement in European projects like EUFITMOS and GoPA! necessitates the formulation of local normative values to link national fitness assessment procedures with international norms (Gába et al., 2021; World Health Organization [WHO], 2020). This study sought to evaluate flexibility and sprint performance in Albanian children and adolescents aged 7–18 years, comparing results between pupils involved exclusively in school-based physical education and those participating in organized sports.

It was postulated that: Motor performance, encompassing flexibility and speed, would enhance significantly with age in

both genders; Children and adolescents engaged in organized sports have markedly greater flexibility and quicker sprint times compared to their counterparts participating solely in physical education.

Methodology

A total of 1,015 children took part in the 20 m sprint assessment, including 709 boys and 306 girls, aged 6 to 18 years. In the physical education (PE) group, participation among boys ranged from N = 15 at age 6 to N = 114 at age 12, with sample sizes gradually declining in later adolescence (N = 10 at age 18). For girls, participation ranged from N = 17 at age 6 to a peak of N = 100 at age 11, before decreasing to N = 7 by age 18. Across sport disciplines, the distribution of participants varied by age and gender. Among boys, the largest groups were in basketball (N = 8–95 per age), football (N = 17–64), volleyball (N = 2–7), and taekwondo (N = 1–2 per age category). For girls, participation was highest in volleyball (N = 2–38 per age), followed by football (N = 1–17 per age), while basketball and taekwondo included smaller subgroups (N = 1–6).

Table 1. Number of Participants (N) By Age, Gender, and Sport Discipline – 20 M Sprint Test

Age (years)	Boys				Girls			
	PE	Basketball	Football	Taekwondo	PE	Volleyball	Football	Basketball
6	15				17			
7	67	8			55	2		
8	79	7	1		72	7		
9	76	8	17	1	75	4	1	
10	78	20	25		64	12	5	
11	83	29	45		100	17	12	1
12	114	71	64	1	97	11	4	1
13	96	35	45	1	98	9	3	3
14	99	79	35	1	95	22	9	2
15	82	82	31	2	85	38	19	5
16	59	95	32	2	44	25	4	6
17	27	40	10		38	14	11	6
18	10	10	34	1	7	4	9	
Total (N)	890	484	388	11	847	166	97	23

All motor ability assessments were conducted following standardized EUFITMOS and WHO protocols for youth fitness testing (World Health Organization, 2020; Gába et al., 2021). Two motor abilities were measured: flexibility and speed. Flexibility was assessed using the Sit-and-Reach Test (cm), performed on a flat surface with participants seated, knees fully extended, and feet placed against a standardized measuring box. The better of two attempts was recorded. Speed was assessed through the 20 m sprint test (seconds), performed on an indoor or outdoor flat surface, with electronic timing gates ensuring measurement precision. Each participant performed two maximal sprints, and the best time was retained for analysis. Prior to testing, a standardized warm-up including dynamic stretching and two practice runs was provided.

Data were analysed using IBM SPSS Statistics (Version 26.0). Descriptive statistics (Mean ± SD) were computed for each age group, gender, and sport discipline. The Shapiro–Wilk test verified normality, and Levene’s test assessed homogeneity of variance. Between-group comparisons (PE vs. sport

disciplines) were examined using one-way ANOVA, followed by post-hoc Tukey tests where applicable. Significance levels were set at $p < .05$ and $p < .01$. Pearson’s correlation coefficients were used to explore associations between flexibility and sprint performance within gender and age subgroups. Data were visualized in tables and graphs to illustrate developmental trends across age categories.

Results

Table 2 presents the descriptive statistics (Mean ± SD) for flexibility performance in boys aged 7–18 years, assessed by the Sit & Reach test across physical education (PE) and four sport disciplines. In the PE group, mean values ranged from 21.2 ± 5.67 cm at age 12 to 26.7 ± 8.11 cm at age 18. Among sport disciplines, flexibility scores varied across ages. Basketball players recorded mean values between 17.1 ± 5.5 cm (age 10) and 27.0 ± 8.5 cm (age 15). Football players showed results from 20.6 ± 7.7 cm (age 14) to 30.5 ± 7.6 cm (age 17). For taekwondo, mean values ranged from 16.0 cm (age 11) to 41.0

Table 2. Flexibility (Sit & Reach Test, cm): Results for Boys (Ages 7–18)

Age	Physical Education	Basketball	Football	Taekwondo	Karate
7	24.1 ± 5.55				**28.0 ±
8	22.9 ± 5.20	*23.5 ± 5.8	**30.0 ± 30.0		22.5 ± 5.8
9	22.3 ± 5.43	**18.7 ± 6.9	**26.0 ± 5.8	**26.0 ±	**24.7 ± 4.1
10	22.6 ± 5.17	**17.1 ± 5.5	**24.0 ± 4.1		**26.4 ±
11	21.5 ± 5.51	22.0 ± 5.2	21.2 ± 5.9	**16.0 ±	**24.4 ±
12	21.2 ± 5.67	21.9 ± 6.5	21.3 ± 5.5		**24.9 ±
13	22.5 ± 6.44	21.6 ± 7.5	*20.7 ± 6.4	**39.0 ± 7.1	**25.7 ±
14	24.8 ± 6.13	24.6 ± 8.2	**20.6 ± 7.7	24.0 ± 7.1	**26.2 ±
15	24.7 ± 7.66	**27.0 ± 8.5	23.8 ± 8.8	25.0 ± 7.1	*26.5 ±
16	25.6 ± 7.21	26.5 ± 9.2	**28.0 ± 7.2	**32.0 ± 7.1	
17	26.4 ± 7.63	**20.2 ± 7.1	**30.5 ± 7.6		26.9 ±
18	26.7 ± 8.11		27.5 ± 7.1	**41.0 ±	

Note. ** - Correlation is significant at the 0.01 level (2-tailed) - PE vs each sport disciplines; * - Correlation is significant at the 0.05 level (2-tailed) - PE vs each sport disciplines.

cm (age 18), while karate participants demonstrated averages between 22.5 ± 5.8 cm (age 8) and 26.9 cm (age 17).

Table 3 displays the descriptive statistics (Mean ± SD) for flexibility performance in girls aged 7–18 years, measured using the Sit & Reach test across the physical education (PE) group and three sport disciplines. In the PE group, mean flexibility scores ranged from 20.6 ± 5.64 cm at age 10 to 27.5 ±

6.23 cm at age 18. For volleyball, mean values varied between 24.1 ± 4.4 cm (age 7) and 34.3 ± 7.0 cm (age 18), with standard deviations ranging from approximately 4 cm to 11 cm. Basketball players were represented between ages 11 and 16, with mean values from 24.0 ± 3.5 cm (age 12) to 33.0 ± 9.1 cm (age 13). In football, flexibility means ranged from 29.3 ± 5.6 cm (age 14) to 44.0 ± 3.3 cm (age 9).

Table 3. Flexibility (Sit & Reach Test, cm): Results for Girls (Ages 7–18)

Age	Physical Education	Volleyball	Basketball	Football
7	25.4 ± 5.58	24.1 ± 4.4		
8	25.0 ± 5.23	24.2 ± 9.1		
9	24.4 ± 6.00	23.9 ± 6.0		**44.0 ± 3.3
10	20.6 ± 5.64	**23.3 ± 7.4		**35.9 ± 6.4
11	23.5 ± 5.63	**29.4 ± 6.8	**31.5 ± 8.7	**31.3 ± 6.4
12	25.0 ± 6.23	**29.0 ± 7.1	24.0 ± 3.5	**36.3 ± 6.4
13	26.2 ± 7.05	**29.1 ± 6.4	**33.0 ± 9.1	**32.7 ± 1.5
14	27.6 ± 6.69	**31.8 ± 10.7	**24.5 ± 4.5	*29.3 ± 5.6
15	26.9 ± 7.44	**31.4 ± 7.4	**28.0 ± 9.1	**32.6 ± 6.0
16	23.9 ± 7.23	**33.6 ± 6.6	24.4 ± 4.5	**35.9 ± 6.9
17	26.0 ± 7.56	**32.5 ± 6.8		**32.5 ± 5.0
18	27.5 ± 6.23	**34.3 ± 7.0		**34.1 ± 4.5

Note. ** - Correlation is significant at the 0.01 level (2-tailed) - PE vs each sport disciplines; * - Correlation is significant at the 0.05 level (2-tailed) - PE vs each sport disciplines.

Table 4 presents descriptive data (Mean ± SD) for sprint performance among boys aged 7–18 years, assessed through the 20 m sprint test across the physical education (PE) group and four sport disciplines. In the PE group, mean sprint times ranged from 4.94 ± 0.60 s at age 7 to 3.55 ± 0.64 s at age 17, with a slightly higher value (3.98 ± 0.93 s) at age 18. Volleyball participants, represented between ages 10 and 12, recorded mean sprint times of 4.67 ± 0.38 s, 4.50 ± 0.37 s, and 4.38 ± 0.37 s, respectively. For basketball, mean values ranged between 4.35 ± 0.42 s (age 7) and 3.30 ± 0.20 s (age 17). Football players demonstrated mean times from 4.49 ± 0.23 s (age 8) to 3.04 ± 0.19 s (age 18). Taekwondo participants showed results between 3.58 s (age 13) and 3.21 s (age 18), though several age categories lacked data.

Table 5 presents descriptive data (Mean ± SD) for sprint performance among girls aged 7–18 years, assessed with the 20 m sprint test across the physical-education (PE) group and four sport disciplines. In the PE group, mean sprint times ranged from 5.08 ± 0.75 s at age 7 to 4.34 ± 0.58 s at age 15, followed by a slightly higher value of 5.07 ± 1.37 s at age 18. Among volleyball players, mean values varied between 4.58 ± 0.11 s (age 7) and 3.87 ± 0.20 s (age 18). Basketball participants, observed mainly between ages 12 and 17, recorded times from 3.53 ± 0.10 s to 3.80 ± 0.17 s. For football players, mean values ranged from 3.95 ± 0.13 s (age 9) to 3.54 ± 0.17 s (age 18). Taekwondo participants were represented in limited age groups, with available means between 3.79 ± 0.06 s (age 16) and 3.92 s (age 12).

Table 4. 20 m Sprint (Speed): Results for Boys (Ages 7–18)

Age	Physical Education	Volleyball	Basketball	Football	Taekwondo
7	4.94 ± 0.60		**4.35 ± 0.42		
8	4.57 ± 0.61		4.51 ± 0.47	4.49 ± 0.23	
9	4.51 ± 0.45		4.38 ± 0.49	**4.18 ± 0.30	**3.78 ±
10	4.39 ± 0.57	4.67 ± 0.38	4.21 ± 0.30	**3.87 ± 0.30	
11	4.27 ± 0.56	*4.50 ± 0.37	4.05 ± 0.40	**3.73 ± 0.32	
12	4.11 ± 0.48	**4.38 ± 0.37	**3.83 ± 0.40	3.74 ± 0.31	
13	4.13 ± 0.58		**3.72 ± 0.35	**3.50 ± 0.31	**3.58 ±
14	3.96 ± 0.59		*3.55 ± 0.30	**3.39 ± 0.22	**3.53 ± 0.16
15	3.71 ± 0.44		3.41 ± 0.34	3.37 ± 0.22	**3.26 ± 0.16
16	3.61 ± 0.52		*3.35 ± 0.19	*3.31 ± 0.16	*3.29 ± 0.04
17	3.55 ± 0.64		*3.30 ± 0.20	*3.20 ± 0.20	
18	3.98 ± 0.93		**3.39 ± 0.25	**3.04 ± 0.19	**3.21 ±

Note. ** - Correlation is significant at the 0.01 level (2-tailed) - PE vs each sport disciplines; * - Correlation is significant at the 0.05 level (2-tailed) - PE vs each sport disciplines.

Table 5. 20 m Sprint (Speed): Results for Girls (Ages 7–18)

Age	Physical Education	Volleyball	Basketball	Football	Taekwondo
7	5.08 ± 0.75	**4.58 ± 0.11			
8	4.97 ± 0.64	*4.54 ± 0.28			
9	4.85 ± 0.60	4.62 ± 0.40		**3.95 ± 0.13	
10	4.77 ± 0.68	4.65 ± 0.32		**3.90 ± 0.24	
11	4.52 ± 0.49	4.51 ± 0.47		**3.71 ± 0.32	
12	4.38 ± 0.44	4.41 ± 0.52	**3.53 ± 0.10	**3.56 ± 0.12	**3.92 ±
13	4.44 ± 0.52	*4.02 ± 0.72	**3.60 ± 0.10	**3.84 ± 0.14	**3.70 ±
14	4.43 ± 0.59	**3.79 ± 0.24	**3.67 ± 0.21	**3.59 ± 0.19	
15	4.34 ± 0.58	**3.83 ± 0.39	**3.80 ± 0.17	**3.55 ± 0.14	
16	4.39 ± 0.54	**3.79 ± 0.25	**3.69 ±	**3.65 ± 0.29	**3.79 ± 0.06
17	4.63 ± 0.59	**3.79 ± 0.32	**3.77 ±	**3.69 ± 0.14	
18	5.07 ± 1.37	**3.87 ± 0.20		**3.54 ± 0.17	

Note. ** - Correlation is significant at the 0.01 level (2-tailed) - PE vs each sport disciplines; * - Correlation is significant at the 0.05 level (2-tailed) - PE vs each sport disciplines.

Discussion

This study investigated flexibility and sprint performance in Albanian children and adolescents aged 7–18 years, comparing results between physical education participants and those involved in organized sports. The findings indicated distinct age-related patterns and sport-specific variations, aligning with results from other European cohorts (Beunen & Malina, 1988; Ortega et al., 2008). In general, both flexibility and speed enhanced progressively with age, indicating neuromuscular maturity, greater limb length, and improved motor coordination (Malina, Rogol, Cumming, Coelho e Silva, & Figueiredo, 2015).

The Sit & Reach test results indicated that flexibility generally improved with age in both boys and girls, although the patterns differed by sport discipline. Participants of both genders engaged in sports requiring frequent stretching or high mobility, such as taekwondo, football, volleyball, and basketball, had elevated mean values relative to those in physical education-only groups. The observed differences were statistically significant across many age groups ($p < .05$ and $p < .01$), indicating the impact of sport-specific training stimuli on joint range of motion (Behm, Chaouachi, Lau,

& Wong, 2011; Cejudo et al., 2015). In boys, flexibility improved from roughly 21 cm at age 12 to 26–27 cm by late adolescence among physical education participants, whereas taekwondo and football athletes demonstrated averages beyond 30 cm, reaching a maximum of 41 cm in the oldest taekwondo cohort. These findings correspond with studies indicating that frequent dynamic stretching and martial arts training enhance hamstring and lower back flexibility (Sands et al., 2013). Females had superior average Sit & Reach scores compared to males across almost all age groups, a disparity corroborated by literature linking increased flexibility in females to earlier biological maturation and enhanced joint laxity (Alter, 2004; Beunen et al., 1997). Volleyball and football athletes had flexibility averages above 30 cm from the age of 13, suggesting that repetitive sport-specific actions such as reaching, kicking, and diving likely facilitate enduring flexibility improvements (Gabbett & Georgieff, 2007).

In the Albanian setting, these normative values provide novel regional evidence. Prior data regarding children's motor skills in Albania has been inadequate and disjointed, with insufficient recording of age-specific reference standards (Jarani, 2015; Jarani & Ylli, 2020). The current dataset

thus establishes a crucial baseline for evaluating developmental and training impacts on flexibility in educational and athletic environments. The results of the 20 m sprint test similarly indicated a constant enhancement with age in both boys and girls. Average sprint durations progressively diminished from childhood to late adolescence, indicating typical growth-related improvements in stride length, stride frequency, and anaerobic efficiency (Virus et al., 1999; Philippaerts et al., 2006). In male physical education groups, sprint times enhanced from 4.94 ± 0.60 seconds at age 7 to 3.55 ± 0.64 seconds at age 17, but female speeds improved from 5.08 ± 0.75 seconds to 4.34 ± 0.58 seconds over the same period. These statistics reflect tendencies observed in cross-European studies on youth motor fitness (Tomkinson et al., 2018; Tambalis et al., 2021).

Participants trained in sports surpassed their classmates engaged solely in physical education across nearly all age groups. Among males, football players recorded the swiftest times (about 3.0–3.3 seconds for ages 15–18), succeeded by basketball and taekwondo athletes. The significant enhancements observed in footballers align with the sport's unique requirements for brief accelerations and multidirectional sprints (Haugen, Tønnessen, & Seiler, 2012). Likewise, girls engaged in volleyball and football had superior sprint times compared to their peers in physical education, with average durations ranging from 3.6 to 3.9 seconds during late adolescence. Similar results have been observed in Mediterranean populations, indicating that organized sports engagement markedly improves speed and coordination development (Castillo-Rodríguez et al., 2019; Tambalis et al., 2022). This research constitutes one of the initial extensive datasets on teenage motor performance in Albania, adhering to established measuring techniques akin to those employed in EUFITMOS and WHO 24-hour movement efforts (Gába et al., 2021; WHO, 2020). The identified developmental trajectories align with international standards, affirming that Albanian children exhibit similar growth-related advancements in physical fitness as their European counterparts when afforded sufficient access to organized sports and physical education settings.

The persistent superiority of athletes in both flexibility and speed assessments highlights the prospective advantages of expanding extracurricular sports programs and updating physical education curricula in Albanian schools. These findings underscore the necessity for national reference standards and ongoing monitoring to assess physical fitness trends and guide public health and educational policies (Jarani, 2018; Pate et al., 2019).

Conclusion

This study provides the first comprehensive reference values for flexibility and sprint performance among Albanian children and adolescents aged 7–18 years, revealing clear developmental patterns and significant differences between physical education (PE) participants and those engaged in organized sport disciplines. Across all age groups, sport-trained children consistently demonstrated superior flexibility and faster sprint times compared with their PE peers, particularly in sports such as football, volleyball, and taekwondo, where training involves repetitive dynamic movements, stretching, and short bursts of acceleration. These findings confirm that structured and sport-specific

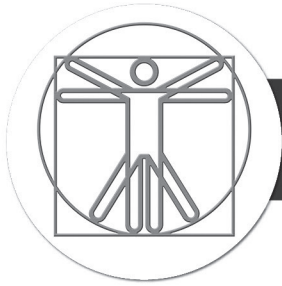
training contributes more effectively to motor skill development than standard school-based PE alone.

From a practical standpoint, the results underline the need to strengthen and modernize PE curricula in Albanian schools by integrating more structured, skill-oriented, and age-adapted physical activities. Early participation in organized sports should be encouraged to support the development of key motor abilities and lifelong physical activity engagement.

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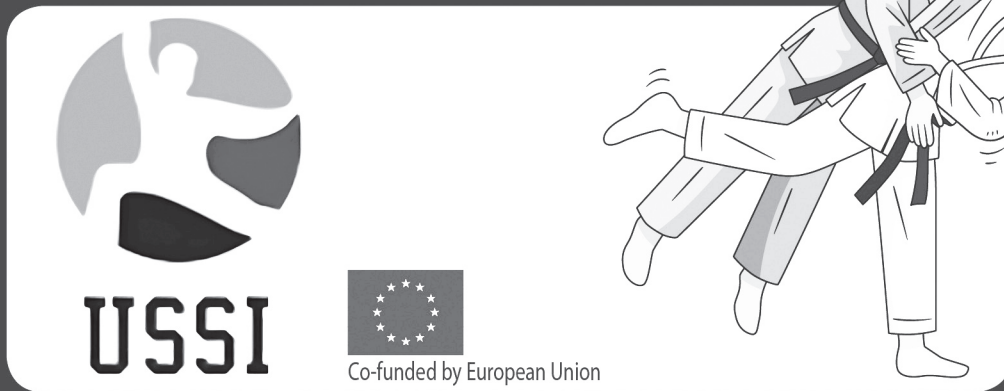


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USSSI focuses on empowering communities, coaches and youth through innovative training, community engagement events, and knowledge exchange between partners.



Project Activities

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