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Comparison of Motoric Characteristics in 11-12 Year-Old Primary School Athlete Students (Footballers and Wrestlers)

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ABSTRACT

The purpose of this study is to compare and evaluate certain motoric characteristics of primary school athlete students aged 11-12, specifically footballers and wrestlers. Within the scope of the study, motor performance parameters such as flexibility, balance, arm movement speed, standing long jump, sit-ups, 30-meter sprint, bent arm hang, and hand grip strength were measured. The obtained data were analyzed using one-way analysis of variance (ANOVA) and the LSD test. There was no significant difference in average height and body weight between the football and wrestler students according to their branch ($p>0.05$). Significant differences were observed between age groups in terms of height, body weight, and sports age ($p<0.001$). In comparisons made by gender, significant differences were found in all motoric characteristics except for the 30-meter sprint time ($p<0.001$). Additionally, analyses according to age groups revealed significant differences in all motoric parameters ($p<0.001$). Positive and significant correlations were found among parameters such as flexibility, balance, arm movement speed, sit-ups, hand grip strength, and long jump; whereas a negative and statistically insignificant relationship was observed between the 30-meter sprint and long jump ($p>0.05$). Grip strength has been found to be highly correlated with flexibility, balance, arm strength, sit-up, and long jump. In conclusion, the motoric performances of footballer and wrestler children aged 11-12 vary depending on age and gender. Gender differences particularly affect the development of some motoric characteristics in female students, while a more stable development is observed in males. Considering this in planning training programs will enable the provision of more efficient and effective sports education appropriate to the children's developmental processes. It is also recommended that similar studies be repeated with larger sample groups in different age ranges and sports branches.

Keywords: *Primary Education, Motor Performance, Student, Sport, Football, Wrestling.*

INTRODUCTION

The school age period is considered the most productive phase for the development of children's motor skills. During this period, children's responses to physical loads vary at different stages of growth and development. The development of physical attributes accelerates during certain phases and continues with periods of deceleration. Although speed performance reaches its limits earlier compared to other motor skills in children, different types of speed do not develop equally (Miftakhov et al., 2019).

Exercises characterized by high force production through muscle contractions can be used as fundamental tools to support speed and strength development in school-aged children. Such exercises emphasize the speed and power components of movement, contributing to children's motor development. However, research conducted across Europe shows that only one-third of school-aged children meet the recommended levels of physical activity (Cavill et al., 2006). A significant decrease in physical activity participation rates, especially among children aged 10-16 and particularly girls, has been observed (Strauss et al., 2001). A similar trend is evident in Turkey, where children's physical activity levels decline due to various environmental and individual factors (Meydanlıoğlu, 2015). This situation leads to the early onset of many chronic diseases, primarily obesity.

Physical activity is emphasized as a fundamental factor in both the physical and mental development of children (Koca et al., 2019). Insufficient physical activity at an early age is associated with low movement capacity and health problems in later periods. Speed development in boys occurs in two stages: between 7-9 and 13-16 years of age, while the most suitable period for skill training is stated as 9 years for boys and 8 years for girls. Regarding flexibility development, the age range of 6-10 years is considered the most appropriate period for both sexes (Canadian Sport for Life, 2005). The goals of physical education lessons at the primary education level include improving children's basic motor skills such as strength, agility, and coordination (Hekim & Hekim, 2015). This age group, specifically 8-13 years, is a critical period during which children make significant progress in motor skills. An athlete's performance is directly dependent on the development of strength, speed, flexibility, and jumping techniques (İmamoğlu et al., 2018). Factors affecting these performance components include age, height, body weight, aerobic and anaerobic power, body composition, resting heart rate, and blood pressure (Güneş et al., 2019; Koca et al., 2019). Additionally, motoric features, technomotor proficiency, learning capacity, emotional and cognitive development, and social factors are other important components determining sports performance.

The primary education period is when children's physical growth and developmental rates reach their peak. This period is significant not only academically but also physiologically, socially, and emotionally (Çöndü et al., 2018). Even among children born in the same calendar year, differences in biological development levels can be observed. Some individuals mature early, while others mature late (Sanıvar, 2014). These differences can lead to pronounced gender-based distinctions in anthropometric features such as body weight, height, and strength (Ertat, 1990; İmamoğlu et al., 1994). The most notable elements of physical performance are speed and strength development, which progress in parallel with biological maturation (Born et al., 2018). Boys particularly reach the peak of their athletic potential between the ages of 11 and 14; during this period, height, strength, and speed capacities increase significantly (Cumming et al., 2017). It is known that age and the level of biological maturity have positive effects, especially on running performance (Abbott et al., 2019).

Coordination between organs is largely established in girls aged 10-11 and boys aged 10-12, and this period is considered a phase during which motor skills can be effectively developed (Güler, 2018). However, agility development varies depending on the sport branch (Arı et al., 2017). The literature also reports significant differences in motor skill levels based on gender (İmamoğlu & Şner, 2019). Simultaneous evaluation of anthropometric data and motor skills is of great importance for the healthy monitoring of children's developmental processes (Milanese et al., 2010). Since childhood forms the foundation for motor development in later ages, it is extremely important to determine motor development levels, especially in preschool and school-aged children (Valentini et al., 2015). Muscle strength development can be adversely affected, particularly in boys, due to developmental delays such as underweight and short stature (Milushkina et al., 2017). Additionally, some experts in Turkey suggest that early excessive exercise load on children engaged in sports may negatively impact their development.

Childhood is one of the most critical stages of an individual's physical and motor development. The age range of 11-12 years is especially important as it is a period marked by accelerated growth and maturation and rapid development of motor skills. During this period, children's fundamental physical characteristics and motor abilities play a decisive role both for healthy development and their future sports careers. Differences in motoric performance according to age, gender, and sport branch among athletes necessitate the individualization of training programs. In Turkey, there is a risk of negative impact on children's development due to the decrease in physical activity levels and the early exposure of children engaged in sports to intensive exercise loads. This situation makes it necessary to evaluate motoric characteristics accurately and comprehensively. However, the literature contains only a limited number of studies comparing motoric features of children aged 11-12 across different sports branches. Therefore, comparing fundamental motoric features such as agility, speed, and strength between footballer and wrestler children will provide important data for tracking athletes' development and optimizing training according to age and gender differences. Moreover, the findings will be beneficial in terms of sports education and children's health. This study has been conducted to better understand the physical development processes of athlete children and to base sports-related planning on a scientific foundation.

While football actively uses the legs and head, wrestling relies more on the arms. Bridge movements are particularly important in wrestling. These two sports were chosen because their motor performance parameters differ significantly.

METHOD

The study included 11- and 12-year-old footballer and wrestler students attending various primary schools in Samsun province who were also athletes. Measurements were taken while the students participated in sports training at different clubs. Consent was obtained from the students' parents. Students under the age of 11 and over the age of 12 were excluded from the study. Students with any disability were also excluded.

Data Collection

Physical measurements such as height and body weight, as well as motoric features including flexibility, arm movement speed, balance, standing long jump, arm strength, hand grip strength, sit-ups, and sprint speed, were measured for the voluntary participants.

Height and Body Weight

Participants' ages were determined from their identity documents. Height was measured with a meter, and body weight was measured using an electronic scale. Measurements were recorded in centimeters (cm) and kilograms (kg).

Flexibility Measurements

The sit-and-reach test was applied to measure flexibility. The test bench was 35 cm long, 45 cm wide, and 32 cm high. The upper surface of the bench measured 45 cm by 45 cm, extending 15 cm beyond the footrest surface. A 0-50 cm ruler with parallel 5 cm intervals was placed on the top surface. The participant bent forward without bending the knees and reached forward as far as possible with hands extended in front of the body, pushing the ruler slowly forward. The participant held the furthest position for 1-2 seconds without bouncing. The test was repeated twice, and the highest value was recorded.

Arm Movement Speed

The touching disk test was used to measure arm movement speed. Children used their dominant hand to touch two plastic disks (labeled A and B) with a diameter of 20 cm placed 80 cm apart as many times as possible within 30 seconds.

Balance Test

The Flamingo balance test was used. The measurement apparatus consisted of a wooden beam 50 cm long, 4 cm high, and 3 cm wide. Participants were asked to balance on the beam for one minute. Each time the participant lost balance (e.g., touching the foot with the other hand, stepping off the beam, touching the floor with any part of the body), the timer was stopped, and the participant was asked to return to the beam. Timing resumed when balance was regained. The total number of balance errors during the 1-minute test was recorded as the score (Altınkök et al., 2019).

Standing Long Jump Test

Participants stood with feet together behind the jump line, swung both arms backward, bent their knees, and jumped forward as far as possible. Two attempts were made, and the best result was recorded.

Sit-Up Test

Abdominal muscle endurance was assessed by counting the number of sit-ups performed in 30 seconds.

30-Meter Sprint

Sprint time over 30 meters was measured using a photocell system. The best time from two attempts was recorded.

Arm Strength

The bent-arm hang test was used to measure arm strength. Participants hung from a pull-up bar with a pronated grip (overhand), shoulder-width apart. They pulled themselves up until their chin was above the bar and held the position as long as possible without letting the chin drop below the bar level. The duration was recorded in seconds.

Hand Grip Strength

Hand grip strength was measured twice consecutively from both the right and left hands. Participants stood upright with their arms straight and slightly away from the body (about 45-degree angle). Grip strength was measured using a Jamar hydraulic hand dynamometer.

Study Limitations

This study included students from only football and wrestling branches. The study was limited to 11-12-year-old primary school students participating in training in these branches. The specific sport type practiced by the students was not taken into account. Also, the participants' ages were recorded by year; recording by months would have been more accurate.

Data Analysis

Data were analyzed using the SPSS (Statistical Package for the Social Sciences) version 27. The Kolmogorov-Smirnov test was used to assess normality, confirming that the data were normally distributed. Analysis of variance (ANOVA) and LSD tests were applied for multiple comparisons and determining differences.

RESULTS

Table 1. Anthropometric characteristics of footballer and wrestler students (average for ages 11 and 12)

Parameters	Branch	n	Mean	Std. Deviation	t	p
Height (cm)	Football Girls	84	143.11	3.19	0.79	0.441
	Wrestling Girls	58	143.18	3.21		
	Football Boys	101	142.45	3.13	0.25	0.542
	Wrestling Boys	77	142.32	3.20		
Body Weight (kg)	Football Girls	84	41.24	3.11	0.36	0.951
	Wrestling Girls	58	41.12	3.21		
	Football Boys	101	38.85	3.16	0.83	0.674
	Wrestling Boys	77	38.18	3.21		

No significant differences were found between football and wrestler students in terms of average height and body weight by branch ($p > 0.05$).

Table 2. Distribution of Height and Body Weight by Age

Parameter	Age Group	N	Mean	Std. Deviation	F / LSD	p
Height (cm)	11-year-old girls (1)	66	141.12	3.12	15.04	0.001**
	12-year-old girls (2)	76	145.16	3.20	1,3 < 2	
	11-year-old boys (3)	80	141.25	3.15	3 < 4	
	12-year-old boys (4)	98	143.52	3.21		
Body Weight (kg)	11-year-old girls (1)	66	39.24	4.81	12.35	0.001**
	12-year-old girls (2)	76	43.12	4.72	1,3,4 < 2	
	11-year-old boys (3)	80	37.15	4.63	3 < 4	
	12-year-old boys (4)	98	39.48	4.29		
Sports Age (Years)	11-year-old girls (1)	66	9.94	0.90	5.96	0.001*
	12-year-old girls (2)	76	3.90	0.91	1,3 < 2,4	
	11-year-old boys (3)	80	2.98	0.97		
	12-year-old boys (4)	98	3.98	0.99		

**p<0.001

A significant difference was found between the groups in terms of height ($F=15.04$, $p<0.001$). According to the LSD test, 12-year-old girls were taller than 11-year-old girls and 11-year-old boys, and 12-year-old boys were taller than 11-year-old boys. For body weight, a significant difference was also observed ($F=12.35$, $p<0.001$). 12-year-old girls had higher body weight than 11-year-old girls, 11-year-old boys, and 12-year-old boys, while 12-year-old boys were heavier than 11-year-old boys. Regarding sports age, 12-year-old girls and 12-year-old boys had higher sports age than the 11-year-old groups ($F=5.96$, $p<0.001$).

Table 3. Comparison of Some Motor Performance Parameters by Gender

Parameter	Gender	N	Mean	Std. Deviation	t	p
Flexibility (cm)	Female	142	30.06	2.59	7.59	<0.001**
	Male	178	28.68	2.64		
Balance (count)	Female	142	8.68	2.59	7.62	<0.001**
	Male	178	10.06	2.63		
Arm Movement Speed (sec)	Female	142	14.37	2.40	7.53	<0.001**
	Male	178	15.52	2.32		
Sit-up (count)	Female	142	19.68	2.59	7.59	<0.001**
	Male	178	21.06	2.64		
30 m Sprint (sec)	Female	142	5.58	0.70	0.98	0.326
	Male	178	5.65	0.61		
Standing Long Jump (cm)	Female	142	145.47	10.33	6.47	<0.001**
	Male	178	147.74	11.94		
Bent Arm Hang (sec)	Female	142	15.18	11.75	5.83	<0.001**
	Male	178	16.33	11.74		
Right Hand Grip Strength (kg)	Female	142	14.10	3.25	4.76	0.001**
	Male	178	15.80	3.16		
Left Hand Grip Strength (kg)	Female	142	14.02	3.02	4.58	0.001**
	Male	178	15.60	3.05		

**p < 0.001

Values are presented as mean ± standard deviation. Independent samples t-test was used to compare physical fitness parameters according to gender. Significant differences were found between females and males in flexibility, balance, arm movement speed, sit-up, standing long jump, bent arm hang, and hand grip strength (p<0.01). However, no significant difference was observed in the 30 m sprint performance (p < 0.001).**

Table 4. Investigation of Differences in Groups by Age and Gender

Parameter	Group	n	Mean	Std. Deviation	F / LSD	p
Flexibility (cm)	11 age girls (1)	66	29.83	2.50	20,02 1,2 > 3,4	<0.001**
	12 age girls (2)	76	30.29	2.65		
	11 age boys (3)	80	28.37	2.61		
	12 age boys (4)	98	28.99	2.67		
Balance (count)	11 age girls (1)	66	8.45	2.50	20,19 1,2 < 3,4	<0.001**
	12 age girls (2)	76	8.87	2.65		
	11 age boys (3)	80	10.04	2.60		
	12 age boys (4)	98	10.08	2.67		
Arm movement speed (sec)	11 age girls (1)	66	14.26	2.37	19,21 1,2 < 3,4	<0.001**
	12 age girls (2)	76	14.47	2.42		
	11 age boys (3)	80	15.49	2.35		
	12 age boys (4)	98	15.55	2.30		
Sit-ups (count)	11 age girls (1)	66	19.39	2.50	20,01 1,2 < 3,4	<0.001**
	12 age girls (2)	76	19.97	2.65		

**p < 0.001

Values are presented as mean ± standard deviation. Differences between age and gender groups were analyzed using one-way ANOVA and LSD post-hoc test. Significant differences were found in flexibility, balance, arm movement speed, and sit-up performance among the groups (p<0.001). Post-hoc results showed that girls (11 and 12 years) had higher flexibility scores than boys, whereas boys demonstrated higher balance, arm movement speed, and sit-up performance than girls (p<0.001).

Table 5. Correlation Table of Students' Motor Performance Parameters

		B	AM	S	30	LJ	GS	Hand Grip
Flexibility	r	,899**	,675**	,789**	-,015	,168**	,612**	,610**
	p	,000	,000	,000	,795	,003	,000	,000
Balance (B)	r		,675**	,799**	-,015	,168**	,610**	,608**
	p		,000	,000	,791	,002	,000	,000
Arm Movement (AM)	r			,675**	-,049	,185**	,439**	,433**
	p			,000	,382	,001	,000	,000
Sit-ups (S)	r				-,015	,168**	,601**	,600**
	p				,795	,003	,000	,000
30 m Sprint (30)	r					-,037	,015	,015
	p					,511	,787	,787
Long Jump (LJ)	r						,221**	,200**
	p						,000	,000
Grip Strength (GS)	r							0,856**
	p							,000

**p < 0.001

There are strong positive correlations among flexibility, balance, arm movement speed, sit-up count, hand grip strength, and long jump performance (all significant at p < 0.001). This suggests that improvements or higher levels in one of these motor skills tend to be associated with better performance in the others. Conversely, the 30-meter sprint time shows a very weak, negative, and statistically insignificant correlation with long jump performance (p > 0.05). This indicates that sprint speed at 30 meters is not strongly related to standing long jump results in this sample.

DISCUSSION AND CONCLUSION

In this study, no significant differences were found between the average height and body weight of 11- and 12-year-old football and wrestling students based on their sports branch (p>0.05). This finding indicates that the type of sport does not have a significant impact on anthropometric characteristics in children of similar age groups. Similar results have been reported in the literature, showing no significant differences in height and body weight between different sports branches in child and adolescent athletes. For example, a study by Milanese et al. (2010) reported that anthropometric measurements of young athletes across various sports branches were at similar levels. Likewise, Ertan et al. (2003) stated that there were no significant differences in height and weight among athlete children aged 11-13 years based on their sports branch.This situation can be explained by the similar levels of biological maturation and growth rates of children in the 11-12 age group. At this age, the sport branch may not have yet created a long-term and intensive

training effect that significantly alters body structure. Additionally, individual differences in growth and development processes may lead to the absence of statistically significant differences between groups in terms of group averages (Born et al., 2018). However, with increasing age and longer training durations, the selective effects of sports branches on anthropometric features become more pronounced. Therefore, the lack of differences in height and body weight among branches at early ages reflects the general developmental characteristics during childhood, and such differences may emerge as age progresses and training intensity increases.

In this study, height, body weight, and sports experience of 11-12-year-old female and male students were examined, and significant differences in these parameters were detected according to age ($p<0.001$). Our findings showed that both height and body weight increased with age. Especially in 12-year-old female students, a faster increase in height and body weight was observed, which can be explained by the accelerated physiological development during puberty in girls. Similar age-related differences in height and weight were also reported in a study conducted by İmamoğlu and Şener (2019) on children aged 11-12 years. The results of this study are consistent with the literature and show that the increase in body weight is more pronounced in girls compared to boys. This can be attributed to hormonal and developmental differences during puberty. During puberty, fat tissue increases faster in girls than in boys, which accelerates weight gain (Malina and Bouchard, 1991).

Previous studies also support that motor fitness performances are significantly related to age, with higher performance values obtained in boys (Milanese et al., 2010). These differences can be linked to boys' advantages in muscle mass and strength development. Additionally, the sports experience of both genders being approximately 3-4 years suggests that children generally start regular sports activities around the age of 8, which supports the positive effects on motor development. In our study, significant increases in height and body weight were observed with age in both girls and boys, with a particular acceleration due to puberty effects in girls. These findings highlight the importance of closely monitoring growth and development parameters during childhood and adolescence. Furthermore, the positive effects of sports experience on motor performance emphasize the necessity of encouraging children to engage in sports activities at an early age.

The flexibility levels of female and male students aged 11-12 were also examined, and it was determined that girls had significantly higher flexibility levels than boys ($p<0.001$). This finding aligns with many studies in the literature. For example, Yüksel et al. (2014) stated that gender and age factors jointly affect children's flexibility levels, with girls being more flexible than boys across all age groups, and this difference reaching its peak during adolescence (Pratt, 1989; Branta et al., 1984). Our finding that girls scored higher than boys in the sit-and-reach test aligns with the view that the sudden increase in lower extremity length in boys may affect flexibility measurements (Branta et al., 1984). Additionally, as expressed by Temur and Selçuk (2017), the denser connective tissues in males compared to females are among the biological reasons for girls' advantage in flexibility. Various changes in flexibility development have been observed across different age groups. Yüksel et al. (2014) reported that flexibility decreases until ages 12-13 in children, remains stable between ages 13-15, and then increases until 18. In girls, flexibility remains stable between ages 5-11, increases until 14, and then reaches a plateau. This developmental process may partly explain the sex differences in flexibility values observed in the age group of our study.

Studies related to flexibility in the literature also parallel our results. For instance, İmamoğlu and Şener (2019) found significant sex differences in flexibility among children aged 11-12, while Çöndü et al. (2018) reported that girls in 4th grade had higher flexibility than boys. On the other hand, Erdoğan (2022) reported that in gymnasts aged 7-11, boy's demonstrated better flexibility performance than girls, suggesting that flexibility development may vary depending on the sports branch and individual differences. Our study also observed the positive contribution of regular sports to flexibility development. Kalınca et al. (2022) noted that flexibility development was more pronounced in girls who practiced sports regularly. This supports the role of regular physical activity in improving muscle coordination, tissue elasticity, and general motor functions. Flexibility is shaped by the interaction of multiple factors such as genetics, biological structure, gender, age, and regular physical activity. Therefore, it is recommended to implement appropriate exercise programs to maintain and improve flexibility during childhood and adolescence. Developing individualized approaches considering the differences in flexibility development between girls and boys is important for motor development and performance.

In our study, the static balance values of 11-12-year-old female and male students were examined, and it was determined that female students had significantly better balance performance compared to males ($p<0.001$). This result is consistent with studies by Hurüz and Ateş Çakır (2020), who found that women have higher static balance performance on both left and right legs compared to men. Additionally, findings by Gribble et al. (2009) and Riemann and Davies (2013) also show that females have superior static balance compared to males. The literature reports varying results regarding the effect of sports on balance performance. For example, Balı et al. (2019) found no significant difference in static balance between girls practicing judo and those who did not, whereas Moraru et al. (2014) showed that children practicing gymnastics had better balance performance than those who did not engage in sports. This indicates that the type of sport and training intensity play important roles in balance development. İmamoğlu and Şener (2019) detected significant age-related differences in Flamingo balance test results among non-

athlete children aged 11-12 years. In their study, Temur et al. (2022) reported an average balance time of 9.50 seconds for 10-year-olds and 6.17 seconds for 12-year-olds, supporting the view that balance ability improves with age. Korkmaz (2020) demonstrated significant improvements in Flamingo balance test pre- and post-test scores in 11-year-old children. Similarly, Gonzales et al. (2014) reported Flamingo test scores of 9.3-9.5 for boys and 8.7-9.4 for girls aged 11-12. In our study, the balance scores were 8.68 for girls and 10.06 for boys, with the difference being statistically significant ($p<0.001$). The better balance performance of female students compared to males can be attributed not only to developmental differences but also to biomechanical and neuromuscular control variations. This study found that female students demonstrated better static balance performance than male students. This finding aligns with the literature and emphasizes the importance of developmental differences across age groups. Furthermore, considering the effects of sports branches and training duration on balance performance, it is recommended to implement appropriate balance exercises at an early age to support children's motor development.

In this study, arm movement speed and sit-up counts of 11-12-year-old female and male students were evaluated, and significant differences were found between genders in both tests ($p<0.001$). The average arm movement speed for female students was 14.37 seconds, while for male students it was measured as 15.52 seconds. This result slightly differs from İmamoğlu and Şener's (2019) study, which found no statistically significant difference in the plate-touching test among non-athlete children. Korkmaz (2020) reported arm movement speed test results for 11-year-old children as 13.45 seconds in the pre-test and 13.67 seconds in the post-test for the experimental group. The values in our study are close to Korkmaz's findings. In the sit-up test, male students (21.06 repetitions) performed better than female students (19.68 repetitions), and this difference was statistically significant ($p<0.001$). This finding aligns with Çöndü et al. (2018), who reported that boys outperformed girls in sit-up counts among 4th and 5th graders. Additionally, Korkmaz (2020) found an average of 32.42 sit-ups in the experimental group of 11-year-old children, indicating reasonable consistency considering differences in study conditions and groups.

The better performance of male students in the sit-up test can be explained by earlier development of muscle strength and endurance in boys. Meanwhile, the shorter arm movement speed times for girls may provide an advantage in fine motor skills and coordination. This highlights how physiological and neuromuscular differences related to gender can affect motor performance early on. Our study indicates that gender has a significant effect on arm movement speed and sit-up performance, and these differences are related to biological and physiological factors in children's development. Based on these findings, it is recommended to design training programs tailored to age and gender to improve motor skills.

In this study, 30-meter running times of 11-12-year-old female and male students were evaluated, and no significant difference was found between genders ($p>0.05$). The average running time for girls was 5.58 seconds, while for boys it was 5.65 seconds. This result partially differs from İmamoğlu and Şener (2019), who found significant differences in running performance between age groups and genders among non-athlete children. Milanese et al. (2010) reported 30-meter running times of 5.02 seconds for boys and 4.81 seconds for girls aged 10-12. Miftakhov et al. (2019) measured 30-meter running times in 11-12-year-olds as 5.7 seconds in the initial test and 5.1 seconds one year later in the experimental group. These differences may vary depending on the participants' sports experience, training duration, and conditions. Gül et al. (2012) reported significant improvements in 30-meter running speed over years in male child wrestlers, indicating that regular training and experience positively affect running performance. The findings of our study suggest that basic running speed in children aged 11-12 is influenced more by individual differences and training history than by gender. Moreover, the difference in the rate of physical development between genders at this age does not yet have a clear impact on running performance. It was concluded that 30-meter running performance varies with age and training level, but gender does not have a significant effect on performance in this age group. Therefore, age-appropriate and individualized training programs are recommended to improve running performance in children.

In our study, standing long jump performances of 11-12-year-old girls and boys were examined, with girls averaging 145.47 cm and boys 147.74 cm. The difference between genders was found to be statistically significant ($p<0.001$). Similar studies in the literature also support gender differences in standing long jump performance in comparable age groups. Gonzales et al. (2014) reported long jump distances for 11-12-year-old boys ranging between 141.4 cm and 148.9 cm. İmamoğlu and Şener (2019) found results in non-athlete 11-12-year-old children between 143.95-148.92 cm for girls and 143.03-149.17 cm for boys. Korkmaz (2020) reported standing long jump values between 142.17 cm and 148.00 cm in 11-year-old children. Our findings align well with these literature data. The higher long jump performance of boys compared to girls can be attributed to differences in muscle strength and explosive power development that begin early in life. Additionally, boys' accelerated motor development and physical activity habits may also influence performance differences. It can be stated that there are significant gender differences in standing long jump performance in the 11-12 age group, which are related to biological development processes. Therefore, it is important to evaluate children in explosive power-based motor tests such as long jump according to their gender and age characteristics and to organize training programs accordingly.

In our study, bent arm hang test performances of 11-12-year-old girls and boys were evaluated. Boys' average time

was measured as 16.33 seconds, and girls' as 15.18 seconds, with the difference between genders being statistically significant ($p<0.001$). This result indicates that boys have higher arm strength than girls. Similar studies in the literature support gender differences in strength development in similar age groups. Gonzales et al. (2014) reported bent arm hang times between 10.4 and 12.8 seconds for 11-12-year-old boys, while the same age girls had times between 6.4 and 7 seconds. İmamoğlu and Şener (2019) also found significant differences between girls and boys in the bent arm hang test in non-athlete 11-12-year-olds. Korkmaz (2020) reported bent arm hang times of 15.75 seconds (pre-test) and 15.95 seconds (post-test) in the experimental group of 11-year-old children. Our study's values are consistent with Korkmaz's findings. These gender differences in strength development can be linked to boys' faster increases in muscle mass and strength, especially in the pre-pubertal period (Hekim & Hekim, 2015). Moreover, it is known that regularly performed physical activities positively contribute to children's physical, physiological, psychological, sociological, and motor development (Koç & Tekin, 2011). Boys' superior performance in the bent arm hang test compared to girls may be associated with biological developmental processes and physical activity habits. To support strength development in children, it is important to encourage regular and planned physical activities considering age and gender characteristics.

In this study, handgrip strengths of 11-12-year-old girls and boys were examined. The average right-hand grip strength was 14.1 kg for girls and 15.80 kg for boys; the left-hand grip strength was 14.02 kg for girls and 15.60 kg for boys. The differences between girls and boys in both right and left handgrip strengths were statistically significant ($p<0.001$). Boys' higher handgrip strength compared to girls can be associated with increases in muscle mass and strength during biological development. Korkmaz (2020) reported right and left handgrip strengths of 13.83 kg and 12.17 kg, respectively, in the experimental group of 11-year-old children. Our values are parallel to Korkmaz's findings, though it is notable that girls' left-hand grip strength values are closer to boys' compared to the right hand. Boraczyński and Sozański (2015) stated that the rate of children's physical development varies according to the volume and intensity of physical activity within the annual training cycle. This indicates that, besides gender differences in handgrip strength, individual training habits and sports experience also play a role. Handgrip strength is an important indicator of motor development in children, and boys' superiority in this area is related to biological developmental processes and physical activity levels. To support strength development in children, it is recommended to plan regular and age-appropriate physical activities. In our study, the physical performance parameters of children aged 11-12 were evaluated in terms of age and gender, and significant differences were found in flexibility, balance, arm movement, sit-up count, 30-meter sprint, long jump, bent arm hang, and handgrip strength ($p<0.001$). However, it was observed that most of these differences originated from gender.

Yaman (2014) stated that biological maturity levels significantly affect performances such as aerobic endurance, handgrip strength, flexibility, and explosive power independently of chronological age. This finding supports that physiological changes during puberty directly influence the development of physical performance in children. Çöndü et al. (2018), on the other hand, found no significant differences between 4th and 5th-grade students aged 11-12 in body weight, flexibility, balance, sit-ups, arm movement, 30-meter sprint, long jump, and arm strength, drawing attention to the similarity of performance across ages. Although our study detected significant differences related to age, these differences were not significant within gender groups ($p>0.05$). For example, flexibility, balance, sit-up, and handgrip strength values of 11-year-old girls were very close to those of 12-year-old girls. Similarly, differences between age groups in boys were small. However, more distinct age differences were observed in the 30-meter sprint and standing long jump tests. Twelve-year-old girls performed better than 11-year-old girls and boys, and 12-year-old boys achieved the highest long jump values. This can be explained by the effects of the puberty process starting at around age 12 in girls. Malina et al. (2014) noted that girls biologically mature earlier than boys, which affects performance differences. In boys, a significant increase in muscle strength generally appears after age 12 (Erdoğan, 2022). Differences in muscle strength and performance development vary according to age, gender, biological maturity, nutrition, physical activity level, and genetic factors (Cumming et al., 2018).

Genetic factors have been emphasized in the literature to particularly influence abilities such as speed and agility (Ağaoğlu et al., 2009). It is known that physically active children's fitness and motor coordination improve according to their years of sport participation (Opstoel et al., 2015). Tomkinson et al. (2018) reported that boys outperform girls in muscle strength, power, endurance, speed, and cardiovascular fitness tests, while girls have advantages in flexibility. The findings of our study show that gender is a determining factor in children's physical performance development. Although age-related differences are observed in some physical parameters between ages 11 and 12, the effect of biological maturation is more pronounced in performances such as muscle strength and explosive power. Therefore, it is important to consider biological maturity levels alongside chronological age when monitoring children's physical development. In conclusion, to improve children's physical performance and support their healthy development, regular physical activities appropriate to age, gender, and biological maturity levels should be planned.

Many studies have shown that muscle strength is an important component of running speed. Milanese et al. (2010) found significant correlations between standing long jump and 30-meter sprint performances in both girls and boys. This

finding shows a direct relationship between muscle strength, explosive power, and speed. Yıldız et al. (2017) found a strong negative correlation between agility and horizontal jump values, and Ödemiş (2023) revealed a negative and significant relationship between long jump and agility in children. This suggests that while agility is evaluated as the ability to change direction quickly in specific ways, different motor control and muscle functions may come into play in movements requiring explosive power such as horizontal jumps. In our study, positive relationships were observed among flexibility, balance, arm movement, handgrip strength, sit-up numbers, and long jump values ($p<0.001$). However, the relationship between the 30-meter sprint and long jump was negative but not significant ($p>0.05$). This relationship between standing long jump and 30-meter sprint demonstrates the critical role of horizontal movement of the center of mass and leg muscle strength in both tests. Still, the time-based speed requirement of running and the different explosive power and technical components of long jump may weaken their correlation. Literature frequently confirms that strength, endurance, and coordination among motor skills increase with age (Geraedts, 2020; Shlag et al., 2021). This increase results from biological development, hormonal changes, and social interactions. Especially, the coordination between movement sequences and muscles in children improves with age, supporting the increase in physical performance. Our data indicate that intensive exercise does not have a negative effect on children's growth and development, but rather supports the development of physical fitness and motor skills. Accordingly, regular and age-appropriate exercise support for children is critically important for motor skill development and overall health.

RECOMMENDATIONS

In this study, significant gender-related differences were identified in motor performance parameters among athlete students aged 11-12 years (footballers and wrestlers) in all tests except the 30-meter sprint. Additionally, it was determined that the growth and development processes of the children were progressing normally. Anthropometric measurements and motor performance test results generally fell within the reference norms according to age and gender. While limited changes in motor performance parameters were observed in 11- and 12-year-old female students, similarities in these parameters continued among male students. This finding highlights the necessity of carefully evaluating the developmental characteristics of female athlete students when preparing training programs.

Considering the physical characteristics and motor performance differences specific to children's age and gender during the planning of sports activities will enhance the effectiveness of training and positively contribute to their developmental processes. In this context, it is recommended that coaches develop training strategies appropriate to age and gender by taking individual differences into account. For future studies, conducting comprehensive research with larger sample sizes, including different sports branches and age ranges, will allow for a more detailed evaluation of children's physical development and motor performance. Additionally, investigating the effects of biological maturity levels and training intensity on motor development will contribute to optimizing training programs for young athletes.

Author Contributions

Y A., O. Ö. & N. M.: data collection. O. İ. & O. Ö.: data analysis and original draft preparation. Y. A., O. İ. & N. M.: review and editing. All authors have read and agreed to the published version of the manuscript.

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Institutional Review Board Statement

This study was conducted in accordance with the ethical report titled "Comparison of Agility, Speed, and Strength Values in Footballers and Wrestlers" approved by the Ondokuz Mayıs University Social and Human Sciences Research Ethics Committee on 28.03.2025, meeting number. In this regard, the demographic information form and scales prepared were collected online and face to face.

Informed Consent Statement

Informed consent was obtained from all subjects involved in this study.

Data Availability Statement

Datasets are available through the corresponding author upon reason-able request.

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Conlifts of Interest

The authors unequivocally assert that this research was undertaken while devoid of any commercial or financial affiliations that might be perceived as potential conlifts of interest.

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