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ORIGINAL RESEARCH

Effects of periodic training on physical and motor performance in male wrestlers

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Abstract

Background: The aim of this study was to investigate the effects of 12 weeks wrestling training on the physical and motor performance parameters of wrestlers in athlete training centers. **Methods**: The effect of 12 weeks of intensive training was investigated in 33 wrestlers aged 12–14 years in athlete training centers in Çorum province. Paired samples *t*-test was used in the statistical procedures. **Results**: The difference between the scores before and after measuring the physiological and motor characteristics of the wrestlers in the athlete training centers was found to be significant ($p < 0.001$). There was an improvement in physical and motor characteristics due to the effect of training during the training period. **Conclusions**: It was found that the development of physical and motor characteristics of wrestlers who underwent intensive wrestling training in athlete training centers showed a significant improvement depending on training and growth. In addition, it was found that the pushing force was lower than the pulling force and the grip strength of the left hand was lower than that of the right hand in the wrestlers in athlete training centers, but this difference disappeared during training and as a function of development. Weak physiological and motor characteristics of child wrestlers undergoing intensive training in athlete training centers should be identified by pretesting and special training should be conducted to eliminate these weaknesses. **Clinical Trial Registration**: https://clinicaltrials.gov/study/NCT06716333.

Keywords

Periodic training; Wrestling; Motor performance

1. Introduction

Wrestling performance is shaped by a range of anthropometric and physiological characteristics that serve as essential determinants of success. This sport requires athletes to achieve a balance of endurance (aerobic, anaerobic, respiratory functions), strength, flexibility, speed, agility, balance, reaction time and strategy, all of which contribute to high athletic performance. Strength, in particular, functions as a crucial biomotor skill, playing a pivotal role in both defensive and offensive actions, including the execution and countering of techniques. Moreover, there exists a strong correlation between an athlete's physical structure, mechanical efficiency and performance outcomes. However, physical structure alone does not account for success; it is the interplay of physical attributes with motor skills like power, endurance and flexibility that collectively define an athlete's potential for success in wrestling [1–7].

In addition to physical attributes, talent in wrestling is influenced by a blend of conditional motor skills, technical skills, cognitive characteristics and social factors. Essential components such as learning ability, motivation, emotional resilience and cognitive processing contribute significantly to a wrestler's aptitude and skill development [7–9]. As international competitions intensify, Turkish athletes must develop a keen understanding of their own and their opponents' body compositions, specifically in terms of endurance, strength and conditioning. Wrestling, as a multifaceted sport, relies on complex energy systems, with anaerobic alactic and glycolytic pathways taking precedence during bouts [10, 11].

For young athletes, assessments like Eurofit tests are instrumental in determining baseline health, nutritional conditions, exercise habits, and the anatomical and functional profiles of children engaged in sports [12, 13]. Variables such as age, height, body weight, aerobic and anaerobic capacity, body composition, flexibility, resting heart rate and blood pressure are all significant factors affecting physical fitness [14]. Wrestling demands rapid movements in short bursts of time, making anaerobic performance as critical as aerobic capacity. Success on the mat hinges on physical strength, as strength is essential for both executing and countering techniques [15].

Wrestling involves intermittent muscle-strengthening activities, requiring athletes to maintain balance and stability, especially during rapid position changes [16–18]. Wrestlers frequently engage in pushing and pulling movements, underscoring the need for age- and gender-appropriate training programs [19]. Recognizing and monitoring the physical and physiological characteristics of young wrestlers are crucial steps for fostering athletic success [20]. In Turkish wrestling, specialized training centers play an integral role in preparing athletes for success. These centers facilitate the development of tailored training programs that address the specific needs of children who have recently entered the sport, thereby contributing to the establishment of appropriate age-based training regimens.

The long-term adaptability of athletes is a complex challenge in sports training, aiming to enhance athletic abilities, expand functional reserves and maintain health. Biochemical assessments are frequently used to monitor adaptive changes in the body's energy systems [21, 22]. Accurate measurement of muscle strength is fundamental for crafting suitable training programs, boosting performance, reducing injury risks and designing effective injury rehabilitation protocols [23, 24].

Analyzing wrestlers comprehensively allows for the optimization of their physical and motor performance to achieve peak outcomes. The purpose of this study is to examine the annual development of physical and motor performance in wrestlers enrolled in athletic training centers, thereby contributing insights into the efficacy of structured training programs over a one-year period. In this direction, the following research questions were addressed:

Does a 12-week intensive training program significantly improve the physical performance (*e.g.*, strength, endurance, flexibility) of young wrestlers?

Is there an improvement in the wrestlers' motor performance parameters (*e.g.*, speed, strength) during the training period?

2. Materials and methods

2.1 Study participants

Thirty three wrestlers who participated in training within the athlete training center in Çorum province participated in the study voluntarily. The athletic training centers in this study aim to support young athletes in their physical, social and academic development by providing comprehensive resources, including accommodation, nutritional support, training facilities and access to healthcare. These centers serve a range of sports disciplines, such as wrestling, judo and athletics, and are equipped to foster high-level athletic performance through structured training programs led by qualified coaches. Each center's infrastructure is designed to meet international standards for sports training, allowing athletes to prepare for both national and international competitions. The study was conducted in accordance with the principles outlined in the Declaration of Helsinki. Informed consent was obtained from all participants and their legal guardians prior to data collection, ensuring confidentiality and anonymity of personal data.

The participants were recruited between (01 January 2024 and 31 March 2024). The inclusion criteria for this study required participants to be aged 12–14 years, actively engaged in the wrestling program at the training centers, and free of any injuries or health conditions that could prevent their participation in the training program. Exclusion criteria included having a history of musculoskeletal injuries within the past 6 months, chronic illnesses or failure to attend more than 80% of the scheduled training sessions during the study period.

The study was conducted in accordance with the principles outlined in the Declaration of Helsinki. Informed consent was obtained from all participants and their legal guardians prior to data collection, ensuring confidentiality and anonymity of personal data.

2.2 Measurements

Measurement of body weight and height: A Tanita digital scale was used to measure the participants' body weight. The measurements of the subjects' body weight were carried out with a scale with an accuracy of 0.01 kg. The subjects were measured barefoot and wore only shorts during the measurements. The measurement results were given in "kg". Height was measured with a Stanley brand height meter with an accuracy of 0.01 m. When measuring height, the head was upright, the soles of the feet were on a flat surface, the knees were tensed, the heels were together and the body was in an upright position. The measurement results were given in "cm" [25].

Long jump from a standing position: The measurements were taken on a flat surface behind a line and the subjects were asked to jump from the point where they were standing to the furthest point with both feet. The value at the last point at which they fell was then recorded in "cm" [26].

20 m shuttle run test: the 20 m shuttle run test was carried out according to Leger and Lambert (1982). The signals for the running speed were controlled with the Sport Expert Test Timer. The test was started at 8.5 km/h and increased by 0.5 km/h every minute. Participants were asked to walk 20 m at each signal. The test was terminated if the participants could not complete the 20 m distance three times in succession, even though the signal sounded. The estimated Maximal Oxygen Consumption (VO2max) values of the participants were calculated using the formula proposed by Leger *et al.* [27].

30 m sprint: the 30 m sprint values of the subjects were determined by running on the tartan track with suitable running shoes through digital photocells attached to the start and end points [26]. Measurement of hand grip strength: This test was conducted using a Takei model 78.011 hand dynamometer. After a 5-minute warm-up period, subjects stood with the arm measured at a 45-degree angle with no flexion and no contact with the body. The same situation was recorded in kg for the right and left hand [15, 25].

Throwing a medicine ball: subjects were asked to throw a 2 kg medicine ball as far as possible from a point determined by a line with the knees on the floor and the hips facing upwards. The distance between the point at which the ball first touched the ground and the starting point was recorded in "cm" [26].

Sit-to-lie flexibility test: subjects' flexibility scores were measured on the sit and stretch bench. Subjects were asked to place the soles of their feet on the surface of the coffee table and reach their hands to the furthest point on the coffee table without bending their knees. The last point they reached was recorded in "cm" [26].

30 s number of sit-ups: The maximum number of sit-ups the

subjects performed in 30 s with their hands behind their back and knees bent was recorded. Vertical jump: Measurements were taken using the Takei A5406 Vertical Jump Meter Digital device (Takei Scientific Instruments Co., Ltd., Niigata, Japan). The measurement results were recorded in cm. Anaerobic power: the height of the vertical jump was used to determine anaerobic power. The formula is as follows: P = $\sqrt{4.9} \times$ weight $\times$ $\sqrt{D}$ P = Anaerobic power (kg·m/s), D = Vertical jump distance (m) $\sqrt{4.9}$ = Standard time.

2.3 Training program

A 12-week period is recognized in the literature as an optimal period for endurance and strength development. Studies show that a regular training period of 8–12 weeks provides significant improvements in physical performance [28–30]. Therefore, in this study, a 12-week period was preferred to reliably observe the performance changes of the athletes. In training centers for athletes, close training programs are generally carried out for wrestlers. The participants trained a total of 400 minutes per week, 5 days per week and about 80 minutes per day. Pre-measurements were taken upon arrival at the sports centers and post-measurements were taken after 12 weeks of intensive training. The program included basic exercises such as squats, deadlifts, push-ups and interval running to increase strength and endurance. These exercises were repeated with a certain frequency and duration in a weekly cycle. The load intensity was between 60–90% of each wrestler's own maximum performance. The training sessions consisted of 20 minutes of gymnastic warm-up, 50 minutes of basic technical training and 10 minutes of stretching. There may be deviations from the general program during the training sessions. One of the weaknesses of this study is that it assumes that the same type of program is applied to the wrestlers in each athlete training center.

2.4 Statistical analysis methods

All statistical analyses were conducted using SPSS (Version 22, IBM (International Business Machines Corporation), Armonk, NY, USA). A paired samples t-test was used to compare pre- and post-training measurements, as it is suitable for evaluating mean differences within the same group at two different time points. Effect sizes (Cohen's d) were calculated to assess the practical significance of the observed differences.

3. Results

The average age of the 33 wrestlers is 13.44 years, with a mean height of 157.33 cm and body weight of 51.22 kg. Age and weight show moderate variability, while height is relatively consistent.

It was found that the difference between the values before and after measuring the physiological and motor characteristics of the wrestlers of the Athlete Training Center was significant (Figs. 1,2) ($p < 0.001$).

4. Discussion

In this study, the age was 13.44 years, the height 157.33 cm and the body weight 51.22 kg (Table 1). Bayraktar *et al.* [31] (2012); In determining the anthropometric profile norms of adolescent male wrestlers, a height of 156.42 cm and a body weight of 50.86 kg were found in 13–14-year-old wrestlers. Sadeghi *et al.* [8] (2019) examined the 2-year development of 12.84-year-old wrestlers in a wrestling training center and reported that their height increased from 156.04 cm in 2010 to 162.76 cm in 2012 and their body weight increased from 51.66 kg to 59.67 kg, although the increases were not significant. In this study, age, height and weight values were similar to Bayraktar *et al.* [31] (2012) and Sadeghi *et al.* [8] (2019). However, the increase in weight observed in this study is thought to be due to muscle development during the year. It is thought that there may be a natural increase in muscle mass, especially as children get older, and resistance training may contribute to muscle hypertrophy [32]. The small differences between Bayraktar and Sadeghi's studies may be due to the anthropometric profiles of the study groups or the intensity of the training programs [8, 31].

TABLE 1. Anthropometric characteristics of athlete training center wrestlers.

	n	Mean	S.d.
Age (yr)	33	13.44	6.18
Height length (cm)	33	157.33	1.14
Body weight (kg)	33	51.22	10.66

S.d.: Std deviation.

İbis *et al.* [33] (2017) found that the average long jump in wrestlers from athletic training centers was 167.51 cm in 12-year-olds and 198.90 cm in 15-year-olds. Sadeghi *et al.* [8] (2019); In wrestlers aged 12.84 years in a wrestling training center, the long jump value was 179 cm at the first measurement and 185.60 at the last measurement. The long jump value was 181.94 cm in 14-year-old wrestlers (Bayraktar *et al.* [34], 2012) and 197.95 cm in 15-year-old wrestlers. Aksoy *et al.* [15] (2020) found that the long jump was 160.30 cm in the 12-year-old group and 190.88 cm in the 15-year-old group and the difference between them was significant. Prokopczyk *et al.* [20] (2024) found that the value of standing long jump in wrestlers aged 13–15 years was 184.2 cm in the first measurement and 182.7 cm in the last measurement in a period of one year. Aedma (2013), in a study of wrestlers aged 12–14 years, found the long jump value to be 194.10 cm at the first measurement and 198.00 cm at the measurement after 8 weeks of training [35]. In the study by Yoon (2002), it was found that the average long jump of wrestlers at the wrestling training center increased from 191 cm in the pre-test results to 202 cm in the post-test results and this difference was not significant [36]. In this study, it was found that the long jump scores of the wrestlers in the athlete training centers were significant ($p < 0.001$) at the first and last measurement (Table 2). When evaluated in terms of long jump performance, the results recorded in this study are close to other studies in the

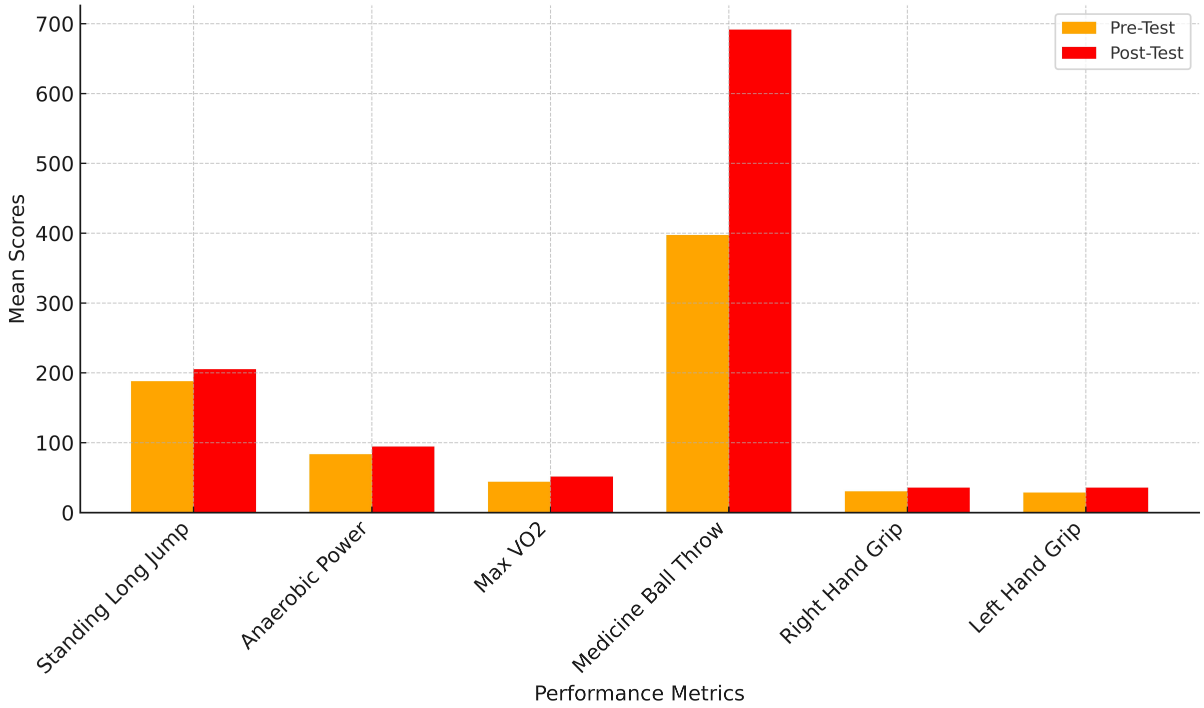

FIGURE 1. Comparison of pre-test and post-test performance metrics in wrestlers. VO2max: Maximal Oxygen Consumption.

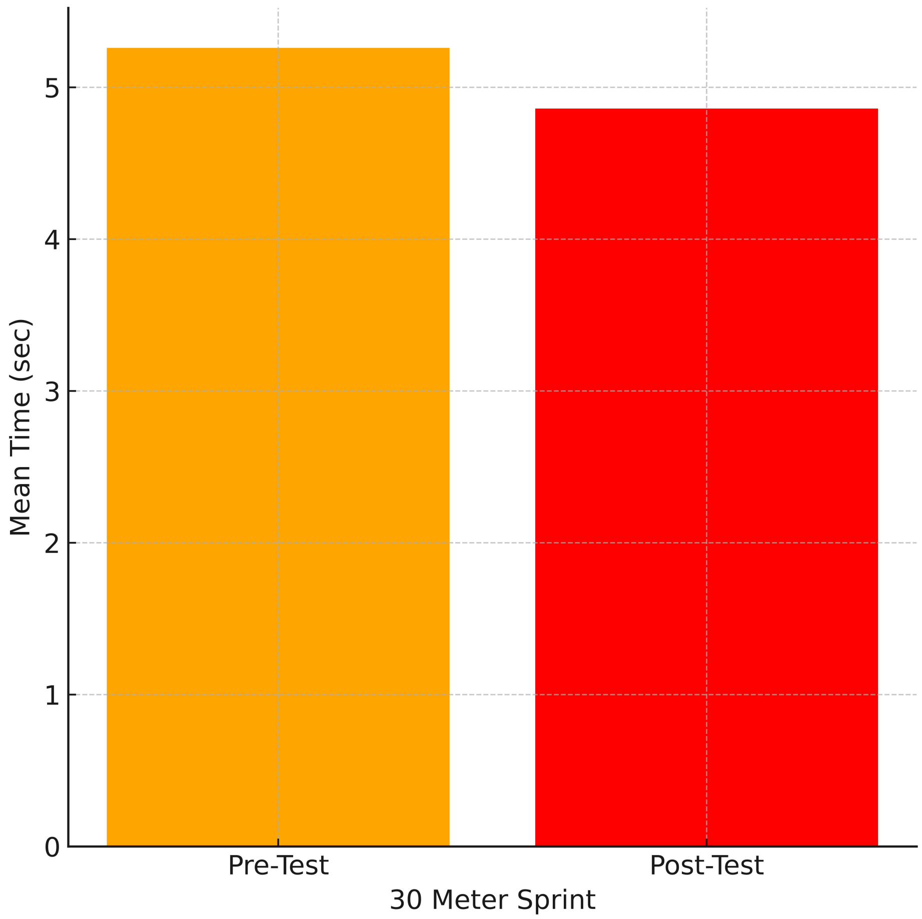

FIGURE 2. Pre-test and post-test comparison for 30 meter sprint times.

TABLE 2. Comparison of pre and post measurement values of physiological and motoric characteristics of athlete training center wrestlers.

	n	Mean	S.d.	*T*	*p*	Cohen's *d*
Standing long jump (cm)						
Pre-test	33	188.23	18.15	−6.32	<0.001**	0.884
Post-test	33	205.28	20.33			
Thirty meter sprint (s)						
Pre-test	33	5.26	0.32	−4.60	<0.001**	0.701
Post-test	33	4.86	0.74			
Anaerobic power (kg·m/s)						
Pre-test	33	83.63	16.42	−5.60	<0.001**	0.711
Post-test	33	94.45	13.89			
VO2max (mL/kg/min)						
Pre-test	33	44.05	4.81	−20.81	<0.001**	1.664
Post-test	33	51.45	4.05			
Throwing medicine ball (cm)						
Pre-test	33	397.54	9.98	−19.94	<0.001**	>2.00
Post-test	33	691.65	9.83			
Right hand grip strength (kg)						
Pre-test	33	30.45	1.74	−3.52	<0.001**	>2.00
Post-test	33	35.77	1.79			
Left hand grip strength (kg)						
Pre-test	33	28.58	1.78	−3.52	<0.001**	>2.00
Post-test	33	35.70	1.75			
Sit lie flexibility (cm)						
Pre-test	33	25.24	2.32	−6.22	<0.001**	0.978
Post-test	33	27.49	2.28			
Number of sit-ups (repetitions)						
Pre-test	33	28.38	3.70	−6.79	<0.001**	1.664
Post-test	33	34.13	3.19			

***$p < 0.001$. S.d.: Std deviation; VO2max: Maximal Oxygen Consumption.*

literature, but are inconsistent with the studies of Yoon (2002) and Aksoy *et al.* [15] (2020). These differences are thought to be related to the age groups of the athletes participating in the study, the duration and content of the training programs. For example, it can be assumed that the athletes in this study benefited from more specific training programs to increase leg muscle strength. In this context, it has been evaluated that the improvement in long jump performance may occur as a direct result of strength training [37].

The values for the 30-meter run of wrestlers from athlete training centers were found to be 5.20 s in the 12-year-old age group and 4.73 s in the 15-year-old age group [33]. Yoon (2002) found that the average 30-meter sprint of the wrestlers was 4.81 s in the pre-test results and 5.24 seconds in the post-test results and this difference was significant [36]. Prokopczyk *et al.* [20] (2024) found that the 30-meter sprint value of wrestlers aged 13–15 years was 4.98 s in the first measurement and 4.97 s in the last measurement in one year. The value for the 30-meter sprint was found to be 4.94 s in 14-year-old wrestlers and 4.76 cm in 15-year-old wrestlers [31, 34]. In their study, Podrigalo *et al.* [38] (2015) found no significant difference in the 30-meter sprint parameters of 15–17-year-old wrestlers. Çağlar *et al.* [39] (2024) found that 10 weeks of explosive strength training in adolescents in the 16–17 age group significantly improved the athletes' 30-meter sprint times [39]. In this study, the value for the 30-meter sprint was 5.26 s before the test and 4.86 s after the test. There is a significant difference between the pre-test and post-test 30-meter sprint at $p < 0.001$ (Table 2). In the analysis for the 30-meter run time, it was determined that the improvement observed in this study was consistent with the results obtained by Çağlar *et al.* [39] (2024), but contradicted with the studies of Prokopczyk *et al.* [20] (2024) and Podrigalo *et al.* [38] (2015). This may be due to individual differences in muscle development and explosive strength levels of the athletes or the content of the training programs. Especially explosive strength training is known to contribute to sprint performance by promoting muscle mass increase [40].

When examining the body profiles of wrestlers from athletic training centers, anaerobic power of 46.54 kg·m/s was found in 12-year-olds and 71.39 kg·m/s in 15-year-olds [33]. Bayraktar *et al*. [34] (2012) found an anaerobic power value of 73.63 kg·m/s in a study of 15-year-old wrestlers. In the study by Aksoy *et al*. [15] (2020), the anaerobic power value was 41.96 kg·m/s for the 12-year-old age group and 70.72 kg·m/s for the 15-year-old age group and this difference was found to be significant. In the study by Yoon (2002), the anaerobic power of the wrestlers was found as 86.09 kg·m/s before the test and 96.91 kg·m/s after the test and it was found that there was no significant difference [36]. Kianzadeh *et al*. [4] (2022) found anaerobic power between 95.60 kg·m/s and 107.79 kg·m/s in 12–13-year-old Greco-Roman wrestlers. In this study, anaerobic power values of 83.33 kg·m/s were found in the pre-test and 94.23 kg·m/s in the post-test. In the study, the anaerobic power values differed significantly between the pre-test and the post-test ($p < 0.001$) (Table 2). The increase in anaerobic power observed in our study is similar to the increases reported in the studies of Yoon (2002) and Kianzadeh (2022). This increase in anaerobic power is thought to be related to the resistance training and sprint exercises. These exercises, which target the anaerobic energy system, improve muscle response to short-term high energy demand [41].

It has been reported that active children can show a significant improvement in VO2max values [42]. While ATP (Adenosine Triphosphate) is produced at a very high rate during explosive throws or lifting, aerobic pathways are utilized during pauses and/or between rounds to sustain effort and accelerate the recovery process [2]. Yoon (2002) reported that in the pre-test results of wrestlers, VO2max was 44.70 mL/kg/min in the pre-test results and 51.98 mL/kg/min in the post-test results, and this difference was found to be significant [36]. In this study, the VO2max values were 44.05 mL/kg/min at the first measurement and 51.45 mL/kg/min at the post-test results. There was a significant difference between the first and last measurement of VO2max values were significantly different ($p < 0.001$) (Table 2). When evaluated in terms of VO2max, the improvement in aerobic capacity reported in the literature was also observed in this study [36]. This indicates that the VO2max capacity of the athletes increased and their aerobic system strengthened. It is known that high-intensity interval exercises, especially with increasing age, contribute to the development of VO2max [40].

Sadeghi *et al*. [8] (2019) reported that the throwing distance of the medicine ball in wrestlers at the wrestling training center was 583.60 cm in 2010 and 680.00 cm in 2012 and this change was not significant according to year. Prokopczyk *et al.* [20] (2024) found that the throwing distance of the medicine ball in wrestlers in the 13–15 age group was 554 cm in the first measurement and 612 cm in the last measurement, over a period of one year. The values for throwing the medicine ball by wrestlers in training centers for athletes were 465 cm in the 12-year-old group and 703 cm in the 15-year-old group [33]. Bayraktar *et al*. [31] (2012) found in a study that the throwing distance of the medicine ball in 15-year-old wrestlers was 729 cm. Aksoy *et al.* [15] (2023) reported that the throwing distance of the medicine ball increased to 503.94 cm in the 12-year-old group and 673.18 cm in the 15-year-old group and this difference was significant. Yoon (2002) found that the average throwing distance of the medicine ball in the wrestlers was 413 cm before the test and 703 cm after the test and this difference was not significant [36]. In this study, the throwing distance of the medicine ball was 397.54 cm in the first test and 691.65 cm in the last test. In our study, the values for the throwing distance of the medicine ball were found to be significantly different between the first and the last measurement ($p < 0.001$) (Table 2). Improvements were recorded in the medicine ball throwing results, which were consistent with the values reported in the literature. This improvement may be due to the training aimed at increasing the upper body strength of the athletes. In the literature, it is known that training that increases the strength of the upper body muscles has a positive effect on throwing performance [43]. In this context, the effects of the pulling and pushing movements applied during the study, especially on the shoulder and chest muscles, may have contributed to this improvement.

Aedma (2013), in a study of wrestlers aged 12–14 years, found that hand grip strength values were 35.15 kg in the right hand and 35.40 kg in the left hand when first measured, while they were 38.90 kg in the right hand and 38.45 kg in the left hand when measured after 8 weeks of training [35]. The hand grip strengths of wrestlers in athlete training centers were found to be 23.33 kg for the right hand and 22.60 kg for the left hand in 12-year-olds, and 37.04 kg for the right hand and 36.24 kg for the left hand in 15-year-olds [33]. Prokopczyk *et al*. [20] (2024) found a hand grip strength of 26.1 kg at the first measurement and 34.8 kg at the last measurement over a one-year period in wrestlers aged 13–15 years. In a study of 14-year-old wrestlers, Bayraktar *et al*. [34] (2012) found a grip strength of 32.65–32.47 kg in the right and left hand. In another study, Bayraktar *et al.* [31] (2012) found a grip strength of 37.98–37.58 kg in the right and left hand of 15-year-old wrestlers. Aksoy *et al.* [15] (2020) found that the hand grip strength of the wrestlers in their study in the 12-year-old age group was 21.51 kg for the right hand and 21.56 kg for the left hand, while the right hand was 34.80 kg and the left hand was 34.82 kg in the 15-year-old age group and found that the difference was significant. In this study, the right hand grip strength was found to be 30.45 kg in the pre-test and 35.77 kg in the post-test, while the left hand grip strength was 28.58 kg in the pre-test and 35.70 kg in the post-test. The wrestlers' grip strength increased significantly during the one-year training period ($p < 0.001$) (Table 2). While the grip strength of the left hand was lower than that of the right hand in the first measurements, it was similar in the last measurements. In the hand grip strength assessment, a significant increase in hand strength was observed throughout the study. This increase can be considered as a natural age-related development as well as a result of the resistance training. Especially the increase in hand muscle strength directly affects performance in sports such as boxing and wrestling [44].

Flexibility is an important factor for success in the sport of wrestling, which is characterized by complex skills. Flexibility has a positive effect on the application of techniques as it allows the wrestler to move far. Flexibility has a positive effect on the application of techniques by enabling the wrestler to move far [3]. Flexibility is the most appropriate training phase for flexibility in boys and girls between the ages of 6 and 10 [45]. İmamoğlu *et al.* [3] (2018) found no significant difference in flexibility scores when examining some characteristics of child wrestlers by weight class. Yoon (2002) found no significant difference in the flexibility scores of wrestlers [36]. Bayraktar *et al.* [31] (2012), when comparing some physical-physiological parameters of sprinters and throwers with wrestlers of the same age group, found a shuttle average of 31.98 in 415 male wrestlers with an average age of 15.11 years. In this study, the number of sit-ups was 28.38 in the pre-test and 34.13 in the post-test. The difference between the number of pre-test and post-test shuttles was significant ($p < 0.001$) (Table 2). In this study, the increase in the number of sit-ups can be interpreted as physical development and the training programs applied for one year promoted the development of trunk strength.

5. Conclusions

It was found that the development of physical and motor characteristics of wrestlers who underwent intensive wrestling training in athletic training centers showed a significant improvement as a function of training and growth. It was also found that the wrestlers in the athlete training centers had lower push strength than pull strength and lower left hand grip strength than right hand grip strength, and this difference disappeared during training and as a function of development. Weak physiological and motor characteristics of child wrestlers undergoing intensive training in athlete training centers should be identified with pre-tests and special training should be conducted to eliminate these weaknesses.

6. Limitations

In this study, it was assumed that all participants followed similar training programs; however, in reality, individuals' additional physical activities outside of training may differ. Furthermore, given the participants' adolescence, the effects of differences in biological development on performance were not controlled for. Furthermore, important factors such as dietary and rest habits were not assessed. The timing of measurements may differ during certain periods of biological development, which may limit the reliability of the results.

AVAILABILITY OF DATA AND MATERIALS

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

AUTHOR CONTRIBUTIONS

EC and ÇÜ—designed the research study. AÇ and YEG—performed the research. BB—provided help and advice on statistical analysis. EC and FÇ—analyzed the data. FÇ, YEG, AÇ, ÇÜ and BB—wrote the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Istanbul Esenyurt University Ethics Committee Commission numbered 2024/07. Informed consent was obtained from all participants and their legal guardians prior to their inclusion in the study. The participants were provided with detailed information about the study's purpose, procedures, potential risks and benefits. It was emphasized that participation was entirely voluntary, and they could withdraw at any time without penalty or loss of benefits. Confidentiality and anonymity of personal data were assured throughout the study in compliance with ethical standards outlined in the Declaration of Helsinki.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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