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ORIGINAL RESEARCH

The effect of technical training on physical parameters of 11-14 years old freestyle wrestlers

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Received: April 13, 2023

Accepted: June 20, 2023

Online Published: June 30, 2023

Abstract

This study aims to determine the physical changes resulting from technical training applied to adolescent wrestlers. Twenty-four male wrestlers volunteered to participate in the study. Participants were randomly divided into two groups: Experimental group (EG, n=14) and Control group (CG, n=14). The EG had a mean age of 12.54±0.82 years, a mean body weight of 48.36±8.23 kg, and a mean height of 156.18±8.58 cm. The CG had a mean age of 13.62±0.33 years, a mean body weight of 47.43±6.65 kg, and a mean height of 158.24±2.26 cm. The EG performed a 12-week technical training specific to freestyle wrestling while the CG continouned their regular wrestling training. Before and after the 12 week training period, skinfold thickness and body circumference measurements were carried out. There were significant differences between pre and post tests in subscapula, biceps, triceps, pectoral, abdominal, suprailiac, abdominal, suprailiac, and tight ($p<0.05$). No significant change was observed in the abdominal, suprailiac skinfold thickness measurements. Subscapula, biceps, triceps, triceps, pectoral, and tight parameters significantly decreased after the 12 week period ($p<0.05$). No significant difference was found between the pre-test and post-test in EG ($p>0.05$). There are significant changes between the pre and post tests in shoulder, chest, chest (inspiration), chest (expiration), abdomen, hip, thigh, forearm tight, calf, arm, arm circumference, forearm circumference measurements ($p<0.05$). After the technical training, all circumference measurements significantly decreased except for one shoulder. There was no significant difference between the pre test and post test in one shoulder and calf circumference measurements ($p>0.05$). However, there were significant changes in the pre test and post test in the CG. The houlder, chest, chest (inspiration), chest (expiration), abdomen, hip, thigh, forearm thigh, arm, arm circumference, and forearm measurement increased after a 12-week standart wrestling training period ($p<0.05$). As a result, this study revealed that a 12 week technical training specific to the wrestling declined skinfold thickness like regular wrestling training. Except single shoulder measurements, body circumference measurements demonstrated significant increases after technical training. These results indicate that technical training in freestyle wrestling positively contributes to the physical development of adolescent wrestlers.

Keywords: Physical parameters, technical training, wrestling.

Introduction

Wrestling significantly contributes to the overall development of both physical and mental capacities, motor skills, and the acquisition of technical and tactical knowledge. Over time, freestyle and armoured wrestling techniques and tactics have undergone significant improvements through physical, theoretical, and psychological studies, reaching high levels today. Wrestling competitions have transformed into

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To Cite: Güven, F. (2023). The effect of technical training on physical parameters of 11-14 years old freestyle wrestlers. *Turk J Kinesiol*, 9(2), 115-124. **DOI:** 10.31459/turkjkin.1282317

captivating performances. The sport's international evolution, facilitated by the systematic organization of annual continental competitions, has gained momentum, capturing the interest of an increasing number of countries. One of the major advantages of wrestling is its inclusion in the Olympic Games program since its inception (Neferu, 2014). Wrestling is a branch that intricately combines defense and offense organization, requiring quick application of techniques and constant struggle and effort while maintaining continuous contact with the opponent (Gümüş, 2005). In wrestling, various physical fitness components such as strength, speed, quickness, flexibility, balance, muscular endurance, and cardiovascular endurance greatly influence performance. Wrestling is a challenging sport that incorporates numerous physical and technical components within a short timeframe (Camic et al., 2009). It is crucial for wrestlers to apply appropriate techniques, as well as resist and counter the techniques employed by their opponents.

Flexibility is also vital for a wrestler's success, as it allows for more comfortable execution of techniques. Wrestlers' strength, speed, flexibility, power, endurance, aerobic and anaerobic capacities significantly impact wrestling performance, and these factors should be maximized through appropriate training programs to ensure success in wrestling (Nikitushkin, 2009). Wrestling is not solely a competition focused on defeating opponents, but also a sport that demands high levels of endurance, anthropometric characteristics, aerobic and anaerobic capacities, respiratory functions, strength, flexibility, speed, quickness, balance, reaction time, and strategy (Yoon, 2002). Wrestling encompasses various weight categories. When determining the weight classes for wrestlers, physical characteristics such as height, body weight, and body fat ratio are taken into consideration. Valuable qualities required for wrestlers, such as flexibility, speed, dexterity, and intelligence, are most apparent during adolescence and youth. However, it is essential to consider the age, anatomical, physiological, and psychological characteristics of adolescents and young adults to avoid causing irreversible physiological and mental trauma to their developing bodies. A significant portion of the bone tissue is covered with cartilage in young men, rendering their skeletal systems more adaptable due to the smaller amounts of calcium and phosphorus salts present in the bone tissue (Zatsiorsky, 2009).

The choice of body composition technique often depends on the purpose for which the data will be used and the specific context. In relation to high-performance sports, assessing body composition is considered a performance or selection criterion (Malina et al., 2011). Body composition is a crucial variable for performance. In weight-sensitive sports, many athletes resort to extreme methods to rapidly reduce mass or maintain low body mass to gain a competitive advantage. Optimal performance is achieved when wrestlers' body mass and shape align with their perceived body ideal (Juricskay & Mezey, 1994). While body fat can serve as a biomechanical counterbalance, adipose tissue also functions as a vital endocrine organ for overall health. Athletes facing increased risk of eating disorders encounter conflicting biomechanical and health requirements (Müller, 2009). Understanding and measuring athletes' body composition have been central to medical research for nearly a century. Although significant progress has been made through landmark studies and the utilization of new and combined analytical methods, ethical and methodological limitations have hindered the establishment of an absolute standard against which assessment methods can be compared in humans. Presently, no gold standard for body fat assessment achieves accuracy better than 1% (Balsevich, 2009).

Determining physical and physiological characteristics and monitoring their development play a vital role in achieving success in wrestling. The athlete's physical characteristics, correct technique, and motivation, as well as the physical-motor characteristics of young wrestlers based on their position during competitions, their ability to move effectively, and their decision-making skills, are crucial factors in determining success in wrestling. Therefore, the identification and development of wrestling-related characteristics can only be accomplished through scientific tests and studies (Mirwald et al., 2002). This study aims to determine the physical changes resulting from technical training applied to adolescent wrestlers.

Methods

Twenty-four male wrestlers volunteered to participate in the study. Participants were randomly divided into two groups: Experimental group (EG, n=14) and Control group (CG, n=14). The EG had a mean age of 12.54±0.82 years, a mean body weight of 48.36±8.23 kg, and a mean height of 156.18±8.58 cm. The CG had a mean age of 13.62±0.33 years, a mean body weight of 47.43±6.65 kg, and a mean height of 158.24±2.26 cm.

The study received approval from the families of the athletes, who were free from any health problems or injuries. Approval from the local Ethics Committee (date: 27.04.2023 and number: 09-2023/124) was obtained before beginning the studies.

The 12-week study involved the application of technical trainings specific to freestyle wrestling for the wrestlers in the EG, while the wrestlers in the CG received general wrestling training. Anthropometric measurements were taken on the first day of the study, subcutaneous fat thickness measurements on the second day, and body circumference measurements on the third day. These measurements were repeated before and after a 12-week technical training of the study.

Anthropometric Measurements

The participants' height was measured in centimeters (cm) using a precise stadiometer (Salus, Milan, Italy) with their heels together and their heads upright. Their weight was determined in kilograms (kg) using a precise weighing scale (Salus, Milan, Italy) (Cochrane et al., 2015).

Subcutaneous Fat Measurements

Subcutaneous fat thickness was measured by pinching the skin and subcutaneous fat between the thumb and index finger, perpendicular to the skin fold, on the right side of the body. The thickness of the subcutaneous adipose tissue and the double layer of the skin were measured in millimeters using a Skinfold caliper (Azzi et al., 2018). The following measurements were taken: Biceps, measured from the widest point of the biceps muscle; triceps, measured from the widest point of the triceps muscle; Subscapula, measured 2 cm below the inferior angle of the scapula; pectoral, measured diagonally from the lateral edge of the m. pectoralis towards the nipple; Abdominal, measured 3 cm lateral to the umbilicus; iliac, measured 1-2 cm above the iliac bone; quadriceps, measured from the widest point of the quadriceps femoris muscle; and calf, measured vertically from the widest part of the m. triceps surae muscle and medially.

Body Circumference Measurements

Circumference measurements were taken using a non-flexible tape measure (Aptamil brand) according to anthropometric measurement protocols. The tape measure was wrapped around the following points for circumference measurements: Single shoulder circumference, measured from the upper part of the deltoid muscle, encircling the shoulder; arm excitation circumference, measured from the midpoint of the humerus, surrounding the biceps and triceps muscles; arm contraction circumference, measured at the midpoint of the humerus, surrounding the biceps and triceps muscles, with the arm in the contracted position; forearm excitation circumference, measured from the widest region of the forearm proximally, in the relaxed position; forearm contraction circumference, measured at the widest part of the forearm, with the forearm in the contracted position; chest circumference, measured at the costasternal circumference; chest inspiratory circumference, measured from the underside of the nipples after a maximal inspiration (breath held at this point); chest expiration circumference, measured from the underside of the nipples after a maximal exhalation; abdominal circumference, measured starting from the umbilicus and encircling at the same horizontal plane; hip circumference, measured from the widest point of the gluteus maximus muscle, wrapping the tape measure horizontally and slightly upwards; thigh circumference, measured by wrapping the tape measure around the midpoint of the thigh with the knee flexed at ninety degrees; and calf circumference, measured by wrapping the tape measure around the widest points of the gastrocnemius and triceps surae muscles (Minetto et al., 2022).

Anthropometric Measurements

Participants' weight was measured in (cm) with a precision (Salus, Milan, Italy) stadiometer with the heels of the feet together and the head upright. Participants' weight was determined in kg with a precision (Salus, Milan, Italy) weighing scale (Cochrane et al., 2015).

Skinfold thickness measurements

Subcutaneous fat thickness was assessed by gently grasping the skin and underlying fat tissue between the thumb and index finger, pulling in the direction of the skin fold on the right side of the body. The measurement involved determining the thickness of both the subcutaneous adipose tissue and the double layer of the skin, and the values were recorded in millimeters. To obtain these measurements, a Skinfold caliper (Azzi et al., 2018) was used. The specific anatomical sites and corresponding measurement techniques were as follows:

Biceps: Measured at the midpoint of the widest region of the biceps muscle.

Triceps: Measured at the midpoint of the widest region of the triceps muscle.

Subscapula: Measured 2 cm below the inferior angle of the scapula.

Pectoral: Measured diagonally from the lateral edge of the m. pectoralis towards the nipple.

Abdominal: Measured 3 cm lateral to the umbilicus.

Iliac: Measured 1-2 cm above the iliac bone.

Quadriceps: Measured at the midpoint of the widest region of the quadriceps femoris muscle.

Calf: Measured vertically from the widest part of the m. triceps surae muscle, medially.

Body circumference measurements

Circumference measurements were taken from the following points with Aptamil brand non-flexible tape measure in accordance with anthropometric measurement protocols. It was measured surrounding the most prominent points of the deltoid muscles and by holding the tape measure over both shoulders.

Single shoulder circumference: It was measured from the upper part of the deltoid muscle and the tape measure was measured from the armpit to encircle the shoulder.

Arm excitation circumference: It was measured from the midpoint of the humerus surrounding the biceps and triceps muscles.

Arm contraction circumference: Measured with a tape measure at the midpoint of the humerus surrounding the biceps and triceps muscles and with the arm in the contracted position.

Forearm excitation circumference: Measured from the widest region of the forearm proximally in the relaxed position.

Table 1. The technical training program for wrestlers aged 11-14.

Monday	After at least 5 minutes of jogging run, at least 10 minutes of warm-up training was performed in the form of stretching and games for the whole muscular system, and the training was ended by applying basic technical training.
Tuesday	Technical training 3 minutes 60%-90% wrestling match training in groups of 3, 1 person in the middle and 2 people to be loaded, 1.30 minutes, 30 seconds rest in every 3 minutes, 3 sets were made. Complementary technical training on the mat and jogging for at least 5 minutes followed by at least 10 minutes of stretching of the whole muscular system.
Wednesday	Station work in pairs Only 1 set (1 minute rest-return time) At least 5 minutes jogging run followed by at least 10 minutes stretching of the whole muscular system. Technical training formats specific to age groups were applied.
Thursday	12 sets of press (alternating partners) 1min 6 sets with 6 sets of unloading 6 sets without unloading known technical tactical work with 60% 90% loading intensity with complementary strength at least 5 minutes jogging run followed by at least 10 minutes stretching of the whole muscular system.
Friday	After at least 5 minutes of jogging run followed by at least 10 minutes of stretching of the whole muscular system, technical training was performed with the game format and ended with stretching.
Saturday	Morning After warming up for 15 minutes, 4 km running and 400-200-100 m runs were done in 2 sets, jogging for at least 5 minutes, followed by at least 10 minutes of stretching of the whole muscular system. Afternoon After at least 5 minutes of jogging run followed by at least 10 minutes of opening and stretching of the whole muscular system, technical tactical work 4x3 minutes complementary weight training was done in the form of up and down. After at least 5 minutes of jogging run, it was finished with at least 10 minutes of whole muscle system stretching.
Sunday	Morning After 15 minutes of warm-up, 4 km running and 400-200-100 m runs, 2 sets of jogging for at least 5 minutes, followed by at least 10 minutes of stretching the whole muscular system. Afternoon After warming up, wrestling technical training was performed for 3 minutes each, 4 sets of matches, gymnastic movements without complementary strength and jogging for at least 5 minutes, followed by at least 10 minutes of stretching and opening of the whole muscular system.

Forearm contraction circumference: Measured at the widest part of the forearm with the forearm in the contracted position.

Chest circumference: It was considered as the costasternal circumference and measured.

Chest inspiratory circumference: Measured from the underside of the nipples after a maximum inspiration (breath held at this point).

Chest expiration circumference: Measured from the underside of the nipples after a maximal exhalation.

Abdominal circumference: The tape measure was measured starting from the umbilicus and encircling to the same point in the horizontal plane.

Hip circumference: It was measured from the widest point of the gluteus maximus muscle by wrapping the tape measure horizontally and slightly upwards.

Thigh circumference: It was measured by wrapping the tape measure around the midpoint of the thigh with ninety degrees knee flexion.

Circumference: It was measured by wrapping the tape measure around the widest points of the gastracinemius and tricepssurae muscles (Minetto et al., 2022).

Technical Training

The EG performed the technical trainings specific to freestyle wrestling during 12 weeks (Table 1).

Data Analyses

The data obtained in the study were presented as mean and standard deviation. Normality analysis was performed using the Shapiro-Wilk test. Unpaired t-test was used for comparing groups, and paired t-test was used for comparing pre-test and post-test measurements. A significance level of 0.05 was considered. Data analysis was conducted using Jasp 0.16.1 software.

Table 2
Demographic charactersitics of participants (Mean ± SD).

Variables	Tests	EG (n=14)	CG (n=14)
Age (year)		12.54 ± 0.82	13.62 ± 0.33
Weight (kg)	Pre-test	48.36 ± 8.23	47.43 ± 6.65
	Post-test	48.55 ± 6.45	47.86 ± 5.44
Height (cm)	Pre-test	156.18 ± 8.58	158.24 ± 2.26
	Post-test	157.08 ± 5.17	159.33 ± 4.51

EG: Experimental Group; CG: Control Group.

Results

Table 2 shows mean age, weight and heigh of the participants in EG and CG. Table 3 shows the results of pre-test and post-test subcutaneous measurements of the wrestlers in the EG. There were significant differences between pre and post tests in subscapula, biceps, triceps, pectoral, abdominal, suprailiac, abdominal, suprailiac, and tight ($p<0.05$). The skinfold thickness measurements in EG significantly decreased after the training.

Table 3
Comparisons of the pre and post tests skinfold thicknesses in EG.

Parameter	Tests	Mean ± SD	t	p
Subscapula	Pre-test	10.09 ± 6.62	3.627	0.005*
	Post-test	9.18 ± 5.87		
Biceps	Pre-test	6.86 ± 4.54	5.164	0.000*
	Post-test	6.13 ± 4.13		
Triceps	Pre-test	10.04 ± 4.17	9.083	0.000*
	Post-test	8.54 ± 3.74		
Pectoral	Pre-test	10.0 ± 6.95	5.367	0.000*
	Post-test	8.68 ± 6.17		
Abdominal	Pre-test	16.5 ± 9.02	6.13	0.000*
	Post-test	14.90 ± 8.29		
Suprailiac	Pre-test	7.90 ± 6.62	3.73	0.004*
	Post-test	7.18 ± 6.10		
Tight	Pre-test	16.36 ± 6.85	5.175	0.000*
	Post-test	15.04 ± 6.09		

** p < 0.05*

Table 4
Comparisons of the pre and post tests skinfold thicknesses in CG.

Parameter	Tests	Mean ± SD	t	p
Subscapula	Pre-test	11.04 ± 4.25	4.343	0.002*
	Post-test	10.55 ± 3.22		
Biceps	Pre-test	5.60 ± 6.04	6.536	0.000*
	Post-test	5.32 ± 7.19		
Triceps	Pre-test	10.24 ± 3.06	7.118	0.000*
	Post-test	9.78 ± 6.28		
Pectoral	Pre-test	10.55 ± 6.95	3.87	0.000*
	Post-test	9.87 ± 5.25		
Abdominal	Pre-test	15.7 ± 6.133	4.55	0.645
	Post-test	16.02 ± 5.44		
Suprailiac	Pre-test	7.02 ± 6.44	4.11	0.214
	Post-test	7.25 ± 6.27		
Tight	Pre-test	16.05 ± 5.54	6.731	0.001*
	Post-test	14.89 ± 5.01		

** p < 0.05*

Table 5
Body circumference measurements in EG.

Variables	Tests	Mean ± SD	t	p
Shoulder	Pre-test	93.72 ± 6.05	-7.416	0.000*
	Post-test	95.72 ± 6.14		
One Shoulder	Pre-test	38.63 ± 2.76	0.636	0.539
	Post-test	36.36 ± 11.11		
Chest	Pre-test	77.27 ± 5.04	-10,456	0.000*
	Post-test	79.09 ± 5.20		
Chest (inspiration)	Pre-test	80.54 ± 4.86	-16.166	0.000*
	Post-test	83.09 ± 5.28		
Chest (expiration)	Pre-test	75.36 ± 5.22	15.588	0.000*
	Post-test	72.90 ± 5.01		
Abdomen	Pre-test	72.72 ± 7.68	11.739	0.000*
	Post-test	70.81 ± 7.66		
Hip	Pre-test	80.09 ± 7.66	-3.184	0.010*
	Post-test	81.18 ± 7.04		
Thigh	Pre-test	43.63 ± 4.49	-11.656	0.000*
	Post-test	44.77 ± 4.25		
Front Arm Thigh	Pre-test	43.90 ± 4.5	-8.714	0.000*
	Post-test	45.13 ± 4.41		
Calf	Pre-test	31.90 ± 2.67	-12.279	0.000*
	Post-test	33.18 ± 2.77		
Arm	Pre-test	23.81 ± 2.56	-9.69	0.000*
	Post-test	25.0 ± 2.55		
Arm Circumference	Pre-test	25.45 ± 2.60	-9.238	0.000*
	Post-test	26.90 ± 2.94		
Front Arm	Pre-test	22.54 ± 1.55	-15.588	0.000*
	Post-test	23.77 ± 1.55		

Table 6
Body circumference measurements in CG.

Parameter	Tests	Mean ± SD	t	p
Shoulder	Pre-test	94.06 ± 5.35	-6.313	0.000*
	Post-test	96.03 ± 5.21		
One Shoulder	Pre-test	38.44 ± 4.11	0.571	0.351
	Post-test	37.23 ± 8.64		
Chest	Pre-test	77.33 ± 5.35	-11,726	0.000*
	Post-test	79.65 ± 5.04		
Chest (inspiration)	Pre-test	81.33 ± 5.03	-15.103	0.040*
	Post-test	83.14 ± 542		
Chest (expiration)	Pre-test	76.15 ± 5.11	14.333	0.000*
	Post-test	74.02 ± 5.23		
Abdomen	Pre-test	72.12 ± 7.49	10.687	0.020*
	Post-test	71.44 ± 7.15		
Hip	Pre-test	80.61 ± 6.54	-3.416	0.010*
	Post-test	82.33 ± 6.63		
Thigh	Pre-test	42.88 ± 4.24	-9.762	0.020*
	Post-test	44.03 ± 4.16		
Front Arm Thigh	Pre-test	43.71 ± 4.33	-9.315	0.010*
	Post-test	44.89 ± 4.61		
Calf	Pre-test	32.24 ± 2.67	0.345	0.217
	Post-test	31.45 ± 2.34		
Arm	Pre-test	23.81 ± 3.14	-10.560	0.000*
	Post-test	24.44 ± 2.27		
Arm Circumference	Pre-test	25.02 ± 2.87	-8.952	0.020*
	Post-test	25.90 ± 2.26		
Front Arm Measurement	Pre-test	22.23 ± 165	-14.319	0.000*
	Post-test	23.44 ± 1.07		

Table 4 shows the results of the pre-post test subcutaneous measurements in the CG. No significant change was observed in the abdominal, suprailiac skinfold thickness measurements. Subscapula, biceps, triceps, triceps, pectoral, and tight parameters significantly decreased after the 12 week period ($p<0.05$).

Table 5 presents the body circumference measurements in EG. When compared the one shoulder measurements in EG, no significant difference was found between the pre-test and post-test ($p>0.05$). There are significant changes between the pre and post tests in shoulder, chest, chest (inspiration), chest (expiration), abdomen, hip, thigh, forearm tight, calf, arm, arm circumference, forearm circumference measurements ($p<0.05$). After the technical training, all circumference measurements significantly decreased except for one shoulder.

Table 6 shows the body circumference measurements before and after the training in CG. Paired t-test results showed that there was no significant difference between the pre test and post test in one shoulder and calf circumference measurements ($p>0.05$). However, there were significant changes in the pre test and post test in the CG. The houlder, chest, chest (inspiration), chest (expiration), abdomen, hip, thigh, forearm thigh, arm, arm circumference, and forearm measurement increased after a 12-week standart wrestling training period ($p<0.05$).

Discussion

The development of technical training and body composition in adolescent wrestlers is crucial for their overall performance and success in the sport. In addition to regular wrestling training, incorporating specific technical training exercises can have a significant impact on the athletes' body composition and ultimately improve their wrestling abilities. This discussion aims to explore the importance of integrating technical training alongside regular wrestling training to enhance body compo-

sition in adolescent wrestlers.

Previous studies have examined similar aspects of adolescent wrestlers, including anthropometric measurements (such as height, weight, skinfolds, and body composition) and motor tests (speed, flexibility, and endurance) for wrestlers aged between 10 and 14 years. These studies have shown a significant relationship between physical characteristics and motor abilities, indicating the impact of physical attributes on performance (Acar & Koca, 2020; Camic et al., 2010; Aksoy et al., 2020a). Furthermore, the training age and type of training have been identified as factors that may influence the outcomes of such studies (Aksoy et al., 2020b). In another study focused on improving the anthropometric and body composition profiles of wrestlers, the relationship between anthropometric variables and physiological, fitness, and technical factors was highlighted. The study emphasized the importance of anthropometric characteristics and body composition in determining an athlete's performance (Cieslinski, 2020b).

The present study evaluated the subcutaneous measurement results of various parameters, including subscapula, biceps, triceps, pectoral, abdominal, suprailiac, and thigh, for the wrestlers of the EG. The results showed a significant changes between the pre-test and post-test measurements ($p<0.05$). However, in the CG, only the parameters of subscapula, biceps, triceps, pectoral, and thigh demonstrated a significant changes, while abdominal and suprailiac subcutaneous measurements did not show a significant change. These findings align with a similar study that reported significant correlations in subcutaneous measurements of various body regions (Addo & Himes, 2010). Furthermore, a study involving 114 adolescent female wrestlers examined body composition variables (such as body mass index, body fat percentage, fat-free mass, and fat-free mass index) and fitness measures (including grip strength, back strength, sit-up, rope climbing, and endurance running tests). The study observed a significant increase in back strength but no changes in height and body mass (Arakawa et al., 2020b).

Regarding the impact of technical training on the wrestlers, the present study found no significant difference in the pre-test and post-test measurements of single shoulder circumference for both the experimental and control groups. However, significant changes were observed in the pre-post test results of other circumference measurements, such as shoulder, chest, chest (inspiration), chest (expiration), abdomen, hip, thigh, forearm, calf, and arm circumferences. These findings indicate that technical training influenced various body measurements, except for the single shoulder circumference.

Another study analyzed changes in body composition and motor characteristics in 19 wrestlers who underwent 8 months of wrestling training. The study evaluated various measurements, including body weight, circumferences of different body parts, regional muscle strength, anaerobic strength, skinfold thickness, and body fat percentage. The results indicated a positive effect of wrestling training on leg strength, biceps, triceps, and abdominal skinfolds (Demirhan, 2020b).

As training methods become more advanced, athletes are expected to deviate from general morphological norms in order to maximize their efficiency (Müller et al., 2006b). Therefore, understanding the morphofunctional characteristics of wrestlers, especially at an early age, and incorporating modern training methods are crucial in the early stages of sports specialization (Stewart & Hannan, 2000). Psychological training is also important for wrestlers to master and effectively use wrestling techniques. Different techniques can provide a competitive advantage, and their effectiveness can be influenced by the physical and psychological characteristics of the wrestlers (Hsi-Po et al., 2020a).

Technical training in wrestling focuses on developing specific skills, techniques, and strategies required in the sport. It involves a combination of drills, repetitions, and practice sessions that aim to improve various aspects of wrestling, such as takedowns, escapes, pins, and transitions. While regular wrestling training primarily focuses on improving overall strength, endurance, and conditioning, technical training places a specific emphasis on refining wrestling-specific skills. By incorporating technical training into their routine, adolescent wrestlers can enhance their technical proficiency, tactical understanding, and decision-making abilities during matches (Hsi-Po et al., 2020b).

One significant benefit of technical training is its impact on body composition. Body composition refers to the proportion of lean mass (muscle, bone) and fat mass in the body. Achieving an optimal body composition is essential for wrestlers as it directly influences their strength, power, speed, and agility. Technical training, with its focus on skill development, often involves dynamic movements, explosive actions,

and bodyweight exercises that contribute to the development of lean muscle mass and reduction of body fat (Demirhan, 2020a). Integrating technical training exercises that target specific muscle groups and movement patterns can lead to improvements in overall body composition. For example, exercises that involve explosive takedowns, quick transitions, and rapid change of directions can enhance muscular power, speed, and agility while simultaneously promoting fat loss. Additionally, techniques that require wrestlers to maintain a low center of gravity, such as stance and motion drills, can engage the lower body muscles, improving leg strength and stability (Aksoy et al., 2020a). Furthermore, technical training can also contribute to improved muscular endurance. Wrestling matches often require sustained effort and repeated exertion of strength over a prolonged period. By incorporating drills that simulate match conditions and involve high-intensity intervals, wrestlers can enhance their muscular endurance and maintain optimal performance throughout a match (Arakawa et al., 2020a).

It is important to note that technical training should be supplemented with proper nutrition and recovery strategies to maximize its impact on body composition. Adequate protein intake is essential to support muscle repair and growth, while a balanced diet with appropriate caloric intake is necessary to fuel training sessions and optimize body composition changes. Sufficient rest and recovery periods allow the body to adapt and respond positively to the training stimulus, ensuring optimal gains in lean muscle mass and reduction in body fat (Cieslinski, 2020a).

In conclusion, incorporating technical training alongside regular wrestling training can significantly contribute to the development of body composition in adolescent wrestlers. The specific exercises and drills involved in technical training help improve muscle strength, power, speed, agility, and endurance while promoting a favorable body composition with increased lean muscle mass and reduced body fat. By implementing a well-rounded training program that encompasses both technical and physical aspects, coaches and athletes can enhance their performance and achieve their full potential in the sport of wrestling (Müller et al., 2006a). As a result, this study revealed that a 12 week technical training specific to the wrestling declined skinfold thickness like regular wrestling training. Except single shoulder measurements, body circumference measurements demonstrated significant increases after technical training. These results indicate that technical training in freestyle wrestling positively contributes to the physical development of adolescent wrestlers. The results are consistent with previous research highlighting the relationship between physical characteristics, training methods, and performance outcomes in adolescent wrestlers. Further studies should continue to explore the long-term effects of technical training on wrestlers and consider additional factors such as psychological training and different wrestling techniques.

Authors' Contribution

Study Design: FG; Data Collection: FG; Statistical Analysis: FG; Manuscript Preparation: FG; Funds Collection: FG.

Ethical Approval

The study was approved by the Karamanoğlu Mehmetbey University Ethic Committee with the decision of the ethics committee dated 27.04.2023 and numbered 09-2023/124. The study was conducted in accordance with the Declaration of Helsinki.

Funding

The author declares that the study received no funding.

Conflict of Interest

The author hereby declares that there was no conflict of interest in conducting this study.

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