

Observation of the effects of 8-week pilates training on performance in 10-12 age group handball players

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Abstract

This study aimed to examine the effect of 8-week pilates training on the performance of handball players in the 10-12 age group. Of the 30 people included in the study, 10 were sedentary, 10 were given only handball training, and 10 were given Pilates training in addition to handball training. Participants' height, weight, waist and hip circumference measurement values, sit-up, push-up, vertical jump, 10-meter run and plank test values were measured. BMI values were also calculated. Descriptive and Anova tests were used in the SPSS 22 package program to analyze the data. As a result of the analyses, it was determined that there was a significant ($p=.003$) difference between the pre-test and post-test average values of the subjects. It turned out that the difference between the mean waist circumference values of the study groups was significant ($p = .029$). It was determined that there was a significant ($p=.006$) difference between the mean hip circumference values of the groups. It was determined that there was a significant ($p=.000$) difference between the pre-test and post-test shuttle values. Again, it was determined that both the push-up pre-test - post-test value difference ($p = .000$) and the vertical jump pre-test - post-test value difference ($p = .000$) of the groups were significant. Finally, it was determined that both the difference in BMI values between the groups ($p = .024$) and the difference between the participants' pre-test and post-test values ($p = .028$) were significant. The fact that Pilates exercises are not too high intensity, the correct breathing technique has been developed, and the posture is more solid and dynamic make pilates preferred. When exercises specific to the core area are performed, the exercises can become more attractive thanks to the variety and richness of Pilates movements.

Keywords: Handball, pilates, core

10-12 Yaş grubu hentbolcularda 8 haftalık pilates antrenmanının performansa etkisinin gözlemlenmesi

Özet

Bu çalışmayla, 10-12 yaş grubu hentbolculara uygulanan 8 haftalık pilates antrenmanının performansa etkisinin incelenmesi amaçlandı. Araştırmaya dahil edilen 30 kişiden 10'u sedanter, 10'una sadece hentbol antrenmanı verilmiş, 10'una ise hentbol antrenmanına ek olarak Pilates antrenmanı verilmiştir. Katılımcıların boy, kilo, bel ve kalça çevresi ölçüm değerleri, mekik, şınav, dikey sıçrama 10 metre koşu ve plank testi değerleri ölçüldü. Ayrıca BKİ değerleri de hesaplandı. Verilerin analizinde SPSS 22 paket programında betimsel ve Anova testleri kullanılmıştır. Yapılan analizler sonucunda, denekler ait ön test – son test ortalama değerleri arasında anlamlı ($p=.003$) farklılığın olduğu belirlendi. Çalışma gruplarına ait bel çevresi ortalama değerleri arasındaki farkın anlamlı ($p= .029$) olduğu ortaya çıktı. Grupların kalça çevresi ortalama değerleri arasında anlamlı ($p=.006$) düzeyde farklılık olduğu tespit edildi. Mekik değerleri ön test- son test değerleri arasında anlamlı ($p=.000$) bir farklılığın olduğu belirlendi. Yine gruplara ait hem şınav ön test – son test değerleri farkının ($p=.000$) hem de dikey sıçrama ön test – son test değerleri farkının ($p=.000$) anlamlı olduğu belirlendi. Pilates egzersizlerinin çok yüksek yoğunlukta olmaması, doğru nefes tekniğinin geliştirilmiş olması, duruşun daha sağlam ve dinamik olması pilatesin tercih edilmesine neden olmaktadır. Core bölgesine özel egzersizler yapıldığında Pilates hareketlerinin çeşitliliği ve zenginliği sayesinde egzersizler daha çekici hale gelebilmektedir.

Anahtar Kelimeler: Handball, pilates, core

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INTRODUCTION

Pilates originated in Germany about a century ago. Later, towards the 1920s, it started to be used effectively in America. Over time, it started to be used as a more popular exercise in various parts of the world (Muscolino & Cipriani, 2004; Anderson & Spector, 2009).

Pilates was originally created to rehabilitate and treat, to make the body more flexible, to ensure good general health, to strengthen the muscles in the core area and to improve posture (Choi et al., 2019).

It includes activities of lower intensity than Pilates, dance and different aerobic exercises. Fluent movement rhythm, centering, sharpness of movement and use of breathing, concentration during the execution of movements is very essential for a healthy body structure (Solomon, 2003; Robinson & Hunter, 2003).

The core is referred to as the power zone or center point. This central region is responsible for many movements. The core region carries out activities such as the provision of power and its development, ensuring balance and continuity of coordination. The core region is responsible for transferring the generated power to the whole body, creating strength and improving posture (Fig, 2005).

The core area developed as a result of training is necessary for minimizing injuries and for maximum performance. Sports activities carried out aim to keep the athletes at the maximum level physically. When proper work is done in the core area, the risk of injury will be reduced and technical skills will be made easily (McGill, 2010).

Handball is a team game played in two teams of 7 players on the field. It is a branch where two teams are in a high struggle, physical strength and speed are at the forefront. Each team has a total of 16 players. When the match starts, 7 of the 16 players are on the field as principals and the remaining 9 substitutes take their places on the reserve bench. The team holding the ball tries to score a goal by taking advantage of the opposing team's defensive weaknesses by making a pass. In the game of handball, the ball is played by hand. Goalkeepers can use all parts of their body without any restrictions while defending the goal. Players holding the ball with their hands can take a maximum of 3 steps. Also, players cannot hold the ball for more than 3 seconds. The team that scores the most goals against the opposing goal wins the match (Pirselimoğlu et al., 2019).

In Pilates exercises, the muscles that are mainly emphasized are the core (central column). It is called the region of the body and is considered as the "power house of the body". Core region; upper wall of the diaphragm, lateral walls of the transversus abdominis, It is thought that the back wall is formed by the multifidius and the floor is formed by the pelvic floor muscles. It is likened to a cylinder (Şimşek & Katırcı, 2011). Walkers, runners, skiers, divers, golfers, baseball players, gymnasts, boxers, almost all athlete groups benefit from pilates. Many professional football teams benefit from free gymnastics and pilates mat exercises to stretch and strengthen their muscles, increase their endurance and have balanced bodies. Pilates mat the exercises also teach the visualization technique that athletes often use to improve their performance. Martha Graham and George Balanchine, dance pioneers, benefited from the muscle strengthening, lengthening and stretching effects of free gymnastics and pilates mat training. Today's first generation pilates master Her instructors, Romana Kryzanowska, Eve Gentry, Kath Grant, Ron Fletcher and Carola Trier, are among the dancers who once resorted to pilates mat exercises to heal (Müftüoğlu, 2015).

MATERIAL AND METHOD

Research group (Universe sample)

The research group consisted of a total of 30 men, 10 sedentary and 20 handball players, who volunteered to participate in the study playing handball in the province of Van. In the study, a training program with 8 weeks of Pilates was applied to the athletes. Of the 30 individuals included in the study, 10 were sedentary, 10 of them were given only handball training and 10 of them were given Pilates training in addition to handball training.

Data collection tools

Handball players were trained 2 days a week for 2 hours in total. Before the Handball Training, general warm-up was done and then branch-specific exercises were included. On the day of the handball training, the group of 10 people selected as the study group was given Pilates training in addition to the handball training (Table 1) Immediately after the end of the handball training, the subjects were given 20 minutes to rest in order to do Pilates exercises. As a pre-test-post-test before and after the 8-week training; Height, Weight, BMI Measurements, Waist Circumference Measurements, Hip Circumference Measurements, Sit-Up Test, Push-up Test, Vertical Jump Test, 10 M Running Test and Plank Test measurements were taken.

Analysis of data

For the analysis of the data, descriptive and Anova tests were used in the SPSS 22 package program.

Height, weight, body mass index

Measurements: The heights of the subjects participating in the study were measured with a Holtain brand stadiometer with a sensitivity of ± 1 mm. Height of the subjects; It was measured in the anatomical posture, bare feet, heels together, while the subject was holding his breath, after the head was positioned in the frontal plane, with the head plate touching the vertex point, and the values were recorded in cm (Sever, 2013). The weight measurements of the subjects were made with a scale with ± 100 g precision.

Measurement; It was taken in kg in bare feet and anatomical posture while the subjects were only wearing shorts. Body mass indexes (BMI) were obtained by dividing the weight in kilograms by the square of the height in meters.

Waist Circumference: The point where the waist circumference is seen the thinnest (approximately anterior to the abdomen where the height of the abdomen is highest) was measured with an anthropometric tape after the subject had a normal expiration 2 – 2.5 cm above the navel and recorded in centimeters (Heyward & Wagner, 2004).

Hip Circumference: Measured from the point of maximum posterior hip width over the gluteal fold with an anthropometric tape and recorded in centimeters (Heyward & Wagner, 2004).

Sit-up Test: The abdominal endurance of the subjects was measured with the YMCA 1-minute sit-up test (Myers et al., 1973). Subjects were placed on their backs on the mat with their knees bent at approximately 90 degrees, hands tied behind the head. With the sign, the left knee was touched with the right elbow and returned to the starting position, then the right knee was touched with the left elbow. Each touch was counted as one point, and correct repetitions in 1 minute were recorded as the maximum number of sit-ups (Henderson & Beryy, 2017). **Push-up Test:** In the standard push-up position (hands pointing forward, at shoulder level, back straight, heels in a pivotal position), a push-up is completed when the chest touches the mat and the elbows come back to the straight Position (ACSM, 2013). The

number of repetitions that the subjects achieved by maintaining the correct posture without resting was recorded as the maximum push-up score.

Vertical Jump Test: Athlete standing on two legs near a wall, stretching his arm with fingers pressed into chalk powder, making a mark on the wall. At this point, attention was paid that the feet of the athlete did not rise from the ground and that the arm length was full. Standing in the same position, he leaps with all his might and leaves his mark on the highest point he can touch. The distance between these 2 points gives the vertical jump height of the athlete (Sipal, 1989).

10 M Running Test: The speed skills of the subjects were evaluated with the 10 meters short running test. Each athlete repeated each test twice, and the best result was evaluated. The 10m sprint test was determined in seconds when the athletes exit the photocell at a distance of 1 meter from the photocell while standing and complete the distance at maximum speed at a distance of 10m.

Plank Test: It is one of the basic static tests used to measure the strength of the trunk. The subjects were asked to lie face down, with their forearms and elbows bilaterally shoulder-width apart and on their toes, to raise the pelvis, to form a straight line with the neck, shoulders, back, hips and legs parallel to the ground, and to maintain this posture (Plank position). With the start of the period, the time until the subject gets tired and/or breaks his posture was recorded in seconds.

Table 1. The content of the pilates training program applied to the study group.

Training Period	1.Week	2. Week	3. Week	4.Week	5.Week	6.Week	7.Week	8.Week
Pilates Training Time(min)	35	35	35	40	40	40	45	45
Repetition	6	6	6	8	8	8	10	10
Training Frequency(Week/Day)	2	2	2	2	2	2	2	2

Table 2. The content of the handball training program applied to the study group.

Training Period	1.Week	2. Week	3. Week	4.Week	5.Week	6.Week	7.Week	8.Week
Handball Training Time(min)	60	60	60	60	60	60	60	60
Training Frequency (Week/Day)	2	2	2	2	2	2	2	2

FINDINGS AND DISCUSSION

Tablo 3. ANOVA results of plank pretest-posttest mean values

Variance Groups	Square Sum	Stand. Devia.	Square Average	F	P
Among Groups	8616,016	29			
Group (handball/handball core/ sedentary)	1570,268	1	785,134	3,009	,066
Failure Rate	7045,748	27	260,954		
Among Subjects	247,858	30			
Measurement (pre-test / post-test)	71,068	1	71,068	10,912	,003
Group*Measurement	,947	2	,474	,073	,930
Failure Rate	175,843	27	6,513		
Total	8.863,874	59			

When table 3 was examined, it was seen that there was no significant ($f=3.009$, $p=0.066$) difference between the mean plank values of the groups. On the other hand, there was a significant ($f = 10,912$; $p=0.003$) difference between the mean values of the plank pre-test and post-test within the subjects.

Tablo 4. ANOVA results of the participants' waist circumference pretest-posttest mean values

Variance Groups	Square Sum	Stand. Devia.	Square Average	F	P
Among Groups	1.645,683	29			
Group (handball/handball core/ sedentary)	378,433	2	189,217	4,031	,029
Failure Rate	1267,250	27	46,935		
Among Subjects	6.052,45	30			
Measurement (pre-test / post-test)	0,417	1	,417	1,860	,184
Group*Measurement	2,033	2	1,017	4,537	,020
Failure Rate	6,050	27	,224		
Total	1.651.735,45	59			

Considering Table 4, it was determined that there was a significant difference between the groups in the average waist circumference values of the participants at the level of $p = 0.029$ ($F = 4.031$). At the same time, it was observed that there was a significant difference ($F = 4.537$; $p = 0.020$) between the pretest and posttest values in both groups. On the contrary, it was found that the average waist circumference values within the subjects did not differ significantly ($F = 1.860$; $p = 0.184$) in terms of pre-test and post-test.

Table 5. ANOVA results of participants' hip circumference pretest-posttest mean values

Variance Groups	Square Sum	Stand. Devia.	Square Average	F	P
Among Groups	2,518,483	29			
Group (handball/handball core/sedentary)	801,233	2	400,617	6,299	,006
Failure Rate	1717,250	27	63,602		
Among Subjects	2,5	30			
Measurement (pre-test / post-test)	,017	1	,017	,220	,643
Group*Measurement	,433	2	,217	2,854	,075
Failure Rate	2,050	27	,076		
Total	25184855	59			

Considering Table 5, it can be seen that there was a difference at the level of $p=0.006$ ($F=6.299$) between the mean hip circumference values of the groups included in the study, but it was found that there was no significant difference between the mean values of the pre-test and post-test measurements performed within the group ($F=0.220$; $p=0.643$).

Table 6. ANOVA results of participants' sit-up pre-test – post-test mean values

Variance Groups	Square Sum	Stand. Devia.	Square Average	F	P
Among Groups	1970333	29			
Group (handball/handball core/sedentary)	35,733	2	17,867	,249	,781
Failure Rate	1934,600	27	71,652		
Among Subjects	93000	30			
Measurement (pre-test / post-test)	38,400	1	38,400	32,604	,000
Group*Measurement	22,800	2	11,400	9,679	,001
Failure Rate	31,800	27	1,178		
Total	2063333	59			

When the sit-up values of the participants in table 6 are examined in terms of in-group and between-groups, there is no significant difference between the groups ($f=0.249$, $p=0.781$). it was determined that there was a significant ($f=32,604$; $p=0.000$) difference between the pre-test and post-test values within the subjects.

Tablo 7. ANOVA results of participants' push-up pretest-posttest mean values

Variance Groups	Square Sum	Stand. Devia.	Square Average	F	P
Among Groups	2292483	29			
Group (handball/handball core/ sedentary)	18,633	2	9,317	,111	,896
Failure Rate	2273,850	27	84,217		
Among Subjects	58500	30			
Measurement (pre-test / post-test)	28,017	1	28,017	32,258	,000
Group*Measurement	7,033	2	3,517	4,049	,029
Failure Rate	23,450	27	,869		
Total	2350983	59			

When table 7 was examined, it was determined that the mean values of push-ups did not differ significantly between the groups ($f= 0.111$; $p=0.896$),but there was a significant ($f=32,258$; $p=0.000$) difference between the pretest and posttest values within the subjects.

Tablo 8. ANOVA results of the participants' vertical jump pretest-posttest mean values

Variance Groups	Square Sum	Stand. Devia.	Square Average	F	P
Among Groups	1,028,333	29			
Group (handball/handball core/ sedentary)	21,033	2	10,517	,282	,757
Failure Rate	1007,300	27	37,307	1007,300	27
Among Subjects	89000	30			
Measurement (pre-test / post-test)	48,600	1	48,600	47,716	,000
Group*Measurement	12,900	2	6,450	6,333	,006
Failure Rate	27,500	27	1,019		
Total	1117333	59			

When table 8 was examined in terms of vertical jump values of the participants, it was determined that these values did not show any significance between the groups ($f=0.282$; $p=0.757$). it was found that the same values differed significantly ($f= 47,716$; $p=0.000$) within the subjects in the context of pretest-posttest.

Tablo 9. ANOVA results of participants' 10 m sprint pre-test – post-test mean values

Variance Groups	Square Sum	Stand. Devia.	Square Average	F	P
Among Groups	2004,005				
Group (handball/handball core/ sedentary)	,005	2	,002	,033	,968
Failure Rate	2,004	27	,074		
Among Subjects	0,288	30			
Measurement (pre-test / post-test)	,066	1	,066	8,822	,066
Group*Measurement	,020	2	,010	1,339	,279
Failure Rate	,202	27	,007		
Total	2.004,293	59			

When table 9 was examined, it was determined that the 10 m sprint values of the participants did not differ significantly between the groups ($f=0.033$; $p=0.968$), however, there was no significant difference ($f=8.822$; $p=0.066$) in terms of pre-test and post-test values within the subjects.

Tablo 10. ANOVA results of participants' BMI pre-test - post-test values

Variance Groups	Square Sum	Stand. Devia.	Square Average	F	P
Among Groups	353,237	29			
Group (handball/handball core/ sedentary)	85,687	2	42,843	4,324	,024
Failure Rate	267,550	27	9,909		
Among Subjects	2,834	30			
Measurement (pre-test / post-test)	,468	1	,468	5,415	,028
Group*Measurement	,032	2	,016	,187	,831
Failure Rate	2,334	27	,086		
Total	356,071	59			

Considering table 10, it was determined that the differences in bmi values between the groups were significant($f=4.324$; $p=0.024$), while these values differed significantly between the pre-test and post-test ($f=5.415$; $p= 0.028$) within the subjects.

DISCUSSION

In this study, it was investigated whether Pilates exercises have an effect on the performance of the handball players on the parameters of "Height, Weight, BMI Measurements, Waist Circumference Measurements, Hip Circumference Measurements, Sit-up Test, Push-up Test, Vertical Jump Test, 10 M Running Test and Plank Test", and to what extent if any. In this study, there was no significant difference between the mean plank values of the groups, while there was a significant ($p=0.003$) difference between the plank pre-test and post-test mean values within the subjects. When the literature is examined, there are studies with similar results to the study. In a study examining the Effects of Pilates Exercises on Core Stabilization and Balance Parameters in Elite Basketball Players, it was stated that there was a significant relationship between the plank test and some parameters. While there was a significant difference in the mean waist circumference values of the participants between the groups ($p=0.029$), it was found that the mean waist circumference values within the subjects did not differ significantly in terms of pretest and posttest ($p=0.184$). It was determined that there was a difference at the level of $p=0.006$ between the mean hip circumference values of the groups, however, there was no significant ($p=0.643$)

difference between the mean values of the pretest and posttest measurements performed within the group.

When the literature is examined, it is seen that there are similar and different results to the study. As a result of Pilates exercises performed for one hour, once a week for 6 months, in middle-aged women, no significant difference was found in the values of waist and hip circumferences. It examined the effects of eight weeks of cyclic exercise and Pilates exercises on some physical characteristics and blood lipids in women. In this study, a significant difference was found in hip values in the Pilates group. In a study examining the effects of Pilates exercises on core stabilization and balance parameters in elite basketball players, no significant difference was found in the values between Waist and Hip ratio. Examined the effect of Pilates on body composition in women. In the study, a significant difference was found between hip circumference and waist circumference between pre-test and post-test values. When the sit-up values of the participants were examined at the in-group and between-group levels, it was found that there was no significant ($p=0.781$) difference between the groups, but there was a significant ($p=0.000$) difference between the pre-test and post-test values within the subjects. When the literature is examined, it is seen that there are similar and different results to the study. The effects of 12-week Pilates mat exercise on some biomotor properties and technical performance of 14–15-year-old female volleyball students were investigated. In the study, no significant difference was found between the pre-test and post-test values of the 30-second sit-up test in the control group. A significant difference was found between the pre-test and post-test in the sit-up study performed in the experimental group. The effect of Pilates exercises using a mat on the efficiency of the transversus abdominus and internal oblique muscles was investigated. Thirty-four healthy individuals were exercised twice a week for 8 weeks. As a result of the exercises, it was observed that it increased the transversus abdominus activity. The effects of mat and reformer Pilates exercises on some physical and functional parameters in middle-aged sedentary women were investigated. In the study, it was stated that there was a significant difference in the results of the sit-up test between the exercise groups and the control groups. As a result of the analysis, it was determined that the mean values of the push-ups did not differ significantly between the groups ($p=0.896$), but there was a significant ($p=0.000$) difference between the pre-test and post-test values within the subjects. When the literature was examined, similar and different results were obtained in the current study.

There was no significant difference in the values between the first measurement of the push-up test, which is one of the muscle endurance tests, in the study titled "Investigation of the effects of mat Pilates and instrumental Pilates on some physical fitness parameters in women, posture, joint mobility and functional movement analysis". In the last measurement, a significant difference between the values was obtained.

Considering the vertical jump values of the participants, it was determined that these values did not show significance between the groups ($p=0.757$). It was found that the same values differed significantly ($p=0.000$) within the subjects in the context of pretest-posttest.

In his study titled "The Effects of Pilates Exercises on Core Stabilization and Balance Parameters in Elite Basketball Players", he stated that there was a significant difference in the vertical jump parameter. The effect of Pilates mat exercises on some parameters in female volleyball players aged 14-15 was investigated. The experimental group was given Pilates exercises for 12 weeks, two hours a week. No significant difference was found in the vertical jump parameter in the control group. In the experimental group, a significant difference was found between the pre-test and post-test values of the vertical jump parameter. The effects of 12-week Pilates mat exercise on some biomotor features and technical performance of 14–15-year-old female volleyball students were investigated. Although there was no significant difference between the pre-test and post-test values in the vertical jump parameter in the control group, it was stated that there was a significant difference between the pre-test and post-test in the experimental group.

It was determined that the 10 m sprint values of the participants did not differ significantly between the groups ($p=0.968$), and there was no significant difference ($p=0.066$) in terms of pre-test and post-test values within the subjects. The effects of Pilates exercises applied to university students on some motor features and body composition were investigated. A significant difference was found between the pre-test and post-test results of the 30-meter speed parameter of the subjects in the exercise group. There was no difference in the pre-test and post-test results of the control group. As a result of the analyzes performed,

it was determined that the differences in BMI values between the groups were significant ($p=0.024$), while these values differed significantly ($p= 0.028$) in terms of pre-test and post-test within the subjects. The effect of 8-week Pilates exercises in middle-aged women was examined. As a result of the study, it was stated that there was a significant

difference between Pilates and mat exercises and the pre-test and post-test body weight values. Examined the effects of walking and Pilates on body composition in middle-aged women. As a result of the study, a significant difference was found in the body mass index of the walking and Pilates group.

CONCLUSION AND RECOMMENDATIONS

• According to the results of the research, it has been determined that Pilates exercises can be effective in increasing the performance of handball athletes in terms of motoric and technical characteristics. As a result, when both this study and other studies are examined, it is reported that Pilates exercises should be included in training programs in order to achieve high performance in handball and other sports branches.

• Having Pilates-specific exercises in handball training will both enrich the training program and contribute to the physical performance of the players.

• The fact that the pilates exercises are not very high intensity, the correct breathing technique is developed and the posture is more robust and dynamic makes pilates preferred. When exercises specific to the core region are performed, the exercises can become more attractive thanks to the variety and richness of Pilates' movements.

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