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THE EFFECTIVENESS OF 8 WEEK CORE EXERCISE PROGRAMS ON THE FLEXIBILITY AND AGILITY LEVELS OF WRESTLERS

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ABSTRACT

The main purpose of this study was to examine the effect of core exercises on the flexibility and agility of the wrestlers. This study was conducted with 22 wrestlers aged over 18 years. The 22 wrestlers were divided into control and experimental groups. The control group consisted of 8 wrestlers and the experimental group consisted of 14 wrestlers. While the control group continued only routine wrestling exercises, the experimental group was included in core exercise for 8 weeks in addition to wrestling exercises. SPSS (Ver.20) was used for the statistical analysis of the. There was a statistically significant difference in the fat ratio in the control group, there was a significant change in the BMI values in the experimental group. Statistically significant difference was seen in the double-leg flexibility values in the end-test results in the control group. When the double-leg flexibility and left leg flexibility pretest and post test scores of the experimental group were compared, a significant difference was detected, but no difference was found in the right leg flexibility value. A significant difference was seen among the agility values in the experimental group according to the pre-test and final test values ($p<0.05$). As the results suggest it can be said that the core training has a statistically significant effect on flexibility and agility performance of wrestlers and it may be applied as part of training.
Keywords: *Wrestling, flexibility, agility, core exercise.*

1. INTRODUCTION

The term core is often associated with a limited group of muscles, especially abdomens, in the popular media; However, other passive tissues, such as bones, cartilage and ligaments, are also important. The skeleton provides the structural frame of the body and acts as a lever mechanism that causes movement that controls or that prevents by means of the neurologically regulated production of

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muscle torque (muscle strength causing joint movement). The musculoskeletal system is similar to a kinetic chain (bones that attach to joints) consisting of rigid bones (Willardson, 2014), which are connected via ligaments on the ligaments (connective tissue that attaches connective tissue). Core is also defined as the region between the rib cage and knees along with being focused on the abdomen, waist and hips (Fig, 2005).

The control and balance of body can be improved by core training, the risk of injury can be decreased by strengthening many large and small muscles, and the efficiency of the movements or the efficiency of transitions between movements increase depending on increasing in balance (Herrington & Davies 2005). The flexibility and agility are important in wrestling in which there is a transition between movements, and in which the techniques are performed repeatedly. Flexibility, mobility or patency of joint motion in the sports science are defined as the motion angle of twisting, turning, folding of joints within their normal patency (Sar, 2001). Agility is defined as a control and coordination skill that allows the body and joints to be in correct position in space during very rapid changings in the direction along the movement sequence (Sheppard & Young, 2006).

The aim of this study is to examine the effect of core exercises which will be regularly applied in addition to the training of the wrestlers who regularly exercise on the flexibility and agility of the wrestlers.

2. METHODS AND MATERIALS

2.1 Participants

In the study, a total of 22 wrestlers who were on an average 18 years old, involved in wrestling exercise regularly, did not have any health problems, had no injury in the last 6 months and voluntarily willing to participate in the study were selected as the subjects.

2.2 Variable and Tools to measure the Variables

2.2.1 Body Mass Index (BMI): Measurements of body composition were performed with the TANITA BC-420SMA Body Composition Analyzer. It was paid attention that the device is on a flat and rigid floor. Athletes' feet were naked during the measurement and clothes did not affect their weight were used. In order to make each foot is open equally on device and weight was given equally. It was ensured that body was upright and the eyes are pointed at a determined point on the opposite side. The person who was in the anatomical condition on the

device, did not move in any way after the command had been given but it followed the commands. The body weight was automatically recorded by the device in kilograms (kg), the body fat was in percentage (%), and the BMI values was in percentage (%).

2.2.2 Flexibility Test: The sit and reach elasticity test was applied for the elasticity test measurement. At the beginning of the test, the exact body figure was demonstrated in order that test could be performed correctly and properly by the subjects. The subjects were prevented from twisting his knees or pulling himself forward to the sit and reach stand. The test was applied to each subjects twice. The best of two trials value was recorded in centimeter (cm).

2.2.3 Agility Test: In the agility test, a test parkour with a width of 5 meters, a length of 10 meters and consists of three cones lined up 3.3 meters intervals on a straight line in midpoint was established in a closed sports hall with a synthetic floor. The test consists of 40-meter straight running and 20-meter slalom running between the cones, including the 180º turns in every 10 meters. After the test track had been prepared, a two-port photocell electronic timekeeping system (Tümer Electronic LLC, Turkey) was installed in the start and end point in order to measure with ± 0.01 second accuracy. It was ensured all subjects to perform the test twice and best rating that was considered as valid was used in the study.

2.3 Core Training Program: The training program that was applied on wrestlers was based on Willardson's (2014) book named 'developing the core'. There were 12 exercises in the training program. These exercises were applied to subjects of experimental group as an addition at the end of wrestling exercises for 3 days a week. The practice of the exercises in the program started with 8 reps in the first week and was increased by 2 reps in each week. So when the subjects arrived at week 8, they already had practiced each of the exercises as 22 reps.

Table 1: Core training schedule

Movements	**1st Week**	**2nd Week**	**3rd Week**	**4th Week**	**5th Week**	**6th Week**	**7th Week**	**8th Week**
Stability Ball Supine Bridge With Leg Curl	8 Reps	10 Reps	12 Reps	14 Reps	16 Reps	18 Reps	20 Reps	22 Reps
Dead Bug	8 Reps	10 Reps	12 Reps	14 Reps	16 Reps	18 Reps	20 Reps	22 Reps
Sit-Up	8 Reps	10 Reps	12 Reps	14 Reps	16 Reps	18 Reps	20 Reps	22 Reps
Medicine Ball	8	10	12	14	16	18	20	22

Pullover Pass	Reps	Reps	Reps	Reps	Reps	Reps	Reps	Reps
Stability Ball Rotating Crunch	8 Reps	10 Reps	12 Reps	14 Reps	16 Reps	18 Reps	20 Reps	22 Reps
Cable Kneeling Rope Crunch	8 Reps	10 Reps	12 Reps	14 Reps	16 Reps	18 Reps	20 Reps	22 Reps
Stability Ball Side Crunch	8 Reps	10 Reps	12 Reps	14 Reps	16 Reps	18 Reps	20 Reps	22 Reps
Angled Barbell Rotation	8 Reps	10 Reps	12 Reps	14 Reps	16 Reps	18 Reps	20 Reps	22 Reps
Side Double-Leg Lift	8 Reps	10 Reps	12 Reps	14 Reps	16 Reps	18 Reps	20 Reps	22 Reps
Medicine Ball Twisting Wall Toss	8 Reps	10 Reps	12 Reps	14 Reps	16 Reps	18 Reps	20 Reps	22 Reps
Bird Dog	8 Reps	10 Reps	12 Reps	14 Reps	16 Reps	18 Reps	20 Reps	22 Reps
Press-Up	8 Reps	10 Reps	12 Reps	14 Reps	16 Reps	18 Reps	20 Reps	22 Reps

2.4 Analysis of Data

SPSS (Ver.20) package was used for the statistical analysis of the data. The error level was accepted as 0.05 for all statistical methods and the values above $p<0.05$ were considered significant. When looked at the Shapiro Wilk Test results, it was observed that there were deviations which were significantly different from normality, in the scores obtained from the study. When looked at the normal distribution curves, it was seen that there was excessive deviation from normality. Furthermore, when the coefficients of skewness and kurtosis were taken into consideration, it was determined that all the scores were within the range of ±2. Cooper and Cutting noted that the normality of the skewness and kurtosis values are within the range of ±2, is a proper situation (Cooper, 2015). Since, it was found that the scores were not at the extreme levels, were in the range of ±2, and there were no excessive deviations in the normal distribution curves, parametric statistical techniques were decided to be used.

Table 2: Skewness-Kurtosis and Shapiro-Wilk test significance level results of the scores

Variables	N	Skewness	Kurtosis	*p*	N	Skewness	Kurtosis	*p*
Double Leg Flexibility Pre-Test	8	0.336	-1.636	0.32	14	-0.757	0.610	0.16
Right Leg Flexibility Pre-Test	8	-0.113	-1.922	0.36	14	-0.661	-0.635	0.20

Left Leg Flexibility Pre-Test	8	0.233	-1949	0.12	14	-0.951	-0.180	0.07
Double Leg Flexibility Final Test	8	0.360	-1.566	0.35	14	-1.506	2.624	0.03*
Right Leg Flexibility Final Test	8	0.187	-1.755	0.43	14	-1.072	0.457	0.04*
Left Leg Flexibility Final Test	8	0.182	-1.960	0.24	14	-1.002	0.522	0.14
Agility Pre-Test	8	0.758	0.940	0.79	14	0.353	-0.010	0.67
Agility Final Test	8	1.315	1.918	0.28	14	1.125	0.441	0.05

3. RESULTS

As a result of the research, flexibility and agility values of the wrestlers are as follows.

Table 3: Comparing of control and experimental group pre-test and final-test values in group

Group	Variable	N	*x*	±SS	*t*	*p*
Control Group	Weight Pre-Test	8	78.25	26.47	1.360	0.216
	Weight Final Test	8	77.84	26.58		
	Fat Pre-Test	8	12.53	7.28	3.899	0.006*
	Fat Final Test	8	11.13	6.65		
	BMI Pre-Test	8	25.99	5.89	1.330	0.225
	BMI Final Test	8	25.85	5.92		
Experimental Group	Weight Pre-Test	14	77.42	20.58	-1.019	0.327
	Weight Final Test	14	78.8	20.9		
	Fat Pre-Test	14	10.11	5.14	.193	0.850
	Fat Final Test	14	9.7	5.05		
	BMI Pre-Test	14	25.51	5.09	-2.243	0.043*
	BMI Final Test	14	25.85	5.10		

$p<0.05$*

When the final test values were examined, it was vivid that the control group had a weight average of 77.84 ± 26.58, fat average of 11.13 ± 6.65 and a body mass index (BMI) of 25.85 ± 5.92, and no significant difference was found ($p>0.05$). However, it was determined that there was a statistically significant difference in the fat ratio of the control group ($p<0.05$). While in the experimental group, there was no statistically significant difference between the values which are weight average of 78.8 ± 20.9, fat average of 9.7 ± 5.05, and body mass index (BMI) of 25.85 ± 5.10 ($p>0.05$). However, it was determined that there was a statistically significant difference in BMI values ($p>0.05$).

Table 4: Comparing of participants' numerical statistic between groups

Variable	Group	N	*x*	±SS	*t*	*p*
Weight Pre-Test	Control	8	78.25	26.47	0.082	0.936
	Experiment	14	77.42	20.58		
Fat Pre-Test	Control	8	12.53	7.28	0.913	0.372
	Experiment	14	10.11	5.14		
BMI Pre-Test	Control	8	25.99	5.89	0.201	0.843
	Experiment	14	25.51	5.09		
Weight Final Test	Control	8	77.84	26.58	-0.093	0.927
	Experiment	14	78.79	20.91		
Fat Final Test	Control	8	11.13	6.65	0.568	0.576
	Experiment	14	9.7	5.05		
BMI Final Test	Control	8	25.85	5.92	0.000	1.000
	Experiment	14	25.85	5.10		

When Table 4 was examined, it was not seen any statistically significant difference between pre-test and final-test values of body weight, body fat ratio and BMI of the control group and experimental group ($p>0.05$).

Table 5: Comparing of pre-test values of control and experimental group athletes

Variable	Group	N	*x*	±SS	*t*	*p*
Double Leg Flexibility	Control	8	31.31	3.13	-1.430	0.168
	Experiment	14	37.43	2.68		
Right Leg Flexibility	Control	8	30.44	2.67	-0.448	0.659
	Experiment	14	32.07	2.29		
Left Leg Flexibility	Control	8	30.63	2.95	-0.457	0.653
	Experiment	14	32.32	2.24		
Agility	Control	8	15.78	2.29	-1.120	0.276
	Experiment	14	17.70	0.18		

In Table 5, it was not observed any significant difference between pre - test values of double leg flexibility, right leg flexibility, left leg flexibility and agility scores of the control group and experimental group ($p<0.05$).

Table 6: Comparing of final test values of control and experimental group athletes

Variable	Group	N	*x*	±SS	*t*	*p*
Double Leg Flexibility	Control	8	33.06	8.87	-1.447	0.163
	Experiment	14	39.54	10.70		
Right Leg	Control	8	30.56	8.65	-0.841	0.410

Flexibility	Experiment	14	34.00	9.52		
Left Leg Flexibility	Control	8	30.38	8.95	-1.092	0.288
	Experiment	14	34.67	8.84		
Agility	Control	8	17.89	1.84	1.945	0.066
	Experiment	14	17.03	0.89		

When Table 6 was examined, the difference in the flexibility and agility final test values of the control and experimental group was not found significant.

Table 7: Comparing of the pre-test and final test elasticity and agility values of control group subjects

Variable	**N**	***x***	**±SS**	***t***	***p***
Double Leg Flexibility Pre-Test	8	31.31	8.86	-3.632	0.008*
Double Leg Flexibility Final Test	8	33.06	8.87		
Right Leg Flexibility Pre-Test	8	30.44	7.55	-0.132	0.899
Right Leg Flexibility Final Test	8	30.56	8.65		
Left Leg Flexibility Pre-Test	8	30.63	8.36	0.267	0.797
Left Leg Flexibility Final Test	8	30.38	8.95		
Agility Pre-Test	8	17.73	0.90	-0.440	0.673
Agility Final Test	8	17.77	0.88		

$p<0.05$*

When Table 7 was examined, while it was seen that there was statistically significant difference between the pre and final test double leg flexibility values of the control group ($p<0.05$), it was not seen any statistically significant difference between right leg flexibility, left leg flexibility and agility scores ($p<0.05$).

Table 8: Comparing of pre-test and final test elasticity and agility values of experimental group athletes

Variable	**N**	***x***	**±SS**	***t***	***p***
Double Leg Flexibility Pre-Test	14	37.43	10.04	-2.381	0.033*
Double Leg Flexibility Final Test	14	39.54	10.70		
Right Leg Flexibility Pre-Test	14	32.07	8.57	-1.411	0.182
Right Leg Flexibility Final Test	14	34	9.52		
Left Leg Flexibility Pre-Test	14	32.32	8.39	-3.349	0.005*
Left Leg Flexibility Final Test	14	34.67	8.84		
Agility Pre-Test	14	17.70	0.66	4.835	0.000*
Agility Final Test	14	17.03	0.89		

$p<0.05$*

When Table 8 is examined, there is a statistically significant difference between the pre-test and final test double leg flexibility values of the experimental group (p<0.05). There was no statistically significant difference between right leg flexibility scores according to final test results (p<0.05); When the left leg flexibility scores were compared, the flexibility scores showed a statistically significant difference (p<0.05) according to the final test results. There was a significant difference between the agility values according to the pre-test and final test values of experimental group (p<0.05).

Table 9: Comparing of the pre-test and final test elasticity and agility values of control and experimental group athletes

Variable	Grup	N	*x*	±SS	*t*	*p*
Double Leg Flexibility Pre-Test	Control	8	31.31	8.86	-1.430	0.168
	Experiment	14	37.43	10.04		
Right Leg Flexibility Pre-Test	Control	8	30.44	7.55	-0.448	0.659
	Experiment	14	32.07	8.57		
Left Leg Flexibility Pre-Test	Control	8	30.63	8.36	-0.457	0.653
	Experiment	14	32.32	8.39		
Agility Pre-Test	Control	8	15.78	6.47	-1.120	0.276
	Experiment	14	17.70	0.66		
Double Leg Flexibility Final Test	Control	8	33.06	8.87	-1.447	0.163
	Experiment	14	39.54	10.70		
Right Leg Flexibility Final Test	Control	8	30.56	8.65	-0.841	0.410
	Experiment	14	34.00	9.52		
Left Leg Flexibility Final Test	Control	8	30.38	8.95	-1.092	0.288
	Experiment	14	34.67	8.84		
Agility Final Test	Control	8	17.89	1.18	1.945	0.066
	Experiment	14	17.03	0.89		

When pre-test and final-test flexibility and agility values of the control and experimental group athletes were compared, there was no statistically significant difference between the groups in double leg flexibility, right leg flexibility, left leg flexibility and agility (p<0.05).

4. DISCUSSION

That the body fat ratio is high can result in reducing the strength, agility and flexibility and can result in loss of energy (Doğu, Zorba, Ziyagil, Aşçi, & Aşçi, 1994). In the result of his study, Sever (2016) found that there was not any difference in terms of the variables between the pre-test and final test in the anthropometric measurements as well (weight, body mass index, waist, hip circumference, waist/hip ratio and body fat percentage), and he found that the

exercises do not affect the footballers' anaerobic characteristics such as speed and quickness and body composition of but increase the core stabilization test scores. In their study, which includes total of 62 participants consisting of 32 experimental and 30 control groups; While Baştuğ, Ceylan, and ye Kalfa (2014) seen that there is significant decrease in weight and body mass index (BMI) of the women who only did walking and jogging and pilates mattress exercise in addition to the walking and running program after 12-week pilates training program, they detected improvements in their flexibility performance. It is seen that the body weight, body mass index (BMI) values and flexibility performances of the control group are negatively affected.

Flexibility is one of the components that is required to be successful in wrestling. Generally, the best wrestlers are those who have good flexibility (Gable, 1998). Başandaç in his study (2014) investigated the effect of the progressive body stabilization exercise program on the upper limb muscle strength, functional activities, flexibility and joint position sensation in the adolescent volleyball players. 42 female volleyball players were included in study (average age 14.50 ± 1.17 years). 21 Athletes constituted the working group and 21 others constituted the control group. Body stabilization exercise training was given to the working group for 8 weeks (3 days / week) and after the training program it was seen that shoulder flexion, extension, abduction, internal / external rotation, elbow flexion and wrist extension muscle strength increased in the working group ($p<0.05$). All flexibility test results showed improvement in the working group. The study of Başandaç (2014) and the study done on the wrestlers show similarity in terms of the application period and the application frequency. The results in the flexibility values between the studies are similar.

Thirty sedentary females as pilates exercise group (n= 15) and control group (n = 15) participated in this study voluntarily in order to investigate the effects of 8 week pilates exercises on flexibility and balance development in 40 to 45 years old women (Çağlav, 2005). Pilates exercise was applied on the experimental group for 8 weeks in the way of 3 days 60 minutes per week. He noted in the conclusion of the study that middle aged individuals participating in regular Pilates exercise provided positive developments in their dynamic balance and flexibility values, and resulted in a decrease in body weight and body fat. The positive development obtained in flexibility that Çağlav (2005) stated in his study is the common points of the two studies.

The athletes participating in the performance improvement regard the agility as a locomotive skill that allows the athlete to change direction. In his study whose aim is to examine the relationship between body composition and agility, Görgülü (2016) studied with the 18 professional football players whose average age was 22.39 ± 2.893 years, average tall was 1.82 ± 0.053 meters,

average body weight was 76.06 ± 4.412 kg and average age of sports was 11.72 ± 2.218 years. As a result, he found that there was no significant difference between agility performance and body circumference measurements and skin fold thickness (p>0.05). At the same time, he noted that there was no significant difference between agility performance and age, height, body weight, body mass index and body fat percentage (p>0.05). After 8 weeks of core training that had applied to wrestlers, there was no positive change in body weight and body fat in the experimental group but it was found that there was a statistically significant difference in BMI values and also statistically significant difference in agility performance. According to these results, contrary to the study (Görgülü, 2016) above, it can be said that there is a significant relationship between BMI and agility.

5. CONCLUSIONS

As a result of the study, while there was a statistically significant difference in the control group in terms of the fat ratio, there was a significant change in the BMI values in the experimental group (see Table 3). A statistically significant difference was seen in the final test result of the control group in terms of the double leg flexibility values (see Table 7). When the pre-test and final test double leg flexibility and left leg flexibility scores of the experimental group were compared (p>0.05), a significant difference was found between them, but it was not found significant difference in the right leg flexibility value (see Table 8) and additionally there was a statistically significant difference in agility performance in the experimental group after the end of 8 weeks (p>0.05). In the light of the statistics, it can be said that core training can provide a statistically positive effect on the double leg flexibility, left leg flexibility and agility values in wrestlers. Core training is therefore thought to be applicable as a part of wrestling training.

6. REFERENCES

Başandaç, G. (2014). Adölesan voleybol oyuncularında ilerleyici gövde stabilizasyon eğitiminin üst ekstremite fonksiyonlarına etkisi. Yüksek. [The effect of progressive body stabilization training on upper extremity functions in adolescent volleyball players. In Turkish] (Master's thesis, Hacettepe University). Hacettepe Üniversitesi Sağlık Bilimleri Enstitüsü. Ankara.

Baştuğ, G., Ceylan, H. İ., & ve Kalfa, S. (2014). Examining the effect of the Pilates exercise program on the performance and body composition of females. *International Journal of Human Sciences, 11*(2), 1274-1286. (In

Turkish)

Çağlav, F. (2005). 40-45 Yaş arası bayanlarda 8 haftalık pilates çalışmasının esneklik ve denge üzerine etkileri. [Effects of 8 weeks Pilates study on flexibility and balance in 40-45 year old women. In Turkish]. (Master's Thesis, Muğla Sıtkı Kocman University). Muğla Üniversitesi Sosyal Bilimler Enstitüsü Beden Eğitimi ve Spor Anabilim Dali, Muğla.

Cooper, C.J. (05 April 2015). SPSS, descriptive statistic. Online available at: http://psychology.illinoisstate.edu/jccutti/ (Accessed 12 March, 2016).

Doğu, G., Zorba, E., Ziyagil, M.A., Aşçi, H., & Aşçi, A. (1994). Calculation of body fat ratio of elite Turkish wrestlers. *Journal of Sport Sciences 2*(6), 3-14. (In Turkish)

Fig, G. (2005). Strength training for swimmers: Training the core. *Strength and Conditioning Journal, 27*(2), 40-42.

Gable, D. (1998). *Coaching wrestling successfully*. United States of America: Human Kinetics.

Görgülü, T. (2016). Vücut kompozisyonu ile çeviklik arasındaki ilişki, [Relationship between body composition and agility. In Turkish]. (Master's thesis, Selcuk University). Selçuk Üniversitesi Sağlık Bilimleri Enstitüsü Antrenörlük Eğitimi Anabilim Dalı, Konya.

Herrington, L. & Davies, R. (2005). The influence of Pilates training on the ability to contract the transverses abdominis muscle in asymptomatic individuals. *Journal of Body Work and Movement Therapies, 9*(1), 52-57.

İşbilir, M. (2010). Futbolcularda dominant ve nondominant ayağa hareket yaptıran kasların kuvvet düzeyi ile ayakta dengelenmeye olan etkilerinin incelenmesi. [Examination of the effects of muscles with dominant and non-dominant foot movements on football strength and standing balance. In Turkish]. (Master's thesis, Ege University). Ege Üniversitesi Sağlık Bilimleri Enstitüsü Hareket ve Antrenman Bilimleri Anabilim Dali Programı. İzmir.

Sari, Ş. (2001). Buz pateni yapan 13-17 yas grubu gençlerin ayak bileği esnekliği ile genel esneklik parametrelerinin incelenmesi. [Examination of the ankle flexibility and general elasticity parameters of 13-17 year-old adolescents with ice-skating, In Turkish]. Yayınlanmamış Yüksek Lisans Tezi (Master's thesis, Istanbul University). İstanbul Üniversitesi Sağlık Bilimleri Enstitüsü, İstanbul.

Sever, O. (2016). Statik ve dinamik core egzersiz çalışmalarının futbolcuların sürat ve çabukluk performansına etkisinin karşılaştırılması. [Comparison of static and dynamic core exercise activities on the speed and speed performance of soccer players. In Turkish] Doktora Tezi (Doctoral thesis, Gazi Universtiy). Gazi Üniversitesi Sağlık Bilimleri Enstitüsü Beden

Eğitimi ve Spor Anabilim Dali. Ankara.

Sheppard, J.M. & Young, W.B. (2006). Agility literature review: Classifications, training and testing. *Journal of Sports Sciences, 24*(9), 919-932.

Wıllardson, J. M. (2014). *Developing the core*. Human Kinetics, p.6.

Yüksel, O., Akkoyunlu, Y., Karavelioğlu, M.B., Harmancı, H., Kayhan, M., & Koç, H. (2016). Effect of core lower limb strength training on basketball players on dynamic balance and shot accuracy. *Marmara University Journal of Sports Sciences, 1*(1), 495-499.