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The Effect of Balance Training on the Reaction Time in Adolescent Period of Children Judoka

Hamza Akay[1*], Önder KARAKOÇ[2], Berna KARAKOÇ[3]

[1] MSc, School of Physical Education and Sports, Bursa,Turkey
[2] Associate Professor, School of Physical Education and Sports, Kilis7 Aralık University, Kilis, Turkey
[3] PhD , School of Physical Education and Sports, Kilis7 Aralık University , Kilis, Turkey

ABSTRACT:
The aim of this study was to determine the effect of balance training on reaction time in adolescent period of children judoka. 40 male male adolescents participated in the study and the subjects were divided into two groups as experimental (20 male age = 13,25 ± 0,91 years) and control (20 male age = 12,60 ± 0,99 years) groups. Pre-test and post-test measurements were made in the study. The experiment and control group was warmed up for 20 minutes. Balance training for the experimental group was conducted within a 90 minutes judo training session, which was conducted three days a week. The control group continued to practice only judo training. Before proceeding to statistical procedures, they were checked for normal distribution and homogeneity. Since the distribution was normal, the Paired Samples T-Test was used for the significance between the pre-test and post-test measurements of the groups. The Independent Samples T-Test was applied to analyze the difference between the experimental group and the control group. In the study; age, height, weight, right hand grip strength, left hand grip strength, vertical jump, elasticity, body fat measurements, visual and auditory reaction time tests were performed. When control group is evaluated; right hand grip strength, flexibility, right leg balance, visual reaction time mean values were found significant ($p < 0.05$). However, there was no significant difference in left hand grip strength, vertical jump, body fat percentage, left leg balance, and auditory reaction mean values ($p > 0.05$).
When the experimental group is evaluated; right and left hand grip strength, flexibility, body fat percentage, right and left leg balance, visual and auditory reaction mean values were found significant ($p < 0.05$). No significance was found only in the vertical jump mean values ($p > 0.05$).
When the pre-test and post-test differences of the physical measurement parameters were compared for control and test group, there was no significant difference in mean values ($p > 0.05$).

As a result, it can be said that the experimental group participates in the regular training practices; the physical parameters are effective in controlling the reaction time and body balance better.

Keywords: Adolescent period, reaction time, Judo.

Introduction

Judo is one of the branches that allow children to develop their affective, cognitive and motor skills. Physically, judo is a balanced reflection of body power to a certain point. Mentally, judo is a fighting sport involving practical intelligence, the power to comprehend events, learning as quick decision-making, and difficult factors to emerge. The ability of a person to maintain equilibrium is also a decisive factor in the development of other motor systems [1].

Judo is a way to gain physical strength, coordination and flexibility as well as mental aspects such as self confidence, balance concentration [2].

The judoka must be able to make the technical applications very fast during the competition and to continue the quickness. At the same time, it is imperative that ideal performance can be

maintained throughout the year. This is due to many factors. For this reason, it is important to develop characteristics such as strength, aerobic power, anaerobic power, speed, quickness, reaction time, flexibility, balance and coordination besides technical and tactical training with specific judo training [3].

Among sports modalities, judo can be defined as a fixed balance and imbalance, action and reaction "game" in which two competitors struggle to gain points by throwing the opponent to the ground and / or hitting the ground; or ending a match completely by applying a holding or control technique [4].

In judo, athletes need to maintain posture control and good balance in order not to lose points and make the techniques better, so balance is very important[5].

According to Monteiro and Evangelista (2015), it is one of the principles of balance training to train in an integrative, safe and efficient way, based on strengthening the core or center of the body. In this context, many studies have been conducted recently investigating the use of core strengthening in sports to maintain and / or improve muscle strength, balance, stability and performance [6].

The main factors affecting judo performance are balance, reaction time and power. Reaction time is one of the variables that can contribute to excellence in high judo performance [7].

There is very few study on reaction time and how effective balance is on judoist children. In this respect, it is thought that this study is important and will contribute to the field. In this context, in this study, it was tried to investigate the balance and reaction systems of adolescent period of Judoka in detail and participate in regular training exercises to increase their balance and coordination abilities, to better control body balances and to investigate whether they differ in terms of reaction time. Besides, it is aimed to be able to make suggestions for athletes, coaches and sports science in this study.

Method

Experimental Method: 40 male adolescents judokas participated in the study and the subjects were divided into two groups as experimental (20 male age = 13,25 ± 0,91 years) and control (20 male years = 12,60 ± 0,99 years) groups. A judge's health board report was taken and a sportsman's license was issued. Ethics committee has been granted.

In the study; age, height, weight, right hand grip strength, left hand grip strength, vertical jump, flexibility, body fat measurements, visual and auditory reaction time tests were performed.

Training schedule:

Judo training was applied for 3 days / 90 minutes per week in both groups selected by randomly and volunteers. Pre-test and post-test measurements were made in the study. The experiment and control group was warmed up for 20 minutes. Balance training for the experimental group was conducted within a 90 minute judo training session, which was conducted three days a week. The control group continued to practice only judo training.

Balance and coordination exercises made for the experiment group were continued for 5 minutes warm up for 3 days a week, 20 minutes balance and coordination training program and finally for judo training in 8 weeks training program for a total of 25 minutes and 3 days a week.

Anthropometric measurements:

In our study, subjects' ages, years of birth were asked to collect descriptive information, and they were determined as years. The subjects were recorded in anatomic condition, with sporting clothes and without shoes, with a weight of 0.1 kg and a digital height scale (SECA, Germany) in this blood, in body length in centimeters, body weight in kilograms [8].

Hand Grip Strength Measurement

The Holtain brand dynamometer is adjusted according to the subject's hand size, the subject tried to squeeze the dynamometer as much as possible without bending the elbow, the arm is straight and at an angle of 10-15 degrees from the shoulder. The best value was recorded after 4 attempts with both hands. The dynamometer was reset after every attempt, the best performance is taken into evaluation [9].

Vertical Jump:

Measurements were made using a vertical jump panel. When the feet are adjacent and the body is in a vertical position, the two arms will be extended up to mark the last point where the fingertips touch. Then the subject leaped up with the double foot up to the whole power and contacted the board. The subject will not take steps during the upward bounce and apply the knees in a 90 degree twisted state. This procedure was repeated 3 times and the best results were recorded.

Flexibility Test:

Flexibility measurements of the subjects were made by sitting and reaching test. Test was made with a table with measuring scale of 0-50 cm on the upper surface, which is 15 cm outside the surface on which the feet touch and with a length 35cm, width 45cm and height 32cm, top surface length 55cm, width 45cm. Measurements were shown to the subjects before measurements [9]. Subjects were sitting barefoot while the knees were at full extension, the feet were open at shoulder width and were based on the test bench while measuring. Without bending the knees, leaning forward with the arms stretched, with the palms facing downwards, leaning forward along the measurement scale, pushing a 30cm long ruler forward slowly and without throwing and they were held for 1-2 sec in the maximum reaching position. The test was repeated twice and the highest result was recorded [10].

Body Fat Percentage:

Skin fold thickness measurements were measured using a skinfold caliper (Holtain, UK) with a 2mm error and applying 10 g of pressure per mm to each opening. Measurements of skin fold thickness were made from the triceps, subskapula, suprailiac and abdominal regions and measurements were taken from the right side of the subjects. In skin fold thickness measurements, the thickness of the subcutaneous fat layer between the index finger and the thumb was set to be light enough to leave muscle tissue. Caliper was held about 1 cm away from the fingers and the thickness of the subcutaneous fat layer held was read within 2-3 seconds of the caliper display and recorded in millimeters [10].

Balance

The static balance values of the athletes were measured. A flamingo balance test was used to determine the balance. For the flamingo balance test, the standard bench made by Eurofit was used. The balance board is 4 cm thick, 3 cm wide and 30 cm long. Two wooden beams are installed beneath two wooden beams, spaced and vertically 2cm wide and 15cm long. The person's stability period on one foot is tested on the balance board. The released foot is bent by holding the same side with the hand, and the released hand is supported by the test taker. The person feels that he is balancing, and then he stops the hand of the person doing the test, and then the chronometer is run. The stop watch is stopped if the retained foot is released or the balance is broken and the foot is separated from the balance board [10, 11].

Reaction Time

Visual and auditory reaction time measurements of the athletes participating in the study were made with the Newtest 1000 instrument. Tool 3 stimulates. 1 and 3 stimuli are visual (light) and 2 stimuli are auditory (sound). Measurements were made in a noiseless and adequate light environment. Information forms were created for each athlete to record the results of the measurements. Subjects will be prompted to press the buttons according to the stimuli as soon as one of the sound or light stimuli is accompanied by the "Ready" command and the results are recorded on the pre-prepared measurement result sheets. Each subject were measured one test and 3 measurements for the stimuli of voice and light. The last 3 measurements were recorded in milliseconds as the best score of the subjects. The athlete's dominant hand was measured when the auditory reaction time was measured [12].

Statistical Analysis

Descriptive Statistics; frequency and percentage distributions mean and standard deviation, standard error is used. Paired Samples T-Test was applied for significance between pre-test and post-test measurements, since normal distribution and homogeneity were determined before distribution to statistical procedures. The Independent Samples T-Test was used to analyze the difference between the experimental group and the control group. The error level in this study is $p < 0,05$.

Results

Table 1. Demographic information for experimental and control groups of Judokas

Variables	*Experimental Group (N=20)*	*Control Group (N=20)*
	Mean ± S.D	*Mean ± S.D*
Age (year)	*13,25 ± 0,91*	*12,60± 0,99*
Height (cm)	*151,95± 11,01*	*144,55± 13,25*
Weight (kg)	*47,50 ± 14,00*	*41,10± 14,97*

The average age of judokas in the experimental group was 13,25 ± 0,91 years, 151,95± 11,01 cm in height, and 47,50 ± 14,00 kg in average body weight. The average age of judokas in the control group was 12,60± 0,99 years, their average height values were 144,55± 13,25 cm and the average body weight values were 41,10± 14,97 kg.

Table 2: Comparison of pre-test and post-test physical parameters of the judokas of the control group

Variables	*PreTest (n: 20)*	*Post Test (n: 20)*		
	Mean ± S.D	*Mean ± S.D*	*t*	*P*
Right hand grip strength (kg)	*10,41± 5,51*	*11,14 ± 5,37*	*-4,597*	*0,000***
Left hand grip strength (kg)	*10,27± 6,40*	*10,79 ± 6,30*	*-2,411*	*0,260*
Vertical jump (cm)	*17,80± 6,63*	*17,55± 6,06*	*0,721*	*0,480*
Flexibility (cm)	*2,15± 4,92*	*3,02± 4,80*	*-2,340*	*0,030**
Body fat percentage(%)	*10,51± 1,78*	*10,46± 1,74*	*1,656*	*0,114*
Right leg balance (sec)	*13,30± 6,27*	*14,30± 6,04*	*-2,874*	*0,010**
Left leg balance (sec)	*12,70± 6,38*	*13,25± 6,21*	*-2,065*	*0,053*
Visual reaction (msec)	*407,85± 60,74*	*377,15± 54,45*	*3,255*	*0,004**
Auditory reaction (msec)	*283,40± 46,29*	*268,65± 52,77*	*1,526*	*0,143*

* P <0.05

When the physical parameters of the control group are examined; right hand grip strength, flexibility, right leg balance and visual reaction time values were found to be significant between the pre and post test (p <0.05). There was no significant difference in left hand grip strength, vertical jump, percentage of body fat, left leg balance and auditory reaction time mean values (p> 0.05).

Table 3: Comparison of pre-test and post-test physical parameters of the judokas of the experimental group

Variables	*PreTest (n: 20)*	*Post Test (n: 20)*		
	Mean ± S.D	*Mean ± S.D*	*t*	*P*
Right hand grip strength (kg)	*13,82± 4,22*	*14,68± 4,29*	*-8,134*	*0,000***
Left hand grip strength (kg)	*12,65± 4,23*	*13,38 ± 4,19*	*-4,455*	*0,000***
Vertical jump (cm)	*20,35± 4,69*	*20,72± 4,98*	*-1,136*	*0,270*
Flexibility (cm)	*3,55± 5,05*	*4,44± 5,14*	*-3,877*	*0,001*
Body fat percentage(%)	*10,53± 1,20*	*10,48± 1,22*	*4,057*	*0,001*
Right leg balance (sec)	*16,15± 5,70*	*17,20± 5,62*	*-2,502*	*0,022*
Left leg balance (sec)	*16,55± 4,27*	*17,65± 4,36*	*-2,288*	*0,034*
Visual reaction (msec)	*406,05± 72,28*	*370,50± 50,30*	*4,711*	*0,000*
Auditory reaction (msec)	*278,15± 52,12*	*251,15± 58,32*	*2,511*	*0,021*

* P <0.05

When the physical parameters of the experimental group were examined, the mean values of right hand grip strength, left hand grip strength, flexibility, percentage of body fat, right leg balance, left leg balance, visual reaction and auditory reaction were found to be significant between pre test and post test ($p < 0.05$). No significant difference was found only in vertical jump values ($p > 0.05$).

Table 4: Comparison of pre-test and post-test physical parameters of the judokas of the experimental group and control group

Variables		*Ortalama ± SD*	*t*	*P*
Right hand grip strength (kg)	*Control Group*	*-0,73± 0,71*	*0,681*	*0,500*
	Experimental Group	*-0,86 ± 0,47*		
Left hand grip strength (kg)	*Control Group*	*-0,52± 0,97*	*0,769*	*0,447*
	Experimental Group	*-0,73± 0,73*		
Vertical jump (cm)	*Control Group*	*0,25 ± 1,55*	*1,305*	*0,200*
	Experimental Group	*-0,37± 1,47*		
Flexibility (cm)	*Control Group*	*-0,87± 1,67*	*0,023*	*0,982*
	Experimental Group	*-0,88± 1,02*		
Body fat percentage(%)	*Control Group*	*0,05± 0,14*	*-0,067*	*0,947*
	Experimental Group	*0,05± 05*		
Right leg balance (sec)	*Control Group*	*-1,00 ± 1,55*	*0,092*	*0,927*
	Experimental Group	*1,05 ± 1,87*		
Left leg balance (sec)	*Control Group*	*-0,55± 1,19*	*1,001*	*0,323*
	Experimental Group	*-1,10 ± 2,14*		
Visual reaction (msec)	*Control Group*	*30,70± 42,17*	*-0,402*	*0,690*
	Experimental Group	*35,55 ± 33,74*		
Auditory reaction (msec)	*Control Group*	*14,75 ± 43,22*	*-0,847*	*0,402*
	Experimental Group	*27,00± 48,08*		

*p<0.05

For the experimental and control group, There was no significant difference in the values of the right hand grip, left hand grip, vertical jump, flexibility, body fat percentage, right leg balance, left leg balance, visual reaction and auditory reaction time mean values(p> 0.05).

Discussion and Conclusion

The aim of this study was to determine the effect of balance training on reaction time in adolescents judokas.

The physical parameters of the participants were compared and the pre and post test results of age, height, weight, right hand grip strength, left hand grip strength, vertical jump, flexibility, body fat measurements, visual and auditory reaction time were included.

The average age of the experimental group was determined as 13,25 ± 0,91 years and the average age of the control group was determined as 12,60 ± 0,99 years. The average height values of the experimental group was 151,95 ± 11, 01 cm, the average height values of the control group was 144,55 ± 13,25 cm.

Claessens et al. (1987) stated that, the world's top judokas have an average height of 1.75 m, a weight of 79.45 kg and an age of 25.3 years [13].

In our study, the mean values of the pre-test of the right hand grip strength of the experimental group were 13.82 ± 4.22 kg, while the post test mean values were 14.68 ± 4.29 kg. The mean values of the pretest of the left hand grip strength were 12.65 ± 4.23 kg, the post test mean values were 13.38 ± 4.19 kg.

In control group, the mean values of the pre-test of the right hand grip strength were 10,41 ± 5,51 kg. while the post test mean values were 11,14 ± 5,37 kg. The mean values of the pretest of the left hand grip strength were 10,27 ± 6,40 kg., the post test mean values were 10,79 ± 6,30 kg. .

There was a significant difference between the test results of the right hand grip and left hand grip strength of the experimental group ($p < 0.05$). In the control group, there was no significant difference between the results of the pre-test and post-test values of the left hand grip force ($p > 0.05$), whereas the values of the right hand grip strength were found significant ($p < 0.05$).

It can be said that the children judokas in the experimental and control groups use the right hand as the dominant hand and in the control group it causes the significant increase in the right hand grip strength values as a result of regular training.

If compare this work with other studies in the literature; Tutkun (1996) found that a right hand grip strength was 50.71 ± 6.01 and a left hand grip strength was 47.20 ± 4,12 kg for Judokas studying at the university [14].

Karakoç (2016) found that Judo's right hand grip strength was 40.70 ± 9.26 kg and left hand grip strength was 39.37 ± 9.07 kg. Karakoç et al. (2015) in another study found that; the mean values of right hand grip strength of male judokas was 47,55 ± 7,40 and the mean values of left hand grip strength was 46,42 ± 7,67 [15].

Researches on judokas in the literature have found close values to each other. In many studies show that grip strength is very effective in Judo. Grip strength is very important because of the intense exercises and struggle about keeping clothes in Judo training. Especially; the intensity, duration, frequency and extent of the training during the preparation period affect the performance levels of the athletes with the model of training [16]

According to the research results; There was no significant difference between pre-test and post-test results of the judokas in both groups ($p > 0.05$).

Brown et al. (1986) investigated the effects on the vertical jump performance of plyometric training of the 26 basketball players. The average age of the subjects participating in the study is 15, the average height is 180cm and the body weights are 67.9kg. As a result of the 34 depth trainings carried out by the athletes on the 45cm bank, an increase of 7.3cm was recorded. In the study, the vertical jump distance was

determined as 54.9cm without joining the arms, 66.3cm with the arm [17].

Al- Ahmad (1990) investigated the effect of 6-week plyometric training on some physical and physiological parameters of basketball players aged 14-18. At the end of the study, there was a significant difference in the vertical jump values of the subjects compared to the control group (P <0.05) [18].

Pliometric training is at the forefront of the training models that are commonly used to support strength development and increase strength in a short period of time. In addition, pliometric training contributes to the development of physical performance [19].

When looking at the literature, it can be shown that no increase in the vertical jump parameters is due to the absence of pliometric exercises, which are very effective on vertical jump ability in the study. As it can be seen from other studies, it is observed that pliometric training in different sports branches causes significant differences on the vertical jump abilities of athletes in general.

In our study,in the experimental group, the mean values of pretest of the flexibility were 3,55 ± 5,05 cm. while the post test mean values of the flexibility were 4.44 ± 5.14 cm. . In the control group, the mean values of pretest of the flexibility were 2,15 ± 4,92 cm. while the post test mean values of the flexibility were 3.02 ± 4.80 cm.

When the parameters of the experiment and control group were examined, there was a significant difference between pre- and post-test flexibility values (p <0.05).

Flexibility is the ability of joints or joint series to move at wide angles. This is why flexibility is not only important for sporting success and performance, but also for prevention from injuries [20].

In the Judo sport, there is a need for a high level of flexibility in order that many techniques can be made at very wide angles and movements are inherently suitable.

In the study, titled “Determining the performance of male judo athletes” by Krstulovic S., judo athletes were grouped as lightweigt, middleweight and heavyweight. In Judo performance tests, the average of flexibility test in lightweight athletes was 4.79 ± 1.23 cm., the average of the flexibility test for middleweight athletes was 5.28 ± 0.95 cm., the average of the flexibility test in the heavyweight athletes was 5.41 ± 0.98 cm. [21].

When comparing this study with similar studies in the literature, it is understood that the balance exercises applied in judo and other branches have a positive effect on the athletes' flexibility ability. It is possible to say that, this study is similar to other studies in the literature.

In the study of some motor performance and body composition somotots of judokas, In the Hungary judo team, body fat percentage for male athletes under 70 kg were found 8.9 ± 0.8% and body fat percentage for male athletes over 70 kg were found 14.0 ± 7.3% [22].

Callister and colleagues found that body fat percentages of the American senior judo group were 8.3 ± 1.0% in the study of physiological characters of elite judo athletes [23].

The body fat percentage in the studies given in the literature above is lower than the body fat percentage in this study so that It is thought that the athletes in the literature have more sports age and more elite groups.

In our study, in the experimental group, the mean values of pre test of the right leg balance test were 16.15 ± 5.70 sec. while the post test mean values were 17.20 ± 5.62 sec. The mean values of pre test of the left leg balance test

were 16.55 ± 4.27 sec., while the post test mean values were 17.65 ± 4.36 sec.

In the control group, the mean values of pre test of the right leg balance test were 13,30 ± 6,27 sec. while the post test mean values were 14,30 ± 6,04 sec. The mean values of pre test of the left leg balance test were 12,70 ± 6,38 sec., the post test mean values were 13,25 ± 6,21 sec.

There was a significant difference between the pre-test and post-test results of the right leg balance and left leg balance of the experimental group ($p < 0.05$). In the control group, there was no significant difference between the results of pre-test and post-test values of the left leg balance ($p > 0.05$), while the results of pre-test and post-test values of the right leg balance were found significant ($p < 0.05$).

Turkeri reported that exercises performed regularly for 12 weeks increased static balance values . Contrary to these two studies, Holm et al. have not found any significant difference in the static balance scores after disability preventive exercise program on a group of 35 handball players [24].

When examining Öztürk and his colleagues study, a similar result was obtained after pilates exercises applied to the middle age and over group and the balance scores increased and a significant difference was found in the results of dynamic balance [25].

Sağıroğlu investigated the effect of pliometric exercises on young basketball players on anaerobic performance and vertical jump height. A group of athletes performed pliometric training for 3 days a week for 8 weeks and other group performed pliometric training only 1 day a week and when looking at balance scores, a significant difference was not found. [26].
Different results were found in the literature on static balance scores after different force exercise programs. The general belief is that balance skills develop after regular exercises. In our study, there was a significant difference in the right and left leg balance test parameters of the experimental group after the balance exercises applied to the experimental and control groups while there was a significant difference in the right leg balance test parameters of the control group and no significant difference was found in the left leg balance test parameters.

According to the results of the research, visual reaction time pre-test mean values of experimental group were 406,05 ± 72,28 msec. while the post test mean values were 370.50 ± 50.30 msec. The mean values of auditory reaction time pretest were 278,15 ± 52,12 msec., the mean values of the post test were 251.15 ± 58.32 msec.

In the control group, visual reaction pre-test mean values were 407.85 ± 60.74 msec. while the post test mean values were 377,15 ± 54,45 msec. The mean values of auditory reaction time pretest were 283,40 ± 46,29 msec., the mean values of the post test were 268.65 ± 52.77 msec.

Visual and auditory reaction time pre-test and post-test results of the experimental group were significant ($p < 0.05$). In the control group, no significant difference was found between the results of the pre-test and post-test values of the auditory reaction time ($p > 0.05$), but visual reaction time pre-test and post-test values were significant ($p < 0.05$).

Abu-Saleh (2010) reported that during the 5 months study program, 2 hours volleyball training for the 3 days a week developed a reaction time. There are also studies where training does not affect reaction time [27].

Whitehurst (1991) reported that, during 8 weeks, 35-40 minutes aerobic exercises for the 3 days a week did not cause any effect on the

elderly women at the time of the reaction [28].

Gavkare, Nanaware and Surdi (2013) reported a reduction in response time (auditory, visual, and whole body time) for a group exercising aerobically for a minimum of 2 years, 2-3 hours a day [29].

According to many studies, it has been concluded that the reaction times of the athletes are better than those of the non-athletes [30,31].
When we look at studies to determine the reaction time in the literature, it is observed that the reaction time parameters are determined to be meaningful as a result of the studies performed in the general sense. However, in other studies, no significance was found in the reaction time parameters, and it has similar results to our work.
In our study, most of the studies in the literature indicated that the training was effective in the positive direction. Our work is parallel to this direction.

When the control group was evaluated in the study, the mean values of right hand grip strength, flexibility, right leg balance, visual reaction time were found significant ($p < 0.05$). However, there was no significant difference in left hand grip strength, vertical jump, body fat percentage, left leg balance and auditory reaction mean values ($p > 0.05$).

When the experimental group was evaluated, there was a significant difference between right and left hand grip strength, flexibility, body fat percentage, left leg balance, right legbalance, visual and auditory reaction mean values. ($p < 0.05$). There was no significant difference in the mean values of vertical jump. As a result, it can be said that the experimental group participates in the regular training practices, the physical parameters are effective in controlling the reaction time and body balance better.

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