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COMPARISON OF DIFFERENT FOOT BASE SIZES WITH Y BALANCE TEST PERFORMANCE IN SEDENTARY WOMEN

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Abstract:
Recently, the effects of some physical fitness variables on performance have emerged as popular research topics for many researchers working in the field of sports sciences. Factors affecting this performance, which is the center of attention of researchers, bring along many different studies. A group of 40 women with a sedentary lifestyle residing in Gaziantep participated voluntarily. 24 hours before the start of the study, the subjects were asked to make preparations for the workout, were informed regarding the details of the research, were asked to wear clothes in the manner required by this study. Care was taken for the subjects participating in the study to be selected by individuals whose age, height, weight and body mass index values were close to each other. In addition, the subjects selected for our study were selected from healthy individuals without anatomical disorders by determining the lower and upper limits of foot sole and foot comb measurements. The tests used in the study were carried out in the Indoor Sports Hall by using the necessary tools and equipment and by resting the participants in the test. In this study, in order to evaluate balance performance, which is an important factor in sportive performances, Y balance scores will be compared with foot sole and comb measurements and the results will be tried to contribute to science.

Keywords: y balance test, performance, sedentary women

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1. Introduction

Recently, the effects of some physical fitness variables on performance have emerged as popular research topics for many researchers working in the field of sports sciences. Factors affecting this performance, which is the center of attention of researchers, bring along many different studies. In addition to all these studies, although there are many studies on the factors that affect the balance ability that are effective in sportive performance, there are no or almost no studies on the soles of the feet that bear the burden of the whole posture in the balance ability of athletes. Because postural stability is the ability of the body to keep the center of gravity within the boundaries of the support surface, and it is also expressed as stability limits. In fact, postural stability means the same as balance (Shumway and Woollacott, 2007).

Balance is one of the important factors determining sporting performance and is defined as the ability to correctly position the center of gravity on the support surface. (Erdoğan et al., 2017). The ability of the whole body to move in coordination is one of the results of having good balance skills. (Koyuncu, 2013). Balance is achieved by the relationship between the center of gravity, the line of gravity and the support surface.

It is carried out by integrating sensory information obtained with vestibular, visual and somatosensory systems in the central nervous system (CNS) and as a result, revealing the appropriate motor responses in the musculoskeletal system. In this way, static and dynamic conditions are adapted (Kanatlı et al., 2006).

Sports-specific movements include performing basic motoric movements at the top level during training or competition, as well as maintaining both static and dynamic balance simultaneously. Learning and training about a sport also improves the effectiveness of dynamic and static balance in daily life activities Although there are many scientific studies that reveal the importance of proprioception in terms of sports, the sensory basis of balance and balance in determining sportive ability, skill and performance (Mononen et al., 2007). There are not enough studies examining the balance characteristics specific to sports branches and comparing their performance. In this study, in order to evaluate balance performance, which is an important factor in sportive performances, Y balance scores will be compared with foot sole and comb measurements and the results will be tried to contribute to science.

2. Material and Methods

The subjects are residing in the city center of Gaziantep and have a sedentary lifestyle; 40 women participated voluntarily to the research. 24 hours before the start of the study, the subjects were asked to make preparations for the workout, were informed regarding the details of the research, were asked to wear clothes in the manner required by this study. Care was taken for the subjects participating in the study to be selected by individuals whose age, height, weight and body mass index values were close to each other. In addition, the subjects selected for our study were selected from healthy individuals

without anatomical disorders by determining the lower and upper limits of foot sole and foot comb measurements. The tests used in the study were carried out in the Indoor Sports Hall by using the necessary tools and equipment and by resting the participants in the test.

2.1. Height

The height of the test subjects without shoes, holding their breath, standing upright on a flat ground with their heels and toes adjacent to a standing position, and a stadiometer (SECA, Germany) with a sensitivity of 0.01 m, is suitable for the desired measurement technique.

2.2. Body Weight

It was taken at 09:00 in the morning in order to get full results from the weight measurements, assuming that the individuals who participated in the study generally did not fill their saturation levels in the morning. While taking weight measurements, care was taken to ensure that the subjects were wearing no shoes and sportswear (tracksuits and t-shirts), and the sensitivity was measured with an electronic scale (SECA, Germany) with a 0.1 kg sensitivity in accordance with the desired measurement technique.

2.3. Body Mass Index Calculation (BMI)

The body mass index of the subjects was calculated by dividing the body weight in kilograms by the square of the height in meters with the formula accepted by the World Health Organization.

Body Mass Index (BMI) = Body Weight (kg) / Square of height (m2).

2.4. Foot Sole Length Measurement

The feet of the subjects were placed on a clean sheet of paper. A pencil was held perpendicular to the paper (at a 90 degree angle) and circumscribed around the feet. The distance between the backmost point of the heel and the tip of the toe was measured with a shoemaker tape measure and the length was measured with a stadiometer (SECA, Germany) with a degree of precision of 0.01 m in accordance with the desired measurement technique. (M.E.B Megep, 2013)

2.5. Foot Comb Width Measurement

The foot comb width of the subjects, the distance between the toes of the first (thumb) toe and the metatarsal, and the distance between the extremities of the parts where the fifth (little finger) joins the metatarsal, the desired measurement with a stadiometer (SECA, Germany) with a precision degree of 0.01 m. It was measured in accordance with the technique.

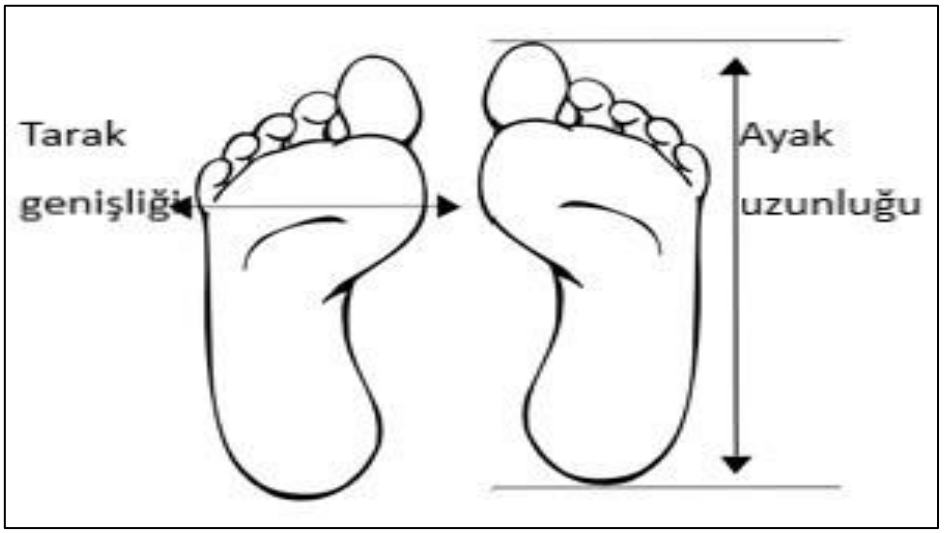

Figure 1: Foot Comb Width Measurement

2.6. Y Balance Test (YBT)

The "Y Balance Test" platform was used to measure dynamic postural control. Each participant's leg length was recorded in centimeters in the supine position by measuring bilaterally from the anteriorsuperioriliac point to the medialmalleolundistal part. Measurements were tested with bare feet, in 3 directions, as the distance between the farthest point from which the participant could reach ANT reach from the toe tip in the center, and PL and PM from the heel of the foot.

During the trial, the participants were asked to keep their hands on the iliac and their heels on the floor, and to make a light touch on the farthest point with the toe of the reach foot. Before the measurement, a short demonstration was made by the experienced researcher on how to apply the test and the participants were allowed to experiment in all directions at least 6 times (Robinson and Gribble, 2008).

After the test trials were completed, each participant was given a 2-minute rest period and then 3 stretches in each direction. During the measurement, it was accepted as a mistake for the participants to transfer their body weight to the reclining foot, separating the heel of the standing foot from the floor or separating their hands from the hip, and the measurement was repeated after the participant was verbally informed.

All reaches are recorded in centimeters. After the data were obtained, the scores obtained by using the formula "Best Reach / Leg Length) x100" for each direction were normalized in order to eliminate the leg length advantage (Robinson & Gribble, 2008). The total score (TOP) value was calculated by taking the average of the normalized ANT, PL and PM scores.

2.7. Statistical Analysis

All data obtained in the study were analyzed in the SPSS 20.0 software package program. Whether the data showed normal distribution was done by Kolmogorov-Smirnov test and since the given showed normal distribution, One-Way Anova test, which is a one-way analysis of variance, was used to determine the difference in the groups. As a result

of the comparisons, Tukey HSD method, one of the Post Hoc multiple comparison tests, was used to determine among which groups the difference occurred. In this study, the significance level was taken as 0.05.

3. Results

Table 1: Descriptive statistical values of the subjects

Variables	Foot sole length 19,0 with 20,0 cm / The toe comb width 8,0 with 8,5 cm	Foot sole length 20,1 with 21,0 cm / The toe comb width 8,6 with 9,0 cm	Foot sole length 21,1 with 22,0 cm / The toe comb width 9,1 with 9,5 cm	Foot sole length 22,1 with 23,0 cm / The toe comb width 9,6 with 10,0 cm
N	10	10	10	10
Percent (%)	25	25	25	25

When we examine Table 1, it is observed that the number and percentage values of the groups participating in the research are discussed.

Table 2: Grouping the subjects according to their feet

Variables	Foot sole length 19,0 with 20,0 cm / The toe comb width 8,0 with 8,5 cm	Foot sole length 20,1 with 21,0 cm / The toe comb width 8,6 with 9,0 cm	Foot sole length 21,1 with 22,0 cm / The toe comb width 9,1 with 9,5 cm	Foot sole length 22,1 with 23,0 cm / The toe comb width 9,6 with 10,0 cm
Group No	1st Group	2nd Group	3rd Group	4th Group
N (number)	10	10	10	10

When we examine Table 2, it is observed that the grouping table according to foot sole and foot comb measurements of the subjects participating in the research is discussed.

Table 3: Descriptive statistical values for the soles of the subjects

Variables	**Foot sole length / The toe comb width**			
	19,0 with 20,0cm 8,0 with 8,5 cm	20,1 with 21,0 cm 8,6 with 9,0 cm	21,1 with 22,0 cm 9,1 with 9,5 cm	22,1 with 23,0 cm 9,6 with 10,0 cm
	Average ± SS	Average ± SS	Average ± SS	Average ± SS
Age (years)	16,6± 1,02	16,8± 1,72	16,0± 1,09	16,4± 1,41
Height (cm)	158,3± 2,01	157,8± 2,29	158,1± 1,99	158,4± 1,55
Weight (kg)	57,86± 2,54	57,65± 2,01	57,75± 1,87	58,02± 2,06
BMI(kg/ m2)	23,09± 1,65	23,15± 1,67	23,10± 1,45	22,12± 2,01

In Table 3 we examine the soles of the subjects according to age and length of metatarsus width, height, weight and body mass is observed that dealt with the average index value.

Table 4: Comparison of the physical parameters of the subjects according to the size of their feet

Variables	Foot sole length / The toe comb width	Average	Standard deviation	F	P	Difference
	19,0 cm with 20,0 cm 8,0 cm with 8,5 cm	16,6	1,02			
	20,1cm with 21,0 cm 8,6 cm with 9,0 cm	16,8	1,72			
Age (years)				0,165	0,876	
	21,1 cm with 22,0 cm 9,1 cm with 9,5 cm	16,0	1,09			
	22,1cm with 23,0 cm 9,6 cm with 10,0 cm	16,4	1,41			
	19,0 cm with 20,0 cm 8,0 cm with 8,5 cm	158,3	2,01			
	20,1cm with 21,0 cm 8,6 cm with 9,0 cm	157,8	2,29			
Height (cm)				0,601	0,583	
	21,1 cm with 22,0 cm 9,1 cm with 9,5 cm	158,1	1,99			
	22,1cm with 23,0 cm 9,6 cm with 10,0 cm	158,4	1,55			
	19,0 cm with 20,0 cm 8,0 cm with 8,5 cm	57,86	2,54			
	20,1cm with 21,0 cm 8,6 cm with 9,0 cm	57,65	2,01			
Weight (kg)				0,402	0,698	
	21,1 cm with 22,0 cm 9,1 cm with 9,5 cm	57,75	1,87			
	22,1cm with 23,0 cm 9,6 cm with 10,0 cm	58,02	2,06			
	19,0 cm with 20,0 cm 8,0 cm with 8,5 cm	23,09	1,65			
	20,1cm with 21,0 cm 8,6 cm with 9,0 cm	23,15	1,67			
BMI				0,453	0,658	
	21,1 cm with 22,0 cm 9,1 cm with 9,5 cm	23,10	1,45			
	22,1cm with 23,0 cm 9,6 cm with 10,0 cm	22,12	2,01			

*p<0.05 significance level

When we examine the table above, we found that age, height, weight and body mass index values of all groups classified according to foot sole length and foot comb width were close to each other and there was no statistically significant difference between them (p> 0.05).

Table 5: Statistical values for the Y balance test of the subjects

Variables	Foot sole length 19,0 cm with 20,0 cm / The toe comb width 8,0 cm with 8,5 cm (Average ± SS)	Foot sole length 20,1 cm with 21,0 cm / The toe comb width 8,6 cm with 9,0 cm (Average ± SS)	Foot sole length 21,1 cm with 22,0 cm / The toe comb width 9,1 cm with 9,5 cm (Average ± SS)	Foot sole length 21,1 cm with 22,0 cm / The toe comb width 9,6 cm with 10,0 cm (Average ± SS)
Previous Right leg	65,43± 4,23	66,74± 5,99	67,90± 4,65	71,35± 5,45
Previous Left leg	64,22± 5,01	68,44± 4,17	69,72± 5,12	70,24± 6,13
Previous Average (cm)	64,32± 3,87	67,59± 4,54	68,81± 4,59	70,79± 5,34
Posteriomedial Right leg	80,01± 5,67	80,19± 6,34	81,45± 5,65	86,17± 6,46
Posteriomedial Left leg	77,60± 4,99	77,97± 5,32	79,05± 6,34	81,34± 5,98
Posteriomedial Average (cm)	78,81± 6,01	79,0± 4,95	80,25± 6,02	83,75± 6,35
Posteriolateral Right leg	81,92± 5,09	79,95± 6,11	82,76± 6,17	88,65± 7,23
Posteriolateral Left leg	80,01± 4,97	81,86± 5,94	82,15± 5,23	87,15± 6,64
Posteriolateral Average (cm)	80,96± 5,45	80,91± 6,31	82,45± 5,54	87,90± 6,29
Total average Y balance test	74,70± 5,87	75,86± 6,45	77,17± 5,19	80,81± 5,99

When we examine Table 5, the Y balance test of the groups is determined by the Anterior, Posteriomedial, Posteriolateral values of the right leg; left leg Anterior, Posteriomedial, Posteriolateral values; Y balance test performance, which is the mean values of the right and left leg Anterior, Posteriomedial, Posteriolateral mean values and the mean values of the right and left leg Anterior, Posteriomedial, Posteriolateral, are seen.

Table 6: Comparison of the foot sole measurements of the subjects with the Y balance test total scores

Variables	Foot sole length / The toe comb width	Average	Standard deviation	F	P	Difference
	19,0 cm with 20,0 cm 8,0 cm with 8,5 cm	74,70	5,87			
Total average Y balance Test	20,1cm with 21,0 cm 8,6 cm with 9,0 cm	75,86	6,45	2,701	0.014*	1-4
	21,1 cm with 22,0 cm 9,1 cm with 9,5 cm	77,17	5,19			2-4
	22,1cm with 23,0 cm 9,6 cm with 10,0 cm	80,81	5,99			

Note: 1- ≤ 20.0 cm and below - 8.0 cm and below, 2- 20.1 to 21.5 cm - 8.1 cm to 8.5 cm, 3- 21.6 to 23.0 cm - 8.6 cm to 9.0 cm, 4- 23.1 cm and above - 9.1 cm and above.

When we examine Table 6, in the comparison of Y balance performance values of the groups classified according to foot sole length and foot comb width measurements with each other; a statistically significant difference was found between groups 1 and 4 in favor of the 4th group ($p < 0.05$). In addition, as a result of the statistical evaluation, a statistically significant difference was found between groups 2 and 4 in favor of the 4th group ($p < 0.05$); although there are differences between the values of groups 1 and 3, groups 2 and 3, and groups 3 and 4, no statistically significant differences were found in these differences ($p > 0.05$).

4. Discussion and Conclusion

In this study, it was investigated whether foot sole length and foot comb width had a significant effect on Y Balance Test reach in sedentary women. The reason we used the Y balance test to determine balance performance in our study is: Y Balance Test (YCT) is shown as one of the screening tools that evaluate dynamic postural control and are used clinically for injury prediction (Butler et al., 2002). In addition, it has been reported that the reach performance scores obtained as a result of the Y Balance Test are important in determining the risk of injury and lower extremity asymmetry (Gribble et al., 2012).

During the study, care was taken that all of the subjects used to obtain the data had a sedentary lifestyle and that they were individuals without statistical differences in terms of age, height, weight and body mass index values.

Because it is thought that the performance of individuals in the same age group but with different height, weight and body mass index will also be different. As a matter of fact, when we look at the studies in the literature, in a study examining the relationships between physical fitness parameters in children aged 9-10, it was found that increases in body mass index negatively affect balance performance (Haslofça et al., 2011). In another study on sedentary women, ıt has been reported that increased body mass index values cause significant decreases in oxygen saturation levels (Taşkın et al., 2019). It is thought that significant decreases in oxygen saturation will cause muscle and bone fatigue and lack of concentration in individuals and consequently balance performance will be negatively affected. Foot sole length and foot comb width values are thought to be important in the balance performance of individuals.

Because the foot is a part of our body that carries all the weight of the body and therefore does a lot of work. For this reason, researches have been made to find the pressure distribution related to the tip of the foot. For years, these pressure points were accepted as the heel, first and thumb fingers, and then this view, namely the Kapandji assumption, was worn out thanks to pedobarography and it was proved that the second and third metatarsal heads were exposed to more pressure (Kanatlı et al., 2006). Postural stability, ie static and dynamic balance, is defined as the ability to control the center of gravity on the support base of the body (Wollacot, 1986). Posture and balance control also constitute the basis for motor skills in daily activities performed by the displacement of the whole body or parts (Ateş et al., 2017).

At the end of our work, in the comparison of the groups classified according to foot sole length and foot comb width with each other according to the Y balance test results; 1st groups with foot sole length between 19.0 cm and 20.0 cm and foot comb width between 8.0 cm and 8.5 cm, foot sole length between 22.1 cm and 23.0 cm and foot comb width It was determined that there was a statistically significant difference in favor of group 4 between groups 4 between 9.6 cm and 10.0 cm. In addition, as a result of the evaluation, a statistically significant difference was found between the 2nd and 4th groups in favor of the 4th group; no significant differences were found between the values of groups 1 and 3, 2 and 3, and groups 3 and 4. When we look at the results obtained in the study, it has been determined that as foot sole length and foot comb width increase, it creates positive effects on Y balance performance.

Position information is perceived by skin receptors and proprioceptors to stay in balance (Ataman, 2015). Joint receptors are responsible for proprioception sensation, and free nerve endings and Merkel discs and Meissner bodies are responsible for skin sensation (Yaltkaya, 2000). These sensory organs are particularly abundant in the soles of the feet and palms (Kaya, 2014). This information believe that it will provide significant advantages to individuals with large foot base surface and foot comb width, especially in dynamic balance performance created by static and postural oscillation. When we look at the literature, there are many studies on Y balance performance, but there are not many studies comparing foot sole and comb measurements with Y balance test. We think that this study we have done will be a study that will shed light for future studies and that foot sole and foot comb measurements are an important factor in Y balance performance.

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