

EVALUATION OF DYNAMIC BALANCE IN WOMEN ACCORDING TO SOME ANTHROPOMETRIC VARIABLES

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Abstract

The aim of the study is to examine the dynamic balance order in women in the context of age, height, body weight, body mass index (BMI), leg length, waist and hip circumference measurement values. Thirty-five female volunteers with a mean age of 39.03 ± 7.51 years were included in the study. Participants' ages, heights, body weights, BMI, leg lengths, waist and hip circumference values were determined. Again, the balance values reached on the Anteroposterior (AP) axis and the balance values reached on the Horizontal axis (ML) were determined, including the right, left and double feet of the participants. In the analysis of the data obtained, descriptive and anova tests were used in the SPSS 22 package program. Among the dynamic balance types, it was determined that only the bilateral AP balance level of the participants differed significantly according to the age variable ($p=0.015$) and the right foot AP balance level differed significantly according to the body weight ($p=0.030$). It was revealed that the balance types in question did not differ significantly ($p<0.05$) in all other anthropometric characteristics evaluated. As a result, it was determined that the left foot AP and ML balance values in the variables included in the study were at the level of normal or ideal balance values. On the other hand, the AP and ML balance values of the right foot were generally found to be at the level of weak balance values.

Keywords: Dynamic balance, Height, Body weight, Leg length, Waist circumference, Hip circumference.

INTRODUCTION

Balance is a feature needed in every aspect of human life. However, it is also very important in terms of sportive performance and business performance. It plays an important role in preventing accidents and injuries that may occur in business life and in displaying sports performance. We see that balance is defined in different ways.

Clark (2004) defines balance as "a feature that allows the movements of the body in a way that adapts to the instant and daily position of the body". Nashner (1997) defined balance as "a complex process involving coordinated activities of many sensory, motor and biomechanical components", while Browne and O'Hare (2001) defined balance as "the ability to maintain a state of balance by positioning our center of gravity on our support surface".

This ability helps to solve motoric problems that arise in conditions where there are narrow resting areas and balance can easily be disturbed, such as the deterioration of balance due to the change in the body's center of gravity (Muratlı, 1997). The center of gravity is the center of our body mass and it changes according to the movement and position of the body segments (Browne and O'Hare, 2001).

Balance is a complex system in terms of maintaining the proportional position of body parts. The harmonious use of different muscle groups and the combination of different sensory perceptions (visual, auditory, sensory) are effective in the emergence of this complex system. The ability to balance, which starts to develop with childhood, reaches adulthood at the age of 10 (Atılğan et al, 2006).

There are two types of balance, static and dynamic balance. Of these, static balance can be defined as the state of keeping people's bodily balance in a certain position on a certain ground. Handstand stance and glider stance can be given as examples of static balance (Muratlı, 2003).

While Aktumsek (2012) defines dynamic balance as "adjustment of body positions such as turning, accelerating and decelerating", Tortop et al. (2014) defined balance as "the ability to move without losing or falling".

Balance is one of the important motoric features that contribute to high performance by allowing life to be organized and more successful. As a result of the researches, it has been determined that the balance has a positive effect on the increase of body performance and allows the performance to become permanent. From this point of view, it is understood that balance plays an important role in skill learning and talent selection. Recent developments in both training methods and techniques and training fields make it possible to apply balance studies to advanced age groups (Köseoğlu, 2000).

Standing balance is essential for many activities of daily living. These changes affect balance ability, and this increases the likelihood of falls during activities in adults. Balance disorders have been reported to be a major factor in the occurrence of falls (Briggs, 1998). Postural stability decreases with age after 30 years of age. The decrease in postural stability with age can be attributed to natural cardiovascular deconditioning, neurological disorders, and deterioration of the balance control system due to disease or age (Isles et al., 2004).

It is possible to talk about the existence of balance in almost every branch of sports. Balance is one of the basic conditions, especially in sports activities based on movement. If the balance is lost, it is not possible to achieve performance, however, serious health problems may occur. Balance has a very important place in the development of skills related to body coordination (Ragnasrdottir, 1996).

Yağcı et al., (2004) reported that balance is one of the main factors in displaying a high level of performance, and that balance performance, which is a complicated skill, can be affected by factors such as height, weight, gender and sports activity.

The aim of this study is to evaluate the balance feature in sedentary women in the context of age, height, body weight in general, and BMI in the context of leg length, waist and hip circumference measurement values in particular.

METHOD

Thirty-five female volunteers with a mean age of 39.03 ± 7.51 years, an average height of 161.40 ± 6.80 cm, and a mean body weight of 75.05 ± 11.61 kg were included in the study.

Their age, height, body weight, waist and hip circumference measurements, leg lengths and dynamic balance levels were determined.

At this point;

Height; Height was measured on a flat surface with the bare feet of the participant using a meter fixed to the wall.

leg length; The leg lengths of the participants were measured with a non-flexible tape measure. While the participants were in the anatomical posture, the distance between the trochanterion region and the floor was determined and recorded in cm. **Body weight;** Body weight was measured with a sensitive electronic scale while the participant was barefoot.

Waist circumference; Waist circumference was recorded by measuring the smallest waist circumference between the lowest rib and anterior superior to the processus spina drug, as a transfer over the navel parallel to the ground.

Hip circumference; The circumference was measured from the widest point on the side, using a non-stretchable tape measure, while the person was wearing the least amount of clothing.

BMI; It was obtained by dividing the participants' body weight (kg) by the square of their height (m) ($BMI=kg/m^2$).

Tecno-body ProKin PK200 model dynamic balance device was used to measure the dynamic balance values of the participants, dynamic balance proprioception values with 0.1° measurement precision, validity and reliability. This device has a tilt position of 12° in all directions from the center to the horizontal axis. In addition, the device can measure in three different degrees as

easy, medium and difficult. Before the measurements were taken, the participants were informed about the test. Then, the device was adjusted to the easy level, and measurements were taken after 1 trial was made for each participant, including the right foot, left foot and both feet.

Dynamic balance measurement measures the displacement of the person's center of gravity along with the movement of the body. During the application, the participant aims to align the center of gravity on the balance platform with the target lines on the screen.

AP Balance: The balance value reached in the Anteroposterior axis (< 0.3 ideal, 0.3-0.6 normal, >0.6 poor balance)

ML Balance: The balance value reached on the horizontal axis (< 0.7 ideal, 0.7-1.4 normal, >1.4 poor balance) (133).

The measured values were transferred to the computer environment. In the analysis of these data, descriptive and anova tests were used in the SPSS 22 package program.

RESULTS

When Table 2, dynamic balance values were evaluated in the context of the age variable, it was seen that AP bilateral foot balance values differed significantly ($p < 0.05$) between the groups, but there was no significant (0.05) difference in terms of other balance values. Again, it was determined that there was no significant ($p < 0.05$) difference according to the length variable. When the dynamic balance value was analyzed according to body weight, it was seen that there was a significant ($p < 0.05$) difference in the AP right foot balance value, and there was no significant ($p < 0.05$) difference in the other balance values. When the dynamic balance levels were examined in terms of hip circumference measurement values, it was found that there was no significant ($p < 0.05$) difference.

Table 1. Average values of the participants for some variables

Variable	N	Average	Standard deviation
Age (years)	35	39,03	7,51
Height (cm)	35	161,40	6,80
Body weight (kg)	35	75,05	11,61
Hip circumference (cm)	35	111,74	9,61
Waist circumference (cm)	35	90,06	12,36
Leg length (cm)	35	86,63	5,09
BMI (kg/m ²)	35	28,56	5,32
AP (Right)	35	1,34	4,12
AP (Left)	35	-0,13	2,58
AP (Double)	35	1,17	2,96
ML (Right)	35	2,33	3,12
ML (Left)	35	-2,01	2,57
ML (Double)	35	0,70	1,78

Table 2. Distribution of dynamic balance levels according to age, height, body weight and hip circumference measurement values

Variable	Group	N	AP (Right)				AP (Left)				AP (Double)				ML (Right)				ML (Left)				ML (Double)			
			Avg	s.d.	F	p	Avg	s.d.	F	p	Avg.	s.d.	F	p	Avg	s.d.	F	p	Avg	s.d.	F	p	Avg	s.d.	F	p
Age (years)	24-28	2	5,63	2,49	1,62	0,19	0,00	0,00	1,029	0,419	2,06	0,52	3,435	0,015*	3,73	5,57	2,27	0,922	-4,41	0,63	0,843	0,531	-0,96	3,86	1,138	0,363
	29-33	6	2,39	3,78			-2,01	3,03			-1,69	2,62			3,17	5,08			-2,02	4,23			2,04	2,36		
	34-38	7	-1,18	2,49			0,71	1,89			-0,22	1,61			2,57	4,17			-1,25	2,10			0,74	1,11		
	39-43	13	2,40	3,21			0,52	3,05			2,22	2,91			2,07	1,71			-1,49	1,97			0,39	1,71		
	44-48	2	1,29	6,97			0,00	0,00			5,00	5,26			1,78	3,11			-2,16	0,38			0,40	0,25		
	49-53	5	-0,83	6,42			-0,83	1,86			1,91	1,35			1,33	1,39			-3,38	2,85			0,61	1,12		

Height (cm)	147-152	5	3,64	3,74	1,792	0,169	-1,00	2,25	0,254	0,858	1,97	1,94	0,159	0,923	1,93	2,33	0,362	0,781	-0,87	2,50	0,664	0,580	0,64	2,40	0,739	0,537
	154-160	11	-0,70	4,79			0,00	0,00			1,22	4,51			2,13	4,00			-2,29	2,18			1,08	1,79		
	161-167	12	2,37	3,98			-1,14	3,63			0,99	2,44			2,03	3,22			-2,57	2,78			0,11	1,63		
	168-174	7	1,12	2,33			0,32	3,07			0,82	1,19			3,46	2,03			-1,42	2,96			1,15	1,66		
Body Wright (kg)	57-66,2	7	3,48	3,10	3,110	0,030*	-1,72	2,87	1,441	0,245	0,12	1,65	1,370	0,268	3,60	4,26	0,585	0,676	-3,20	3,81	1,701	0,176	0,64	2,59	0,227	0,921
	66,3-75,5	14	0,22	2,98			0,90	3,05			0,35	3,40			2,16	3,61			-1,71	1,99			0,92	1,61		
	75,6-84,8	7	2,40	3,87			0,00	0,00			2,47	2,27			1,29	1,39			-1,74	1,37			0,40	2,06		
	84,9-94,1	5	2,83	4,22			-1,00	2,25			3,00	3,64			2,95	2,09			-0,40	2,00			0,30	1,12		
	94,2ve üst	2	-5,76	8,59			0,00	0,00			1,44	0,82			1,14	0,63			-4,90	4,05			1,42	0,64		
Hip circumference (cm)	97-103	8	1,37	3,56	0,620	0,652	2,05	3,42	2,354	0,076	0,18	1,40	2,436	0,069	3,11	3,51	0,963	0,442	-3,23	3,08	1,170	0,344	-0,04	1,77	0,705	0,595
	104-110	10	1,23	6,02			-1,09	2,36			3,39	3,49			1,08	2,59			-2,53	2,15			1,02	1,09		
	111-117	8	3,07	3,28			-0,63	1,77			-0,05	1,93			3,70	4,00			-0,79	2,84			1,31	2,62		
	118-124	5	-0,45	2,88			0,00	0,00			0,31	3,90			1,78	2,85			-1,60	1,71			0,63	1,31		
	125ve üstü	4	0,33	1,87			-1,26	2,51			1,09	2,7			1,85	0,89			-1,20	2,43			0,22	1,93		

* p<0,05

Table 3. Distribution of dynamic balance levels according to leg length, body mass index and waist circumference measurement values

Variable	Group	N	AP (Right)				AP (Left)				AP (Double)				ML (Right)				ML (Left)				ML (Double)			
			Avg	s.d.	F	p	Avg	s.d.	F	p	Avg.	s.d.	F	p	Avg	s.d.	F	p	Avg	s.d.	F	p	Avg	s.d.	F	p
Leg length (cm)	77-80	6	-0,41	5,83	0,640	0,638	-0,84	2,05	1,282	0,299	1,31	1,21	1,001	0,423	2,75	2,51	0,883	0,486	-2,70	3,46	1,074	0,387	1,06	2,26	0,183	0,945
	81-84	8	1,62	2,79			1,26	4,59			-0,35	1,85			3,08	3,90			-2,38	1,85			0,41	1,27		
	85-88	8	0,47	3,31			-0,05	0,13			2,60	4,12			2,71	3,65			-2,82	2,79			0,91	1,33		
	89-92	8	2,19	4,94			0,00	0,00			1,21	2,25			2,39	2,54			-0,49	2,09			0,75	2,35		
	93-97	5	3,04	3,86			-1,84	2,53			1,08	4,38			-0,05	2,26			-1,71	2,61			0,31	2,08		
BMI (kg/m2)	18.5 -24,9	11	2,38	1,96	0,572	0,570	0,61	3,33	0,809	0,454	1,11	3,19	0,020	0,980	4,06	4,17	3,291	0,050	-2,88	2,96	1,812	0,180	0,98	1,72	0,357	0,702
	25 - 29,9	12	0,54	5,55			-0,17	2,51			1,31	3,02			2,14	2,09			-2,28	2,37			0,36	2,17		
	30 - 39,9	12	1,19	4,04			-0,77	1,80			1,08	2,93			0,94	2,20			-94	2,16			0,77	1,48		
Waist circumference (cm)	70-76	6	0,95	2,36	0,682	0,641	1,21	2,16	0,863	0,518	1,52	3,65	1,446	0,238	3,74	3,57	1,075	0,395	-2,94	3,57	1,702	0,166	1,01	1,10	0,664	0,654
	77-83	6	0,82	5,33			0,41	5,04			-1,16	3,04			-0,02	2,45			-2,87	1,36			-0,36	1,93		
	84-90	11	1,79	5,51			0,00	0,00			2,26	3,19			2,90	4,04			-2,83	2,36			1,08	2,01		
	91-97	3	4,92	2,04			-1,39	2,40			1,54	2,46			2,14	2,96			-0,83	1,49			0,97	1,12		
	98-104	2	-1,30	0,49			0,00	0,00			-1,17	0,45			1,21	0,30			0,23	3,38			-0,24	1,52		
	105-112	7	0,63	2,40			-1,43	2,45			1,66	1,35			2,64	0,91			-0,33	2,18			0,88	2,10		

Table 3, when different dynamic balance values were compared according to leg length, BMI and waist circumference measurement values, it was determined that the balance values did not differ significantly (p<0.05) according to these variables.

DISCUSSION

The mean AP balance values of the right foot of the participants were 1.34 ± 4.12 , the mean of the left foot AP balance values were -0.13 ± 2.58 , and the mean of the AP balance values of both feet was 1.17 ± 2.96 . Again, while the average of the participants' right foot ML balance values was 2.33 ± 3.12 , the average of the left foot ML balance values was -2.01 ± 2.57 . The average of the ML balance values of both legs is 0.70 ± 1.78 .

When AP balance values were evaluated according to the literature (133) classification (<0.3 ideal, 0.3-0.6 normal, >0.6 weak balance), it was observed that right foot AP balance and bipedal AP balance values were in the weak balance values group, left foot AP balance values were found to be in the ideal balance values group. However, when the ML balance values of the participants were compared with the classification in the literature (<0.7 ideal, 0.7-1.4 normal, >1.4 poor balance), it was observed that the ML balance values of the right foot were in the weak balance group, and the ML balance values of the left foot were in the ideal balance group. It was determined that the balance levels of the ML group and both feet were at the normal balance level. In the study conducted by Öner (2021), on tennis players aged 11-13, in the pre-test measurements, the mean AP balance values of the right foot were 1.38 ± 1.62 , the average of the left foot balance values were 1.67 ± 1.13 and the average of

the double-footed AP balance values was 1.89 ± 1.48 in the control group. has found. These three average values are in the weak equilibrium value class. Again, in the same study, the control group reported that the mean ML values of the left foot in the pre-test were 2.33 ± 2.01 , the mean of the balance values of the right foot ML was 1.87 ± 1.75 , and the mean ML values of both feet was 2.44 ± 1.86 . It was observed that these equilibrium values were also included in the weak equilibrium values. It is thought that the differences here are mostly due to the physical characteristics arising from age differences.

When the AP balance values of the right foot were evaluated according to the age values of the participants, the average values of -1.18 ± 2.49 and -0.83 ± 6.42 years of the participants between the ages of 34-38 and those between the ages of 49-53 years, respectively. It was seen that they had ideal equilibrium values with It was observed that the participants in the other age groups included in the study had weak balance values. As a result of the statistical analysis of these mean values obtained, it was determined that there was no significant ($p=0.19$) difference according to the age variable. When the left foot AP balance values of the participants were evaluated in the context of the age variable, it was determined that the participants aged between 34-38 years had normal balance values with an average of 0.71 ± 1.89 . It was revealed that all of the other age groups in the study had ideal balance values. As a result of the analysis of these mean values, it was seen that there was no significant difference ($p=0.299$). When the relationship between the age variable and the participants' bipedal AP balance values was examined, the average of the bipedal AP balance values of the participants aged 24-28 was 2.06 ± 0.52 , and the average of the bipedal AP balance values of the participants aged 29-33 was -1 . It was determined to be 69 ± 2.62 . Again, the average of the AP balance values of the individuals between the ages of 34-38 was -0.22 ± 1.61 , the average of the AP balance values of the participants between the ages of 39-43 was 2.22 ± 2.91 , and the average of the AP balance values of the participants aged between 44-48 years was -0.22 ± 1.61 . It was determined that the mean of the foot AP balance values was 5.00 ± 5.26 and the mean of the double foot AP values of those aged between 49-53 was 1.91 ± 1.35 . As a result of the analysis of these available data, it was observed that there was a significant ($p=0.015$) difference. When the ML balance values of the subjects were considered according to the age variable, it was revealed that all subjects had poor balance values compared to the average of the right foot ML balance values. As a result of the statistical analysis of the mean balance values of the groups, it was seen that there was no significant difference ($p=0.922$). Considering the averages of left foot ML balance values, it was understood that all age groups included in the study had ideal balance levels. Analysis of the mean values of the age groups revealed that the differences between the groups were not significant ($p=0.531$). However, when the bilateral ML balance values were considered, it was seen that the participants in the 29-33 age range had weak balance values (2.04 ± 2.36). It was seen that the participants in the 34-38 age range had normal balance values with the mean (0.74 ± 1.11) values, and the participants in the other age groups had ideal balance values. It was observed that the differences between the mean values of all age groups were not significant ($p=0.363$). Hurüz and Ateş-Çakır (2020), in their study on sedentary people, revealed that there was no significant difference between the values of both the right and left legs in terms of dynamic balance between age groups. Here, rather than the difference between the groups, it is whether the groups are in the ideal, normal or weak equilibrium groups. For example, while the right foot and bipedal AP balance values of the participants in the 34-38 age range were at an ideal level, the left foot AP balance values were found to be normal. This is thought to be due to the fact that the left foot is dominant.

When the balance values included in the study were analyzed according to the height variable, it was observed that the right foot AP values of the participants were 147-152 cm in average (3.64 ± 3.74) and those with a 161-167 cm height (2.37 ± 3 cm). ,97) were found to have poor balance. Those with a height of 168-174 cm have normal balance values with an average of 1.12 ± 2.33 and those with a height between 154-160 cm have ideal balance values with an average of -0.70 ± 4.79 . was determined to be. It was determined that these mean values did not show a significant change ($p=0.169$) according to the height variable. When the left foot AP balance values were considered according to the height variable, it was understood that all participants had ideal balance values with their averages. As a result of the analysis of the mean AP balance values of the left foot, it was observed that there were no significant ($p=0.858$) differences. In addition, when the AP balance values of both feet were classified according to the height of the participants, it was determined that those with a height of 147-152 cm had poor balance values (1.97 ± 1.94). Other groups were found to have normal balance values. As a result of the statistical analysis of the mean balance values of the subjects with different heights, it was revealed that there was no significant difference ($p=0.923$) between the groups. However, when the ML balance values were considered in the context of the height variable, it was determined that all age groups had poor balance values in terms of the mean ML balance values of the right foot. It was not observed that the mean values of these groups did not differ significantly ($p=0.781$) according to the height variable. When the left foot ML balance values of the participants were considered, it was determined that all participants had ideal balance values. When the mean values of the groups were compared statistically, it was found that there was no significant (0.580) difference between the groups. In addition to all these, when the ML balance values of both feet are examined, the balance values of the participants with a height of 147-152 cm (0.64 ± 2.40) and the balance values of the participants with a height of 161-167 cm (0.11 ± 1.63) were found to be within the ideal equilibrium values. It was determined that the mean balance values of individuals with a height between 154-160 cm and 168-174 cm were within the normal balance values. It was determined that the ML balance level of both feet did not show a significant difference ($p=0.537$) according to the height variable. Akgöl (1997) reported

in his study that taller people were more successful in balance tests. Again, Era et al. (1997) stated in their study that being short is not important in balance.

When the right foot AP balance values of the participants were examined according to the body weight variable, it was revealed that the average of the AP balance values in those with a body weight of 66.3-75.5 kg and a body weight of 94 kg and above were in the ideal group according to the classification in the literature. It was determined that the averages of the other body weight variable groups had weak balance values. As a result of statistical comparison of these mean values, it was revealed that there was a significant ($p=0.030$) difference between the groups. As a result of evaluating the left foot AP balance values in the context of body weight, it was found that only participants with a body weight between 66.3-75.5 kg had poor balance values (0.90 ± 3.05), although all other groups were different from each other, all of them had ideal balance values were found. It was determined that these mean values did not differ significantly ($p=0.245$) as a result of the statistical analysis. As a result of examining the AP values of both feet according to the body weight variable, it was determined that the average values ($p=0.12 \pm 1.65$) of the participants with a body weight between 57-66.2 kg were within the ideal balance values. It was revealed that the mean values of the participants with a body weight between 66.3-75.5 kg ($p=0.35 \pm 3.40$) were in the range of normal balance values, and the participants in other different body weight groups had poor balance values. As a result of the comparison of these mean values, it was determined that the differences were not significant ($p=0.268$). When the right foot ML balance values of the participants included in the study were considered within the framework of the body weight variable, it was revealed that those with a body weight of 75.6-84.8 kg and those with a range of 94.2 and above had normal balance values. Although the other groups had different equilibrium mean values, it was understood that all of them had weak equilibrium values. It was determined that the differences between the mean values of the groups were not significant ($p=0.676$). On the other hand, it was determined that all participants had ideal left foot ML balance values. It was understood that the differences between these ideal equilibrium values were not statistically significant ($p=1.701$). When the two-foot ML balance values of the subjects are examined according to their body weight levels, those with a body weight of 66.3-75.5 kg and those with a body weight of 94.2 and above have normal ML balance values, while the subjects in all other groups have ideal ML balance values. They were found to have equilibrium values. It was determined that the differences between the mean values of the groups were not significant ($p=0.921$). A study (Hurüz and Ateş-Çakır, 2020) revealed that there is a negative relationship between body weight and dynamic balance values. Again, Mc Graw et al (2000) reported that body weight negatively affects dynamic balance. Moein and Movaseghi (2016) also found in their study that obesity showed a mildly negative correlation between balance. Along with these, Hansen et al. (2000) stated in their study that there was no statistically significant relationship between body weight and balance.

When the AP balance values of the right foot were analyzed in the context of the hip circumference levels of the participants included in the study, it was seen that the mean balance values of those with a hip circumference of 118-124 cm were -0.45 ± 2.88 , which is included in the classification of ideal balance values. It was also determined that those with a hip circumference of 125 cm and above had normal balance values with an average value of 0.33 ± 1.87 . It was revealed that the participants in the other groups had poor balance in terms of their average values. It was determined that there was no significant ($p=0.652$) difference between the balance values of the participants. However, considering their hip circumference and left foot AP balance values, 104-110 cm (-1.09 ± 2.36), 111-117 cm (-0.63 ± 1.77), 118-124 cm (0.00 ± 0.00) and 125 cm and above (-1.26 ± 2.51) had ideal equilibrium values, on the other hand, 97-103 cm (2.05 ± 3), It was revealed that subjects with hip circumference in the range 42 had poor balance values. When these mean values were compared statistically, it was revealed that there was no significant difference ($p=0.076$) between them. Again, when the AP balance values of both feet were examined according to the hip circumference of the participants, it was determined that the subjects with a hip circumference between 97-103 cm (0.18 ± 1.40) and 111-117 cm (0.05 ± 1.93) had ideal balance. It was revealed that subjects with hip circumference between 118-124 cm had normal balance (0.31 ± 3.90) and the other groups had poor balance. It was seen that the difference between these mean values was not significant ($p=0.069$). When the right foot ML balance values were classified according to the hip circumference variable, it was determined that only women with a hip width of 104-110 cm had normal balance values. It was determined that all women with hip circumference outside this range had average weak balance values. In this sense, there were no significant ($p=0.442$) differences between the groups. When the ML balance values of the left foot were examined, it was understood that all women had ideal balance values, and when the mean values of the groups were compared statistically, there was no significant ($p=0.344$) difference between them. When the ML balance values of both feet are examined, it is seen that those with a hip width of 97-103 cm have an average value of -0.04 ± 1.77 , and those with a hip circumference of 125 cm and above have a mean value of 0.22 ± 1.93 . It was determined that they had the ideal balance level with the mean value. Participants with a hip width between 118 and 124 cm had a normal balance level with an average of 0.63 ± 1.31 , and participants with a hip circumference other than these values had a poor balance level in terms of mean values. As a result of the comparison of these mean values, it was revealed that the difference between the groups was not significant ($p=0.595$).

Considering the dynamic balance values of the participants in terms of leg length values, it was determined that the average balance values of the participants with a leg length between 77-80 cm only (-0.41 ± 5.83) were within the ideal balance values in terms of right foot AP balance values. It turned out that all other individuals with different leg lengths had poor balance values. The difference between these mean values was found to be insignificant ($p= 0.638$). When the obtained data were analyzed in terms of left foot AP balance values, it was observed that the average balance values (1.26 ± 4.59) of the participants with a leg length between 81 and 84 cm were at a weak balance level, whereas they had an ideal balance level with the averages of all other groups. It turns out they were. The differences between the groups were found to be insignificant ($p=.299$). In the double-foot AP balance value, it was understood that only the subjects with a leg length between 81-84 cm had an ideal balance level with an average value of -0.35 ± 1.85 , while the subjects in all other groups had poor balance. It was observed that the difference between these mean values was not significant ($p=.423$). When the ML balance values were examined according to the leg length, it was seen that the average of the right foot ML balance values was -0.05 ± 2.26 only in individuals with a leg length of 93-97 cm, and this could be evaluated within the ideal balance level. On the other hand, it was determined that the mean balance values in all the other groups with different leg lengths were >0.6 , which was classified as poor balance level. It was determined that the difference between the mean balance values of the groups was not significant ($p=.486$). When the left foot ML balance values were examined according to the leg length, it was seen that all of the groups with different leg lengths had ideal balance values. Although all of them had ideal equilibrium values, it was determined that the differences between them were not significant ($p= 0.387$). When the ML balance values of both feet were evaluated in the context of the same variable, those with a leg length between 81-84 cm (0.41 ± 1.27) and those with a leg length between 93-97 cm (0.31 ± 2.08) were normal. It was understood that they had equilibrium values, while the other groups had weak equilibrium values. It was observed that there was no significant ($p= 0.945$) difference between these mean values. Moein and Movaseghi (2016) reported in their study on university students that the relationship between lower leg length and dynamic balance was at the level of $r=0.164$.

When the dynamic balance levels of the participants were examined in terms of BMI index values, the average AP balance values of the right foot of those with a BMI between 18.5 and 24.9 kg/m² were 2.38 ± 1.96 , and those with a BMI between 25-29.9 kg/m² on the right. It was observed that the mean of the foot AP balance values was 0.54 ± 5.55 . Again, it was determined that the mean AP values of the right foot of those whose BMI values were in the range of 30 - 39.9 kg/m² were 1.19 ± 4.04 . According to these average values, it was understood that those with a BMI between 25 and 29.9 kg/m² had normal balance values, while the participants in the other groups had weak balance values. The difference between these average values was not significant ($p=0.570$). When the left foot AP values of the participants are considered according to the BMI value, it is seen that the participants with a BMI between 18.5 and 24.9 kg/m² have poor balance, between 25-29.9 kg/m² and between 30-39.9 kg/m². It was determined that those with BMI had ideal equilibrium values. When these mean values were compared statistically, it was revealed that there were no significant ($p= 0.454$) differences between them. When the AP balance values of both feet were examined in the context of BMI value, it was found that the average of the balance values of the participants in all groups was greater than 0.6, which is considered the limit of weak balance values. It was observed that there was no significant difference ($p= 0.980$) between the mean values of the groups. When the right foot ML balance values of the participants were examined according to their BMI values, it was seen that only those with a BMI value in the range of 30-39.9 kg/m² had a normal balance value average (0.90 ± 2.20). It was observed that the other groups had weak equilibrium values. It was determined that there were significant ($p= 0.050$) differences in the mean balance values of the groups. Looking at the ML balance values of the left foot, it was revealed that the participants with a BMI value between 18.5 and 39.9 kg/m² had ideal balance values. Likewise, when the ML balance values of both feet are taken into account, the ideal balance values of the subjects with BMI in the range of 25-29.9 kg / m², the individuals with BMI in the range of 18.5 -24.9 kg / m² and 30-39.9 kg / m². They were found to have normal equilibrium values. It was understood that the differences between these values were not statistically significant ($p=0.702$). Hurüz and Ateş-Çakır (2000) reported in their study that there is a moderate negative correlation between BMI values and dynamic balance. In another study (Greve et al., 2007), the relationship between dynamic balance and BMI was examined and a significant relationship was reported between obesity and postural instability.

When the dynamic balance values of the subjects were examined according to the waist circumference values, the right foot AP balance values were found only in the ideal balance values of those whose waist circumference measurement values were between 98-104 cm (-1.30 ± 0.49), and in all other groups with different waist circumferences. On the other hand, it was revealed that the subjects who took it had weak equilibrium values. It was determined that the differences between the mean values between the groups were not significant ($p= 0.641$). When the left foot AP balance values were considered, it was determined that only those with a waist circumference of 70-76 cm had a weak balance value average (1.21 ± 2.16), whereas all subjects in the other groups had ideal balance values. In addition, it was found that the differences between these mean values were not significant ($p= 0.518$). When the two-foot AP balance values were evaluated according to the waist circumference, it was found that the subjects with waist circumference between 77-83 cm and 98-104 cm had the ideal balance value average, while the subjects in the other groups with different waist circumferences had poor balance values. By statistical comparison of the mean AP balance values of the groups according to the groups, it was found that there was no significant ($p=$

0.238) difference between them. When the right foot ML balance values of the participants are considered within the scope of waist circumference values, it was found that only those with a waist circumference of 77-83 cm had the ideal balance value ($-0,02 \pm 2.45$), while the participants in the groups with other waist circumference values were found to have an ideal balance value. They were found to have weak equilibrium values. It was observed that the difference between the mean values of the right foot ML balance values was not significant ($p= 0.395$). In the mean ML values of the left foot, it was understood that the participants with the whole waist circumference had ideal balance values. However, it is another result that the difference between the mean values of the groups was not significant ($p= 0.166$). When the bilateral foot balance values were considered according to their waist circumference, it was seen that the participants whose waist circumferences were between 77-83 cm and 98-104 cm had averages of -0.36 ± 1.93 and -0.24 ± 1.52 , respectively. It was determined that all of the participants in the other waist circumference groups had weak balance values. It was determined that the difference between these mean values was not significant ($p= 0.654$). In a study (Hurüz and Ateş-Çakır, 2000) it was reported that the dynamic balance level was negatively correlated with the abdominal circumference measurement value.

CONCLUSION

As a result, it was determined that the left foot balance levels of the participants were better than the right foot balance levels at the level of all variables, in the balance levels evaluated according to different parameters, whether in AP or ML balance values.

DECLARATION

Conflict of interest

No conflict of interest in this manuscript

Authors Contributions

Author HBT contributed to the design, analysis, writing and translation of the study, while author HKB contributed to the taking and processing of the measurements.

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