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Original Research

Assessment of effects of obesity on the balance and gait

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ABSTRACT:

Background: In general, a high body mass index (BMI) has no detrimental effects on the locomotor system; nonetheless, obesity is linked to a higher risk of falls and subsequent injuries. The present study was conducted to assess the effects of obesity on the balance and gait. **Materials & Methods:**50 subjects of both genders. All gave their written consent to participate in the study.Group I comprised of obese and group II were non- obese. Functional reach test (FRT) was used for balance testing. The Footprint method was also recorded. **Results:** Out of 50 patients, males were 23 and females were 27. In group I and II, mean foot length (mm) in males was 267.4 and 266.2 and in females was 244.2 and 238.6 respectively. The mean foot width (mm) was 106.4 and 94.2 in males and 94.2 and 92.6 in females. The difference was significant (P< 0.05). The mean FRT in males was 11.8 inches and 16.2 inches in group I and II respectively. In females was 7.8 inches and 11.4 inches respectively. The degree of toe out was 9.2 degrees and 6.7 degrees and in females was 8.9 degrees and 6.8 degrees in group I and II respectively. The difference was significant (P< 0.05). **Conclusion:** Obesity has a negative impact on balance of an individual. The degree of toe out was more in obese group as compared to normal BMI group in both genders. The Step Width measurement was more in males of obese group than that in males of normal BMI group.

Keywords:body mass index, Functional reach test, Functional reach test

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INTRODUCTION

In general, a high body mass index (BMI) has no detrimental effects on the locomotor system; nonetheless, obesity is linked to a higher risk of falls and subsequent injuries.[1]Being overweight puts more strain on the soft tissues, joints, and bones in the body, which impairs musculoskeletal function and causes aberrant body mechanics.[2] These disabilities, which include poor balance, strength, gait, sensory, and neuromuscular function, have been found to be significant risk factors for falls.Strong risk factors for falls have also been found to include decreased walking speed, cadence, and step length in addition to prolonged stance times.[3] Changes in gait brought on by obesity are linked to a higher risk of falls. Numerous research investigations have discovered that obese individuals exhibit significantly reduced walking speeds, step lengths, and step frequencies when compared to non-obese individuals.[4]Furthermore, obese people have longer stance phases and longer periods of double support.[5] Posture provides stability in the obese by counteracting an anterior displacement of the center of mass (COM) from the longitudinal axis of the body associated with obesity, reducing the amount of corrective torque needed to maintain balance.[6]The present study was conducted to assess the effects of obesity on the balance and gait.

MATERIALS & METHODS

The present study consisted of 50 subjects who were able to stand and walk unsupported and had full joint range of motion at shoulder joint of both genders. All gave their written consent to participate in the study.

Data such as name, age, gender etc. was recorded. Body weight, body height, BMI were measured.Group I comprised of obese and group II were non- obese. According to WHO, BMI between 18.5-24.9 was considered as normal, BMI between 25-29.9 was considered as overweight and BMI 30 and above was considered as obese.Functional reach test (FRT) was used for balance testing.The Footprint method was

also recorded. Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

RESULTS

Table I Distribution of patients

Total- 50		
Gender	**Male**	**Female**
Number	23	27

Table I shows that out of 50 patients, males were 23 and females were 27.

Table II Foot length and foot width in both groups

Parameters	Gender	Group I	Group II	P value
Foot length (mm)	Male	267.4	266.2	0.15
	Female	244.2	238.6	0.05
Foot width (mm)	Male	106.4	94.2	0.01
	Female	94.2	92.6	0.04

Table II, graph I shows that in group I and II, mean foot length (mm) in males was 267.4 and 266.2 and in females was 244.2 and 238.6respectively. The mean foot width (mm) was 106.4 and 94.2 in males and 94.2 and 92.6 in females. The difference was significant (P< 0.05).

Graph I Foot length and foot width in both groups

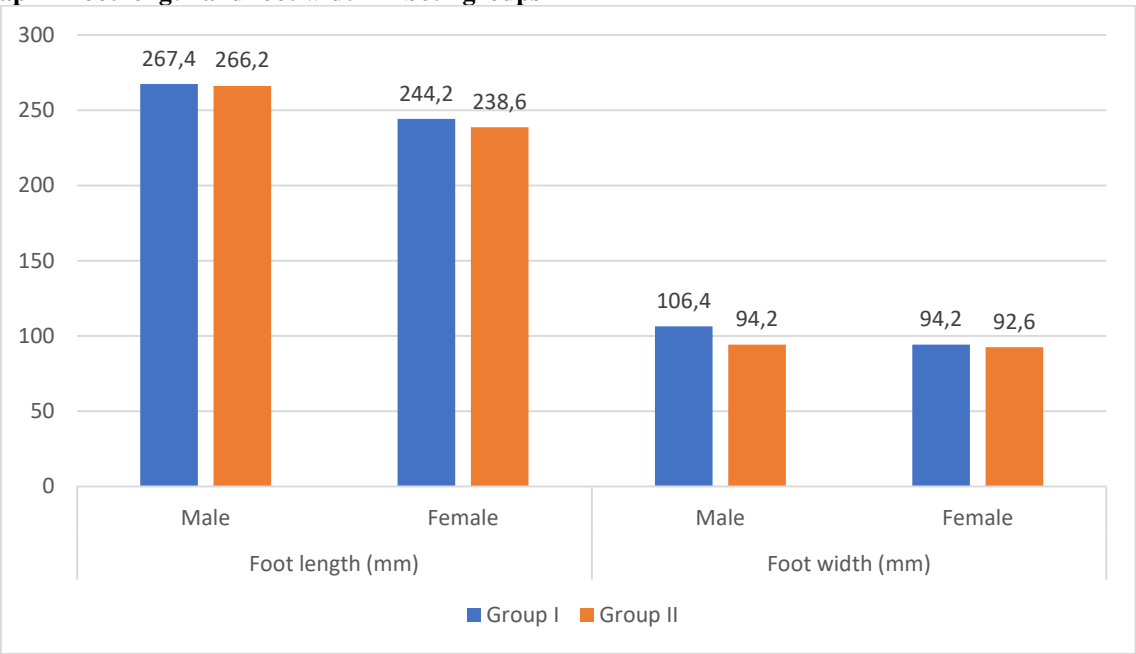
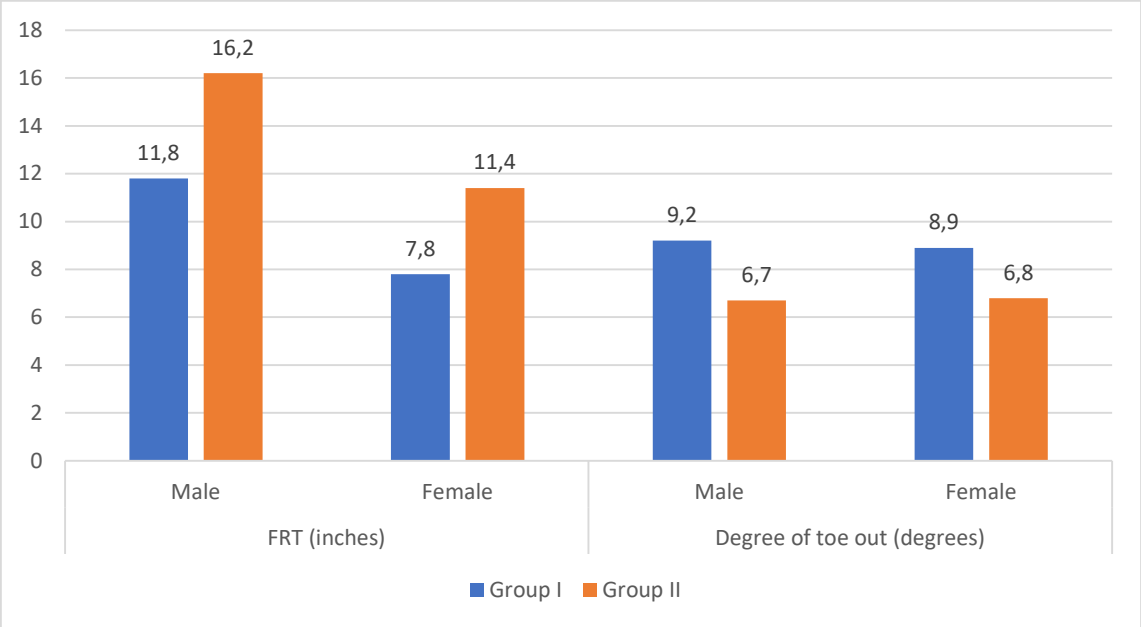


Table III Comparison of parameters

Parameters	Gender	Group I	Group II	P value
FRT (inches)	Male	11.8	16.2	0.02
	Female	7.8	11.4	0.01
Degree of toe out(degrees)	Male	9.2	6.7	0.01
	Female	8.9	6.8	0.04

Table III, graph II shows that mean FRT in males was 11.8 inches and 16.2 inches in group I and II respectively. In females was 7.8 inches and 11.4 inches respectively. The degree of toe out was 9.2 degrees and 6.7 degrees and in females was 8.9 degrees and 6.8 degrees in group I and II respectively. The difference was significant (P< 0.05).

Graph I Comparison of parameters



DISCUSSION

Obesity has a strong correlation with several medical disorders.[7] Obesity is strongly linked to respiratory disorders, osteoarthritis (OA), cardiovascular disease, type 2 diabetes mellitus, and hypertension.[8] Furthermore, compared to non-obese people, obese people typically experience higher levels of functional impairment.[9,10]The present study was conducted to assess the effects of obesity on the balance and gait.

We found that out of 50 patients, males were 23 and females were 27. Sarkar et al[11] evaluated the effects of obesity on the balance and gait parameters likestep width and foot angle (degree of toe out) in young adults were studied.60 subjects of both the genders were taken. 30 were taken as a controlgroup (non-obese, BMI < 25) and 30 were taken as experimental group(obese, BMI 30 >). Functional Reach Test (FRT) was used for BalanceTesting and the Footprint method was used for Gait parametersmeasurements. The value of functional reach test in females was 11.90±0.12inches in control group and 7.01±1.80 inches in experimental group (t=5.31,P<0.001) and in males, it was 16.45±0.72 inches in control and 11.66±0.53inches in experimental group (t=6.47, P<0.001). The degree of toe out infemales was 6.66±0.08 degrees for control and 8.13±0.21 degrees forexperimental group (t=4.08, P<0.01) and in males, it was 6.59±0.04 forcontrol and 9.79±0.51 for experimental group (t=6.53, P<0.001). The stepwidth was found to be 4.41±0.15 inches (control group) and 6.27±0.35inches (experimental) in males (t=4.53, P<0.01) and it was 3.95±0.03 inches(control) and 3.42±1.05 inches (experimental) in females (t=0.77, P>0.05).

We found that in group I and II, mean foot length (mm) in males was 267.4 and 266.2 and in females was 244.2 and 238.6 respectively. The mean foot width (mm) was 106.4 and 94.2 in males and 94.2 and 92.6 in females. Hills et al[12]in their study the gait patterns of ten obese and ten normal-weight, prepubertal children were evaluated. Temporal and kinematic analyses were conducted on representative gait cycles at three speeds of walking: slow, normal, and fast. Subjects were filmed by two phase locked cameras, one each in the sagittal and frontal planes, operating at a speed of 50 frames per second while the subjects traversed a 10-m walkway in one direction. Obese subjects displayed longer cycle duration, lower cadence, lower relative velocity, and longer stance period than normal-weight subjects at all speeds. Other temporal differences included gait asymmetry and greater stride width for the obese, all pointing to a slower, more tentative normal speed and problems encountered when walking at speeds other than normal. Greatest instability was evidenced at the slow speed of walking. Joint angle displacement data showed a largely invariant pattern among speeds for most joints studied and similar patterns for both study groups. Normal-weight subjects displayed more consistent patterns of rotation at all joints and speeds, and for the hip and knee joints, there was greater total excursion that favored increased flexion. Obese subjects displayed a more flat-footed weight acceptance period in early stance and a greater external rotation (out-toeing) of the foot at all phases of the gait cycle.

We found that mean FRT in males was 11.8 inches and 16.2 inches in group I and II respectively. In females was 7.8 inches and 11.4 inches respectively. The degree of toe out was 9.2 degrees and 6.7 degrees and in females was 8.9 degrees and 6.8 degrees in group I and II respectively. Spyropoulos et al[13]compared the kinematic components of the walking gait of obese men to those of nonobese men. Self-paced walking trials of 12 obese volunteers, ranging in age from 30 to 47 years and in obesity from

70% to 99% above ideal body weight, were recorded via cinematography. The following findings were recorded: (1) obese persons (1.09m/sec) walk significantly slower than nonobese subjects (1.64m/sec); (2) obese persons take significantly shorter strides (1.25m vs 1.67m) and exhibit step widths (0.16m) twice those of nonobese persons (0.08m); (3) mean hip abduction angles of the obese are significantly different at some events of the walking cycle from the hip angles of nonobese persons; (4) mean hip and knee flexion angles are not significantly different for obese and nonobese subjects; and (5) obese individuals demonstrate a walking gait pattern with significantly greater mean magnitude of ankle dorsiflexion and lesser mean magnitude of ankle plantar flexion than nonobese subjects throughout the walking cycle.
The limitation of the study is the small sample size.

CONCLUSION

Authors found that obesity has a negative impact on balance of an individual. The degree of toe out was more in obese group as compared to normal BMI group in both genders. The Step Width measurement was more in males of obese group than that in males of normal BMI group.

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