ISSN : 2350-0743

www.ijramr.com

International Journal of Recent Advances in Multidisciplinary Research
Vol. 05, Issue 04, pp.3761-3764, April, 2018

RESEARCH ARTICLE

INFLUENCE OF BODY MASS INDEX ON LUMBAR FLEXIBILITY AND RISK OF FALLS IN ADULT SUBJECTS

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ARTICLE INFO

Article History:
Received 20th January, 2018
Received in revised form
24th February, 2018
Accepted 30th March, 2018
Published online 30h April, 2018

Keywords:

Body mass index (BMI)- Lumbar Flexibility -Risk of fall- Back range of Motion (BROM).

ABSTRACT

Background: Obesity is recognized as a major health problem in the world, obesity is accompanied with reduce postural control and stability and could be one cause of risk of fall and also is increase various musculoskeletal disorders including impairment of the spine.
Objective: was conducted to investigate the effect of body mass index (BMI) on lumber flexibility and on risk of falls.
Subjects: 87 adult subjects of both genders with their ages ranged from 20 to 40 years participated in this study. Subjects were classified into 3 groups according to BMI. Group A: was consisted of twenty eight subjects of normal weight (BMI: 20 - 24.9). Group B: was consisted of thirty subjects who had overweight (BMI: 25 - 29.9). Group C: was consisted of twenty nine subjects who had mild obesity (BMI: 30 - 34.9), with their mean ages were (27.64 ± 4.71), (28.33 ± 7.41) and (30.31 ± 6.78) years respectively.
Methods: Lumbar flexibility were measured for groups using back range of motion (BROM) device and risk of fall were evaluated with functional reach test. Results: the study revealed that there was no significant difference in lumbar flexibility between 3 groups of flexion with (p= 0.757) and extension with (p= 0.131). and there was significant difference in risk of fall among (group A versus C) and (group B versus C) with (p=0.007) and (p=0.015). while there was no significant difference between (group A versus B) with (p=0.805).
Conclusion: Our study revealed that there was risk of fall in obese subjects in comparison to normal and overweight subjects. These alterations in the balance would be associated with decreased postural control capacity and may be the cause of balance deficiency in obese subjects.

INTRODUCTION

Obesity is recognized as a major health problem in the world, and the incidence of this condition is escalating at an alarming rate, obesity significantly increases the risk of developing numerous medical conditions, including hypertension, stroke, type I diabetes, gout, osteoarthritis, certain cancer, and various musculoskeletal disorders including impairment of the spine (Vismara *et al*., 2010). In addition, some recent studies highlighted the effects of this disease on the musculoskeletal system, or motorskills, balance and also associated with postural instability (Hue *et al*., 2007) which is commonly described as the ability to maintain or restore the center of mass with respect to the base of support. Several systems, such as the brain, visual, vestibular, proprioceptive sense, and musculoskeletal systems, contribute to the control of postural stability while standing and deficits in these systems result in postural instability (Vincent *et al*., 2013). Obese individuals may lack the capacity to coordinate the rapid multi-joint movements required to regain postural control when perturbed, These will increase the required torque for stabilization (Corbeil *et al*., 2011).

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Obesity is often associated with structural and functional limitations that may limit movement control (Hills *et al*., 2002) with impairment of normal gait, flattening of the foot arches and influence gait patterns (i.e., slower walking velocity, longer double support time, and greater step width) (Sharma, 2001 and McGraw *et al*., 2000). The obese individuals have reduced functional ability as compared with individuals with normal weight and during stance, obese patients show an hyperextension of the lumbar spine (O'sullivan *et al*., 2006) similar to the anterior translation of the center of mass in pregnant women (Whitcome *et al*., 2007). Obese individuals have reported functional limitations in activities of daily living, particularly for tasks requiring increased flexibility (Larsson and mattsson, 2001) Some researchers have reported that low back pain is associated with increased body mass index (BMI)(Park and Seok, 2014)

MATERIALS AND METHODS

Participants

Eighty seven normal subjects of both sexes were participated in this study. The subjects were excluded from the study if they Pregnant women, mechanical or discogenic back pain or neurological or musculoskeletal disorders or spine pathology

or spinal operation or balance disorder, knee osteoarthritis or ankle instability or flat foot, poly neuropathy or diabetes (systemic disease), any previous spine surgery or vertebral compression fracture, symptoms of vertigo, dizziness or any vestibular problems. They were assigned into three studies groups according to BMI. Group A: was consisted of twenty eight subjects of normal weight (BMI: 20 - 24.9). Group B: was consisted of thirty subjects who had overweight (BMI: 25 - 29.9). Group C: was consisted of twenty nine subjects who had mild obesity (BMI: 30 - 34.9), with their mean ages were (27.64 ± 4.71),(28.33 ± 7.41) and (30.31 ± 6.78) years respectively.

Design of the study

A cross sectional design was used. Subjects were assigned into three groups (A, B, C)

- Group A: was consisted of twenty eight subjects of normal weight (BMI : 20 - 24.9).
- Group B: was consisted of thirty subjects who had overweight (BMI : 25 - 29.9).
- Group C: was consisted of twenty nine subjects who had mild obesity (BMI : 30 - 34.9).

Instrumentation

Weight and height scale was used to measure weight and height in order to calculate the (BMI), The back range of motion (BROM) device is modified protractor geniometer for measuring trunk motions (lumbar flexion and extension) and functional reach test (FRT) to evaluate risk of fall (ROF).

Procedures

Pretesting and familiarization

The test aims was explained for the subjects. The subjects were familiarized with BROM and FRT through giving full instructions about the procedures to be done. Subjects had readand sign consent form.

BROM for test lumbar flexion and extension

Examiner palpated the subject to locate S1 and T12 and mark it, place the BROM flexion and extension unit on S1, patient erect and place movable arm on T12 and record distance between S1 and T12 and then record the distance from full flexion and from full extension(Paul, 1992).

FRT for evaluate risk of fall

Ask the subject to position themselves close to the wall with arm outstretched and hand fisted then ask the subject to reach as far forward as you can without taking a step, keeping the feet flat on the floor and record the difference between the starting and ending position numbers.

Statistical analysis

Results are expressed as mean ± standard deviation, median, minimum, maximum and number (%). Comparison between categorical data [n (%)] was performed using Chi square test. Test of normality, Kolmogorov-Smirnov test, was used to measure the distribution of data.

Accordingly, comparison between not normally distributed variables in the three groups was performed using Kruskal Wallis ANOVA test. Comparison between normally distributed variables in the three groups was performed using one way analysis of variance (ANOVA) followed by Least significant difference test if significant results was recorded. Statistical Package for Social Sciences (SPSS) computer program (version 19 windows) was used for data analysis. P value ≤ 0.05 was considered significant.

RESULTS

The current study was conducted on 87 subjects. Classified into three groups according to their BMI: Group A (normal weight): consisted of 28 individuals where their BMI ranged from20to 24.9 kg/m^2. Group B (over weight): consisted of 30 individuals where their BMI ranged from BMI 25 to 29.9 kg/m^2. Group C (obese): consisted of 29 individuals where their BMI ranged from30 to 34.9 kg/m^2.

I- Physical (general) characteristics of the patients

The mean value (± SD) of age in groups A, B and C were 27.64 ± 4.71, 28.33 ± 7.41 and 30.31 ± 6.78 yrs., respectively. There was no statistical significant difference between the three groups (F= 1.331; p= 0.270) (Table 1). As regards gender distribution in group A, 14 patients (50%) were females and 14 (50%) were males while in group B they were 16 (53.3%) and 14 (46.7%) respectively. In group C, 17 patients (58.6%) were females and 12 (41.4%) were males. They were statistically comparable (Chi square value = 0.435 and p value= 0.805 (Table 1).

Extension

Descriptive statistics of extension in the three studied groups. The median value of extension in groups A, B and C were 5.0 (1.0-7.0), 4.0 (3.0-8.0) and 4.0 (2.0-7.0), respectively. There was no statistical significant difference between the median value of extension in the three studied groups with Chi square value = 4.066 and p value = 0.131 (Table 2).

Flexion

Descriptive statistics of flexion in the three studied groups. The mean value of flexion in groups A, B and C were 13.50 ± 2.65, 13.03 ± 2.47 and 13.41 ± 2.53, respectively. There was no statistical significant difference between the mean value of extension in the three studied groups with F value = 0.279 and p value = 0.757 (Table 3).

FRT

Descriptive statistics of FRT in the three studied groups. The mean value of FRT (± SD) in groups A, B and C were (36.71 ± 6.37), (37.10 ± 5.95) and (32.83 ± 5.41), respectively. There was a statistical significant difference in the mean value of FRT between the three groups with F value = 4.641 and p value = 0.012. The mean value of FRT was significantly decreased in group C when compared with its corresponding value in both groups A (p= 0.015) and B (p= 0.007) while there was no statistical significant difference in the mean value of FRT between groups A and B (p= 0.805) (Table4).

Table 1. Comparison between mean values of flexion in the three studied groups

	Group A (n= 28)	Group B (n= 30)	Group C (n= 29)	F value	P value
Mean ± SD	13.50 ± 2.65	13.03 ± 2.47	13.41 ± 2.53	0.279	0.757 (NS)

F value= ANOVA test. NS= p> 0.05= not significant.

Table 2. Comparison between median values of extension in the three studied groups

	Group A (n= 28)	Group B (n= 30)	Group C (n= 29)	χ^2 value	P value
Median (min.-max.)	5.0 (1.0-7.0)	4.0 (3.0-8.0)	4.0 (2.0-7.0)	4.066	0.131 (NS)

χ2= Chi square of Kruskal Wallis ANOVA test. NS= p> 0.05= not significant.

Table 3. Physical (general) characteristics of the three studied groups

	Group A (n= 28)	Group B (n= 30)	Group C (n= 29)	F value	P value
Age (yrs.)					
Min.-max.	23.0-39.0	20.0-40.0	20.0-40.0		
Mean ± SD	27.64 ± 4.71	28.33 ± 7.41	30.31 ± 6.78	1.331	0.270 (NS)
Gender					
Female [n (%)]	14 (50.0%)	16 (53.3%)	17 (58.6%)	χ^2= 0.435	0.805 (NS)
Male [n (%)]	14 (50.0%)	14 (46.7%)	12 (41.4%)		
BMI (kg/m^2)	22.86 ± 1.35	27.46 ± 1.33	31.81 ± 1.30	---	---

Data are expressed as mean ± SD or number (%). χ2= Chi square test. NS= p> 0.05= not significant.

Table 4. Comparison between mean values of FRT in the three studied groups

	Group A (n= 28)	Group B (n= 30)	Group C (n= 29)	F value	P value
Mean ± SD	37.10 ± 5.95	36.71 ± 6.37	32.83 ± 5.41	4.641	0.012 (S)
P value vs gr. A	---	0.805 (NS)	0.007 (S)		
P value vs gr. B	==	---	0.015 (S)		

F value= ANOVA test.S= p≤ 0.05= t significant.NS= p> 0.05= not significant

DISCUSSION

This study was conducted to investigate the effect of body mass index on lumbar flexibility and risk of fall.

The subjects assigned into three groups according to BMI

- GroupA (28): BMI =20- 24.9(normalweight).
- GroupB (30): BMI =25.0 - 29.9(over weight).
- GroupC (29): BMI=30 – 34.9 (obese).

Subjects in three groups were matched in age and sex (there was no significant difference between the three groups regarding age and sex). And this indicates that the differences found in this study were due to the effect of BMI and not due to difference between groups with regard to age and sex. The study findings revealed that there was no significant difference in lumbar flexibility between three groups. The study findings revealed that there was a significant difference in risk of falls between obese and normal subjects and between obese and overweight, however there was no significant difference between overweight and normal.

Limitation of study

This study was limited by psychological condition of the subjects, The physical and psycho physiological factors which might affect the subject's performance, Environmental factors which might affect the subject's performance and Small sample size.

Conclusion

On the basis of the finding of this study, there was risk of fall in obese subjects in comparison to normal and overweight subjects.

These alterations in the balance would be associated with decreased postural control capacity and may be the cause of balance deficiency in obese subjects.

Recommendation

Repetition of the study with a larger sample size, Studying the effect of BMI on flexibility of other joints, Studying the effect of obesity class 2 an d class3 on lumbar flexibility, Studying the effect of obesity class 2 an d class3 on risk of fall , balance management including evaluation and treatment in obese subjects , Studying the effect of central obesity on lumbar flexibility and risk of fall.

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