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## Association of body mass index with flexibility in adults.

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## ABSTRACT

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**Objectives:** To determine the frequency of obesity in normal adults and find association between flexibility and body mass index. **Study Design:** A cross-sectional study was done using non-probability convenient sampling. **Place & Duration of Study:** The study was started in February 2019 –July 2019. The data was collected from universities and hostels of Islamabad Capital Territory. **Material & Methods:** A total of n=295 female and n=53 male participants who fulfilled the selection criteria were included in the study. A self-structured questionnaire was used. Data was analyzed using SPSS software. **Results:** 348 individuals participated in the study; most of them were university students. Females (84.8%) were in greater number as compared with males (15.2%) and mean age of the participants was  $21 \pm 2.4$  years. The results showed an association of body mass index (BMI) with flexibility. Knee ranges were affected mostly by increase in body mass index because muscle bulk was greater and resulted in restricted range of motion. Most of the individuals had normal flexibility irrespective of body mass index. Hip flexion was decreased mainly due to less use of hamstrings. Upper limb had greater flexibility because it is used more in proportion to lower limb. **Conclusion:** The study concluded that there is significant association between flexibility and body mass index. The study found that 3.7% adults were obese and 0.3% were morbid obese. **Study Design.** A cross-sectional study was done using non-probability convenient sampling. **Authorship credit :** “Criteria authorship scientific article” has been used “Equal Contribution” (EC). **Citation :** Sanaa Jarral, Suhail Karim, Iram Shehzadi, Mehak Fatima Malik, Ali Razaqat, Muhammad Junaid Akram ; Association of body mass index with flexibility in adults ; Ita. J. Sports Reh. Po. 2021; 8 (18); 3; 2 ; 1892 - 1903 ; DOI: 10.17385/ItaJSRP.21.18.080302; ISSN 2385-1988 [online] ; IBSN 007-11119-55; CGI J OAJI 0,101]. Published online. **Correspondence for first author:** Sanaa Jarral, e mail : Sanaajarral123@yahoo.com tel. +92341-1569606

**Key words:** Body mass index, Statistical Package for Social Sciences



## INTRODUCTION

Overweight and obesity is rapidly increasing around the whole world. WHO states that over 1.3 billion adults in the world are overweight and 600 million lies under the category of obese (1). In the western world obesity is becoming a serious health issue day by day, according to a study conducted in 2010 in United Kingdom 65% of adults are considered to be overweight and 25% are obese (2). The Body Mass Index (BMI) is a measurement of the human body weight (kg)/height (m<sup>2</sup>) in adults and according to it they are subjected to the groups (3).

Obesity is becoming a threat and its prevalence is rising day by day worldwide. Major factors causing the rise in obesity are, energy imbalance (intake and expenditure), factors relating to mood, genes and ecology can make a person obese (4). In a study conducted in 2000 by Kopelman it was stated that obesity is the major contributor for premature death and this is becoming a huge burden for the government and health givers all around the world (2). Body Mass Index (BMI) has been divided into different categories by the world Health organization (WHO) (Geneva, Switzerland) and the National Heart, Lung, and Blood Institute (Bethesda, Maryland) which are underweight (less than 18.5 kg/m<sup>2</sup>), normal weight (18.5-24.9 kg/m<sup>2</sup>), overweight (25.0-29.9 kg/m<sup>2</sup>) and obesity (30.0kg/m<sup>2</sup> or more) (5).

A necessary element of physical aptitude is flexibility. For gaining human physical conditioning, it is considered to be one of the necessary features, as stated by American college of sports medicine (6). Flexibility can also be defined as “the physiological range of motion of a given joint” and it has an important role in the performance of simple or complex movements involved in activities of daily living. Decreased flexibility can result in musculoskeletal damage. According to Holland (18), range of motion decreases with age and depending on the joint, up to 50 % of flexibility can be lost (7). Improving the whole body flexibility has good effects for the human body. Too much flexibility however can cause damage to muscles, joints and ligaments. Factors influencing flexibility are mobility



(the extent to which a joint can move), plasticity (the level of change of form or shape of the stretchable component), elasticity (the elongation or extension of the muscular components) and pliability (dermatological changes in part required for flexibility and movement) (6).

The rise in our sedentary behaviors, the modifications we have made into our diets and no or minimal activity are leading towards obesity, a major component of body mass index. For avoiding body injury, fitness check is a must. This study was conducted in Sindh and comparisons were made between students of china and Pakistan. Two parameters were observed in it that are physical flexibility and rise in weight or obesity. The test for flexibility was sitting and reach test while BMI was used to categorize weight results. The results showed that flexibility was greater among Chinese population while obesity ratio was greater among Pakistanis (8).

A decrease in strength has been linked with the aging process. Physical activity is helpful for the multiple body systems like respiratory, cardiovascular. Walk is effective for decreased mobility; coordination exercises can reduce length of postural tremors. For mobility and flexibility of knee muscles, stretching is useful. Large BMI means increase in mobility impairment in older adults. Increase in weight loss and increase in shedding of lean body mass is associated with low fitness in adults. For gaining normal weight and preventing oneself from effects of weight loss or gain, physical exercise is a must. Balance exercise resulted in gains in resistance exercises and also improved flexibility training in standing position (9).

## **METHODOLOGY**

It was a comparative cross sectional study conducted from February 2019- July 2019. The data was collected from Islamabad Capital Territory and from universities and hostels. Non-probability convenient sampling technique was chosen. Data was collected directly from patients after getting an informed consent. Healthy adults having age between 19-44 years were chosen for study. Participants excluded were with any known musculoskeletal deformity or condition, any known neurological conditions or with history of trauma/



fracture. A self-structured questionnaire was designed. For calculating BMI, participant's weight and height were measured at the spot using weighing machine and measuring tape respectively. Data was analyzed using SPSS software.

## RESULTS

348 individuals participated in the study; most of them were university students. Females (84.8%) were in greater number as compared with males (15.2%) and mean age of the participants was  $21 \pm 2.4$  years. The results showed an association of body mass index with flexibility. Knee ranges were affected mostly by increase in body mass index because muscle bulk was greater and resulted in restricted range of motion. Most of the individuals had normal flexibility irrespective of body mass index. Hip flexion was decreased mainly due to less use of hamstrings. Upper limb had greater flexibility because it is used more in proportion to lower limb.

**Table 1.** Frequency of BMI

BMI Categories	Frequency (%)
Underweight	93 (26.7%)
Normal	193 (55.5%)
Overweight	48 (13.8%)
Obese	13 (3.7%)
Morbid Obese	1 (0.3%)

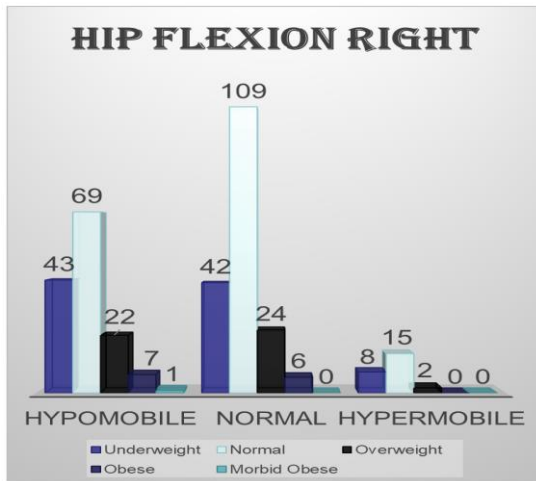


Figure 1. Hip Flexion Right

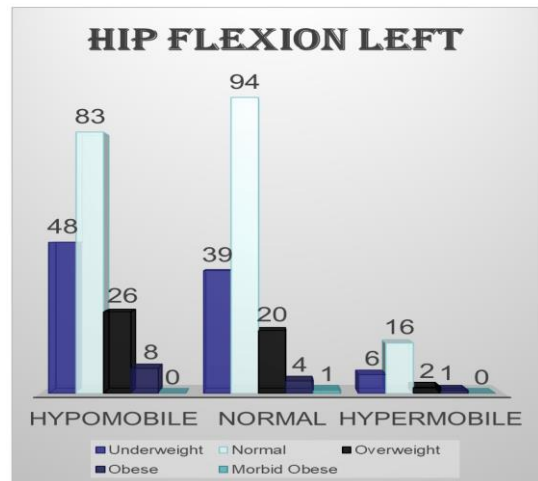


Figure 2. Hip Flexion Left

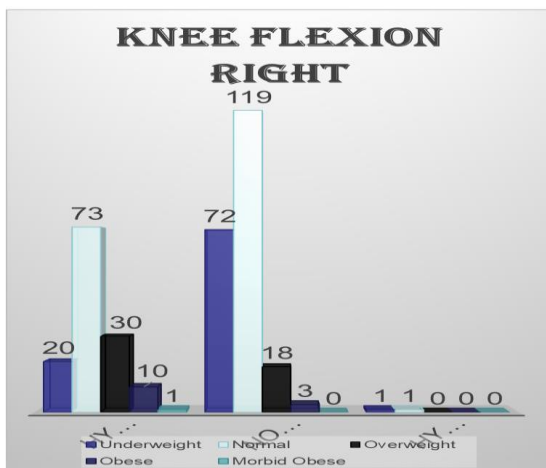


Figure.3 Knee Flexion Right

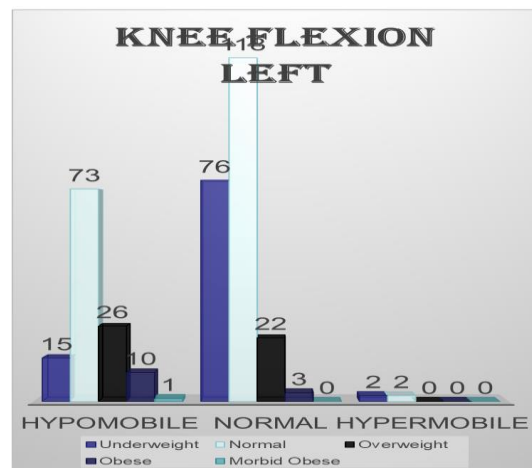


Figure 4. Knee Flexion Left

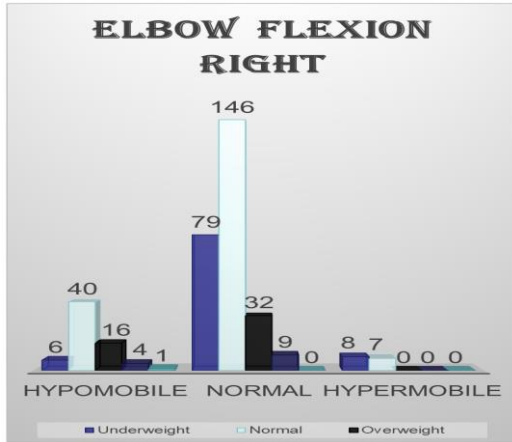


Figure 5. Elbow Flexion Right

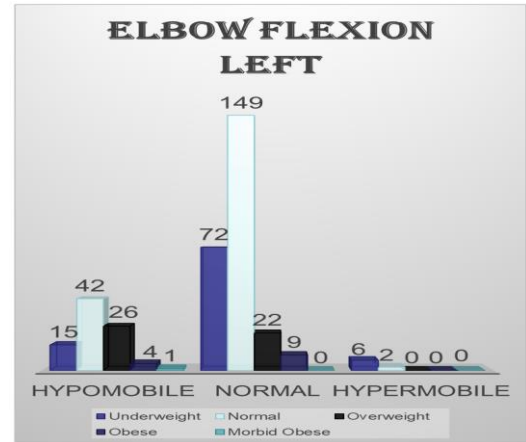


Figure 6 .Elbow Flexion Left

## DISCUSSION

This study was conducted early in 2019, among university students (96%), and (4%) were of other occupations. The study included both the males and the females. Females were comparatively in greater proportion than the males. The purpose of the study was to determine the association of body mass index with physical flexibility in adults and to see the frequency of obesity in normal population. The results showed that most of the participants had tight hamstrings which restrict their hip flexion up to the normal range. With the help of this study it was found that ranges of few joints vary as compared to the normal ranges.

Most of the participants fall in the normal category of BMI, followed by underweight, and then overweight participants and the frequency of obesity were least. In this study when upper and lower limb flexibility was compared in the major joints which includes hip and the shoulder joint (ball and socket) it was observed that shoulder joint was more flexible comparative to the hip joint. The shoulder joint shows more flexibility because most of the activity of daily livings is performed by the upper limb and lower limb is used less comparatively.



In current study, hip flexion with knee extension (right and left) had decreased ranges in most of obese individuals. Underweight individuals also had decreased hip flexion while in previous study it was mentioned that low body mass index means greater fitness which contradicts our results (10) because in this study, most of the participants had tight hamstrings due to less physical activity.

In current study, hyper flexibility was mostly seen in ankle and shoulder joints. Ankle dorsiflexion was normal in most of the individuals and some of the individuals had hyper flexibility at this joint. Same results were observed in shoulder extension in which most of the individuals had hyper flexibility.

In current study, knee flexion was decreased in overweight and obese individuals and in a previous study it was concluded that greater body mass index means less flexibility in lower limb (11). The restricted ranges were due to bulky fascia which was result of increased BMI, which was stated in a previous study (12) and this study proves the same. Individuals with greater BMI had hyper mobile joints (11) and in this study, it was also found that the individual with morbid obesity had hyper flexibility at shoulder adduction while he had normal ranges in most of other joints.

In a study conducted in past, it was discussed that being overweight is inversely associated with physical fitness (13) and in current study; it was also proved that overweight individuals had decreased range of knee flexion.

In a previous study, individuals with greater amount of body fat had more issues in performing tests linked with flexibility (14). While in current study, it was seen that most of the individuals had normal flexibility when associated with BMI except for knee flexion in which there was decreased ROM due to greater amount of fat that was present in knee area. Flexibility was greater among Chinese population while obesity ratio was greater among Pakistani population (15). In current study, it was seen that most of the individuals





were underweight as compared to obese because in targeted population most of the participants were students who had poor eating habits. In another study, it was stated that people with less body mass index were less flexible (9) but in current study, it was seen that most of the underweight individuals had normal ranges in most of the joints. This was due to the fact that they were less bulky and this results in no restriction of range of motion. Hence, they had normal ranges. One of a previous study concluded that underweight and normal weight participants were more physically fit as compared to obese and overweight participants (16), while same results were observed in the current study in which lean and normal individuals had normal ROMs of most joints.

It was seen that the individuals with routine of exercise were more flexible comparative to the participants living sedentary, same results were also observed in the study conducted previously, repetitions, time of physical activity and the extent to which activity is performed effects fitness (10). According to a previous study, females were more flexible with greater ranges (17), while the current study found that the males were more flexible as compared to the females because males have greater level of physical activity.

## CONCLUSION

The study concluded that, there is an association between body mass index and flexibility. The frequency of underweight was greater than obese. It is not necessary that obese individuals have decreased range of motion compared to individuals with normal weight. Age was an independent factor but gender was a dependent factor. Males were more flexible as compared to females because of high level of physical activity. All the ranges of the underweight individuals were normal except hip flexion.



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