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## Research Article

# Characterization of symptomatic Knee Joint in Sudanese

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**Abstract:** Knee Joint is one of largest and complex joint in the human body. The aim of this study was to characterize symptomatic knee joints in Sudanese population by using height and circumference of knee joint to predict pathological changes that appear in the plain X-ray film in advance. A total of 257 symptomatic knee joints were measured. One hundred and six showed no change in the x-ray film 'normal', (56 male and 50 female), 151 of symptomatic patient's showed change of knee joint in the plain X-ray 'diseased' (55 males and 96 females). Their age range between 18-65 years, bio-data such as height, weight, body mass index heights and circumferences of knees were recorded. In this study we found that there is a significant difference between the height and circumference of the knee for male and female, but there is inclusive differences regarding Rt and Lt knee in normal cases. While the circumference of the knee showed a significant difference between those with remarkable X-ray changes and the symptomatic one without obvious X-ray changes. In conclusion we can estimate the symptomatic patient without changes in X-ray from those with changes by using their age, body mass index and period of disease in a multi-regression equation to predict each groups where the index of possibility increase 0.009, 0.003 and 0.015 for age, period of disease and body mass index respectively; where index one indicate no change in X-ray and index two indicate presence of changes.
**Keywords:** Knee joint, Circumference, BMI.

## INTRODUCTION

The knee joint is not only one of the largest, but also one of the most complex joint in the human body. It is able to withstand significant strain and injury risks in everyday and occupational life as well as in sports. However, people with anatomical problems such as bowlegs or knock knees may experience pain. Normal age related processes and excess weight, as well as physical inactivity, can lead to wear and tear on the joint [1].

The circumference of the knees and thighs at three locations was measured in 10 patients on two consecutive occasions by three observers. Analysis of the results for inter observer, intra observer and among-patient variation established that a change in circumference noted by different observers on two different days is significant if it exceeds 1-5 cm at the midpatella, 2-7 cm at 7 cm above, and 3-5 cm at 15 cm above the patella. If a single observer performs both measurements, the change need exceed only 1-0, 2-0, and 2-7 cm, respectively, to be significant [2].

A strong association was found between high body mass index and the presence of knee osteoarthritis in study conducted in odds ratio 3.90 for highest versus lowest quartile of BMI [3].

The main objective of the current study was to characterize the knee joints in Sudanese population by using plain X-ray and MRI to alleviate the differences that arise in the knee joints measurements which attributed to the characteristic and pathological changes.

## MATERIALS AND METHODS

This study was carried in Khartoum state – Sudan in the period from June/2012 to September/2014 in the Modern Medical Centre and Antalya Medical Centre. All measurements and imaging acquisitions and diagnosis were carried by the same staff and author to insure reproduce ability and accuracy. The sample of this study consisted of 257 symptomatic knee joints patient, all patient were examined by planner x-ray for knee. One hundred and six showed no change in the X-ray film 'normal', (56 male and 50 female), 151 of

symptomatic patient's showed change of knee joint in the plain X-ray 'diseased' (55 males and 96 females), their age range between (18-65) years. Bio-data such as height, weight, body mass index and different heights and circumferences of knees were recorded. The heights were taken by normal tape in centimeters with the patient sitting the knee joint at 90 degrees with the ankle joints. The length was taken from upper knee to the lower sole of foot. The circumference also was taken from the middle of the knee joint in the widest area in the knee with full extended knee joint. The data were analyzed by Microsoft EXCEL and statistical package for social science SPSS version 16 under windows.

## RESULTS AND DISCUSSION

The results of this study revealed that; there was a difference between male and female body mass index (BMI) although their weight showed minor variation, and this proved by study performed by Story *et al*. [4] and study performed by Bellisle *et al*. [5], Table 1 & 2. Also in respect to height and circumference of knee there were no remarkable differences between Rt. and Lt. Knee for normal patient also this agree with study performed by HIckson *et al*. [6]. But if one considered gender there were significant differences between male and female regarding the height and circumference of the knee at $p = 0.05$ using t-test (Table 2).

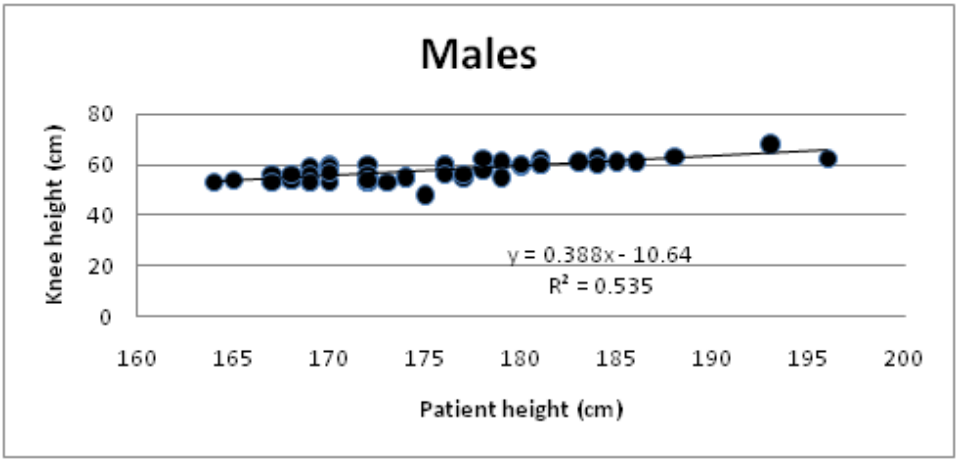
**Table 1: The mean ± standard deviation of patient age, weight, height, body mass index and knee joint dimension (Rt. & Lt.) for male and female)**

| Variables | Male<br>Mean ± SD | Female<br>Mean ± SD |
|---|---|---|
| Age | 39.2 ± 12.3 | 42.5 ± 10.1 |
| Height of the Patient | 175.6 ± 6.8 | 166.0 ± 8.0 |
| Weight of the Patient | 76.8 ± 12.3 | 78.1 ± 15.4 |
| BMI | 24.9 ± 3.7 | 28.3 ± 5.1 |
| Height of the Rt. Knee | 57.5 ± 3.6 | 54.2 ± 3.9 |
| Height of the Lt. Knee | 57.5 ± 3.6 | 54.1 ± 3.9 |
| Circumference of the Rt. Knee | 36.9 ± 3.0 | 39.5 ± 5.3 |
| Circumference of the Rt. Knee | 36.8 ± 3.1 | 39.3 ± 5.3 |

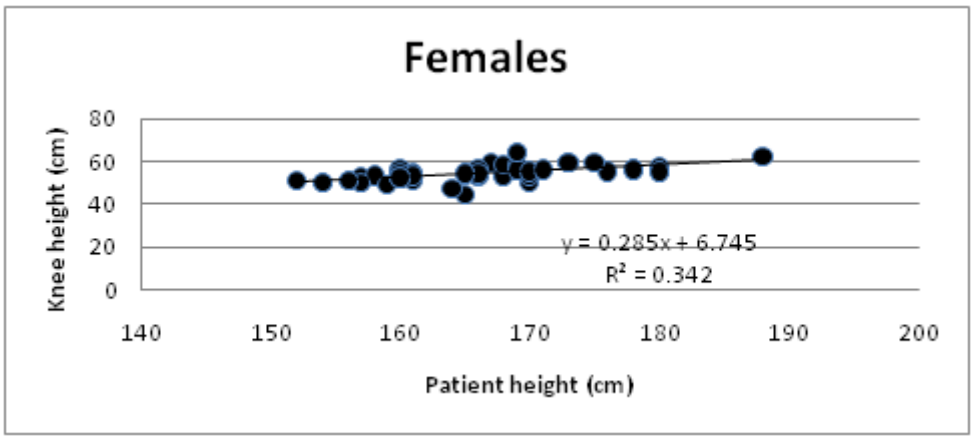
**Table 2: t-test results showed significant differences between male and female in respect to knee measurement; height and circumferences**

| Gender (1) | t-test for Equality of Means | |
|---|---|---|
| | t | Sig. (2-tailed) |
| Height of Rt. Knee | 4.530 | .000 |
| Height of Lt. knee | 4.623 | .000 |
| Circumference of Rt. knee | 3.192 | .002 |
| Circumference of Lt. knee | 2.966 | .004 |

The height of the knee in male and female showed a significant correlation the patient where in males the it increases by 0.39 cm per each one cm of the patient height, while for females it increase by 0.28 cm for each one cm of the patient height. This relation dictate that the height of the knee in male were longer than that of the female in respect to higher coeffecient as well as the height of male which exceed the female (Fig. 1 A & B).



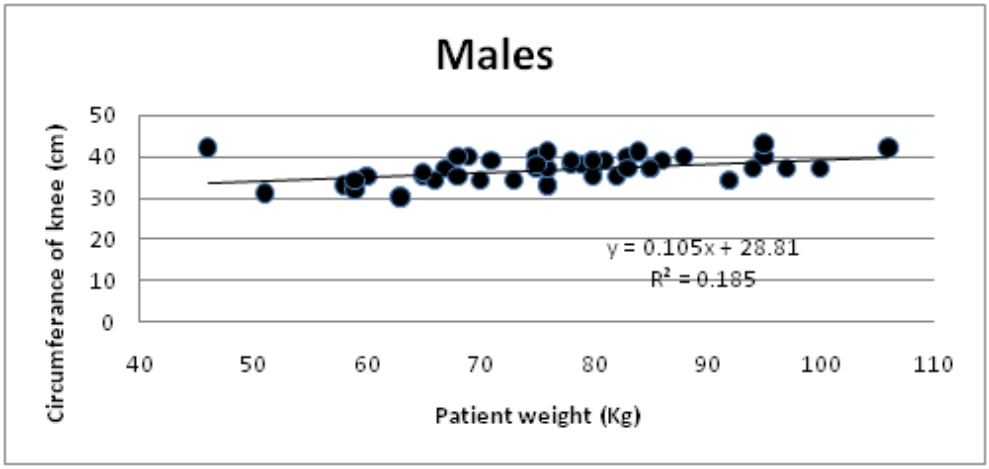

(A)



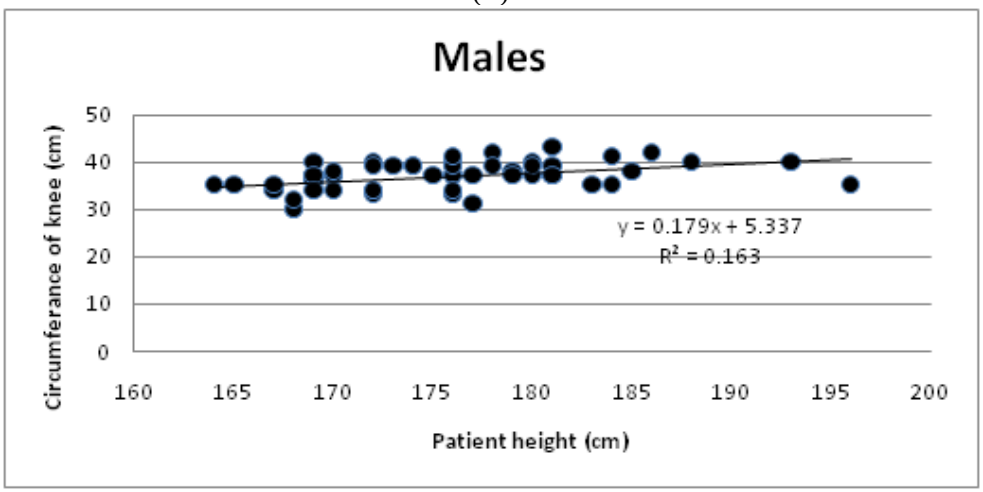

(B)

**Fig. 1: scatter plot showed a direct linear relationship of the knee height and patient height for male in (A) and female (B)**

Similarly the circumference of the knee was significantly associated with the patient height and weight together for male and female separately. Where the knee circumference increases by 0.11 cm/Kg of patient weight and by 0.18cm/cm of patient height for male as shown in Fig. 2: A & B.



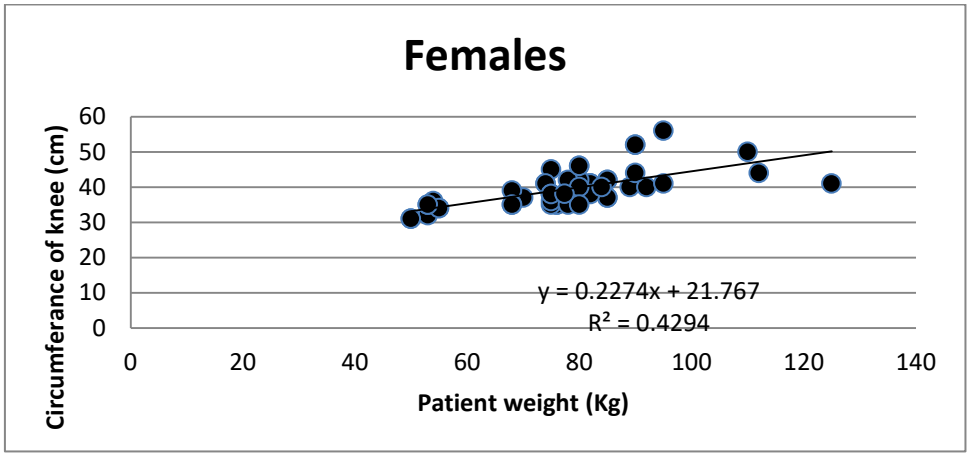

(A)



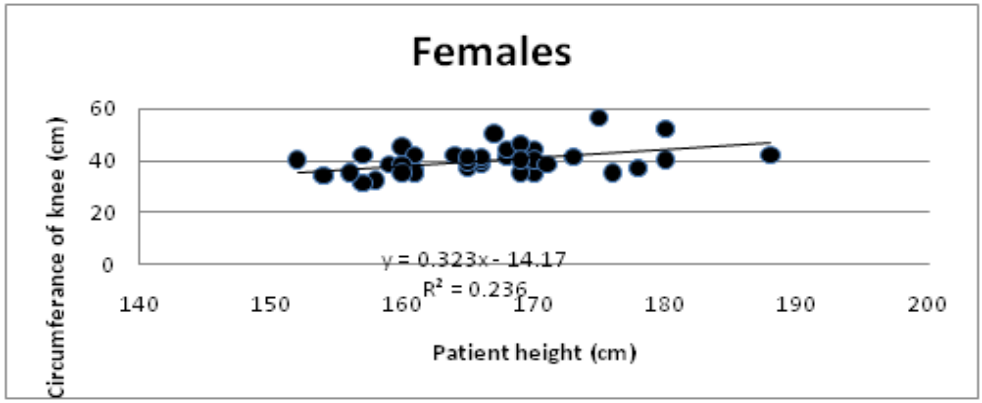

(B)

**Fig. 2: scatter plot showed a direct linear relationship of the knee circumference for males and patient weight in (A) and height (B)**

For female the knee circufrence in respect to patient weight increase by 0.23 cm/Kg of body weight while for height it increases by 0.32 cm/cm of height. This result also dictate that; circumferance of knee for female is more than that of male. This increase represented by the increase in the coeffecient in cerase of weight and height (Fig. 3: A & B)




(A)




(B)

**Fig. 3: scatter plot show a direct linear relationship of the knee circumference for females and patient weight in (A) and height (B)**

In this study researchers compared the height and circumference of the knee in symptom patients 'but with a normal X-ray finding' with those suffering from knee joint diseases 'remarkable change in the x-ray film'. The knee circumference showed a significant difference between the two groups while the knee height showed inconclusive result (Table 3). This means disease affect the circumference due to fluid effusion or swelling of the knee area. Also Andrew *et al*. published a manuscript regarding association between and knee height measurements and knee joint structure in an asymptomatic cohort, they revealed that in asymptomatic community-based adults, increased bone area is associated with increased measures of knee height, also found that increased knee height measurements were associated with increased knee cartilage volume and a reduced risk for medial knee cartilage defects. The associations with bone area may simply reflect the association of inherently larger bony structures. However the beneficial associations demonstrated with cartilage morphology suggest that an increased knee height may confer a beneficial biomechanical environment to the chondrocyte of asymptomatic adults [7]. This study is limited; it did not expose to type of disease or categorized the measurement according to disease.

**Table 3: A significant *t*-test between the normal knee in x-ray and abnormal one concerning the height and circumference of the knee**

| Variable | *t* | *p* |
|---|---|---|
| Height of Rt. Knee & Height of Lt. knee | 1.841 | .067 |
| Circumference of Rt. knee & Circumference of Lt. knee | 3.692 | .000 |

The status of the symptomatic knee joint weather it show pathology in x-ray or not were significantly correlated with the age of the patient, period of disease and body mass. The coefficient of these associations can be used in a multiple regression equation to predict the presence or absence of the disease prior x-ray examination as follows: knee state = (Age×0.009) + (period of disease×0.003) + (BMI×0.015)

## CONCLUSION

This study found that the height and circumference of the knee of male and female were significantly different. The height of the knee significantly associated with the height of the patients, where this height can be estimated for male and female using these equations: Knee height = (0.39 × patient height) - 10.6 and Knee joint = (0.29 × patient height) + 6.7 for male and female respectively. The circumference of the male and female were associated with the height and weight of patients as follows: Knee circumference = (weight × 0.08) + (height×0.13) + 7.7 and Knee circumference = (weight × 0.19) + (height×0.16) - 2.1 for male and female respectively.

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