

Ossification of Bones of the Knee Joint in 17 to 20 Years of Age in South Indian Population

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ABSTRACT

A radiological study was done in south Indian subjects between 17 years to 20 years of age. 32 Males and 18 female's knee joint were studied.

The attempt was made to differentiate the fusion between males and females and it is observed that majority of subjects were having mixed diet, with healthy stature. The fusion in the lower end of femur in males was 17 years of age to 20 years and in females it was before 17 years of age to 19 year. The fusion of upper end of tibia and fibula in males was observed between 17 to 19 years of age while in females before 17 year of age to 18 year. This study shows that there is to one year earlier fusion occurs in female than males. This study will certainly help the Anatomist, Anthropologist Orthopedician and Medico-legal expert.

Key words: Epiphysis, Fusion, Tibia, Fibula, Femur.

INTRODUCTION

It is rightly said that, the skeleton of a particular individual is able to adapt to its owners way of life¹. Hence environmental factors and dietary habits of south Indian population certainly differ from other parts of the country, moreover south Indians are regarded as "Dravidian race"². Hence their genetic makeup, architecture of knee joint has to differ from other parts of the country because many factors known to influence and modify the joints development such as deprivation of raw materials and vitamins, hormonal imbalances and abnormal mechanical situations. Hence attempt is made to study the ossification of knee joint in 17 to 20 years of age through radiological study. Because normal life span of osteoclast is 20 years. Hence complete normal development of knee joint occurs at this age moreover this period of age is also notorious for crimes such as rape, fight, murder etc. Hence it has medico-legal importance apart from anatomical and anthropological study.

MATERIAL AND METHODS

Fifty (50) healthy students (32 Males and 18 females) from south Indian studying in MBBS course at Sri B.M Patil Medical College are selected and their age was 17 to 20 years. Their age was confirmed through office documents.

They are made to stand in un-locking position and X-ray was taken AP and lateral view by qualified radiologist. Prior to X-ray it is tested that, no student had any knee joint problem. Study of patella was excluded as it is a sesmoid bone having multiple secondary centres.

RESULTS

Table 1

Out of 50 cases 32 were male and 18 were females. Among 32 males maximum i.e. 15 (46%) were in the age group of 17 years to 18 years and 5 (15.6%) were in the age group of 18 to 19 years and 12 (37.05%) were in the age group of 19 to 20 Years.

Among 18 females maximum i.e. 10 (55.5%) were in the age group of 17 to 18 years and 7 (38.8 %) were in the age group of 18 to 19 years. And 1 (5.5%) were in the age group 19 to 20 Years.

Table 1. Distribution of cases by age & sex

| Age Group | Male | Female | Total |
|-----------|------------|------------|-----------|
| 17 - 18 | 15 (46.8%) | 10 (55.5%) | 25 (50%) |
| 18 - 19 | 5 (15.6%) | 7 (38.8%) | 12 (24%) |
| 19 - 20 | 12 (37.5%) | 1 (5.5%) | 13 (26%) |
| Total | 32 (100%) | 18 (100%) | 50 (100%) |

Table 2

Out of 50 cases 9 were vegetarian (18%) and 41 (82%) were having mixed diet.

Table 2. Distribution of cases by food habit

| Food Habit | Number | Percentage |
|--------------|-----------|-------------|
| Vegetarian | 9 | 18% |
| Mixed | 41 | 82% |
| Total | 50 | 100% |

Table 3

Out of 32 males 4 (12.5%) were vegetarian and 28 (87.5%) were having mixed diet out of 18 female 5 (27.5%) were vegetarian and 13(72.2%) were having mixed diet.

Table 3. Distribution of cases by sex & food habit

| Food Habit | Male | Female | Total |
|--------------|------------------|------------------|------------------|
| Vegetarian | 4 (12.5%) | 5 (27.7%) | 9 (18%) |
| Mixed | 28 (87.5%) | 13 (72.2%) | 41 (82%) |
| Total | 32 (100%) | 18 (100%) | 50 (100%) |

Table 4

The average weight of males and females in the study was 60 kgs and 49 kgs respectively.

Table 4. Average weight of cases by sex

| Weight | Male | Female |
|----------------|-------|--------|
| Average Weight | 60 Kg | 49 Kg |

Table 5

Average height of males and females was 166.1 cms and 155.2 cms respectively.

Table 5. Average height of cases by sex

| Height | Male | Female |
|----------------|----------|----------|
| Average Height | 166.1 Cm | 155.2 Cm |

Table 6

It was observed that 10 males out of 32 (31.25%) had the fusion of lower end of femur in the 17 years to 17½ years and in 15 males (46.5 %) had fusion in the age of 19 years and 7 male (21.8%) fusion completed at the age of 20 years.

Table 6. Fusion of lower end of femur in males

| Age | 17 - 17.5 | 17.5 - 18.5 | 18.5 - 20 |
|-------------|-------------|-------------|-----------|
| No of Cases | 10 (31.25%) | 15 (46.5%) | 7 (21.8%) |

Table No 7

In females out of 18 females 9 female (50 %) had fusion of lower end of femur at the age of before 17

years only and 6 female (33.00%) had fusion at the age of 18 years and remaining 3 (16.6%) female the fusion occurred in 19 years.

Table 7. Fusion of lower end of femur in females

| Age | < 17 Years | 18 Years | > 18 Years |
|-------------|------------|-----------|------------|
| No of Cases | 9 (50%) | 6 (33.3%) | 3 (16.66%) |

Table No 8

Out of 32 males 6 males (18.75%) had fusion of upper end of tibia and fibula at the age of 17 to 17½ years of age while and 10 males (31.25 %) had complete fusion occurred of 18 to 18½ years of age while in 17 males (53.2%) complete fusion occurred in 19 years of age.

Table 8. Fusion of upper ends of tibia & fibula in males

| Age | 17 - 17 ½ | 18 - 18 ½ | 19 & Above | Total |
|--------------|------------|-------------|-------------|-----------|
| No. of Cases | 6 (18.75%) | 10 (31.25%) | 17 (53.12%) | 32 (100%) |

Table No 9

Out of 18 females 10 female (55.55%) the upper ends of tibia and fibula had complete fusion at the age before 17th years and in 8 females (44.15%) the fusion completion observed at the age of 17½ to 18 years.

Table 9. Fusion of upper ends of tibia & fibula in females

| Age | Before 17 Years | Between 17 - 18 | Total |
|--------------|-----------------|-----------------|-----------|
| No. of Cases | 10 (55.55%) | 8 (44.45%) | 18 (100%) |

DISCUSSION

In the present study out of 50 subjects 32 were males among them 15 (46%) were in the age group of 17 to 18 years and 5 (15.6%) were in the age group of 18 to 19 years and 12 were in the age group of 19 to 20 years. While in the female out of 18 cases 10 (55.5%) were in the age group of 17 to 18 years and remains 7 cases (38.8%) were 18 to 19 years and 1 (5.5%) was 19 to 20 Years of age (Table 1) Hence our study was an ideal attempt to observe the ossification of bones of knee joint i.e. lower end of the femur and upper ends of tibia and fibula.

It was also observed that the subject studied were 41 were mixed diet while 9 were vegetarians (Table 2) in males 28 (87%) were mixed diet and female 13 (72.2%) were mixed diet (Table 3)because for the proper formation and development of cartilage canals and the secondary centre of ossification in the distal chondro epiphysis of human femur linked with osteogenesis³. It occurs only in healthy subjects and present study was carried out in quite healthy subject

whose body weight was more or less 60 kg in males and 49 to 50 kg in females (Table 4) and average height of males and females was 166.1 cms and 155.2 cms respectively (Table 5) because ossification of long bones is influenced by dietic, climatic, hereditary, nutritional, sociological, racial, environmental and geographical factors ⁴.

In the present study it was observed that, 10(31.25%) of males had complete ossification of lower end of femur was between 17 years to 171/2 of age and complete ossification observed at 15 males (46.5%) at the age of 19 years.

It was also observed that 7 (21.8%) males had complete ossification between 181/2 years to 20 years of age (Table 6).

Among 18 females 9 female (50%) had complete ossification of lower end of femur completed at 17 years only while 6 female (33.3%) it was observed that ossification completed at the age of 18 years and 3 female (16.66%) had complete ossification was observed in 19 years of age (Table 7).

The present study was in agreement with previous workers^{5,7} and earlier ossification in female was also more or less in agreement with other workers⁸ as bones of lower end remains distinct until seventieth in females, and 18 to 19th in males when epiphyseal line ossifies, so the lower end is the growing end of the bone ⁹.

In the present study upper ends of tibia and fibula out of 32 males 6 males (18.75%) had ossification of tibia and fibula completed at the age of 17 to 171/2 years and 10 males (31.25%) had complete ossification in the age of 18 to 181/2 years. While in 17 males (53.00%) complete ossification observed in 19 years of age (Table 8).

In the present study of upper ends of tibia and fibula in females. Out of 18 females 10 females (55.5 %) had complete ossification before 17 years of age (already ossified) while remaining 8 females (44.4%) had shown complete ossification at the age of 17 to 18 years (Table 9) which was earlier than males. The study was in agreement with other workers who observed complete ossification between 16 to 18 years of age^{10,12}. Although exact process of ossification is still obscure but skeleton of a particular individual is able to adapt to its owners way of life because bone is a dynamic tissue that responds to the variety of environment and cope with biomechanical stress. Hence variation in the fusion of bones of knee joint could be to cope with environmental stimuli and to overcome biomechanical

stress¹³ Hence it can be hypothesized that, bones of the female are more adaptive than male bones hence fusion occurs earlier in females.

CONCLUSION

In the present study it was observed that majority of subject were having mixed diet and male's weight was near about 60 kg and females was about 48 to 50 kg.

The secondary fusion in males of lower end of femur was 17 years to 20 years and in females it was between before 17 years of age (probably 16 years) to 19 years.

In the upper end of tibia and fibula in males the secondary fusion was between 17 to 19 years of age while in females it was before 17 years to 18 years.

It was observed that females bones of knee joint fuse six months to one years earlier than males.

This study of south Indians ossification or fusion of bones of knee joint believed as Dravidians race will certainly help the anatomist, anthropologist, orthopedician and medico-legal experts. Because books and literatures always cannot be relied upon.

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