IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

"A Comprehensive Examination Of Pramana Shareera In Relation To Femur, Tibia, And Fibula Length"

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Abstract: Science has a profound impact on society, from advance in healthcare that extend human life spans to technological innovations that transform the way we live and work scientific discoveries influence health care, the environment, technology and more, improving our daily lives.

Ayurveda the ancient science of life; have proved its successful existence because of their combatant base & unique principles that have remained impervious till date. But now the interpretation of this science has become challenging to the present era where it has not been streamlined in a proper way which foliage the learner in cross road due to improper gloss.

To unscrew the pathology of various disease, through understanding of the structural and functional built up of human physique is inevitable. *Pramana shareera* is one such aspect which includes the study of science aspires at betterment of living. It is A scientific study includes annotations, measurements of entities, addition of data's & lastly scrutiny of entire findings to arrive at a conclusion.

It's of ample significance as it helps to determine the life expectancy of an individual.[1] *Charakacharya* enumerates that a person endowed with '*Pramanavat Shareera'* will have longevity, strength, happiness, power, wealth & virtues where as those with high or poor measurements will hold qualities contrary to that which explained in the classics.[2] Mentions supportive of the above view can be seen in *Susruta Samhita* also.[3]

In Forensic science the Anthropometry, which is a systemized measuring technique that expresses quantitatively the dimensions of human body & skeleton; is dealt with identification of a person as well as estimation of stature, age, sex, etc from the body parts.

Pramana shareera has been given prime importance in Ayurvedic classics. *Pramana* means measurement. *Anguli pramana* is one of the important types of measurement which is used for measuring the dimensions like *ayama, vistara, utsedha* etc., of different parts and sub-parts of human body.

Pramana shareera is one of the criteria, used in the examination of the patient. It helps in assessing the life span, strength, health of the person. It is also useful in assessing the outcome of the treatment.

The study includes: -

1. To study on pramana shareera in detail.
2. To study Asthi shareera in detail.
3. Comparison of length of right and left femur, tibia, fibula bone.

Index Terms - Pramana Shareera, Asthi Shareera, Lateralization of right and left femur along with tibia and Fibula.

I. INTRODUCTION

Ayurveda is one of the most ancient systems of medicine. The word *Ayurveda* denotes comprehensive and profound knowledge of *Ayu*. It defines health factors responsible for maintenance and promotion. It is in fact set of practical and simple guidelines for long life and good health. *Ayurveda* as a medical science basically demands understanding of the structural and functional constitution of human body. *Pramana shareera* can be of immense help in understanding the concepts.

Detailed description of *Pramana shareera* is available in *Charaka Samhita, Shushrutha Samhita, Astanga Sangraha and Astanga Hrudaya*. *Pramana* includes study of measurements of human body constituents including the *Rasadi dhatus* as well as the measurement of different body parts.

It plays a major role in assessing the life span of the individual[1]. It is one among the *Dashavidha pariksha* of the patient through which we get knowledge regarding the *Bala* of the patient[2]. The *Vaidya* has to and must examine the patient's *Anga Pratyanga pramana* to assess the life span to decide whether the treatment that is to be given by him would be fruitful or not.

Acharyas described measurement of different *Anga* and *Pratyanga*.[3,4,5] It is mainly assessed by using *Swa-Angula* as unit measurement.[6,7,8] Measurement with individual parameter looks more scientific method rather than fixing on average basis. The term "asthi sharira" comes from Sanskrit, where "asthi" means "bone" and "sharira" means "body." In the context of Indian philosophy and Ayurveda, "asthi sharira" refers to the physical body, particularly the skeletal structure. It is considered one of the three main components of the human body, along with "sukshma sharira" (subtle body) and "karana sharira" (causal body).Structural Foundation: The asthi sharira provides the essential framework and support for the body, allowing for movement and protection of vital organs. In Ayurveda, bones are associated with the earth element and are believed to be responsible for stability, strength, and endurance.

Health and Wellness Maintaining the health of the asthi sharira is crucial for overall well-being. This can involve proper nutrition, exercise, and lifestyle practices that support bone health .Connection to Other Bodies While the *Asthi sharira* is the physical aspect, it interacts with the *Sukshma* and *karana sharira*, highlighting the holistic view of human existence in Indian philosophy. Role in Yoga and Spirituality.In many yoga practices, understanding and acknowledging the *Asthi sharira* can aid in physical alignment and enhance the connection between body and mind.

In summary, the *Asthi sharira* is a vital aspect of the human experience, representing not just the physical form but also its interconnectedness with mental and spiritual dimensions.

Pramana can be correlated with Anthropometry or Anthropology which is useful only for physical measurement in order to assess height, age, gender etc. and is mainly used in identification of individuals.[9,10] Whereas in Ayurveda, there is wide range application of *Pramana Shareera* and is not merely limited to identification but gives valuable information regarding mental and physical constitution as well as social well-being of the individual.[11]

Concept of *Pramana* does not refer to the measurement of human body parts alone but it has also been utilized in the preparation of different instruments like *Mandalgra, kharapatra, Shalya Shastra*. In the field of *Panchakarma* it is utilized to measure *the Basti Netra, Basti Dravya* etc.

The lower limb is one among the *Shadanga*, it is most important part of the human body, without which human being cannot be picturized. The *Anguli Pramana* of different parts and sub- parts of the body has been mentioned in *Ayurvedic* classics. Average height of person is mentioned by *Acharya Sushruta* as 120 *Angula*, 84 *Angula* by *Acharya Charaka* and *Acharya Vagbhata*

Ayurvedic principles are formulated on the scientific parameters available on those times. The criteria to measure the individual anthropometric points is not mentioned in our classics. Any subject whether medicine or any studies requires constant revision of subject matter. A multitude factors such as advancement of scientific methodology and technological innovations give rise to new ideas or throw light on already held

ideas, these are to be incorporated into the system having duly reviewed the entire concepts. Hence with the help of modern science an effort is made to put light on the concept of *Pramana shareera*.

METHODOLOGY

SOURCE OF DATA

- Literary and Conceptual study are on the data compilations from the Bruhatrayees, Laghutrayees, and other classical books including journals, presented papers, previous work done, and corelated, analyzed with the knowledge of Contemporary science on the subject.

METHOD OF COLLECTION OF THE DATA

- Samhitas, Books, Thesis, Journals including published Articles on the concept related to subject will be reviewed and related information will be collected and analyzed scientifically.
- For the present study minimum of 30 apparently healthy individuals in and around the Ayurveda Mahavidyalaya & Hospital campus were selected for taking measurements.

Inclusion criteria

- Apparently healthy individuals of age group 25 to 35 years of age considered
- Patients irrespective of gender, religion and socio-economic status will be selected

Exclusion criteria

Individuals with deformities like fracture, pathologies pertaining to musculoskeletal system and other metabolic disorders

- Individuals with congenital deformities
- Individuals who had undergone amputation of limb

Instruments

- Measuring tape
- Measuring callipers

Assessment criteria: -

Anguli pramana was measured using measuring callipers according to references mentioned in the classics. The length of the lower limb (femur, tibia, fibula).

Angula Pramana

- Width of Madhyama Parva of Madhyama-anguli or Width of proximal Inter-phalangeal joint of middle finger.
- Width of the palm at the level of metacarpophalangeal joints (2nd -5th) and dividing it by four.
- Length of the middle finger and dividing it by five.
-

Measurements Swa-anguli

Length of the femur bone: -

It is measured from the finding visible axis of the head with superior surface of greater trochanter, at lower end lateral epicondyle of femur for measurement.

Length of the femur bone: -

It is measured from the finding visible axis of the head with superior surface of greater trochanter, at lower end lateral epicondyle of femur for measurement.

Fig no 01: measurement of Femur bone

Measurement of tibia and fibular length: -

First will ask them to stand on a stool or table, ask them to put right foot forward and rotate it outwards to make accessing central leg easier now will find and mark the medial malleolus and find and mark superior surface of medial condyle and fix the point and measure of fibula calculated from tip of styloid process to the tip of lateral malleolus.

Measurement of both right and left side of the lower limb bones (femur, tibia, fibula) are taken in centimeters and compared each other, calculated mean, standard deviation too look after lateralization.

Fig no 2: measurement of tibia bone

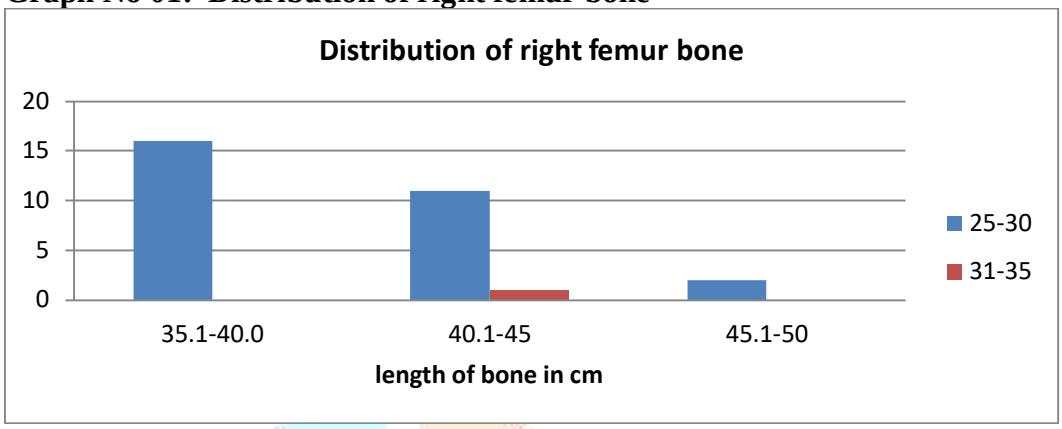
Fig no 3: measurement of fibula bone.

OBSERVATION AND RESULTS:

Table no 01: Measurement of length of right femur bone

Age group	Length of right femur bone		
	35.01-40.00	40.01-45.00	45.01-50.00
25-30	16	11	02
31-35		01	

Graph No 01: Distribution of right femur bone



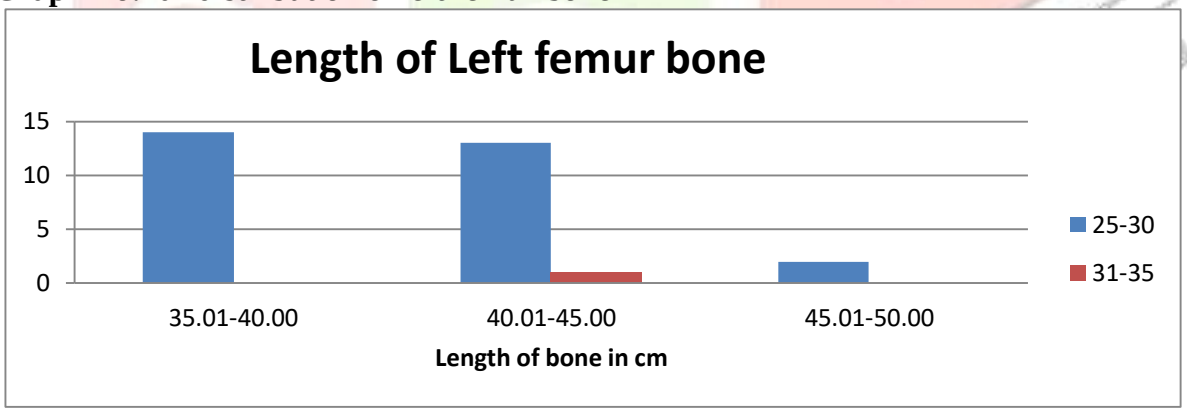
The length of right femur varies from 35.00cm to 50.00cm. the mean of the right femur is 40.85cm and standard deviation is 2.61cm

Length of left femur bone

Table no 02: measurement of length of left femur bone

Age group	35.01-40.00	40.01-45.00	45.01-50.00
25-30	14	13	02
31-35		01	

Graph No: 02 distribution of left femur bone



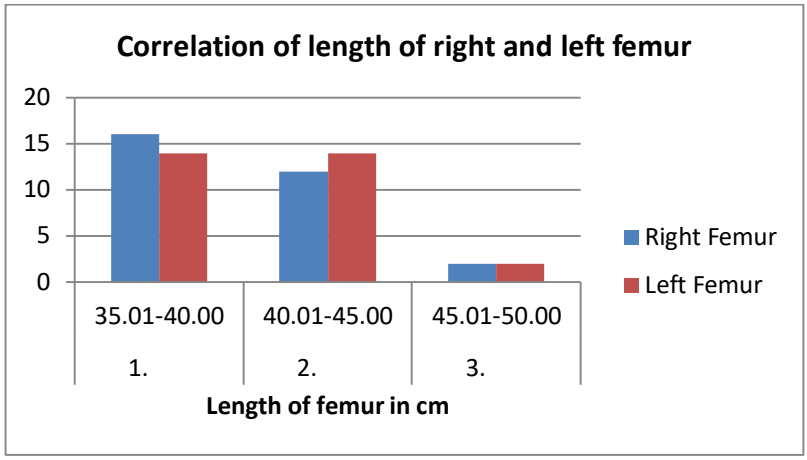
The Length of Left femur varies from 35.00cm to 50.00 cm. the mean of the Left femur is 40.83cm and standard deviation is 2.61cm.

Correlation of the length of Right and Left Femur Bone

Table no 03: Correlation of the length of Right and Left Femur Bone

SL. No	Length of Femur Bone	Right Femur	Left Femur
1.	35.01-40.00	16	14
2.	40.01-45.00	12	14
3.	45.01-50.00	02	02

Graph No 03: Correlation of the length of Right and Left Femur Bone



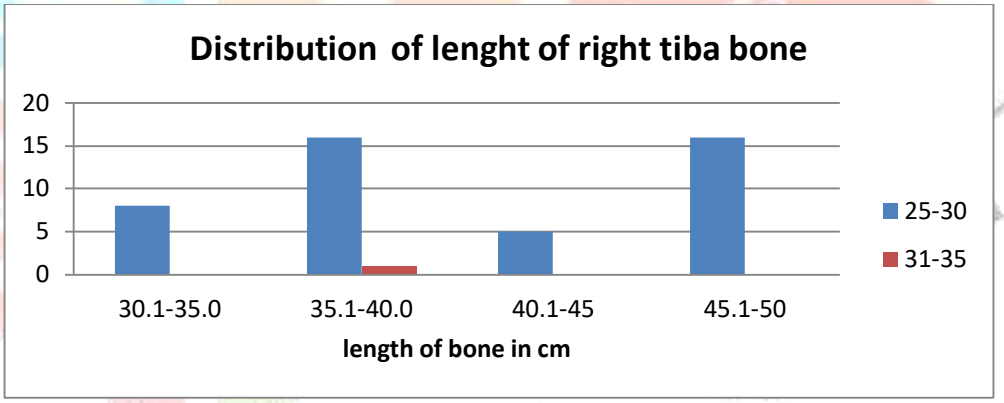
In the present study the student paired -t test obtained is t=0.154 and p -value is =0.87 As $p < 0.05$, there is no statistical significance between the length of the right and left femur.

Length of right tibia bone

Table no 04: **measurement of length of right tibia bone**

Age group	30.01-35.00	35.01-40.00	40.01-45.00
25-30	08	16	05
31-35		01	

Graph No 04: distribution of right tibia bone



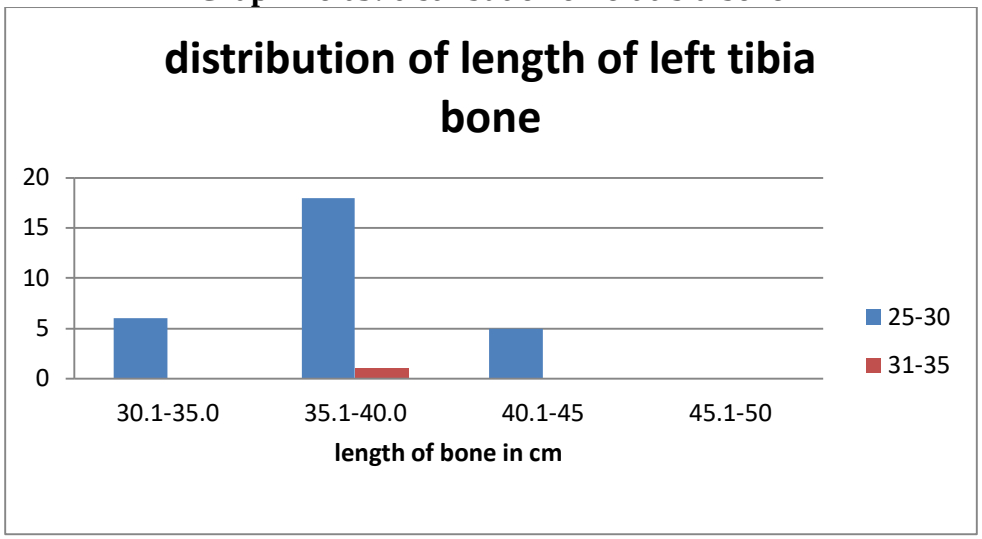
The length of right tibia varies from 35.00cm to 50.00 cm. the mean of the right tibia is 37.33cm and standard deviation is 2.55cm.

Length of left tibia bone

Table no 05: **measurement of length of left tibia bone**

Age group	30.01-35.00	35.01-40.00	40.01-45.00
25-30	06	18	05
31-35		01	

Graph No 05: distribution of left tibia bone



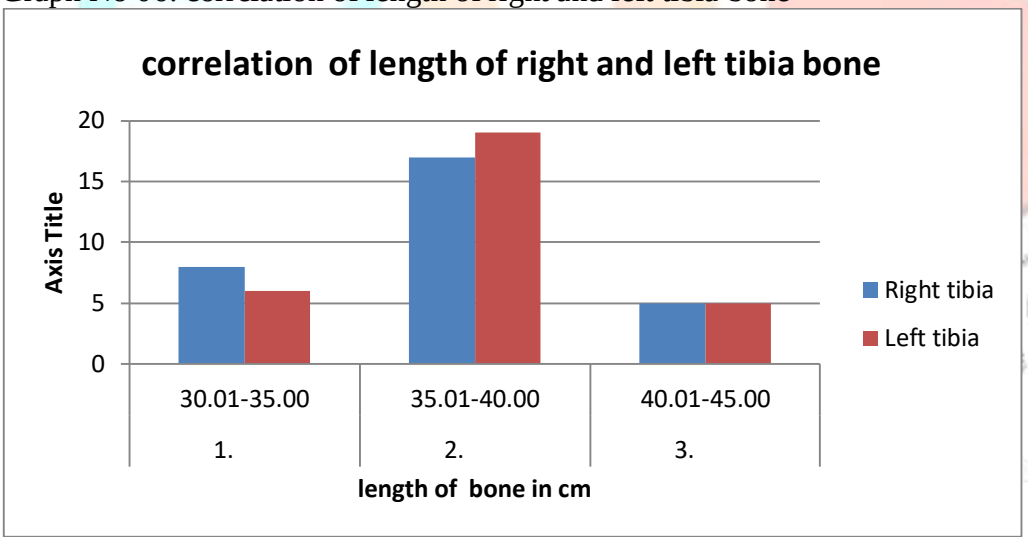
The length of left tibia varies from 35.00cm to 50.00 cm. the mean of the left tibia is 37.35cm and standard deviation is 2.74cm.

Correlation of the length of Right and Left tibia Bone

Table no 06: **measurement of length of Right and Left tibia bone**

SL. No	Length of tibia Bone	Right tibia	Left tibia
1.	30.01-35.00	08	06
2.	35.01-40.00	17	19
3.	40.01-45.00	05	05

Graph No 06: correlation of length of right and left tibia bone



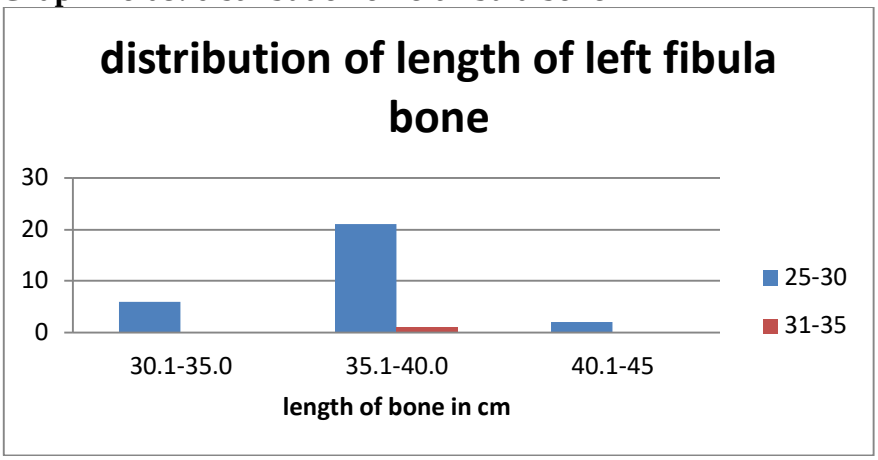
In the present study the student paired -t test obtained is t= - 0.120 and p- value is =0.90 As $p < 0.05$,there is no statistical significance between the Length of the Right and Left Tibia .

Length of left fibula bone

Table no 08: **measurement of length of left fibula bone**

Age group	30.01-35.00	35.01-40.00	40.01-45.00
25-30	06	21	02
31-35		01	

Graph No 08: distribution of left fibula bone



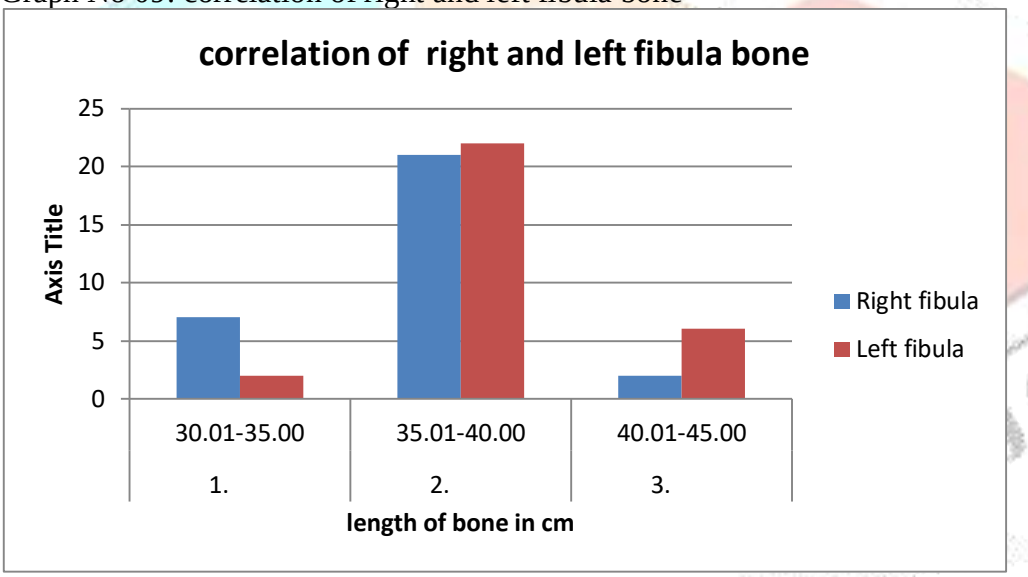
The length of left fibula varies from 35.00cm to 50.00 cm . the mean of the left fibula is 36.70cm and standard deviation is 2.44cm.

Correlation of the length of Right and Left fibula Bone

Table no 09: measurement of length of right and left fibula bone

SL. No	Length of fibula Bone	Right fibula	Left fibula
1.	30.01-35.00	07	02
2.	35.01-40.00	21	22
3.	40.01-45.00	02	06

Graph No 09: correlation of right and left fibula bone



In the present study the student paired -t test obtained is t= - 0.078 and p- value is =0.93 As $p < 0.05$,there is no statistical significance between the Length of the Right and Left Fibula.

Discussion

Pramana of Anguli measured from

A. Width of proximal inter-phalangeal joint of middle finger varies from 1.201 - 1.271cm with the mean 1.236 and SD 0.1392cm.
B. Width of palm at the palm at the level of metacarpo-phalangeal joints (2^{nd}-5^{th}) and dividing it by 4 varies from 1.701 - 1.771cm with mean 1.737 and SD 0.1696.
C. Length of the middle finger and dividing it by 5 varies from 1.817 - 1.870cm with the mean 1.843 and SD 0.1346cm.

Interpretation of Descriptive Statistics for Femur Bone Length

The table presents the descriptive statistics for the length of the femur bone measured in centimeters from a sample of 30 individuals. Here's a breakdown of the key statistics:

- Sample Size (N): The analysis is based on 30 measurements of femur length, indicating a reasonably sized sample for statistical inference.

- Minimum and Maximum: The lengths of the femur range from 36.0 cm to 46.5 cm. This range suggests variability in femur size among the individuals in the sample, which could be influenced by factors such as age, gender, or ethnicity.

- Mean: The average length of the femur bone in this sample is approximately 40.85 cm. This value serves as a central point around which the measurements are distributed, providing a summary of the data.
- Standard Deviation: The standard deviation is about 2.61 cm, indicating that the femur lengths deviate from the mean by this amount on average. A relatively small standard deviation compared to the mean suggests that most of the measurements are clustered close to the average, but there is still a notable range in lengths.

- Variability: The range of 10.5 cm (from 36.0 cm to 46.5 cm) along with a standard deviation of 2.61 cm points to a diverse population. This could be explored further to understand the factors contributing to this variability.

- Population Implications: Depending on the context (e.g., anthropological studies, medical assessments), the mean femur length could provide insights into the population's characteristics or health assessments.

- Further Analysis: Additional statistical analyses, such as comparisons between different demographic groups (e.g., gender, age), could provide deeper insights into the femur length distributions.

In summary, the descriptive statistics provide a foundational understanding of femur bone length in the sample, and further investigations can build on these insights to explore underlying trends and factors influencing bone length. Length of right and left femur bone.

- The length of the femur measured by using angula pramana measured by taking width of the proximal inter-phalangeal joint of the middle finger varies from
- It varies from 35.00cm to 50.00 cm with the mean 40.85cm and standard deviation is 2.61cm
- It varies from 35.00cm to 50.00 cm with the mean of the Left femur is 40.83cm and standard deviation is 2.61cm.
- In the present study the student paired -t test obtained is t=0.154 and p -value is =0.87 As $p > 0.05$, there is no statistical significance between the length of the right and left femur.
- In the present study, the paired t-test yielded a t-value of 0.154 and a p-value of 0.87. Since the p-value is greater than the conventional alpha level of 0.05, we conclude that there is no statistically significant difference between the lengths of the right and left femur.
- This suggests that any observed differences in femur lengths are likely due to random variation rather than a systematic difference. Therefore, we can state that the lengths of the right and left femurs in the sample population can be considered comparable, indicating that they are statistically similar in this study.
- In summary, the data do not support the hypothesis that there is a meaningful difference in femur length between the two sides.

  Length of right and left tibia bone
  - The length of right tibia varies from 30.00cm to 45.00 cm. The mean of the right tibia is 37.33cm and standard deviation is 2.55cm.
  - The length of left tibia varies from 30.00cm to 45.00 cm. The mean of the left tibia is 37.35cm and standard deviation is 2.74cm.

- In the present study the student paired -t test obtained is t= - 0.120 and p- value is =0.90 As p > 0.05, there is no statistical significance between the Length of the Right and Left Tibia. In the present study, the paired t-test resulted in a t-value of -0.120 and a p-value of 0.90. Since the p-value is significantly greater than 0.05, we conclude that there is no statistical significance between the lengths of the right and left tibia.
- This indicates that the differences observed in tibia lengths are likely due to random chance rather than a true effect. In other words, the lengths of the right and left tibias in the sample population are statistically similar.
- To summarize, the analysis suggests that there is no meaningful difference in tibia length between the two sides, reinforcing the conclusion that any variations are not significant from a statistical standpoint.

Length of right and left fibula bone

- The length of right fibula varies from 30.00cm to 45.00 cm. The mean of the right fibula is 36.69cm and standard deviation is 2.39cm.
- The length of left fibula varies from 30.00cm to 45.00 cm. the mean of the left fibula is 36.70cm and standard deviation is 2.44cm.
- In the present study the student paired -t test obtained is t= - 0.078 and p- value is =0.93 As p >0.05, there is no statistical significance between the Length of the Right and Left Fibula.
- The present study includes 30 healthy volunteers between the age group of 25-35 years. The maximum numbers of the volunteers are between the age group of 25-35 years.
- The length of jangha, total length of the lower limb, the height measured by parameter coincides with the measurement mentioned in the classics.
- The length of the thigh does not coincide with any values mentioned in the classics. The reason may be due to the landmarks used in the present study are not matching with those used by our acharyas.
- The length of the thigh however coincides with the length of the janu uparista bhaga. The janu uparista bhaga is measured from the janu sandhi (knee joint) to kati sandhi (sacroiliac joint).
- Our Acharyas categorically explained measurements with individual parameter i.e. by considering the swa-angula pramana. It is specific for every individual irrespective of place, race, gender etc. It seems to be more scientific method of measurement rather than fixing on average basis.

Conclusion:

The present study demonstrates that there is no significant difference in the length of the right and left fibula within the tested population, as evidenced by the high p-value obtained through paired t-test analysis. while these results contribute to the understanding of fibula and tibia anatomy, further research is warranted to explore the implications of these findings in a broader context. This structure provides a comprehensive discussion around your findings, highlighting the significance, implications, and avenues for future research while addressing the limitations of the study.

Asymmetry is not a man's privilege as it exists in other primates and animals the asymmetry between right and left femur, tibia, fibula, as it has been maintained by old and modern researchers, must be considered inherited.

It can be enhanced or reduced according to individual's habits and activities, age, nutrient, over use or disuse of the limb.

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