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An observational study of Consideration of Anguli Pramana in view of the Health Status in the present era

Research Article

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Abstract

Introduction: *Anguli pramana* is an age-old technique of human body measurements stated in Ayurveda. Acharyas have mentioned *Anguli pramana* for various parts of the body. The study aimed at its validation in the present era on the basis of health status. There are so many factors related to the health status of individual. Hence, the present study aimed at health status wise consideration of *Anguli pramana*. Method: With prior ethical permission, 770 healthy participants of both gender between age group 18-50 years in Ahmednagar and Nashik region were selected. Measurements were taken for selected body parts. The middle finger width of the right hand at proximal interphalangeal joint was used as a unit for *Anguli pramana*. Collected data analyzed using the student's t test for inference. Result: On comparison of measured values for selected parameters and the standard values stated by acharya in both genders found statistically different except for few parameters i.e., *Pad parinah*, *Pad vistar* and *Prakoshṭha ayam*. Discussion: The study shows variations in values obtained by *Anguli pramana.* This could be due to evolutionary changes and lifestyle of a human being. Though the findings are applicable to the selected sample size and selected parameters, the study could further be extended as this is a non-invasive ancient method of anthropometry. Revision of all the values for the present era will definitely serve as an alternative method for prediction of health of human being.

Keywords: *Anguli pramana, Swa-anguli pramana,* Anthropometry, Waist Hip Ratio, Health status.

Introduction

Anguli pramana is a unique measurement technique stated by acharyas in ancient times when there was no any sort of standardized unit of measurements. Acharya Charaka has mentioned '*Sama Ayam Vistar*' i.e., proportionate body. (1) Description of *Pramana Sharir* in Charaka Samhita is found in *Dashavidha pariksha* (Tenfold examination). According to Acharya Chakara, it can be a useful tool to assess the *Ayu* (life span) and *Bala* (strength) of the patient before proceeding for treatment. (2) Acharya Sushruta also mentioned it as the tool for assessment of Ayu (life span) also to judge the economic condition of the patient before starting the treatment. According to him, person with appropriate *pramana* of the body parts leads to good health, long life, and prosperity. (3) Acharyas have mentioned all the anthropometric measurements about two millennia back. There might be changes in the values of measurement due to evolutionary as well as lifestyle changes of the human being. (4,5) On conducting vigorous literature search, it was found that not a single study was being carried out based on the basis of health status. Hence, present study was planned to study *Anguli pramana* of individual on the basis of Health status.

Alternative measures which assess abdominal adiposity, like waist circumference and waist–hip ratio is considered to be superior to Body Mass Index (BMI) in prediction of health risk. It is based on a principle that increased visceral adipose tissue is associated with various metabolic abnormalities. For instance, decreased glucose tolerance, reduced insulin sensitivity and adverse lipid profiles, which are proven risk factors for type 2 diabetes and cardiovascular disease. (6)

Waist circumference

There are different opinions on measurement of the waist circumference as follows,

a) As per W.H.O. protocol, waist circumference measurement should be made at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest (WHO, 2008b).
b) The United States National Institutes of Health (NIH) protocol recommends waist circumference measurement should be made at the top of the iliac crest.
c) The NIH also provided a protocol for the measurement of waist circumference for the Multi-Ethnic Study of Atherosclerosis (MESA) study which indicates that the waist measurement should be made at the level of the umbilicus or navel.

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However, published reports indicate that waist circumference measured at the level of the umbilicus may underestimate the true waist circumference (7, 8).

Waist-Hip Ratio (WHR)

The Waist-Hip Ratio is used as an indicator (measure) of the health of a person and the risk of developing adverse health conditions as well. Evidence showed that people with 'apple-shaped' bodies (more fat around the waist) are prone to more health risks than those with 'pear-shaped' bodies (more fat around the hips) (9).

WHR is also considered as a measurement of obesity. As per WHO, abdominal obesity can be defined as a WHR above 0.90 for males and above 0.85 for females, or BMI above 30.0. According to the National Institute of Diabetes, Digestive and Kidney Diseases (NIDDK) women with WHR more than 0.8, and men with more than 1.0, are at increased health risk because of their fat distribution (7).

Measurement

Waist-Hip Ratio is a derived anthropometric measure of body composition. It is derived by the ratio of waist circumference to the hip circumference.

As per WHO protocol, Waist circumference is measured at the midpoint between the lower margin of the least palpable rib and the top of the iliac crest, using a stretch resistant tape that provides a constant 100g tension. Whereas, Hip circumference is measured around the widest portion of the buttocks, with the tape parallel to the floor.

While taking both measurements, the participant is asked to stand erect with feet close together, arms at the side and body weight evenly distributed on both feet. The participant should be relaxed, and the measurements are taken at the end of a normal expiration. Both the measurements are recorded and WHR is calculated as follows, (7)

$$\text{Waist-Hip Ratio (WHR)} = \frac{\text{Waist circumference}}{\text{Hip circumference}}$$

W.H.O. cut-off points and risk of metabolic complications (7)

Indicator	Cut-off points	Rick of metabolic
Waist	> 94cm (M), >	Increased
Waist	> 102cm (M), >	Substantially
Waist-Hip	> 0.90cm (M),	Substantially

Note- M: male, F: female

Applications

Waist–hip ratio is suggested as an additional measure of body fat distribution. It can be measured more precisely than skin folds. It provides an index of both subcutaneous and intra-abdominal adipose tissue. (10) Evidence showed that abdominal obesity measured as Waist–Hip Ratio was associated with an increased risk of myocardial infarction, stroke and premature death. However, these diseases were not associated with measures of generalized obesity such as BMI. (11) In females, BMI was associated with increased risk of above-mentioned diseases. However, Waist-Hip Ratio proved to be a stronger and independent risk prediction factor than BMI. (12)

Health Status Indicators

The health status indicators are characteristics of a population which can be quantified. These are used as supporting evidence for the purpose of describing the health of a population. Generally, a survey is carried out so as to get the data in this regard in a certain population. Thereafter, statistical analysis is carried out so that a statement can be made about the health of a population. Health indicators are often used by the Government so as to guide 'Health care policy'. (13) Incidence count of any of the following in a population may be considered as health indicators,

1. Low birth weight
2. Obesity
3. Arthritis
4. Diabetes
5. Asthma
6. High blood pressure
7. Chronic pain
8. Oral health problem
9. Depression
10. Hospital visits due to injury
11. Reports of waterborne diseases or foodborne illness. (14)

Importance

Information about the Health status of a population is having major social, political and economic importance. The purpose of Health indicators is to produce appropriate information about health status, health risks and health outcomes so as to establish priorities. Health information serves as a useful and easily accessible tool to all potential users at every moment, from health care providers to the general public. (15) It is not possible to measure Health in exact measurable forms. However, measurements have been framed in terms of illness (or lack of health), consequences of ill-health (morbidity, mortality) and economic, occupation and domestic factors that promote ill-health. Health indicators are in concurrence with this purpose. Thus, useful in deciding the health of a population. (16)

Methodology

Ethical clearance: Ethical clearance obtained before commencement of the study from the Institutional Ethical Committee.

Study design: Observational type of study design was preferred.

Sampling technique: Nonprobability sampling technique was used for selecting samples.

Sample size: For the present study, 770 healthy participants of both male and female gender were selected between age group 18-50 years.

Inclusion criteria: Age group between 18-50 years of both gender, same geographical areas, same socio-economic class.

Exclusion criteria: Wheelchair bound individuals, person with disability, person having difficulty in standing steady or straight.

Materials: Measuring tape, digital Vernier caliper, Calculator, Informed Consent Form, Case Record Form.

Assessment parameters:

Following parameters were selected for the present study,

1. *Swa-anguli pramana*: Width of the middle finger of the right hand, (17)
2. *Purush ayam* (Height)
3. *Purush vistar* (Arm span)
4. *Shir parinah* (Head circumference)
5. *Bahu ayam* (Length of arm)
6. *Prakoshtha ayam* (Length of forearm)
7. *Prakoshtha parinah* (Forearm circumference)
8. *Manibandha parinah* (Wrist circumference)
9. *Hasta ayam* (Length of hand)
10. *Hasta vistar* (Breadth of hand)
11. *Uru ayam* (Length of thigh)
12. *Uru parinah* (Thigh circumference)
13. *Janu ayam* (Length of knee)
14. *Janu parinah* (Knee circumference)
15. *Jangha ayam* (Length of leg)
16. *Jangha parinah* (Leg circumference)
17. *Gulpha parinah* (Ankle circumference)
18. *Pad ayam* (Length of foot)
19. *Pad vistar* (Width of foot)
20. *Pad parinah* (Circumference of foot)
21. *Kati vistar* (Breadth of waist)
22. *Urdhwa shakha ayam* (Length of upper limb)
23. *Adho shakha ayam* (Length of foot lower limb)

Other anthropometric parameters

For Waist-Hip Ratio (WHR): a) Waist circumference b) Hip circumference.

Study was conducted with prior ethical clearance. Total 770 participants of both male and female gender and age group 18-50 years were selected from Ahmednagar and Nashik region. Consent was taken before commencement of taking actual measurements. The measurements were taken using measuring tape for the selected parameters first in centimeter and later converted into *Anguli pramana*. For *Anguli pramana*, as a unit of measurement, width of the middle finger of the right hand at proximal interphalangeal joint was used for which digital Vernier caliper was used. All the data received was recorded on the case record form. While analyzing the data first the participants were segregated into two groups viz. Female participants and Male participants. Waist-hip ratio calculated for all participants separately and recorded on case record form. *Anguli pramana* of selected parameters as stated by acharya Charaka and Sushruta were considered as standard values. The measured mean was compared with this standard value for each selected parameter separately for each group. Student's t test was used for statistical analysis of the data.

Observations and Results

Table 1: Gender distribution of the study population

Gender	Number	Percentage
Male	278	36.10
Female	492	63.90
Total	**770**	**100.00**

Table 1 shows that there were 36.10% male participants and 63.90% female participants.

Table 2: Health Status distribution of study population

S.N.	Health Indicator	Number	Percentage
1	Low birth weight	6	0.78
2	Obesity	45	5.84
3	Arthritis	2	0.26
4	Diabetes	2	0.26
5	Asthma	4	0.52
6	High blood pressure	8	1.04
7	Chronic pain	0	0
8	Oral health problem	1	0.13
9	Depression	0	0
10	Hospital visits due to injury	4	0.52
11	Reports of waterborne diseases or foodborne illness	7	0.91
12	None of the above / Healthy	696	90.39

From Table 2 it can be observed that 90.39% of participants were not having any of the above ailments listed above and they were apparently healthy.

Table 3: Waist Hip Ratio (W.H.R.) distribution of study population

Gender	W.H.R.	Number	Percentage
Male	0.9 or less	198	25.71
	Above 0.9	80	10.40
Female	0.85 or less	210	27.27
	Above 0.85	282	36.62
Total		**770**	**100.00**

Table 3 shows that the percentage of normal WHR was higher in male participants (25.71%) while in female participants, no much difference found in the percentage of normal and abnormal WHR.

Table 4: Comparison of actual average value with the value stated by Charaka in males whose Waist Hip Ratio is 0.9 or below

No.	Parameter	Std. Value	Actual Mean	S.D.	S. E.	t Value	p Value	Remark
1	*Purush ayam*	84	93.0572	5.9057	0.4197	21.5257	0.0000	Significant
2	*Purush vistar*	84	95.0771	6.1020	0.4336	25.4794	0.0000	Significant
3	*Shir parinah*	32	30.5100	1.9074	0.1356	-10.9641	0.0000	Significant
4	*Bahu ayam*	16	18.4379	1.6880	0.1200	20.2707	0.0000	Significant
5	*Prakoshtha ayam*	15	15.3780	1.3259	0.0942	4.0012	0.0001	Significant
6	*Hasta ayam*	12	10.2953	0.8450	0.0601	-28.3169	0.0000	Significant
7	*Uru ayam*	18	25.3016	2.6053	0.1852	39.3357	0.0000	Significant
8	*Uru parinah*	30	25.9837	2.9481	0.2095	-19.1211	0.0000	Significant
9	*Janu ayam*	4	4.5136	3.5121	0.2496	2.0527	0.0414	Significant
10	*Janu pariṇah*	16	20.3609	2.2697	0.1613	26.9677	0.0000	Significant
11	*Jangha ayam*	18	20.6539	2.4614	0.1749	15.1335	0.0000	Significant
12	*Jangha parinah*	16	18.8702	2.0550	0.1460	19.6033	0.0000	Significant
13	*Pad ayam*	14	13.4428	1.1474	0.0815	-6.8157	0.0000	Significant
14	*Pad vistar*	6	5.8587	0.5812	0.0413	-3.4129	0.0008	Significant
15	*Kati vistar*	16	20.5787	3.1631	0.2248	20.3176	0.0000	Significant

From Table 4 it can be observed that there is a significant difference between the average actual value recorded and the standard value stated by Acharya Charaka for specific parameter in terms of *Anguli pramana* in the group of male participants having waist hip ratio 0.9 or below.

Table 5: Comparison of actual average value with value stated by Sushruta in males whose Waist Hip Ratio was 0.9 or below

No.	Parameter	Std. Value	Actual Mean	S. D.	S. E.	t Value	p Value	Remark
1	*Purush ayam*	120	93.0572	5.9057	0.4197	-64.0331	0.0000	Significant
2	*Bahu ayam*	16	18.4379	1.6880	0.1200	20.2707	0.0000	Significant
3	*Prakoshtha ayam*	16	15.3780	1.3259	0.0942	-6.5845	0.0000	Significant
4	*Prakoshtha parinah*	12	12.3031	1.4373	0.1021	2.9602	0.0035	Significant
5	*Manibandha parinah*	12	9.0662	0.7726	0.5968	-53.3009	0.0000	Significant
6	*Hasta ayam*	6	10.2953	0.8450	0.0601	71.3468	0.0000	Significant
7	*Hasta vistar*	4	4.8042	0.3978	0.0283	28.3755	0.0000	Significant
8	*Uru ayam*	18	25.3016	2.6053	0.1852	39.3357	0.0000	Significant
9	*Uru parinah*	32	25.9837	2.9481	0.2095	-28.6429	0.0000	Significant
10	*Janu parinah*	14	20.3609	2.2697	0.1613	39.3358	0.0000	Significant
11	*Jangha ayam*	18	20.6539	2.4614	0.1749	15.1335	0.0000	Significant
12	*Jangha parinah*	16	18.8702	2.0550	0.1460	19.6033	0.0000	Significant
13	*Gulpha pariṇah*	14	13.7094	1.7302	0.1230	-2.3570	0.0194	Significant
14	*Pad ayam*	14	13.4428	1.1474	0.0815	-6.8157	0.0000	Significant
15	*Pad vistar*	5	5.8587	0.5812	0.0413	20.7385	0.0000	Significant
16	*Pad parinah*	14	13.1829	1.0145	0.0721	-11.3052	0.0000	Significant
17	*Kaṭi vistar*	18	20.5787	3.1631	0.2248	11.4428	0.0000	Significant
18	*Urdhwa shakha ayam*	32	41.2475	2.9733	0.2113	43.6526	0.0000	Significant
19	*Adho shakha ayam*	50	52.7385	4.1401	0.2942	9.2840	0.0000	Significant

From the Table 5 it can be observed that there is a significant difference between average actual value recorded and the standard value stated by Sushruta for specific parameters in terms of *Anguli pramana* in the group of males having waist hip ratio 0.9 or below.

Table 6: Comparison of actual average value with the value stated by Charaka in males whose Waist Hip Ratio was above 0.9

No.	Parameter	Std. Value	Actual Mean	S.D.	S. E.	t Value	p Value	Remark
1	*Purush ayam*	84	92.5516	6.6019	0.7381	11.5131	0.0000	Significant
2	*Purush vistar*	84	94.0998	6.8240	0.7629	13.1548	0.0000	Significant
3	*Shir parinah*	32	30.7343	2.0797	0.2325	-5.4095	0.0000	Significant
4	*Bahu ayam*	16	18.3618	1.6460	0.1840	12.7529	0.0000	Significant
5	*Prakoshtha*	15	15.5305	1.5157	0.1695	3.1109	0.0026	Significant
6	*Hasta ayam*	12	10.2370	0.7682	0.0859	-20.3974	0.0000	Significant
7	*Uru ayam*	18	24.6468	2.1077	0.2356	28.0300	0.0000	Significant
8	*Uru parinah*	30	25.4351	2.9997	0.3354	-13.5259	0.0000	Significant

9	*Janu ayam*	4	4.5094	0.5570	0.0623	8.1276	0.0000	Significant
10	*Janu pariṇah*	16	21.1892	3.0916	0.3456	14.9189	0.0000	Significant
11	*Jangha ayam*	18	20.2543	1.9153	0.2141	10.4609	0.0000	Significant
12	*Jangha parinah*	16	19.0418	2.1885	0.2447	12.3532	0.0000	Significant
13	*Pad ayam*	14	13.6683	1.3222	0.1478	-2.2301	0.0286	Significant
14	*Pad vistar*	6	5.9678	2.2148	0.2476	-0.1294	0.8974	Significant
15	*Kaṭi vistar*	16	22.5929	2.4983	0.2793	23.4556	0.0000	Significant

From the Table 6 it can be observed that there is a significant difference between the average actual value recorded and the standard value stated by Charaka for specific parameters in terms of *Anguli pramana* in the group of male participants having waist hip ratio above 0.9.

Table 7: Comparison of actual average value with the value stated by Sushruta in males whose Waist Hip Ratio was above 0.9

No.	Parameter	Std. Value	Actual Mean	S. D.	S. E.	t Value	p Value	Remark
1	*Purush ayam*	120	92.5516	6.6019	0.7381	-36.9538	0.0000	Significant
2	*Bahu ayam*	16	18.3618	1.6460	0.1840	12.7529	0.0000	Significant
3	*Prakoshtha ayam*	16	15.5305	1.5157	0.1695	-2.7532	0.0073	Significant
4	*Prakoshtha parinah*	12	12.4001	1.5861	0.1773	2.2422	0.0278	Significant
5	*Manibandha parinah*	12	9.4691	0.7685	0.0859	-29.2721	0.0000	Significant
6	*Hasta ayam*	6	10.2370	0.7682	0.0859	49.0208	0.0000	Significant
7	*Hasta vistar*	4	4.8353	0.3975	0.0444	18.6775	0.0000	Significant
8	*Uru ayam*	18	24.6468	2.1077	0.2356	28.0300	0.0000	Significant
9	*Uru parinah*	32	25.4351	2.9997	0.3354	-19.4521	0.0000	Significant
10	*Janu parinah*	14	21.1892	3.0916	0.3456	20.6689	0.0000	Significant
11	*Jangha ayam*	18	20.2543	1.9153	0.2141	10.4609	0.0000	Significant
12	*Jangha parinah*	16	19.0418	2.1885	0.2447	12.3532	0.0000	Significant
13	*Gulpha pariṇah*	14	13.5648	1.5444	0.1727	-2.5049	0.0143	Significant
14	*Pad ayam*	14	13.6683	1.3222	0.1478	-2.2301	0.0286	Significant
15	*Pad vistar*	5	5.9678	2.2148	0.2476	3.8837	0.0002	Significant
16	*Pad parinah*	14	13.6285	1.4412	0.1611	-2.2912	0.0246	Significant
17	*Kaṭi vistar*	18	22.5929	2.4983	0.2793	16.3401	0.0000	Significant
18	*Urdhwa shakha ayam*	32	41.6944	2.9031	0.3246	29.6807	0.0000	Significant
19	*Adho shakha ayam*	50	52.4209	4.0407	0.4518	5.3252	0.0000	Significant

Table 7 shows that there is a significant difference between the average actual value recorded and the standard value stated by Sushruta for specific parameters in terms of *Anguli pramana* in the group of males having waist hip ratio above 0.9.

Table 8: Comparison of actual average value with value stated by Charaka in females whose Waist Hip Ratio was 0.85 or below

No.	Parameter	Std. Value	Actual Mean	S.D.	S. E.	t Value	p Value	Remark
1	*Purush ayam*	84	96.8361	9.3960	0.6484	19.7498	0.0000	Significant
2	*Purush vistar*	84	98.5670	7.5202	0.5189	28.0036	0.0000	Significant
3	*Shir parinah*	32	33.7930	2.3159	0.1598	11.1929	0.0000	Significant
4	*Bahu ayam*	16	18.9477	1.7600	0.1215	24.2125	0.0000	Significant
5	*Prakoshtha ayam*	15	15.8240	1.3265	0.0915	8.9810	0.0000	Significant
6	*Hasta ayam*	12	10.6941	1.0546	0.0728	-17.9015	0.0000	Significant
7	*Uru ayam*	18	28.3692	2.7451	0.1894	54.6088	0.0000	Significant
8	*Uru parinah*	30	28.4919	3.2027	0.2210	-6.8075	0.0000	Significant
9	*Janu ayam*	4	5.1331	0.5340	0.0368	30.6773	0.0000	Significant
10	*Janu pariṇah*	16	21.4414	2.6671	0.1840	29.4946	0.0000	Significant
11	*Jangha ayam*	18	22.2333	2.3085	0.1593	26.5105	0.0000	Significant
12	*Jangha parinah*	16	20.0772	2.2124	0.1527	26.6424	0.0000	Significant
13	*Pad ayam*	14	13.8895	1.1314	0.0781	-1.4124	0.1543	**Not Significant**
14	*Pad vistar*	6	5.8713	0.5298	0.0366	-3.5122	0.0005	Significant
15	*Kaṭi vistar*	16	23.9536	2.7349	0.1887	42.0432	0.0000	Significant

From the Table 8 it can be observed that there is a significant difference between the average actual value recorded and the standard value stated by Charaka for specific parameter in terms of *Anguli pramana* in the group of females having waist hip ratio 0.85 or below except for parameter '*Pad ayam*'.

Table 9: Comparison of actual average value with value stated by Sushruta in females whose Waist Hip Ratio was 0.85 or below

No.	Parameter	Std. Value	Actual Mean	S. D.	S. E.	t Value	p Value	Remark
1	*Purush ayam*	120	96.8361	9.3960	0.6484	-35.6402	0.0000	Significant
2	*Bahu ayam*	16	18.9477	1.7600	0.1215	24.2125	0.0000	Significant
3	*Prakoshtha ayam*	16	15.8240	1.3265	0.0915	-1.9176	0.0565	**Not Significant**
4	*Prakoshtha parinah*	12	11.4401	1.4032	0.0968	-5.7686	0.0000	Significant
5	*Manibandha parinah*	12	9.1378	0.7857	0.0542	-52.6632	0.0000	Significant
6	*Hasta ayam*	6	10.6941	1.0546	0.0728	64.3504	0.0000	Significant
7	*Hasta vistar*	4	4.8928	0.4031	0.0278	32.0154	0.0000	Significant
8	*Uru ayam*	18	28.3692	2.7451	0.1894	54.6088	0.0000	Significant
9	*Uru parinah*	32	28.4919	3.2027	0.2210	-15.8355	0.0000	Significant
10	*Janu parinah*	14	21.4414	2.6671	0.1840	40.3353	0.0000	Significant
11	*Jangha ayam*	18	22.2333	2.3085	0.1593	26.5105	0.0000	Significant
12	*Jangha parinah*	16	20.0772	2.2124	0.1527	26.6424	0.0000	Significant
13	*Gulpha pariṇah*	14	13.4348	1.6173	0.1116	-5.0525	0.0000	Significant
14	*Pad ayam*	14	13.8895	1.1314	0.0781	-1.4124	0.1593	**Not Significant**
15	*Pad vistar*	5	5.8713	0.5298	0.0366	23.7744	0.0000	Significant
16	*Pad parinah*	14	13.9827	1.2171	0.0840	-0.2059	0.8371	**Not Significant**
17	*Kaṭi vistar*	18	23.9536	2.7349	0.1887	31.4711	0.0000	Significant
18	*Urdhwa shakha ayam*	32	42.8970	3.1656	0.2184	49.7655	0.0000	Significant
19	*Adho shakha ayam*	50	56.9931	4.8914	0.3375	20.6688	0.0000	Significant

Table 9 shows a significant difference observed between the average actual value recorded and the standard value stated by Sushruta for specific parameters in the group of females having waist hip ratio 0.85 or below except for parameters *Prakoshtha ayam*, *Pad ayam*, *Pad parinah*.

Table 10: Comparison of actual average value with value stated by Charaka in females whose Waist Hip Ratio was above 0.85

No.	Parameter	Std. Value	Actual Mean	S.D.	S. E.	t Value	p Value	Remark
1	*Purush ayam*	84	96.0722	8.8849	0.5291	22.7764	0.0000	Significant
2	*Purush vistar*	84	97.8879	7.6356	0.4547	30.4892	0.0000	Significant
3	*Shir parinah*	32	33.6880	2.2167	0.1320	12.7649	0.0000	Significant
4	*Bahu ayam*	16	18.9674	1.8498	0.1102	26.8912	0.0000	Significant
5	*Prakoshtha ayam*	15	15.6671	1.3463	0.0802	8.3059	0.0000	Significant
6	*Hasta ayam*	12	10.6736	0.7700	0.0459	-28.8765	0.0000	Significant
7	*Uru ayam*	18	27.7876	2.8108	0.1674	58.3706	0.0000	Significant
8	*Uru parinah*	30	28.6898	3.3160	0.1975	-6.6236	0.0000	Significant
9	*Janu ayam*	4	5.0989	0.5856	0.0349	31.4573	0.0000	Significant
10	*Janu pariṇah*	16	21.9614	2.2801	0.1358	43.8268	0.0000	Significant
11	*Jangha ayam*	18	21.9904	2.2555	0.1343	29.6569	0.0000	Significant
12	*Jangha parinah*	16	20.2655	2.4052	0.1432	29.7292	0.0000	Significant
13	*Pad ayam*	14	13.8231	1.1250	0.0670	-2.6356	0.0089	Significant
14	*Pad vistar*	6	5.9167	0.5611	0.0334	-2.4898	0.0134	Significant
15	*Kaṭi vistar*	16	24.7878	2.5170	0.1499	58.5268	0.0000	Significant

From the Table 10 it can be observed that there is a significant difference between the average actual value recorded and the standard value stated by Charaka for specific parameters in terms of *Anguli pramana* in the group of female participants having waist hip ratio above 0.85.

Table 11: Comparison of actual average value with value stated by Sushruta in females whose Waist Hip Ratio was above 0.85

No.	Parameter	Std.	Actual	S. D.	S. E.	t Value	p Value	Remark
1	*Purush ayam*	120	96.0722	8.8849	0.5291	-45.1443	0.0000	Significant
2	*Bahu ayam*	16	18.9674	1.8498	0.1102	26.8912	0.0000	Significant
3	*Prakoshtha ayam*	16	15.6671	1.3463	0.0802	-4.1449	0.0000	Significant
4	*Prakoshtha parinah*	12	11.7722	1.3625	0.0811	-2.8022	0.0054	Significant
5	*Manibandha parinah*	12	9.1844	0.6606	0.0393	-71.4463	0.0000	Significant
6	*Hasta ayam*	6	10.6736	0.7700	0.0459	101.7488	0.0000	Significant
7	*Hasta vistar*	4	4.9412	0.4355	0.0259	36.2309	0.0000	Significant

8	*Uru ayam*	18	27.7876	2.8108	0.1674	58.3706	0.0000	Significant
9	*Uru parinah*	32	28.6898	3.3160	0.1975	-16.7341	0.0000	Significant
10	*Janu parinah*	14	21.9614	2.2801	0.1358	58.5302	0.0000	Significant
11	*Jangha ayam*	18	21.9904	2.2555	0.1343	29.6569	0.0000	Significant
12	*Jangha parinah*	16	20.2655	2.4052	0.1432	29.7292	0.0000	Significant
13	*Gulpha pariṇah*	14	13.4437	1.4881	0.0886	-6.2672	0.0000	Significant
14	*Pad ayam*	14	13.8231	1.1250	0.0670	-2.6356	0.0089	Significant
15	*Pad vistar*	5	5.9167	0.5611	0.0334	27.3880	0.0000	Significant
16	*Pad parinah*	14	14.0428	1.6354	0.0974	0.4387	0.6612	**Not Significant**
17	*Kaṭi vistar*	18	24.7878	2.5170	0.1499	45.2068	0.0000	Significant
18	*Urdhwa shakha*	32	42.9346	3.2338	0.1926	56.6811	0.0000	Significant
19	*Adho shakha ayam*	50	56.5578	4.9045	0.2921	22.4141	0.0000	Significant

Table 11 shows significant difference observed between the average actual value recorded and the standard value stated by Sushruta for specific parameter in terms of *Anguli pramana* in the group of females having waist hip ratio above 0.85 except for parameter '*Pad parinah*'.

Table 12: Parameters for whom ancient *Anguli pramana* and actual body measurements were found comparable

No.	Comparison with the value stated by	Comparison for category of participants	Parameter	Test	Test statistic value	p Value	Remark
1	Charaka	Female (WHR 0.85 or below)	*Pad ayam*	t- test	-1.4124	0.1543	Comparable
2	Sushruta	Female (WHR 0.85 or below)	*Prakoshtha ayam*	t- test	-1.9176	0.0565	Comparable
3	Sushruta	Female (WHR 0.85 or below)	*Pad ayam*	t- test	-1.4124	0.1593	Comparable
4	Sushruta	Female (WHR 0.85 or below)	*Pad parinah*	t- test	-0.2059	0.8371	Comparable
5	Sushruta	Female (WHR above 0.85)	*Pad parinah*	t- test	0.4387	0.6612	Comparable

From the Table 12, it can be observed that in the mentioned categories the *Anguli pramana* can be taken valid in the present era.

Discussion

The Waist-Hip Ratio (WHR) is a quick measure of fat distribution that may help to indicate a person's overall health. People who carry more weight around their middle than their hips may be at a higher risk of developing certain health conditions like Cardiovascular disease, Type 2 Diabetes etc. This is based on the rationale that increased visceral fat is closely associated with a range of metabolic abnormalities, including decreased glucose tolerance, reduced insulin sensitivity and adverse lipid profiles, which are the risk factors for Type 2 Diabetes and Cardiovascular disease. According to WHO, healthy Waist-Hip Ratio is 0.9 or less in males and 0.85 or less for females. If it is more than these values, they are an indicator of health risk. (7)

The researcher compared the health status obtained using anthropometric parameter i.e., Waist-Hip Ratio (WHR) and *Anguli pramana* for various body parameter measurements. For this purpose, the researcher has calculated Waist-Hip Ratio for all the participants. Then the original data of 770 participants was segregated gender wise into two groups of male and female. Group of male participants further divided into two subgroups i.e., a) WHR less than or equal to 0.9 b) WHR more than 0.9 having sample size 198 and 80 respectively. Similarly, another group of female participants further divided into two subgroups i.e., a) WHR less than or equal to 0.85 b) WHR more than 0.85 having sample size 210 and 282 respectively. (Table 3)

Consideration of validation in Male Participants

Male participants with Waist-Hip Ratio 0.9 or below

There was a difference between the average actual value recorded and the standard value stated by *Acharya* Charaka for specific parameters in terms of *Anguli pramana* in this subgroup (Table 4). Thus, it can be concluded that for male participants having Waist-Hip Ratio 0.9 or below, *Anguli pramana* stated by Acharya Charaka may not be taken valid in the present era.

Similarly, the actual average value was found different from the value stated by *Acharya* Sushruta for this category (Table 5). Thus, it was confirmed that for male participants having Waist-Hip Ratio 0.9 or below, *Anguli pramana* stated by Acharya Sushruta may not be taken valid in the present era.

Male participants with Waist-Hip Ratio above 0.9

For this group of participants, the average actual value recorded and the standard value stated by Acharya Charaka for specific parameters in terms of *Anguli pramana* differed from each other (Table 6). Hence, it can be said that for male participants having Waist-Hip Ratio above 0.9, *Anguli pramana* stated by acharya Charaka may not be taken valid in the present era.

Similarly, it was found that the average actual value recorded and the standard value stated by *Acharya* Sushruta for specific parameters in terms of *Anguli pramana* differed in this group (Table 7). Thus, it can be concluded that for male participants having Waist-Hip Ratio above 0.9, *Anguli pramana* stated by Acharya Sushruta may not be taken valid in the present era.

Consideration of Validation in Female Participants

Female participants with Waist Hip Ratio 0.85 or below

The average actual value recorded and the standard value stated by Acharya Charaka for specific parameters in terms of *Anguli pramana* found varied in this group except for parameter '***Pad ayam***' (Table 8). It was clear that for female participants having Waist-Hip Ratio 0.85 or below, *Anguli pramana* stated by *Acharya* Charaka is not comparable in the present era. Maybe Pad ayam is comparable.

Similarly, the average actual value recorded and the standard value stated by Acharya Sushruta for specific parameters in terms of *Anguli pramaṇa* differed from each other in this subgroup except for parameters ***Prakoshtha ayam***, ***Pad ayam***, ***Pad parinah (***Table 9). Thus, it can be concluded that for female participants having Waist-Hip Ratio 0.85 or below, *Anguli pramana* stated by Acharya Sushruta may not be taken valid in the present era. Maybe *Prakoshṭha ayam, Pad ayam and Pad parinah* is comparable.

Female participants with Waist-Hip Ratio above 0.85

The average actual value recorded and the standard value stated by Acharya Charaka for specific parameters in terms of *Anguli pramana* found varied in this subgroup (Table 10). Thus, it can be concluded that for female participants having Waist-Hip Ratio above 0.85, *Anguli pramana* stated by Acharya Charaka may not be taken valid in the present era.

The average actual value recorded and the standard value stated by *Acharya* Sushruta for specific parameters in terms of *Anguli pramana* in this subgroup found different from each other except for parameter '***Pad parinah***' (Table 11). Thus, it can be concluded that for females having Waist-Hip Ratio above 0.85, *Anguli pramana* stated by Acharya Sushruta may not be taken valid in the present era. Maybe *Pad parinah* is comparable.

Conclusion

When ancient *Anguli pramana* was considered for validation in the present era on the basis of health status, overall results of the study revealed that *Anguli pramana* stated by Acharya Charaka and Sushruta may not be taken valid in the present era except for few parameters. *Pad ayam* (foot length), *Pad vistara* (foot width), *Pad parinah* (foot circumference), *Shir parinah* (head circumference) and *Prakoshtha ayam* (forearm length) were the exceptionally comparable parameters in some subgroups. Most of the comparable parameters were related to the measurements of foot other than this forearm length and head circumference. This may be due less spread of the data because of comparatively small sample sizes in those subgroups. Hence, it can be said that in the mentioned categories only the *Anguli pramana* can be taken valid in the present era.

An evolutionary change as well as changes in the lifestyle of the human being in the present era might be the possible reasons behind this. The conclusion at which the researcher arrived at is merely applicable to the sample size and the selected parameters. Hence, study can be extended further by opting variation in the sample size and the proportionate distribution of the population in demographic parameters. If the anthropometric values in terms of *Anguli pramana* are derived for the present era, it can serve as an alternative non-invasive method of health assessment.

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