

An Exploratory Pilot Study on the Traditional Siddha Anthropometric Diagnostic and Screening Method *Manikkadai Nool* Measurement

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ABSTRACT

Background: The traditional Tamil Siddha medical text '*Agasthiyar Sūdamanikkayaru Sūtram*' exclusively discusses *Manikkadai Nūl* (wrist-thread) measurement as a continuous variable ranging from 4 to 10 fb with an interval of 0.25 fb between each value i.e. 4, 4.25, 4.5, 4.75 etc. and enumerates the corresponding disease conditions associated with each value, as a desk reference for physicians. The current study was aimed to study the distribution pattern of *Manikkadai Nūl* (MN) measurement of students studying in an undergraduate college in Thiruvananthapuram district, Kerala and to analyse the data statistically. *Manikkadai Nūl* measurement is the circumference of forearm which is measured four finger breadth above the wrist. **Methods:** The study group included 166 females and 37 males aged 18-28 years. MN measurement of the participants was recorded. The mean and standard deviation were calculated. The distribution of the MN measurement was generated. Correlation between age and MN measurement was assessed by Pearson's correlation coefficient. The sex difference with respect to MN measurement was assessed by t test. **Results:** The analysis shows positively skewed (theoretically symmetrical) distribution of MN measurement. The mean was 9.28, mode was 9, and the standard deviation was 0.83; MN measurement has no correlation with age and gender. As per the traditional Tamil Siddha text, only 8 out of the 203 participants are in their perfect health state. **Conclusion:** The distribution of the MN measurement was positively skewed (N=203) which could be considered as theoretically symmetrical distribution and if the number of study participants were increased, a perfect symmetrical distribution might be obtained. A thorough study on MN measurement and its correlation with body mass index, waist hip ratio, waist circumference and associated disease conditions will be helpful to develop a non-invasive diagnostic and screening tool for the lifestyle disorders referred in the classical Siddha text.

KEY WORDS

Exploratory pilot study, *Manikkadai Nūl* measurement, Siddha anthropometric diagnostic and screening method, statistical interpretation.

1.0 Introduction

Anthropometric measurements are now regarded as important indicators of an individual's nutritional status.^[1] Anthropometric indicators are strong and easily obtainable predictors at the individual and population level of subsequent morbidity, functional impairment and mortality.^[2] Modern anthropometric studies

demonstrated the wrist circumference as a predictor of diabetes and pre-diabetes stage,^[3] cardio metabolic risk factors,^[4] insulin resistance and chronic kidney diseases.^[5] The body frame size (small, medium, or large boned) is also determined by a person's wrist circumference in relation to his height.^[6]

In the traditional Siddha medicine, an unique anthropometric diagnostic practice called '*Manikkadai Nūl*' (wrist-thread) in which the physician would measure the circumference, four fingerbreadths away from the wrist and use the measurement as a basis for identifying certain physiological and pathological patterns of the patient.^[7] Fingerbreadth (fb) is the unit described for *Manikkadai Nūl* (MN) measurement. The classical Siddha medical text '*Agasthiyar Sūdamanikkayaru Sūtram*'^[8] discusses a range of MN measurement from 4 to 10 fb with an interval of 0.25 fb in between each value i.e. 4, 4.25, 4.5, 4.75 etc. and enumerates the corresponding disease conditions associated with each value as a desk reference for physicians. Apart from these values, the value 11 fb is indicated for perfect health state. These values as predictors of diseases can be used to describe the association between the values and the certain pathological and physiological conditions. As a pilot exploratory study, the MN measurement of the students studying undergraduate course in Thiruvananthapuram district of Kerala, India were collected to study the distribution pattern of MN measurement and analyse the data statistically.

2.0 Materials and methods

2.1 Study population

Data was collected from an undergraduate college located in the Thiruvananthapuram district of Kerala State, India. The study population included 203 young adults (166 females and 37 males) aged 18-28 years.

Permissions were collected in the form of written informed consent obtained from all students who participated in the study. All students from the college were invited to participate. No exclusion criteria were followed. Initially 250 students were approached to participate and of these roughly 80% agreed to participate (203 students).

2.2 Unit of MN measurement

The unit of MN measurement is fingerbreadth (fb) which is a variable. Fb is still used in modern surgical procedures, but also largely contradicted for its inter-surgeon variability.^[9,10] In the study, each individual's fb is used as a standard to measure his / her own body which is followed by the traditional physicians practicing *Varma maruthuvam*, a specialised traumatology treatment method of Siddha system of medicine practiced mainly in the southernmost districts of India viz. Kanyakumari and Thiruvananthapuram districts.

In *Varma maruthuvam*, one fb means the cross measure of the index finger, similarly the combination of index and middle finger for measuring two fb, the index, middle and ring finger for measuring three fb and index, middle, ring and little finger for measuring four fb, which are used traditionally for body measurements.^[11] The more distally placed thumb is excluded in fb measurement; only the anatomically paralleled other four fingers are used.

2.3 Data collection

MN measurement of the total 203 participants was collected in a span of four days in August 2016. The time for assessing MN measurement was fixed between 11 am to 12 noon; there is no specific reason to choose this time period, but to follow uniformity. To minimise both human and instrument (here it is thread) errors, all MN measurement were taken independently by two well trained experts in MN measurement; starch thread without stretching nature is chosen for assessing MN measurement. Right hand for males and left hand for females were used to assess MN measurement, since it is the custom followed in Siddha diagnostic methods like pulse reading.

The following steps are involved in measuring MN measurement (Fig. 1). The point four fb away from the flexor retinaculum of wrist is identified (Fig. 1a). At the identified point, the circumference of the forearm is measured with

thread (Fig. 1b), and then the circumference measured in the thread is converted into number of fb with an accuracy of 0.25(¼) fb. The palmar aspect of the four fb (combination of index, middle, ring and little fingers) of each individuals own hand is used for conversion. First, the four fb was calculated by placing the thread over the imaginary straight line lies over the proximal interphalangeal crease of index, middle and ring fingers and the distal interphalangeal crease of little finger (Fig. 1c). The procedure was repeated until the whole circumference is converted into fb (Figs. 1d and 1e). The classical Siddha text discusses the MN measurement values in 0.25(¼) fb intervals, for this reason the last fb is calculated by dividing the cross measure of that finger in to four parts, and based on the length, it is added to the total measurement as 0.25 or 0.5 or 0.75 or 1 fb. Finally in the data 0.25 and 0.75 fb were averaged to the nearest 0.3 and 0.8, for example 9.25 as 9.3 and 9.75 as 9.8. If the MN measurement collected by the two data collectors differed by more than 10% then they were not included in the database. Data from two participants were omitted on account of such discrepancies. Age and gender were also noted to study the correlation with MN measurement. The study plan doesn't include collection of the disease conditions of the participants.

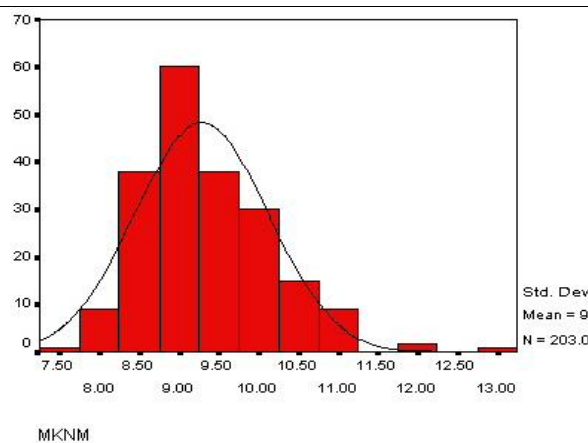
2.4 Statistical analysis

Data was presented as distribution, the mean, the mode and standard deviation (SD) of MN measurement. Correlation between age and MN measurement was assessed by Pearson's correlation coefficient; the sex difference with respect to MN measurement was assessed by t test.

3.0 Results

A total of 203 young adults were measured. The study group consisted of 166 females and 37 males. A positively skewed distribution of MN measurement (Graph 1) was obtained. The age of the study participants (N=203) ranged from 18 to 28 years with a mean of 21.2 and the standard deviation (SD) is 1.88 (Graph 2). The range of the observed MN measurement value is from 7.5 to 12.75 fb and the calculated mean is 9.28 (the nearest classical text value 9.25) and the mode is 9. The SD is 0.83 (the nearest classical value 0.75). Correlation between age and sex with MN measurement were insignificant, $r = 0.043$. The mean value of MN measurement of males (N=37) was 9.37 with a SD of 0.81 and that of females (N=166) was 9.26 with a SD of 0.84. It is not statistically significant, $t=0.752$ and $p=0.453$. The frequencies of the observed MN measurement values and the referred diseases conditions in the classical text are listed in the Table 1.

Graph 1. Distribution of MN measurement



Graph 2. Frequency distribution of the age of the participants

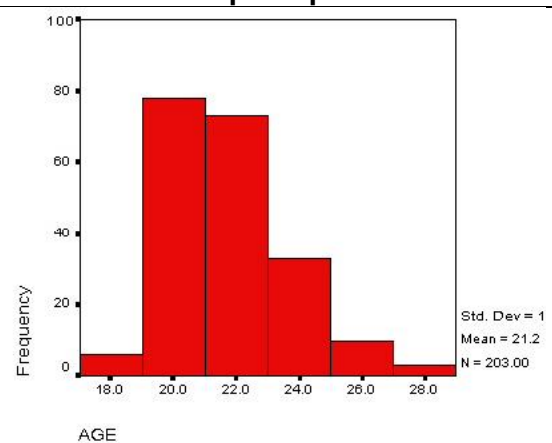


Figure 1. Steps involved in measuring MN measurement



Fig 1a. Identifying the point four fb away from the wrist (each individual's fb is used as a standard for his / her own)



Fig 1b. Measuring the circumference (MN measurement) with thread

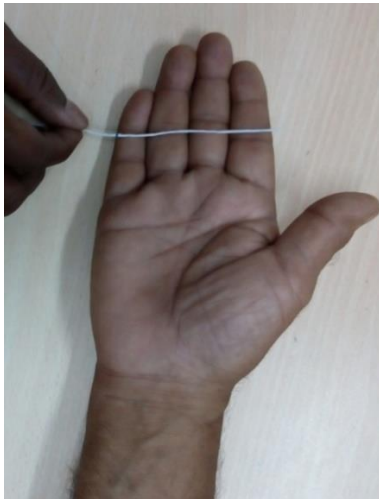


Fig 1c. Converting the MN measurement in to fb - Step 1



Fig 1d. Converting the MN measurement in to fb - Step 2



Fig 1e. Converting the MN measurement in to fb - Step 3

Table.1 Frequency distribution of the observed MN measurement values (N=203) and disease conditions in the classical text

SN	MN measurement	Frequency	Percent	Referred disease conditions in the classical text
1.	7.5	1	0.5	Diseases of bone (such as osteoporosis / osteomyelitis / osteomalacia / rickets), gaseous distension of abdomen, burning sensation of the face, heat condition of the whole body especially eyes, painful lower limbs, abnormal tumour like growth in thigh.
2.	8.0	9	4.4	Disorders of abdomen, oedema of body, sinusitis, throat pain/irritation
3.	8.25	9	4.4	Gaseous distension of abdomen associated with <i>Pitham*</i> , fever, diseases of urinary tract, sexual desire. Within a year the patient may develop diseases of the head
4.	8.5	29	14.3	Cough, furuncle, growing tumour
5.	8.75	19	9.4	Hyperpyrexia/body heat, multiple (stigmatic) skin rashes, gaseous distention of the abdomen, painful anus, pallor of eye, mouth, hands, diseases of <i>Pitham*</i>
6.	9.0	41	20.2	Ear ache, impaired hearing, lumbago, weakness in the thighs
7.	9.25	12	5.9	Reduced urine output, body heat, sleeplessness, sinusitis
8.	9.5	26	12.8	Pallor and heat condition of the body associated with diseases of bone, burning sensation of the eyes, fever, loss of appetite and emaciation
9.	9.75	6	3.0	Bubo / carbuncle, cough, dryness. Within a year the patient may develop liver diseases
10.	10	24	11.8	Gaseous distension of stomach, gastritis, painful limbs and trunk caused by gaseousness
11.	10.25	6	3.0	+
12.	10.50	9	4.4	+
13.	10.75	1	0.5	+
14.	11	8	3.9	Perfect health
15.	12	2	1.0	+
16.	12.75	1	0.5	+
	Total	203	100	

**Pitham* is usually associated with biliousness, acidity, burning sensation of eye and urinary tract, heat condition of the body and mentally disturbed nature; + These values are not discussed in the classical text.

4.0 Discussion

Table 1 shows 9 fb is the most occurred value (mode) i.e. 41 among the 203 (20.1%) participants. Hence, it was postulated that 20% of study participants might have association with the referred disease conditions in the classical text for 9 fb MN measurement i.e. ear ache, impaired hearing, lumbago, weakness in the thighs. A correlation study on the referred disease conditions for each value as per the classical text might be helpful to establish the accuracy of the classical text reference values and associated disease conditions.

As per the Table 1, a person with the MN measurement of 8.25 fb will be affected by diseases of the head within a year. Few more values are also referred in the classical text under the risk of developing diseases prospectively. A cohort study on persons with those values will be helpful to establish the validity and diagnostic accuracy of MN measurement.

The study was conducted among the college students generally considered as normal healthy population. But according to the classical text, the indicator for perfect health is 11 fb which was found only in 8 out of 203 participants i.e. only 3.9% of participants were in perfect health state.

Using MN measurement as a diagnostic and screening tool with reference to the classical text has limitations, since the observed values of the 19 participants (9.4%) ranges from 10.25 to 12.75 fb (except 11 fb) are not discussed in the classical text, for example, the values 12 and 12.75 fb were observed in persons with severe or morbid obesity; the health risks of morbid obesity for these observed values are not covered in the classical text. Another limitation is the range of disease conditions discussed in the classical text which doesn't cover the entire range of human illnesses.

Apart from the MN measurement values observed in the current study i.e. from 7.5 to 12.75 fb, the classical text associates few values

with fatality of a person which usually fall below 6.5 fb, for example, the classical text says, if the MN measurement is 5.5 fb, the patient will die within 10 days. With proper ethical considerations, studying the MN measurement of patients getting treatment in the intensive care unit and terminally ill patients will be helpful to establish the classical text's claim on the correlation of few MN measurement values and fatality.

5.0 Conclusions

The distribution of the MN measurement is positively skewed (N=203) which could be considered as theoretically symmetrical distribution and if the number of study participants were increased, a perfect symmetrical distribution might be obtained.

There are scopes and limitations in using MN measurement as a diagnostic and screening tool. Since it is a pilot study and first of its kind on the traditional Siddha diagnostic and screening method MN measurement, a thorough study on MN measurement, and its correlation with height, weight, body mass index, waist hip ratio, waist circumference and associated disease conditions will be helpful to explore the MN measurement in modern parameters and to develop a non-invasive diagnostic and screening tool for the non-communicable diseases referred in the classical Siddha text '*AgasthiyarSūdamanikkayaruSūtram*'.

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Conflict of interests: Nil

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