The *Cun* Measurement System: an Investigation into its Suitability in Current Practice

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Summary

The Chinese anatomical inch (cun) measurement system is an essential component of traditional point location methods used in acupuncture. This study used the cun system to investigate any variation between the traditional measurements and the sample means for selected finger measurements, and for the forearm and lower leg lengths obtained from 50 volunteer subjects randomly selected from staff and students of the College of Traditional Chinese Medicine, University of Technology, Sydney. Subjects were seated while the finger and arm measurements were recorded, and were standing for leg measurement. Data were converted to ratios for analysis, with the one cun measurement for the thumb designated as the standard.

There were significant differences between the traditional measurements and the sample means for all hand and leg measurements in the sample. The results were generally the same for gender and the age groups studied. The authors conclude that the cun measurement system does not provide accurate estimates for contemporary Australian adults with respect to hand and lower leg measurements nor, to a lesser extent, with respect to measurements of the forearm. Consequently, it is recommended that methods of point location that are less reliant on the cun measurements (such as the proportional method) should be used in preference to the cun-dependent directional method.

Key words

Acupuncture, Acupuncture point location, Chinese anatomical inch (Cun).

Introduction

The need for a standardised system of measurement was recognised by even the earliest civilisations. That developed by the Chinese has been found to date back to 2900 BC, when pieces of jade resembling rulers were used for measurement. These rulers were divided into equal sized increments, with each section measuring approximately 23mm or multiples thereof. It is believed that the 23mm was equivalent to the breadth of the adult thumb joint at the time *(1)*. This was used as the basis for a system of measurement, and it is now known as one Chinese anatomical inch (one *cun*). The Chinese used the one *cun* measurement as well as various lengths and breadths of the fingers in order to locate acupuncture points *(Figure 1)*. These *reference measurements* include:

i. the width of the inter-phalangeal joint of the thumb (1 *cun*)
ii. the width of the index and middle finger, measured at the level of the proximal inter-phalangeal joint of the index finger (1.5 *cun*)
iii. the length of the two distal phalanges of the index finger (2 *cun*)
iv. the width of all four fingers, measured at the level of the proximal inter-phalangeal joint of the index finger (3 *cun*).

Measurements are also defined for other areas of the body. Two such areas examined in this study were the distance between the elbow crease and the wrist crease (12 *cun*), and the distance between the middle of the patella (with the knee extended) to the lateral extremity of the lateral

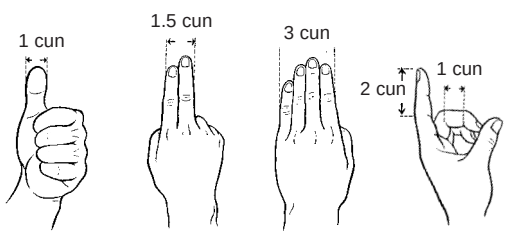

Figure 1. Diagram to show cun measurements using the fingers.

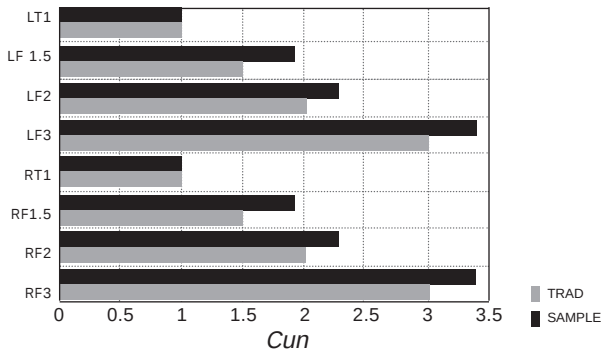

Figure 2. Comparison of traditional measurements and sample means for the measurements of the hand (L = Left, R = Right, T = Thumb, F = Finger).

malleolus (16 *cun*) *(2)*. These are referred to as *traditional measurements*.

The reference measurements are important when locating acupuncture points that are not situated near anatomical landmarks. Two commonly used methods for acupuncture point location are the *proportional* and the *directional* methods. The proportional method divides a distance between two landmarks or reference marks into equal sized sections. The directional method measures from one landmark or reference mark to an acupuncture point, using the *cun* reference measurements.

Examination of the reference measurements themselves and their application was completed in two stages. Firstly, the study compared each subject's hand, arm and leg measurements with the traditional measurements, giving attention to any differences between left and right sides of the body, between the genders, and between three age categories. Secondly, the two and three *cun* reference measurements of the hand were tested against the forearm and lower leg lengths. These were examined because they are most commonly used to locate points on the limbs.

Method

The 50 subjects consisted of staff and students from the College of Traditional Chinese Medicine at the University of Technology, Sydney. There were 22 male and 28 female, with a mean age of 29.7 years (SD ± 8.58). They were categorised into groups by age, with 29 being in the 20-30 year age group, 13 in the 31-41 group and 8 in the 42-52 group.

The lengths of each of the finger reference measurements and the lengths of the forearm and lower leg were recorded in millimetres for each subject. The measurements of the fingers and the arm were recorded while the subject was seated with the arm straight and that of the lower leg was taken while the subject was standing. The measurements on the fingers were made using calipers and those of the forearm and lower leg were made with a tape-measure.

Since the *cun* reference system is essentially ratio based, data were converted to ratios for analysis. This required the assumption of a standard: the one *cun* measurement of the thumb was chosen. For example, the measurements for subject number 1 are outlined in *Table 1*. The conversion of these values into ratio form required each measurement (in mm) to be divided by the thumb measurement (the designated standard one *cun* measurement). In the example, the left finger 1.5 *cun* measurement as a ratio was found by dividing 32mm by 17mm giving a ratio value of 1.88; the left finger two *cun* ratio was found by dividing 43mm by 17mm, giving a ratio of 2.53, and so on. This process was applied to all measurements, with the left thumb being used as the standard for the left side of the body and the right thumb being used for the right side. A similar process was applied to determine the ratio values of the arm and leg with the two and three *cun* measurements as the standards. The millimetre measurements were used only to convert data to ratios for analysis, and are not referred to elsewhere in the paper. The results reported below refer to ratio measurements. Statistical analyses of the ratio values were completed using *t*-tests, one way analysis of variance (ANOVA) and Pearson's product moment correlation coefficient. Departmental ethics committee approval was granted.

Table 1

FINGER MEASUREMENTS IN mm AND *CUN* (Example for Subject Number 1)

Measurement	**Left hand**				**Right hand**			
Reference (cun)	*1*	*1.5*	*2*	*3*	*1*	*1.5*	*2*	*3*
Subject's hand in mm	17	32	43	58	18	33	45	60
Subject's hand in *cun* (as a ratio of mm)	1.00	1.88	2.53	3.41	1.00	1.83	2.50	3.33

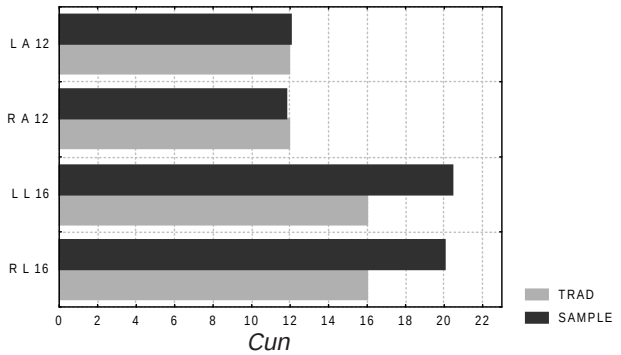

Figure 3. Comparison of traditional measurements and sample means for the measurements of the arm and leg (LA = Left arm, RA = Right arm, LA = Left leg, RL = Right leg).

Results

Figures 2 to 5 summarise the study results. In each figure, the measurements are listed along the *y*-axis, with L referring to the left side of the body and R referring to the right side of the body. The letter T following indicates that this measurement was taken from the thumb, while F refers to measurements taken from the fingers, similarly A refers to the arm and L to the leg. Following these letters is a number which is the length (in *cun*) of the measurement. The number of *cun* is shown along the *x*-axis.

Figure 2 shows the results of the comparison of the sample means and the traditional measurement for each of the measurements of the hand. The sample mean for each of the reference measurements was significantly greater than the traditional measurements ($13.16<t<31.85$, in each case, $p<0.0001$). Note that the thumb measurements for the sample mean and the traditional measurements are the same because the thumb measurement was the standard.

Figure 3 shows the comparison of the sample mean to the traditional measurements for both arm and leg measurements. A significant difference was found for the leg measurements ($-1.32<t<19.93$, in each case, $p<0.0001$) for both left and right legs, while little difference was found between the sample and traditional measurements for either left or right arms ($t=0.62$, $p=0.54$ and $t= -1.32$, $p=0.19$, respectively).

Figure 4 shows the comparison of the sample means and traditional measurements for both the arm and leg when the two *cun* is designated as the standard. The sample means were significantly less than the traditional measurements for the arms, and significantly greater than the traditional measurements for the legs ($-22.38<t<12.11$, in each case, $p<0.0001$).

Figure 5 shows the comparison of the traditional measurements to the sample means for arm and leg measurements using the three *cun* measurement as the standard. In all cases, statistically significant differences were found ($-13.54<t<11.70$, in each case, $p<0.0001$) with the sample means being less than the traditional measurements for the arms, and greater than the traditional measurements for the legs.

Left vs Right

A significant correlation was found between the sample means for both the left and right sides of the body, for the two *cun* ($r = 0.65$, $p<0.05$), the three *cun* ($r = 0.47$, $p<0.05$), the 12 *cun* ($r = 0.78$, $p<0.05$) and the 16 *cun* measurements ($r = 0.76$, $p<0.05$).

Gender

With one exception, results for men and women did not differ from those for the total sample. The exception was the right arm measurement in men, which was significantly less than the traditional measurement ($t = -4.64$, $p<0.0001$). The sample means for the finger measurements were significantly larger than the traditional measurements for both genders, as were the leg measurements ($8.46<t<24.67$, $p<0.0001$ for all finger and both leg measurements).

One way ANOVA revealed significant differences when comparing the measurements of men and women with each other. In each case the *cun* ratio measurements of women were found to be proportionally larger than those of men. The differences found are shown in *Table 2*.

Age

The sample was subdivided by age into three

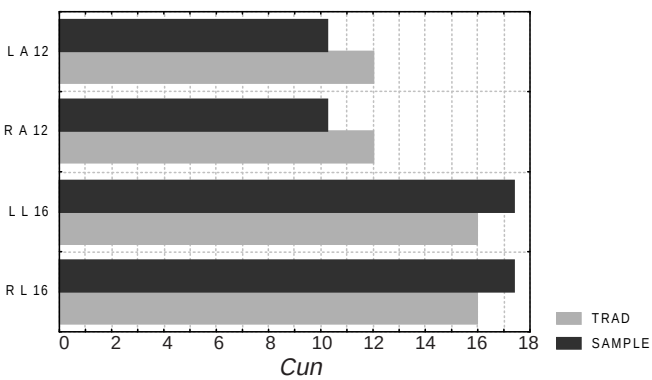

Figure 4. Comparison of traditional measurements and sample means using the 2 cun measurement as standard (LA = Left arm, RA = Right arm, LL = Left leg, RL = Right leg).

Table 2
SIGNIFICANT DIFFERENCES IN RESULTS: IMPLICATIONS FOR MEASUREMENT BETWEEN GENDERS

Measurement	F	*p*
Left hand 2 *cun*	$F_{1,48}$= 5.52	0.02
Right hand 2 *cun*	$F_{1,48}$=15.56	0.0003
Left arm 12 *cun*	$F_{1,48}$= 5.88	0.0192
Right arm 12 *cun*	$F_{1,48}$=17.48	0.0001
Left leg 16 *cun*	$F_{1,48}$=15.89	0.0002
Right leg 16 *cun*	$F_{1,48}$=30.57	0.0001

In each case, using the directional method would result in a point location further from the real point for women than for men

groups (20-30, 31-41 and 42-52 years) to determine whether age was a factor in the accuracy of the *cun* measurement system. However, the findings illustrated in *Figures 2 to 5* also applied to each of the three age groups ($3.96<t<24.10$, in each case, $p<0.005$), with the one exception of the right arm measurement in the 42-52 year age group ($t=-2.43$, $p<0.05$). This sole significant finding when comparing the three age groups was that the mean right leg measurement of the 42-52 year group was smaller than that of the other two groups ($F_{2,47}=4.63$, $p<0.005$).

Summary of results

The findings indicate that the *cun* measurement system is not accurate for the contemporary Australian population. The ratio measurements of the hand and leg are consistently greater than the traditional means (with exception of the right arm measurement in men, and the left leg measurement in the third age group studied) when the one *cun* measurement of the thumb was set as the standard. However, the system is reasonably accurate for the arms with the one *cun* (thumb) as the standard. When the two and three *cun* measurements were designated as standards, the measurements were significantly less than the traditional measurements for the arms, and significantly greater than the traditional measurements for the legs.

Discussion

The results show that the *cun* measurement system does not accurately represent contemporary measurements for the hand and leg, and as a consequence will not produce accurate point locations when using the directional method. This result may be explained if the measurement on which the system was based (*i.e.* the standard) was not the one *cun* measurement of the thumb. Another traditional measurement exists that is also one *cun:* the distance between the skin creases of the middle phalanx of the middle finger *(Figure 1)*. However a survey of final year acupuncture students conducted as part of this research showed that only three of 30 students surveyed knew the correct location of this measurement, and only two actually used it in clinical practice. While this could have been designated as the standard, there is little value in basing research on a measurement that is rarely used.

Alternatively, the two or three *cun* measurements could have been taken as the standard for comparison with the other hand measurements. However, as is shown in *Figures 4 and 5*, they produce substantially different measurements for the arms and legs. The only possible conclusion is that the *cun* measurement system is not an accurate representation of the hand and leg measurements for contemporary Australians.

Measurements showed a positive correlation between left and right sides of the body. This was expected, given that the human form is generally symmetrical. An interesting finding to emerge from this study was the significant difference between male and female subjects for the two *cun* hand measurement and the arm and leg measurements. These are all measurements of length (measuring along one or more bones) rather than breadth (measuring across one or more fingers or bones). The two *cun*, arm and leg measurements were proportionally greater for women than for men. This could possibly be explained by men having broader hands (rather than longer) if the occupations of the men studied were predominantly manual labourers, but in this study the group was comprised of university students or clinicians. Also, men would have greater measurements if the study was referring to actual measurements (mm), however analysis using ratio values shows that women have proportionally longer measurements for the 2 *cun*, the arm and the leg.

The lack of difference between age groups was expected, because age-related body changes are generally restricted to shortening of the spine *(3)*. This does not affect the limbs, or the *cun* system. Also, the significant difference found between the traditional measurements and the sample means was found in a group that included only eight

subjects. This small number may have produced results that do not truly represent that age group.

When the two and three *cun* measurements of the hand were taken as the standards, the proportional lengths of the arms and legs were altered dramatically. Therefore, in clinical practice, a practitioner using the directional method of point location would tend to *over-measure* (measure too far from the reference landmark and pass the acupuncture point) for the arms, or *under-measure* (not measure far enough from the reference land mark and therefore fall short of the acupuncture point) for the legs. Potentially this could reduce the effectiveness of treatment and introduce an alternative explanation for research outcomes. It is quite possible that errors due to the use of this measurement system could have negated results and conclusions drawn from previous clinical trials of acupuncture.

A reason for these differences in body dimensions can be found through reference to anthropometry, which is the measurement of the size and proportions of the human body. Current anthropometric data show a substantial diffrience between the body dimensions of the North American (US) white male, the African American (US) male and the Japanese male *(4)*, and also between the stature of Saudi Arabian males, and those of Canadians, Taiwanese, West Germans, British, Japanese, South Koreans, Thai and Americans *(5)*. This would pose problems in terms of accurate acupuncture point location if, for example, the proportional measurements of the leg were smaller in one population than in another and the hands did not vary accordingly. Using the directional method of point location in this situation would give similar results as when the two and three *cun* measurements were used as the standard, that is: over-measurement and under-measurement.

Conclusions

The system of using body measurements for the location of acupuncture points was designed over 2000 years ago on a specific, Chinese, ethnic population. Data suggest that there are significant differences in both the reference and traditional body measurements between various populations. Consequently, the assumption that the *cun* measurement system is applicable in contemporary Western populations is questionable.

While the *cun* measurement system provides reasonably accurate measurements and distances

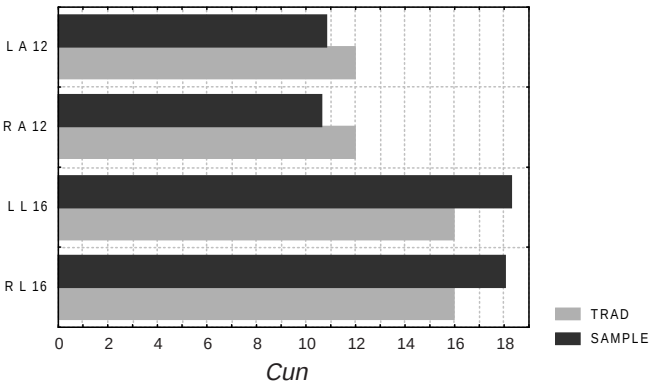

Figure 5. Comparison of traditional measurements and sample means using the 3 cun measurement as standard (LA = Left arm, RA = Right arm, LL = Left leg, RL = Right leg).

for the arms when using the one *cun* (thumb) measurement, it is far from accurate for the measurements of the hands and legs. As a consequence, locating acupuncture points using these measurements will be inaccurate. We recommend that the proportional method of point location be examined in order to test whether its use in preference to the directional method provides greater accuracy when locating acupuncture points.

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Additional Material is available at:
www.medical-acupuncture.co.uk/aimintro.htm