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Analysis of the Bone Proportional Method for Determining Acupoints in the Upper and Lower Abdominal Region in Males and Females



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ABSTRACT

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Background: The purpose of this study was to redefine the location of acupoints in the lower abdomen by taking actual thoracic and abdominal measurements.

Methods: Measurements of the length and height of the thorax, and both the upper and lower abdominal area were compared to standard values defined by the World Health Organization Western Pacific Region (WHO/WPRO), and medical text books such as *Miraculous Pivot*, and *A-B Classic of Acupuncture and Moxibustion*. These measurements were used to redefine the standard of 1 cun, and the cun value of the lower abdomen.

Results: Of the 60 studies screened, all studies used the cun measurement system. Considerable variation in the localization of acupoints in the lower abdominal area were detected. The average measurement of a typical male lower abdomen was within 6.33 cun to 6.34 cun. From this data, 6.5 cun appears to be more accurate than the current standardized length of 5 cun. The standardized index values of the width of the 4 fingers, and the distance from the lateral prominence from the greater trochanter to the popliteal crease (Fm), appeared to apply to only males, as defined by the WHO/WPRO.

Conclusion: Further studies on standardizing the index measurements for the lower abdominal area are necessary. For males, the more accurate standardized length of the lower abdomen was 6.5 cun, whereas for females, the measurement would typically be longer than 6.5 cun.

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Introduction

For thousands of years, acupuncture has been used as a major treatment method of traditional Korean medicine. The clinical procedures that cure various sources of pain, inflammation and aid rehabilitation have been recognized by clinicians and researchers of Western Medicine [1].

The procedure of acupuncture treatment includes stimulating the acupoints linked to the meridian system of the human body. Acupoints are located close to one another and the ability to accurately locate a specific acupoint with the highest precision, is crucial in delivering a treatment with maximum efficacy. The importance of locating acupoints accurately has been emphasized in literature *Peaceful Holy Benevolent Prescriptions* with the phrase “you can’t cure a disease unless you have the correct location” [2].

There have been studies to correctly locate acupoints in scientific ways. The World Health Organization Western Pacific Region’s (WHO/WPRO) standard [3] began updating several cases starting from its first meeting in Manila, Philippines (2003). Although the standardized acupoints provided a worldwide opportunity to engage in acupuncture education, research, and clinical practices, they are not guaranteed to be the most accurate and reliable source. Rather than finding the most effective acupoints, the WHO/WPRO attempted to reach a consensus by combining and generalizing opinions from certain nations (Korea, China and Japan) in order to decide on the standardized acupoints [4].

Even after the establishment of the WHO/WPRO’s standardized acupoints, other indexes from previous studies were continuously referenced (e.g., *A Comparative study on The Location of Acupuncture points by Bone Proportional Cun and Body Cun* [5], *New Standards for Measurement in Meridians and Acupuncture*

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points by Taking the Size of Normal Male Leg [6], and Survey on Setting New standards for Estimation of Acupuncture points in The Upper Limb of Normal Adult [7]). However, these studies failed to provide rational reasonings for the lack of sample size and the misincorporation of both sexes.

Major organs are located around the thorax and abdominal regions. Consequently, many acupoints lay in close proximity to one another within those regions; it is important to be able to correctly locate a specific acupoint with high precision. The old Miraculous Pivot and the modern WHO/WPRO standards coincide with the same acupoints for the thorax and upper abdominal area, but differ in the lower abdominal area (the length from centre of the umbilicus to the pubic symphysis). Miraculous Pivot suggested a length of 6.5 cun while WHO/WPRO suggested 5 cun. In addition to this discrepancy, the length given by WHO/WPRO was to be applied for both sexes. This is problematic for clinical studies since there is a definite dissimilarity when comparing anatomical characteristics between males and females.

In an attempt to resolve these issues, clinical measurements of the upper and lower abdomen from 30 males and 30 females were collected (all 60 participants were in good health with normal physical conditions). The study focused on the length of lower abdomen mainly because the modern and old standardized measurements did not concur. The thorax and upper abdomen measurements were included for comparative purposes in determining the most accurate standardized length of 1 cun.

The anatomical figure of males differs from that of females in terms of the average length from the centre of the umbilicus to the superior border of the pubic symphysis [8]. The purpose of this study was to propose a set of measurements that could later be utilized and incorporated in future research related to this topic such as how to determine the correct acupoints for both sexes.

Materials and Methods

Participants

Total of 60 participants (30 male and 30 female) who were students or staff of Pusan National University School of Korean

Medicine, and who were aged between 20 and 40. The study was approved by the Institutional Review Board (IRB) of Pusan National University (PNUKHIRB-2018001). Every participant was fully aware of the purpose and procedures of this experiment, and submitted informed written consent. As for the exclusion criteria, participants with physical illness (e.g., acromegaly) or pregnancy were excluded from the study.

Measured body parts and methods of measurement

The details of body measurements are shown in Fig. 1 and Table 1, and the values were described in mm. The body parts measured in current study were total body height (Ht), width of the interphalangeal joint of the thumb (Tb), width of the 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger (4F), length from lateral prominence of the greater trochanter to the popliteal crease (Fm), length from suprasternal notch to midpoint of the xiphisternal synchondrosis (Ch), length from midpoint of the xiphisternal synchondrosis to centre of

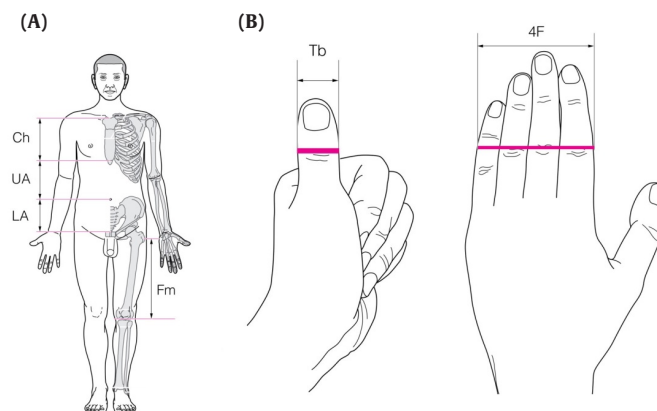


Fig. 1. Body part measurements. (A) Body, (B) hands.

Table 1. Measured Body Parts and Methods of Measurement.

Body parts	measures
Total body height (Ht)	From the sole to the top of the head in the standing position.
The width of the interphalangeal joint of the thumb (Tb)	With someone's thumb straight out, measure the width of the interphalangeal joint of the thumb.
The width of the 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger (4F)	Sticking the 4 fingers side by side, with someone's hand unfolded, measure the width of the 4 fingers at the level of the dorsal crease of the proximal interphalangeal joint of the middle finger.
Distance from the lateral prominence of the greater trochanter to the popliteal crease (Fm)	In the prone position, measure the vertical length from the lateral prominence of the greater trochanter to the popliteal crease.
Distance from the suprasternal notch to the midpoint of the xiphisternal junction (Ch)	In the supine position, measure the vertical length from the suprasternal notch to the midpoint of the xiphisternal junction on the median line of the frontal body.
Distance from the midpoint of the xiphisternal synchondrosis to the centre of the umbilicus (UA)	In the supine position, measure the vertical distance from the midpoint of the xiphisternal synchondrosis to the centre of the umbilicus on the median line of the frontal body.
Distance from the centre of the umbilicus to the superior border of the pubic symphysis (LA)	In the supine position, measure the vertical distance from the centre of the umbilicus to the superior border of the pubic symphysis on the median line of the frontal body.

the umbilicus (UA), and length from centre of the umbilicus to superior border of the pubic symphysis (LA).

The height (Ht) of participants was measured once using a BSM330 (Biospace, Korea), and other measurements of body parts were examined twice by 2 researchers, and the average value recorded. The width of the interphalangeal joint of the thumb (Tb) and the width of the 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger (4F) were measured using a Vernier calliper, Mitutoyo 500-182-30 (Mitutoyo, Japan). Other measurements were taken with a standard tape measure.

Statistical analysis

An Independent *t* test was used to examine the difference between current measurements and WHO/WPRO standard cun values with respect to male and female participants.

IBM SPSS Statistics 20.0 (IBM Inc., Armonk, NY, USA) was used for the statistical analysis. Mean and standard deviation was used

for the results of the statistical analysis, and $p < 0.05$ and $p < 0.01$ were considered as statistically significant.

Results

Measurement results for each of the body parts

Each major body part of the 60 participants (30 males and 30 females), was measured in mm. The mean and standard deviation values were rounded to the nearest 2 decimal places (Table 2).

Cun values of thorax and abdomen based on total body height

Total body height was converted to cun, prior to performing an Independent *t* test. Statistically significant differences were observed between the actual measurement and the WHO/WPRO standard cun measurement for male's thorax, male's lower abdomen, female's upper abdomen and female's lower abdomen ($p < 0.05$; Table 3).

Table 2. Measurements for Each Body Part.

	Measured length (mm)			Length suggested in text (Cun)	
	Male (n = 30)	Female (n = 30)	Total (n = 60)	WHO/WPRO (2008)	Miraculous Pivot (BC 475-221)
Standard body region for cun calculation					
Ht	1,756.03 ± 55.05	1,603.47 ± 53.86	1,679.75 ± 93.99	75	75
Tb	21.09 ± 1.55	17.70 ± 0.98	19.40 ± 2.14	1	1
4F	70.34 ± 3.58	60.02 ± 3.48	65.18 ± 6.27	3	3
Fm	450.17 ± 44.73	397.07 ± 19.92	423.62 ± 43.53	19	-
Body region to be calculated in cun above					
Ch	215.70 ± 13.31	191.80 ± 17.03	203.75 ± 19.36	9	9
UA	187.83 ± 12.20	179.53 ± 21.77	183.68 ± 17.99	8	8
LA	148.07 ± 21.18	168.33 ± 23.72	158.20 ± 24.53	5	6.5

Data are presented as mean ± SD.

Ht, total body height; Tb, width of the interphalangeal joint of the thumb; 4F, width of the 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger; Fm, distance from the lateral prominence of the greater trochanter to the popliteal crease; Ch, distance from the suprasternal notch to the midpoint of the xiphisternal junction; UA, distance from the midpoint of the xiphisternal synchondrosis to the centre of the umbilicus; LA, distance from the centre of the umbilicus to the superior border of the pubic symphysis. Standard provided by World Health Organization Western Pacific Region.

Table 3. Cun Values of Thorax and Abdomen Calculated with Total Body Height.

Standard cun [†]	Male (n = 30)		Female (n = 30)		Total (n = 60)	
	Cun [‡]	<i>p</i> [§]	Cun ^{††}	<i>p</i> [¶]	Cun ^{‡‡}	
Ch_Ht	9	9.21 ± 0.50	0.022*	8.98 ± 0.80	0.837	9.09 ± 0.67
UA_Ht	8	8.02 ± 0.46	0.821	8.40 ± 0.97	0.029*	8.21 ± 0.78
LA_Ht	5	6.33 ± 0.93	< 0.001**	7.88 ± 1.10	< 0.001**	7.10 ± 1.27

Data are presented as mean ± SD.

* $p < 0.05$, ** $p < 0.01$.

[†]World Health Organization Western Pacific Region (2008). [‡], 23.41 mm. ^{††}, 21.38 mm. ^{‡‡}, 22.40 mm.

[§]Independent *t* test between standard cun from WHO/WPRO (2000) and measure of male in current study.

[¶]Independent *t* test between standard cun from WHO/WPRO (2000) and measure of female in current study.

Ht, total body height; Ch, distance from the suprasternal notch to the midpoint of the xiphisternal junction; UA, distance from the midpoint of the xiphisternal synchondrosis to the centre of the umbilicus; LA, distance from the centre of the umbilicus to the superior border of the pubic symphysis. Ch/(Ht/75), Ch_Ht; UA/(Ht/75), UA_Ht; LA/(Ht/75), LA_Ht.

Cun values of thoracic abdomen based on thumb width

Interphalangeal joint of the thumb width (Tb) was assumed as 1 cun. The thumb width (Tb) was converted to cun prior to taking a single *t* test. Statistically significant differences were observed between the actual measurement and the WHO/WPRO standard cun measurements for male and female thorax, upper abdomen and lower abdomen ($p < 0.01$; Table 4).

Cun values of thoracic abdomen based on the width of 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger

The width of 4 fingers on the dorsal crease of the proximal interphalangeal joint (4F) was assumed as 3 cun. Statistically significant differences were observed between the actual measurement and the WHO/WPRO standard cun measurement for thorax, upper abdomen and lower abdomen in females, and the lower abdomen in males ($p < 0.01$; Table 5).

Cun values of thoracic abdomen from lateral prominence of the greater trochanter to popliteal crease

The length between the lateral prominence of the greater trochanter to popliteal crease (Fm) was assumed as 19 cun. Statistically significant differences were observed between

the actual measurement and the WHO/WPRO standard cun measurements for male lower abdomen, and female upper abdomen and lower abdomen ($p < 0.05$; Table 6).

Results of the *t* test for body parts compared with the standard WHO/WPRO values

There were no criteria from the WHO/WPRO standards which were applicable for all 3 areas (thorax, upper abdomen and lower abdomen) from total body height (Ht), width of the interphalangeal joint of the thumb (Tb), width of 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger (4F), and lateral prominence of the greater trochanter to popliteal crease (Fm).

The experimental results did not correspond with the standard WHO/WPRO values when 1 cun was defined by the male width of the interphalangeal joint of the thumb (Tb), female width of the interphalangeal joint of the thumb (Tb) and female 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger (4F). The experimental results for thorax, upper abdomen, and lower abdomen were 10.58 cun, 9.55 cun and 8.03 cun, respectively. The standard WHO/WPRO values state 9 cun, 8 cun and 5 cun for thorax, upper abdomen, and lower abdomen, respectively. The results from this study showed that in the lower abdomen, 4 criteria did not match the criteria in the WHO/WPRO standards (Table 7).

Table 4. Cun Values of Thoracic Abdomen Calculated with Thumb Width.

	Standard cun [†]	Male (n = 30)		Female (n = 30)		Total (n = 60)
		Cun [‡]	<i>p</i> [§]	Cun ^{††}	<i>p</i> [§]	Cun ^{††}
Ch_Tb	9	10.27 ± 0.92	< 0.001**	10.88 ± 1.21	< 0.001**	10.58 ± 1.11
UA_Tb	8	8.94 ± 0.73	< 0.001**	10.16 ± 1.26	< 0.001**	9.55 ± 1.19
LA_Tb	5	7.06 ± 1.17	< 0.001**	9.55 ± 1.50	< 0.001**	8.30 ± 1.83

Data are presented as mean ± SD.

* $p < 0.05$, ** $p < 0.01$.

[†] World Health Organization Western Pacific Region (2008). [‡], 21.09 mm. ^{††}, 17.70 mm. ^{‡‡}, 19.40 mm.

[§] Independent *t* test between standard cun from WHO/WPRO (2000) and measure of male in current study.

[§] Independent *t* test between standard cun from WHO/WPRO (2000) and measure of female in current study.

Tb, the width of the interphalangeal joint of the thumb; Ch, distance from the suprasternal notch to the midpoint of the xiphisternal junction; UA, distance from the midpoint of the xiphisternal synchondrosis to the centre of the umbilicus; LA, distance from the centre of the umbilicus to the superior border of the pubic symphysis.

Ch/(Tb/1), Ch_Tb; UA/(Tb/1), UA_Tb; LA/(Tb/1), LA_Tb.

Table 5. Cun Values of Thoracic Abdomen Calculated with the Width of 4 Fingers on the Dorsal Crease of the Proximal Interphalangeal Joint of the Middle Finger.

	Standard cun [†]	Male (n = 30)		Female (n = 30)		Total (n = 60)
		Cun [‡]	<i>p</i> [§]	Cun ^{††}	<i>p</i> [§]	Cun ^{††}
Ch_4F	9	9.22 ± 0.64	0.086	9.63 ± 1.11	0.004**	9.42 ± 0.92
UA_4F	8	8.02 ± 0.51	0.830	9.01 ± 1.25	< 0.001**	8.51 ± 1.07
LA_4F	5	6.33 ± 0.96	< 0.001**	8.44 ± 1.31	< 0.001**	7.39 ± 1.56

Data are presented as mean ± SD.

* $p < 0.05$, ** $p < 0.01$.

[†] World Health Organization Western Pacific Region (2008). [‡], 23.45 mm. ^{††}, 20.01 mm. ^{‡‡}, 21.73 mm.

[§] Independent *t* test between standard cun from WHO/WPRO (2000) and measure of male in current study.

[§] Independent *t* test between standard cun from WHO/WPRO (2000) and measure of female in current study.

4F, the width of the 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger; Ch, distance from the suprasternal notch to the midpoint of the xiphisternal junction; UA, distance from the midpoint of the xiphisternal synchondrosis to the centre of the umbilicus; LA, distance from the centre of the umbilicus to the superior border of the pubic symphysis.

Ch/(4F/3), Ch_4F; UA/(4F/3), UA_4F; LA/(4F/3), LA_4F.

Table 6. Cun Values of Thoracic Abdomen from Lateral Prominence of the Greater Trochanter to Popliteal Crease (Fm).

	Standard cun [†]	Male (n = 30)		Female (n = 30)		Total (n = 60)
		Cun [‡]	p [§]	Cun ^{††}	p [§]	Cun ^{††}
Ch_Fm	9	9.20 ± 1.19	0.367	9.20 ± 0.92	0.269	9.20 ± 1.06
UA_Fm	8	8.01 ± 1.00	0.971	8.61 ± 1.08	0.004**	8.31 ± 1.07
LA_Fm	5	6.34 ± 1.37	< 0.001**	8.07 ± 1.19	< 0.001**	7.21 ± 1.54

Data are presented as mean ± SD.

* $p < 0.05$, ** $p < 0.01$.

[†] World Health Organization Western Pacific Region (2008). [‡], 23.69 mm. ^{††}, 20.90 mm. ^{†††}, 22.30 mm.

[§] Independent t test between standard cun from WHO/WPRO (2000) and measure of male in current study.

[¶] Independent t test between standard cun from WHO/WPRO (2000) and measure of female in current study.

Fm, distance from the lateral prominence of the greater trochanter to the popliteal crease; Ch, distance from the suprasternal notch to the midpoint of the xiphisternal junction; UA, distance from the midpoint of the xiphisternal synchondrosis to the centre of the umbilicus; LA, distance from the centre of the umbilicus to the superior border of the pubic symphysis. Ch/(Fm/19), Ch_Fm; UA/(Fm/19), UA_Fm; LA/(Fm/19), LA_Fm.

Table 7. The Measurement of Body Parts Compared with the Standard WHO/WPRO Values: Statistical Analysis.

Body region	WHO/WPRO standard cun [†]	$p (p \geq 0.05)$									
		Male (n = 30)					Female (n = 30)				
		Ht	Tb	4F	Fm	Ht	Tb	4F	Fm		
Ch	9	*	**	-	-	-	**	**	-		
UA	8	-	**	-	-	*	**	**	**		
LA	5	**	**	**	**	**	**	**	**		

* $p < 0.05$, ** $p < 0.01$.

[†] World Health Organization Western Pacific Region (2008).

Ht, total body height; Tb, width of the interphalangeal joint of the thumb; 4F, width of the 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger; Fm, distance from the lateral prominence of the greater trochanter to the popliteal crease; Ch, distance from the suprasternal notch to the midpoint of the xiphisternal junction; UA, distance from the midpoint of the xiphisternal synchondrosis to the centre of the umbilicus; LA, distance from the centre of the umbilicus to the superior border of the pubic symphysis.

Discussion

The "Selection of acupoint" is a method for determining the location of a meridian point [9]. For safe and effective acupuncture treatments, accurately locating acupoints is essential. When determining how to locate acupoints, the most widely-used methods use "location of points by anatomical landmarks," "bone proportional cun," and "location of point by finger cun [10]." From "Plain Questions · Skin part theory" [11], "location of points by anatomical landmarks" is used to locate acupoints by viewing the surface markings of the body. From "Plain Questions · bone standard part" [11], "bone proportional cun" is a method for determining the acupoint location by connecting 2 points using major markers such as a bone or a joint. The virtual line is then divided into certain proportions [12,13]. From "Supplement to the Essential Prescriptions Worth a Thousand Gold" [2,14], "location of point by finger cun" is based on the bone standard rule of "determining the area by cun and cuk." This is then converted to finger measurements and corresponds to finger cun [10]. Examples include cun measurements of middle finger, thumb and finger-breadth. There are 2 ways of determining the middle finger cun. One is setting the length of the last, third finger joint as 1 cun. The other is setting the length of the middle, third finger joint as

1 cun. In terms of the thumb, 1 cun is defined as the width of the interphalangeal joint of the thumb (Tb). The finger-breadth cun is a method involving the measurement of 4 fingers on the dorsal crease of the proximal interphalangeal joint except the thumb, which corresponds to 3 cun [10].

In addition to total body height, thumb cun and finger-breadth cun, a length of 1 cun was obtained based on the length from lateral prominence of the greater trochanter to the popliteal crease (Fm). This was due to the long human bones that ultimately affected the total body height [15].

The most widely used method to estimate a person's height is by using the femur length [16]. Since the femur is the longest human bone, it can be a suitable benchmark for measuring the length of each body part including the total body height. So, the length from lateral prominence of the greater trochanter to the popliteal crease (Fm) was selected in determining the length of 1 cun.

The length from ST25 (Tianshu) to CV2 (Qugu) superior border of the pubic symphysis, is noted as 6.5 cun according to Miraculous Pivot bone standard part [17], A-B Classic of Acupuncture and Moxibustion (259 BC) (Ch.7 "Bone and visceral standard by internal organ") [18] and Collection of Gems of Acupuncture and Moxibustion no.1-1 Tuque (Figuring out body by cun and cuk, 1529) [19]. However, based on the Complete Compendium of

Acupuncture and Moxibustion (1601 BC), the length is noted as 5 cun [20]. From this, the abdomen acupoints of CV (Conception Vessel) are equally divided into 5 acupoints. For CV6 (Qihai), acupoints between CV7 (Yinjiao) and CV5 (Shimen) are placed at intervals of 1 cun, with the total length measuring 5 cun [21]. The WHO/WPRO standard also indicates the total length as 5 cun [4]. "Details of Meridians & Acupuncture points" (Volume II) A Guidebook for College Students. The 7th Edition states the length to be both 6.5 cun and 5 cun [22]. Since there are different cun values for the same area in particular, further discussion and research is needed in order to obtain the most accurate standard.

Of all the acupuncture-related medical textbooks many clinicians refer to during their practices, Complete Compendium of Acupuncture and Moxibustion was the only book that revised the lower abdomen length from 6.5 cun to 5 cun. With 40 years of clinical experience, author Yang Jizhou is acknowledged for several medical acupuncture books written before the Ming Dynasty [23]. The book has been re-issued more than 30 times in the 300-year period starting from the Ming Dynasty [24]. In the Complete Compendium of Acupuncture and Moxibustion No. 4 and No.1, the cun of the lower abdomen is indicated as 5 cun (Table 8). This information was extracted from literature Zhenjiujieyao, Collection of Gems of Acupuncture and Moxibustion [23]. Furthermore, No. 7 displays the location of acupoints on the lower abdomen as well as the the cun between each acupoint. This is equivalent to Tongrenmingtangzhitu, which was subsequently corrected by Qinxian. However, Tongrenmingtangzhitu is not considered a widely known acupuncture reference that was applied in Complete Compendium of Acupuncture and Moxibustion. So, the reason for the change of 6.5 cun to 5 cun is not known. Yet, as a result, the length of 5 cun has been set as the standard lower abdomen length by the WHO/WPRO.

According to WHO/WPRO standards, the length from the umbilicus to the superior border of the pubic symphysis (LA) is 5 cun, the length from the midpoint of the xiphisternal synchondrosis to the umbilicus (UA) is 8 cun, and the length from CV22 (Tiantu) to the midpoint of the xiphisternal synchondrosis (UA) is 9 cun. There are definite differences when comparing the

standard values to the current light acupoints map when setting the acupoints CV (Conception Vessel), KI (Kidney Meridian), ST (Stomach Meridian) and SP (Spleen Meridian) in the lower abdomen, upper abdomen, and thoracic abdomen, respectively. The actual locations of KI (Kidney Meridian), ST (Stomach Meridian) and SP (Spleen Meridian) of the lower abdomen are shifted laterally compared to the location of the acupoints in the current map. From the Miraculous Pivot meridian vessel part, the kidney meridian vessel passages directly upwards from the kidney, passing through the liver and the diaphragm [17,25]. In other words, it moves straight from the lower abdomen to the diaphragm. So, if the lower abdomen length is set as 5 cun, KI (Kidney Meridian), ST (Stomach Meridian) and SP (Spleen Meridian) are suggested to be connected in a bent line when they are supposed to be on a straight line in sync with the CV (Conception Vessel) around the umbilicus. Depending on what length the lower abdomen is defined as, the location of organs, muscles and acupoints vary significantly. Even the slightest error can bring a significant impact in terms of the meridian system and Korean medicine.

The thorax and abdomen area include the location of major organs including reproductive organs such as the uterus and ovaries. Throughout the lower abdomen, acupoints CV5 (Shimen) and CV4 (Guanyuan) are located within the six CV7 (Yinjiao), CV6 (Qihai), CV5 (Shimen), CV4 (Guanyuan), CV3 (Zhongji) and CV2 (Qugu). CV5 (Shimen) and CV4 (Guanyuan) have opposite acupoint characteristics [26]. CV5 (Shimen) has a major effect on contraception, whereas CV4 (Guanyuan) has a major effect in infertility treatment. Depending on the total lower abdomen length, the location of these 2 acupoints alone vary greatly and mislocating 1 from another may impact maternal and fetal health during the clinical treatment process. Likewise, further analysis in determining accurate acupoints is necessary since every acupoints greatly differs in their treatment motive.

The main purpose of this study was to determine the accurate acupoint location of the lower abdominal area in an effort to ensure clinical efficacy and safety. For this purpose, 60 individuals (30 adult male and 30 adult female) had specific body parts

Table 8. Studies That Have Suggested a Value for Lower Abdominal Length.

Literature	Author (y)	Main content	Length of lower abdomen (cun)
Miraculous Pivot (Huangdi's Internal classic)	Anonymous (BC 475-221)	One of the parts of Huangdi's Internal classic, the literature that summarises the theory and practice of traditional Chinese medicine before the 2nd century BC. It explains meridian and collateral theory, and acupuncture is very carefully explained.	6.5
A-B Classic of Acupuncture and Moxibustion	Huangfu Mi (ca. 259)	It is the first book in existence that is relatively well-written about acupuncture and it also is an important book for the study of the classical version of Huangdi's Internal classic. This book systematically organised previous acupuncture therapy, and it facilitated the development of acupuncture. It mainly discussed about acupuncture and the moxibustion method and taboo, symptoms of various diseases, viscera and bowels meridian, pulse diagnosis, acupoints, cause of disease	6.5
Collection of Gems of Acupuncture and Moxibustion	Gao Wu (1529)	A book about acupuncture and moxibustion. It explains about viscera and bowels, meridian and collateral, acupoint in volume one. The writer collected and wrote about the methods of acupuncture and moxibustion used by various doctors in volume 2. Further, it described the acupuncture and moxibustion method and moxibustion prohibition in volume 3 and lastly explained about Acupuncture and Moxibustion Verses in volume 4.	6.5
Complete Compendium of Acupuncture and Moxibustion	Yang Jizhou (1601)	It described acupuncture theory of Huangdi's Internal classic, Classic of Difficult Issues, acupuncture method, midnight midday ebb flow, meridian, acupoint, and many doctors' acupuncture and moxibustion methods for various diseases. This book entirely outlined the academic experiences and achievements about acupuncture of the people before the Ming Dynasty.	5

measured and analysed.

Total body height (Ht) was measured using a body height weight machine (Biospace BSM330) to the nearest 0.01 mm. The width of the 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger (4F) and the width of interphalangeal joint of the thumb (Tb) were measured using vernier callipers (Mitutoyo 500-182-30) also to the nearest 0.01 mm. The distance of the greater trochanter to the popliteal crease (Fm), length from the suprasternal notch to the midpoint of the xiphisternal junction (Ch), length from the midpoint of the xiphisternal synchondrosis to the midpoint of the xiphisternal synchondrosis (UA) and length from the midpoint of the xiphisternal synchondrosis to the superior border of the pubic symphysis (LA) were measured to the nearest 1 mm using a tape measure with the subject in a supine position. To minimize measurement error, 2 individuals measured all categories. Individual 1 spectated the direct measurement process while Individual 2 verified the measurements taken by Operator 1.

The mean lower abdominal lengths were 148.07 mm and 168.32 mm for males and females, respectively. Correspondingly, the mean heights were 1,756.03 mm and 1,603.47 mm, respectively. The ratios of lower abdominal length to height were 0.084 and 0.104 in males and females, respectively. This indicated that when comparing females and males with the same total body height, female lower abdomen length was longer than that of males. Anatomically, the length from the pelvic inlet to the diagonal conjugate diameter of the pelvis was measured. All measurement values for males were slightly shorter than those of females. Male pubic symphysis is higher than that of females [8]. This is the reason why the length from the centre of the umbilicus to the superior border of the pubic symphysis (LA) was significantly different between males and females (around 6 cun for males, and around 7 cun for females). Since there is a definite anatomical difference between male and female length between the umbilicus and the superior border of the pubic symphysis (LA), there should be a distinction in the standard cun value for each sex.

Body measurements were converted into cun values using total body height. Results showed that male upper abdomen and female thorax measurements were statistically consistent to WHO/WPRO standard cun values. Measurements with regard to male thorax and lower abdomen and female upper and lower abdomen, were statistically inconsistent with WHO/WPRO standard cun values. Therefore, if the acupoint location was selected using bone proportional cun measurements based on total body height, a more accurate location would be detected for male upper abdomen and female thorax. However, the acupoint location would be less accurate for male thorax and lower abdomen and in female upper and lower abdomen.

Male and female lower abdomen measured 6.33 cun and 7.88 cun, respectively. These values are closer to 6.5 cun, which is the standard value from Miraculous Pivot and A-B Classic of Acupuncture and Moxibustion. The calculated difference was 0.17 cun shorter for males, and 1.33 cun longer for females. Therefore, the more appropriate standard value is 6.5 rather than the current standard 5 cun value stated in the WHO/WPRO standards. Furthermore, the female standard cun value for the lower abdominal length would be greater than 6.5 due to the anatomical differences discussed earlier.

Body measurements obtained from the width of the interphalangeal joint of the thumb (Tb) showed that the cun values were inconsistent with the WHO/WPRO standard values for thorax, upper and lower abdomen in both sexes. Consequently, using the bone proportional cun, based on the width of the interphalangeal joint of the thumb (Tb), is not suitable for

determining the length of thorax, upper abdomen and lower abdomen.

For lower abdomen length, males had a value of 7.06 cun and 9.55 cun for females. There was a difference of 0.56 cun and 3.05 cun from the standard 6.5 cun value.

Body measurements were converted into cun values using the width of 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger (4F). Results showed that the male thorax and upper abdomen measurements were statistically consistent to WHO/WPRO standard cun values. Measurements for male lower abdomen and female thorax, upper and lower abdomen, were statistically inconsistent with WHO/WPRO standard cun values. So, acupoint locations for male thorax and upper abdomen would be more accurate if the acupoint locations were selected using bone proportional cun based on the width of 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger (4F). However, the acupoint locations would be less accurate for male lower abdomen and for female thorax, upper and lower abdomen.

Male and female lower abdomen measured 6.33 cun and 8.44 cun, respectively. Both values are closer to 6.5 cun, which is the standard value from Miraculous Pivot and A-B Classic of Acupuncture and Moxibustion. The calculated difference was 0.17 cun shorter for males, and 1.94 cun longer for females. Therefore, the more appropriate standard value is 6.5 rather than the current standard 5 cun value stated in the WHO/WPRO standards. As a matter of fact, the female standard cun value for the lower abdominal length would be greater than 6.5 due to the anatomical differences discussed earlier.

Body measurements were converted into cun values using the length from the greater trochanter to the popliteal crease (Fm). Results showed that the male thorax and upper abdomen and female thorax measurements were statistically consistent to WHO/WPRO standard cun values. Measurements with regard to male lower abdomen and female upper and lower abdomen were statistically inconsistent with WHO/WPRO standard cun values. Therefore, if the acupoint location was selected using bone proportional cun based on the length from the greater trochanter to the popliteal crease (Fm), a more accurate location would be detected for male thorax and upper abdomen and female thorax. However, the acupoint location would be less accurate for male lower abdomen and female upper and lower abdomen.

Male and female lower abdomen measured 6.34 cun and 8.07 cun, respectively. Both values are closer to 6.5 cun, which is the standard value from Miraculous Pivot and A-B Classic of Acupuncture and Moxibustion. The calculated difference was 0.16 cun shorter for males, and 1.57 cun longer for females. Again, the more appropriate standard value is 6.5 rather than the current standard 5 cun value stated in the WHO/WPRO standards.

In conclusion, the total body height (Ht), width of the interphalangeal joint of the thumb (Tb), width of 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger (4F), and distance of lateral prominence of the greater trochanter to popliteal crease (Fm) were statistically inconsistent in the lower abdomen with the WHO/WPRO standard cun measurements. Sex-specific differences were observed to have the largest variance to the standard values mainly in the lower abdominal area. This emphasized the need to revise the cun measurement of the lower abdomen standard by sex.

Even if the lower abdomen was excluded, there are no standards to select the accurate acupoint of both thorax and upper abdomen properly, regardless of sex. However, 2 criteria for accurate selection of acupoints in the male thorax and upper abdomen were found to be the width of 4 fingers on the dorsal crease of

the proximal interphalangeal joint of the middle finger (4F), and the distance of lateral prominence of the greater trochanter to the popliteal crease (Fm).

Considering that the standard distance in terms of Miraculous Pivot or A-B Classic of Acupuncture and Moxibustion and all acupuncture and moxibustion text books are indicated as 0.5 cun, the study demonstrated that it is more appropriate to use 6.5 cun for male, and for female to use a value larger than 6.5 cun, setting the length by 0.5 cun.

In addition to establishing a reasonable cun for the lower abdomen, a discussion is also needed on how to locate the CV7 (Yinjiao), CV6 (Qihai), CV5 (Shimen), CV4 (Guanyuan), CV3 (Zhongji), and CV2 (Qugu), 6 acupoints on the lower abdomen, and on what basis they should be arranged.

Lower abdomen acupoints of the CV (Conception vessel) are set by the location of the umbilicus in acupuncture publications (Complete Compendium of Acupuncture and Moxibustion and A-B Classic of Acupuncture and Moxibustion). From this, the length of lower abdomen has no effect on the selection of acupoints. For additional methods with higher efficacy, further application of more accurate acupoints would be necessary.

Conclusion

1. Four areas of the body that were measured were total body height (Ht), width of the interphalangeal joint of the thumb (Tb), width of 4 fingers on the dorsal crease of the proximal interphalangeal joint of the middle finger (4F), and lateral prominence of the greater trochanter to the popliteal crease (FM). The resulting measurements indicated that there was no precise standard to use in locating the accurate acupoints for the thorax, upper abdomen and lower abdomen area. For the lower abdomen of both sexes, the measurements for all 4 body parts were found to be inconsistent with the standard WHO/WPRO cun values.

2. The measurement values showed that the baseline height was 1 unit, the ratio of the lower abdominal length to the height was 0.084 for males, and 0.104 for females. The variance of 0.021 was due to differences in anatomical structures between the typical figures of males and females. Thus, both sexes should be considered in selecting acupoints in the lower abdominal area as well as the bone proportional cun.

3. Measurement values indicated the cun of the umbilicus to the superior border of the pubic symphysis (using bone proportional cun) were not 100% consistent with either the standard WHO/WPRO value of 5 cun, or the Miraculous Pivot value of 6.5 cun. However, of the 2 standards, 6.5 cun was more accurate.

4. There should be a separate set of measurement standards for females, especially since the female lower abdomen is 1.5-2.5 cun longer than that of males.

Conflicts of Interest

The authors have no conflicts of interest to declare.

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