



Building up a Standard Physical Measurement Database in Healthy Medical Students and Postgraduate Medical Trainees: A Tool for Clinical Evaluation of Adult Dysmorphology

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Abstract

Background: Clinical diagnosis of human dysmorphology is relied on physical examination and phenotypic characterization. However, the evaluation of adult dysmorphology is limited since most standard reference studied in pediatric population of specific ethnic groups that may be not applied to Thai population.

Methods: Standard physical measurement was performed in Thai medical students and medical trainees at the age of 20-35 years. Past medical history was screened by face-to-face interview to exclude an individual with chronic illness. Hence, the recruited subjects were assumed to represent healthy population. The measurement procedure was based on standard technique worldwide include height, body mass index, several craniofacial and limb parameters.

Results: Total 186 individuals (96 males and 90 females) were recruited for this study. The mean age was 27.20 ± 2.90 years (male 26.92 ± 2.88 , female 27.53 ± 2.85). Physical measurement data was defined as mean \pm standard deviation in males and females, respectively. The height was 174.60 ± 5.10 and 160.16 ± 4.67 cm. The head circumference was 57.47 ± 1.36 and 54.73 ± 1.45 cm. Facial length (forehead to chin) was 17.56 ± 1.07 and 16.13 ± 1.02 cm. Intercanthal distance was 3.43 ± 0.28 and 3.29 ± 0.26 cm. Interpupillary distance was 6.47 ± 0.31 and 6.17 ± 0.33 cm. Ear length was 6.59 ± 0.40 and 6.09 ± 0.35 cm. Mouth length was 5.283 ± 0.48 and 4.978 ± 0.47 cm. Middle finger length was 8.21 ± 0.39 and 7.54 ± 0.43 cm. Palm length was 11.18 ± 0.57 and 10.09 ± 0.49 cm. Sole length was 23.68 ± 1.14 and 21.37 ± 1.10 cm. Centile charts were constructed for future clinical use.

Conclusion: These physical parameters represent the normal variation of adult healthy individuals. This information is a useful reference for diagnosis of adult dysmorphology in Thai ethnic group.

Keywords: measurement, dysmorphology, variation, adult, Thai

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Introduction

Clinical dysmorphology requires well-oriented procedures for phenotypic description. Most of the genetic syndrome presented with dysmorphic features are diagnosed by clinical criteria comprising a number of physical examination compared to standard measurement, e.g., ocular hypertelorism, micro/macrocephaly, microtia, micrognathia and so on^(1,2). In routine clinical practice, many diseases are not feasible to diagnose in a brief period due to disease rarity and diversity of recognitive patterns. Bio-informatics using several online dysmorphology databases is a useful tool to perform the diagnosis by providing technical clinical presentation as an input⁽³⁾. Wrong input data can mislead a physician to make a wrong diagnosis that may affect the way of medical care, investigation and genetic counseling to the patients and families. However, physical measurement is variable and unreliable to use comparatively amongst different ethnic group. In addition, most of the standard measurement data is restricted in pediatrics population less than 18-20 years (WHO global database on child growth and malnutrition #02178); therefore, phenotypic characterization in an adult lacks the references, i.e., craniofacial and limb variations. These variation parameters reflect the same complex interplay of genetic potential, epistasis, and environmental influence on gene expression. In reality, variation in physical measurement should constitute a continuum with obviously dysmorphic individuals concentrated on one extreme and these grading from more subtle disruptions into normal variation⁽⁴⁾. Regarding a primary objective of this study, we aimed to provide the standard reference for Thai adults as a future tool to facilitate clinical genetic service of adult dysmorphology.

Methods

Recruitment of healthy Thai adults

This is a part of project entitled 'Search for

molecular basis of adult dysmorphology and rare genetic disorders (ID 10-54-31)' approved by the Committee on Human Rights Related to Research Involving Human Subjects, Faculty of Medicine Ramathibodi Hospital, Mahidol University. The recruited subjects in this study were focused to Thai medical students and medical trainees of both genders at the age of 20-35 years in the Faculty of Medicine Ramathibodi Hospital, Mahidol University, Thailand. Each subject was performed face-to-face interview with a research investigator to exclude an individual with chronic illness which may affect growth and development including malnutrition, osteoporosis (both primary and secondary causes), chronic kidney disease, chronic lung disease, congenital heart diseases, abnormal bone metabolism, bone fractures with malunion, and hypogonadism. Hence, the recruited subjects were assumed to represent normal healthy Thai adults. Subsequently, they were asked for physical measurement procedures.

Standard physical measurement procedures

The way to perform each measurement was based on standard techniques worldwide as previously published (Fig.1)⁽¹⁾. The required parameters for this study included height, body mass index, head circumference, facial length (forehead to chin), binocular distance, intercanthal distance, interpupillary distance⁽⁵⁾, ear length⁽⁶⁾, mouth length, philtrum width⁽⁷⁾, palms and middle finger length, and soles length⁽⁸⁾. Each measurement was done twice under another observer to check the quality control of the techniques.

Statistical analysis

The measured anthropometric values were analysed by descriptive statistics. The numerical data were calculated for mean, median, standard deviation, and converted to centiles for future use. Normality test in each parameter was performed by

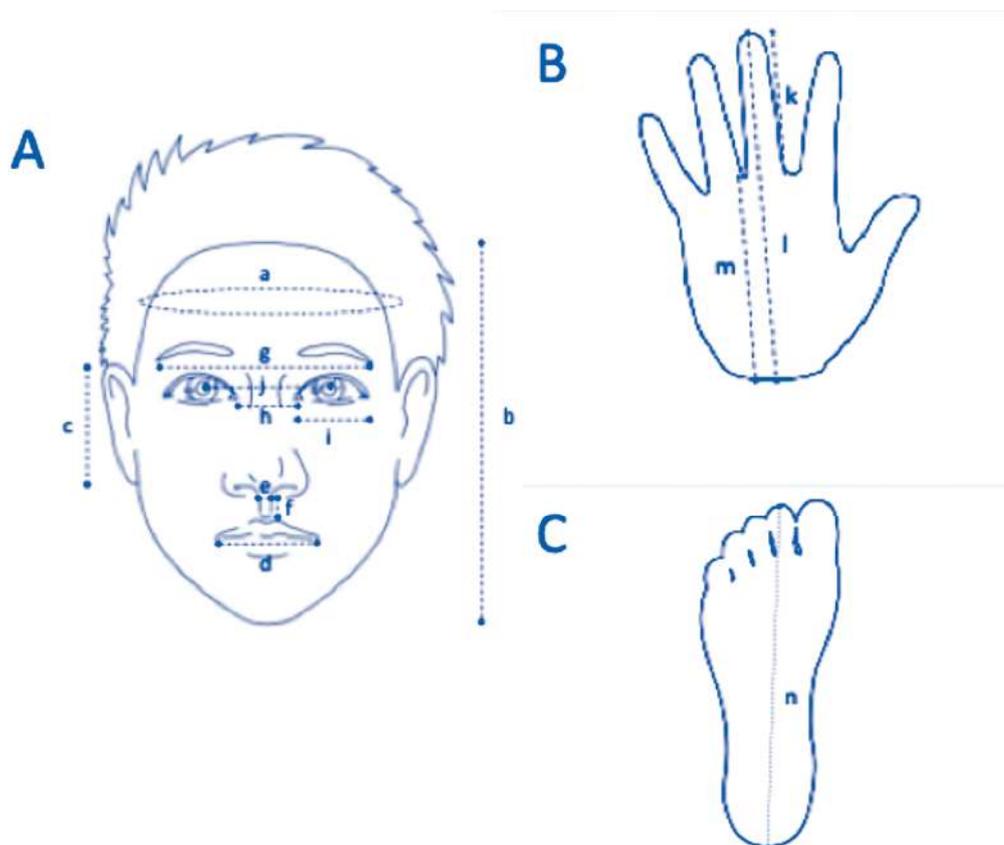


Figure 1. Physical measurement methods. A) craniofacial method, B) hand method, and C) foot method. The identification of each measurement is described in the figures (a-n): a) head circumference, b) facial length, c) ear length, d) mouth length, e) philtrum width, f) philtrum height, g) binocular distance, h) intercanthal distance, i) palpebral fissure length, j) interpupillary distance, k) middle finger length, l) hand length, m) palm length, and n) sole length

D'Agostino & Pearson omnibus test to confirm the data as Gaussian's distribution, using $\alpha = 0.05$. Comparative between two means was done by student t test in which p-value < 0.05 was considered as statistical significance.

Results

Total 186 individuals (96 males and 90 females) were recruited in this study. Each individual was healthy and had no chronic disease which might affect bone growth. The mean age was 27.20 ± 2.90 years (male 26.92 ± 2.88 , female 27.53 ± 2.85). All physical measurement data were distributed as Gaussian distribution. All measurement in males were larger than in

females significantly ($p < 0.01$). Most of the parameters were described in length and width, except few parameters that required a relative ratio in standard clinical identification, i.e., ear-to-face and palm-to-hand ratios. The anthropological values of each measurement and genders were described in Table 1.

To validate this data for clinical use, most of genetic syndrome requires the description of each dysmorphic features in centiles, compared to normal references. Since our data were significantly distributed as Gaussian distribution; therefore, mean measurement was equalled to median and located at 50th percentile. The centile charts were showed in Table 2 for males and Table 3 for females.

**Table 1.** Physical measurement data of healthy adults age 20-35 years

Anthropometric values	Male (n = 96)	Female (n = 90)	P-value
	(mean \pm SD)	(mean \pm SD)	
Age (years)	26.92 \pm 2.88	27.53 \pm 2.85	0.14
Height (cm)	174.60 \pm 5.07	160.16 \pm 4.67	< 0.01
Weight (kg)	70.56 \pm 10.02	50.02 \pm 6.02	< 0.01
BMI (kg/m ²)	23.12 \pm 2.96	19.50 \pm 2.18	< 0.01
Head circumference (cm)	57.47 \pm 1.36	54.73 \pm 1.45	< 0.01
Facial length (cm)	17.56 \pm 1.07	16.13 \pm 1.02	< 0.01
Rt. ear length (cm)	6.59 \pm 0.40	6.10 \pm 0.35	< 0.01
Lt. ear length (cm)	6.60 \pm 0.40	6.09 \pm 0.34	< 0.01
Mouth length (cm)	5.28 \pm 0.48	4.98 \pm 0.47	< 0.01
Philtrum width (cm)	0.57 \pm 0.12	0.52 \pm 0.14	< 0.01
Philtrum length (cm)	1.77 \pm 0.16	1.63 \pm 0.16	< 0.01
Binocular distance (cm)	10.12 \pm 0.50	9.68 \pm 0.47	< 0.01
Intercanthal distance (cm)	3.43 \pm 0.28	3.29 \pm 0.26	< 0.01
Rt. palpebral fissure length (cm)	3.34 \pm 0.21	3.20 \pm 0.18	< 0.01
Lt. palpebral fissure length (cm)	3.34 \pm 0.21	3.20 \pm 0.18	< 0.01
Interpupillary distance (cm)	6.48 \pm 0.31	6.17 \pm 0.33	< 0.01
Rt. hand length (cm)	19.39 \pm 0.85	17.63 \pm 0.81	< 0.01
Lt. hand length (cm)	19.38 \pm 0.85	17.51 \pm 1.36	< 0.01
Rt. palm length (cm)	11.18 \pm 0.57	10.09 \pm 0.49	< 0.01
Lt. palm length (cm)	11.17 \pm 0.58	9.98 \pm 1.18	< 0.01
Rt. middle finger length (cm)	8.21 \pm 0.39	7.54 \pm 0.43	< 0.01
Lt. middle finger length (cm)	8.21 \pm 0.39	7.53 \pm 0.43	< 0.01
Rt. sole length (cm)	23.68 \pm 1.14	21.37 \pm 1.10	< 0.01
Lt. sole length (cm)	23.67 \pm 1.14	21.36 \pm 1.10	< 0.01
Ear to facial length ratio	0.38 \pm 0.028	0.38 \pm 0.030	< 0.01
Palm to hand ratio	0.58 \pm 0.011	0.57 \pm 0.022	< 0.01

Discussion

Normal variation of physical measurement in healthy Thai medical students and trainees

The series of anthropometric values obtained from Thai medical students and medical trainees age of 20-35 years in the Faculty of Medicine Ramathibodi Hospital, showed normal distribution and can be assumed to represent normal variation in normal healthy Thai adults. We excluded individuals with elderly age,

which may be affected by degenerative changes following either menopause or andropause, resulting in physical alteration. On the other hand, chronic illness, which may affect growth and development was excluded by history taking, including malnutrition, osteoporosis (both primary and secondary causes), chronic kidney disease, chronic lung disease, congenital heart diseases, abnormal bone metabolism, bone fractures with malunion, and hypogonadism^(9,10).

Table 2. Male anthropometric data ranged in percentiles (20-35 years)

Anthropometric values	Distribution	P3	P25	P50	P75	P97
Height (cm)	normal	165.91	170.25	174.00	178.00	185.00
Weight (kg)	normal	51.91	65.00	68.00	76.00	97.00
BMI (kg/m ²)	normal	18.28	21.41	22.89	24.49	30.81
Head circumference (cm)	normal	55.36	56.40	57.40	58.50	60.51
Facial length (cm)	normal	15.69	16.70	17.80	18.38	19.52
Rt. ear length (cm)	normal	5.78	6.23	6.60	6.90	7.30
Lt. ear length (cm)	normal	5.78	6.23	6.60	6.90	7.30
Mouth length (cm)	normal	4.26	5.03	5.20	5.78	6.00
Philtrum width (cm)	normal	0.40	0.50	0.55	0.60	0.80
Philtrum length (cm)	normal	1.49	1.70	1.80	1.90	2.01
Binocular distance (cm)	normal	9.20	9.80	10.00	10.30	11.20
Intercanthal distance (cm)	normal	2.99	3.20	3.40	3.60	4.11
Rt. palpebral fissure length (cm)	normal	2.90	3.20	3.30	3.45	3.80
Lt. palpebral fissure length (cm)	normal	2.90	3.20	3.30	3.45	3.80
Interpupillary distance (cm)	normal	5.78	6.30	6.50	6.60	7.05
Rt. hand length (cm)	normal	17.38	19.00	19.40	20.00	20.89
Lt. hand length (cm)	normal	17.38	18.93	19.40	20.00	20.89
Rt. palm length (cm)	normal	9.99	10.90	11.20	11.60	12.13
Lt. palm length (cm)	normal	9.90	10.80	11.20	11.50	12.22
Rt. middle finger length (cm)	normal	7.48	8.00	8.20	8.30	9.12
Lt. middle finger length (cm)	normal	7.48	8.00	8.10	8.40	9.13
Rt. sole length (cm)	normal	21.08	22.90	23.60	24.60	25.70
Lt. sole length (cm)	normal	21.00	22.83	23.60	24.75	25.50

Since all of the recruit subjects were from medical field, most of the interview were assumed to be reliable. However, this population is not represented the people in the whole country, but is restricted to individuals with normal intelligent quotient and well socioeconomical status. Hypothetically, these parameters would not be affected much from general population since data distribution was confirmed as Gaussian distribution. Based on the rule of normal distribution, -3 SD is the 0.13th percentile, -2 SD is the 2.28th percentile, -1 SD is the 15.87th percentile, 0 is the 50th percentile (both the mean and median of the distribution), +1 SD is the 84.13th percentile, +2 SD is the 97.72nd percentile, and +3 SD is the 99.87th

percentile. Hence, the value out of the distribution curve at -2 SD and +2 SD (approximately 3rd and 97th percentile, respectively in the centile charts) is considered as an abnormal finding.

Physical difference compared to data in Thai population

To the best of our knowledge, there are very few physical data measured in Thai population. Only pediatric growth charts published by the Ministry of Public Health in 1999 are widely used in pediatrics at the age less than 20. Previously, we compared height of a dysmorphic patient at the elder age to the reference at 19 years since the growth curve reaches

**Table 3.** Female anthropometric data ranged in percentiles (20-35 years)

Anthropometric values	Distribution	P3	P25	P50	P75	P97
Height (cm)	normal	150.73	156.75	160.00	163.00	168.00
Weight (kg)	normal	38.73	46.00	50.00	54.00	62.08
BMI (kg/m ²)	normal	15.41	18.06	19.53	20.61	23.54
Head circumference (cm)	normal	52.17	53.80	54.95	55.80	57.27
Facial length (cm)	normal	4.00	15.38	16.15	16.83	18.20
Rt. ear length (cm)	normal	5.47	5.88	6.10	6.30	6.78
Lt. ear length (cm)	normal	5.50	5.90	6.10	6.30	6.78
Mouth length (cm)	normal	4.35	4.60	4.80	5.20	6.20
Philtrum width (cm)	normal	0.30	0.40	0.50	0.60	0.93
Philtrum length (cm)	normal	1.40	1.50	1.60	1.70	2.00
Binocular distance (cm)	normal	8.97	9.28	9.80	10.00	10.71
Intercanthal distance (cm)	normal	2.80	3.10	3.30	3.40	3.83
Rt. palpebral fissure length (cm)	normal	2.90	3.05	3.20	3.30	3.63
Lt. palpebral fissure length (cm)	normal	2.90	3.05	3.20	3.30	3.63
Interpupillary distance (cm)	normal	2.90	3.05	3.20	3.30	3.63
Rt. hand length (cm)	normal	16.07	17.20	17.60	18.13	19.33
Lt. hand length (cm)	normal	16.14	17.18	17.60	18.10	19.50
Rt. palm length (cm)	normal	9.10	9.80	10.10	10.40	11.15
Lt. palm length (cm)	normal	9.10	9.80	10.10	10.40	11.15
Rt. middle finger length (cm)	normal	6.62	7.30	7.50	7.80	8.30
Lt. middle finger length (cm)	normal	6.69	7.30	7.50	7.80	8.33
Rt. sole length (cm)	normal	19.37	20.48	21.20	22.00	23.63
Lt. sole length (cm)	normal	19.47	20.48	21.20	22.00	23.70

plateau from the age of 17; hence, the adult height in normal circumstance is implied not much difference from the value of mature age. Another craniofacial parameter used in the identification of dysmorphic feature is a head circumference. To the best of our knowledge, there is only a reference, provided by the Ministry of Public Health, restricted to children up to 6 years (WHO global database on child growth and malnutrition). Therefore, it is very difficult to diagnose micro- or macrocephaly in an adult. Our data is the first database represented Thai people. Regarding other physical measurement, there has been no previous report in Thai population. This is the first data set developed from our study.

Clinical application of the standard references

Our study also showed the first set of craniofacial variability index and may be applicable by using specific values (both numerical and relative values), for example, ocular hypertelorism will be seen more common in Asian when use interpupillary distance verified in Caucasian⁽¹¹⁾. As true ocular hypertelorism is an important clue in clinical diagnosis of chromosomal anomalies^(12,13), diagnosis of ocular hypertelorism in Asian should be based on Asian criteria base on normal Asian distribution. Another example is limb index, Asian people are observed to have shorter hands and fingers than in Caucasian⁽¹⁴⁾. Palm to hand or middle finger ratios may be more useful in clinical

diagnosis of either brachydactyly or short hand^(15,16). If we have the validated standard reference, bio-informatic analysis of dysmorphic features in Thai people will be more accurate. Nevertheless, another relative ratio should be subsequently explored since some of the data cannot be directly interpreted from the certain numerical values.

Since the number of diagnosis of dysmorphology syndromes in Thai adults is increased^(17,18), the reference for phenotypic description is essentially required. Our study was a pilot study of anthropometric measurement in normal healthy adult in Thailand. We have built up a small series of database as a tool for clinical evaluation of adult dysmorphology in Thailand. This database requires further study in larger group to represent normal distribution reference in

normal healthy adults nationwide.

Limitation

The recruited subjects in this study were focused to Thai medical students and medical trainees which seemed to have normal to high intelligence quotient, nutritional status and socioeconomic status. The obtained anthropometric data may not represent nationwide distribution. More data from further study in larger group should be obtained.

Conclusion

These physical parameters represent the normal variation of adult healthy individuals. This information is a useful reference for the diagnosis of adult dysmorphology in Thai ethnic group.

References

1. Allanson JE, Biesecker LG, Carey JC, Hennekam RC. Elements of morphology: introduction. *Am J Med Genet A* 2009;149A:2-5.
2. Ward RE. Facial morphology as determined by anthropometry: keeping it simple. *J Craniofac Genet Dev Biol* 1989;9:45-60.
3. Guest SS, Evans CD, Winter RM. The Online London Dysmorphology Database. *Genet Med* 1999;1:207-12.
4. Ward RE, Jamison PL, Farkas LG. Craniofacial variability index: a simple measure of normal and abnormal variation in the head and face. *Am J Med Genet* 1998;80:232-40.
5. Allanson JE, Cuniff C, Hoyme HE, McGaughran J, Muenke M, Neri G. Elements of morphology: standard terminology for the head and face. *Am J Med Genet A* 2009;149A:6-28.
6. Hunter A, Frias JL, Gillissen-Kaesbach G, Hughes H, Jones KL, Wilson L. Elements of morphology: standard terminology for the ear. *Am J Med Genet A* 2009;149A:40-60.
7. Hennekam RC, Cormier-Daire V, Hall JG, Mehes K, Patton M, Stevenson RE. Elements of morphology: standard terminology for the nose and philtrum. *Am J Med Genet A* 2009;149A:61-76.
8. Biesecker LG, Aase JM, Clericuzio C, Gurrieri F, Temple IK, Toriello H. Elements of morphology: standard terminology for the hands and feet. *Am J Med Genet A* 2009;149A:93-127.
9. Oostdijk W, Grote FK, de Muinck Keizer-Schrama SM, Wit JM. Diagnostic approach in children with short stature. *Horm Res* 2009;72:206-17.
10. Cakan N, Kamat D. Short stature in children: a practical approach for primary care providers. *Clin Pediatr (Phila)* 2007;46:379-85.



11. MacLachlan C, Howland HC. Normal values and standard deviations for pupil diameter and interpupillary distance in subjects aged 1 month to 19 years. *Ophthalmic Physiol Opt* 2002;22:175-82.
12. Cohen MM, Jr. Malformations of the craniofacial region: evolutionary, embryonic, genetic, and clinical perspectives. *Am J Med Genet* 2002;115:245-68.
13. Dollfus H, Verloes A. Dysmorphology and the orbital region: a practical clinical approach. *Surv Ophthalmol* 2004;49:547-61.
14. Janssen SJ, Teunis T, Ter Meulen DP, Hageman MG, Ring D. Estimation of base of middle phalanx size using anatomical landmarks. *J Hand Surg Am* 2014;39:1544-8.
15. Nguyen ML, Jones NF. Undergrowth: brachydactyly. *Hand Clin* 2009;25:247-55.
16. Temtamy SA, Aglan MS. Brachydactyly. *Orphanet J Rare Dis* 2008;3:15.
17. Korpaisarn S, Trachoo O, Sriphrapadang C. Chromosome 22q11.2 deletion syndrome presenting as adult onset hypoparathyroidism: clues to diagnosis from dysmorphic facial features. *Case Rep Endocrinol* 2013;2013:802793.
18. Trachoo O, Assanatham M, Jinawath N, Nongnuch A. Chromosome 20p inverted duplication deletion identified in a Thai female adult with mental retardation, obesity, chronic kidney disease and characteristic facial features. *Eur J Med Genet* 2013;56:319-24.



การสร้างฐานข้อมูลสัดส่วนร่างกายมาตรฐานในนักศึกษาแพทย์และแพทย์ฝึกอบรมหลังปริญญาที่มีสุขภาพดี: เครื่องมือในการประเมินทางคลินิกในผู้ใหญ่ที่มีความผิดปกติของรูปร่างภายนอก

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บทคัดย่อ

ปฐมหลัง: การวินิจฉัยกลุ่มอาการรูปร่างผิดปกติในมนุษย์ จำเป็นต้องใช้ข้อมูลจากการตรวจร่างกาย และการบรรยายลักษณะที่ตรวจพบ อย่างไรก็ตาม การบรรยายลักษณะรูปร่างผิดปกติในผู้ใหญ่ยังมีข้อจำกัด เนื่องจากหลักฐานอ้างอิงต่างๆที่มีมาแล้วแต่เป็นการบรรยายในผู้ป่วยเด็กในเชื้อชาติอื่นๆ ซึ่งอาจจะนำมาใช้กับผู้ป่วยไทยไม่ได้

วิธีการศึกษา: การวัดสัดส่วนร่างกายมาตรฐาน กระทำในนักศึกษาแพทย์และแพทย์ฝึกอบรมหลังปริญญา อายุระหว่าง 20-35 ปี ประวัติการเจ็บป่วยในอดีต ถูกคัดกรอง โดยการสัมภาษณ์ต่อหน้า เพื่อคัดแยกผู้ที่มีโรคประจำตัวเรื้อรังออกจากการศึกษา ดังนั้น ผู้ที่ผ่านเข้าร่วมการวิจัย จะมีสมมติฐานว่าจะเป็นตัวแทนของประชากรทั่วไปที่มีสุขภาพดีได้ การวัดสัดส่วนใช้กระบวนการมาตรฐานที่เป็นสากล ประกอบไปด้วย ส่วนสูง ดัชนีมวลกาย ดัชนีศีรษะ ใบหน้า และระยะคาง

ผลการศึกษา: ผู้เข้าร่วมการวิจัยทั้งสิ้น 186 คน ประกอบไปด้วยเพศชาย 96 คน และ เพศหญิง 90 คน อายุเฉลี่ย 27.20 ± 2.90 ปี (เพศชาย 26.92 ± 2.88 , เพศหญิง 27.53 ± 2.85) ข้อมูลการวัดบรรยายเป็น ค่าเฉลี่ย \pm ส่วนเบี่ยงเบนมาตรฐาน ในเพศชายและหญิงตามลำดับ ส่วนสูง 174.60 ± 5.10 และ 160.16 ± 4.67 ซม. รอบศีรษะ 57.47 ± 1.36 และ 54.73 ± 1.45 ซม. ความยาวใบหน้าจากหน้าผากถึงคาง 17.56 ± 1.07 และ 16.13 ± 1.02 ซม. ระยะห่างระหว่างหัวตา 3.43 ± 0.28 และ 3.29 ± 0.26 ซม. ระยะห่างระหว่างรูม่านตา 6.47 ± 0.31 และ 6.17 ± 0.33 ซม. ความยาวใบหู 6.59 ± 0.40 และ 6.09 ± 0.35 ซม. ความยาวปาก 5.283 ± 0.48 และ 4.978 ± 0.47 ซม. ความยาวนัยกลาง 8.21 ± 0.39 และ 7.54 ± 0.43 ซม. ความยาวฝ่ามือ 11.18 ± 0.57 และ 10.09 ± 0.49 ซม. ความยาวฝ่าเท้า 23.68 ± 1.14 และ 21.37 ± 1.10 ซม. ชาร์ทเซนทิลถูกสร้างขึ้นเพื่อการใช้งานทางคลินิกในอนาคต

บทสรุป: ค่าการวัดร่างกายต่างๆ เหล่านี้แสดงให้เห็นถึงความหลากหลายในบุคคลวัยผู้ใหญ่ ข้อมูลเหล่านี้มีประโยชน์ในการนำมาสร้างข้อมูลอ้างอิง สำหรับการวินิจฉัยภาวะรูปร่างผิดปกติในผู้ใหญ่ สำหรับประชากรไทยได้ต่อไป

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