Original Article

Anthropometric Study of the Normal External Ear in Adult Thai People; Age and Sex-Related Difference

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Background: The reconstruction of an abnormal ear pinna is the most challenging problem for a plastic surgeon. Knowing the normal dimensions of the external ear pinna is an important factor for planning an ear reconstruction surgery especially in bilateral abnormality cases. There were few studies on this aspect from various populations and the ear dimensions were different among ethnicity. The present study attempted to provide anthropometry of the normal Thai ear pinna.

Objective: The present study aims to study normal ear dimensions and position on the face of the Thai people.

Materials and Methods: A cross-sectional study was undertaken from January 2007 to December 2008 in Ramathibodi Hospital, Bangkok, Thailand. A total of 250 subjects with normal ears and faces were measured them both ears. The 131 women and 119 men with an age of 16 to 89 years old were included and subgroup into seven age groups. Ear dimensions and related facial dimensions were measured.

Results: The mean length and width of the ear pinna, concha, ear lobule, auricular inclination angle, protrusion at the most superior part of the helix level, and Tragal level in males was significantly larger than the female. The mean length and width of the ear pinna, ear lobule, and the length of concha were significantly longer in an older age group. Moreover, the mean length and width of the ear pinna and the lobule were significantly higher in the higher weight and BMI group but not for the higher height group. The left and right ear dimensions were not significantly different.

Conclusion: Men's ear pinna is a larger and wider angle of inclination than women's. Bodyweight and BMI have a positive correlation with ear dimensions. Moreover, the ear pinna was increasing in size throughout life in both cartilaginous and non-cartilaginous parts.

Keywords: Anthropometry; Ear; Auricle; Thai; Age

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The congenital ear anomaly is not uncommon and also relates to many syndromic disorders. The abnormality of the ear involved size, shape, and location. The patients with Trisomy 13 and 18 syndromes are reported to have low-set ears and deformed auricles. Down's syndrome patients have smaller auricles than normal[1-4].

The ear pinna reconstruction is a challenging operation for plastic surgeons. It should be harmonious with the craniofacial complex in terms of dimensions, position, and relationship. The reconstructed ear is usually designed from the contralateral normal ear. The problem occurred when both ears were abnormal and the surgeon has to design the ear and position from data of the previous normal ears. So, this study was aimed to get information on the anthropometry of the normal ear pinna in Thais which will assist the surgeons for accurate diagnosis of the abnormal ears and planning for the ear reconstruction.

There are few studies on this aspect from various populations such as the German, White ethnic of North America, Turkish, Italian, Indian[3,5-10]. There is no scientific and systematic study in the Thai population which brings our interest in doing the study.

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Materials and Methods

The study was done in Ramathibodi Hospital from January 2007 to December 2008 including 250 Thai adults who had no facial deformity with normal ear pinnas. All patients were informed and agreed to enter the study. The demographic data such as age, weight, height, BMI were collected from the subjects. The linear parameters of the ear pinna were measured in the head upright position with sliding digital Vernier Caliper two times and the mean value was used. The auricula dimension included (Figure 1):

1) The length of the auricle: the highest point to the lowest point of the ear (1 to 2).

2) The width of the auricle: the most medial point to most lateral point (3 to 4).

3) The length of the lobule: the lowest part of the

intertragic notch to the lowest part of the ear lobule (2 to 6).

4) The width of the lobule: the widest part of the ear lobule (9 to 10).

5) The length of the Concha: the uppermost point of the conchal to the lowest part of the intertragic notch (5 to 6).

6) The width of the Concha: the most lateral point to the most medial point of the concha (7 to 8).

7) The Auricular inclination angle was the degree of posterior rotation of the vertical axis of the ear to the vertical axis of the face. The measurement was done on the lateral view of the patients' picture. The vertical axis of the ear was the line from the uppermost of the ear to the lowest part of the ear and the vertical axis of the face was the line perpendicular to the Frankfort Horizontal line (the lowest point of the orbit and superior point of the external auditory meatus) (Figure 2).

8) The protrusion of the auricle at the most superior part of the helix level was the distance from the mastoid scalp to the uppermost border of the ear (Figure 3).

9) The protrusion at the tragus level was the distance from the mastoid scalp to the most projected rim at the Tragal level (Figure 3).

10) The distance from the lateral palpebral commissure to the helical root was measured (Figure 4).

11) The distance from lateral palpebral commissure to lobular insertion was measured (Figure 4).

12) The lower facial height was the distance from the nasion to the gnathion (Figure 4).

We also created the index of the auricular part to compare the proportion of each ear.

The Auricular index (AI) was calculated from the width of the auricle x100/length of the auricle.

The lobular index (LI) = the width of the lobule x100/length of the lobule.

Conchal index (CI) = the width of the Conchal x100/length of the Conchal.

A simple statistical analysis (Mean, SD) was performed for each age group. A two-tail distribution t-test at a 95% confidence interval was undertaken to study the bilateral variation using SPSS 8.0 software.

The present study was approve by ethics committee, Faculty of Medicine Ramathibodi Hospital, Mahidol University (No. MURA2008/637).

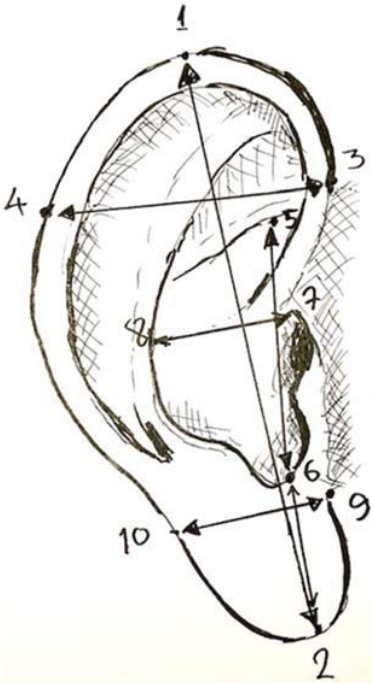

Figure 1. The diagram demonstrated how to measure the ear dimension: Line 1 to 2 the length of the auricle; Line 3 to 4 the width of the auricle; Line 2 to 6 the length of the lobule; Line 9 to 10 the width of the lobule; Line 5 to 6 the length of the Concha; line 7 to 8 the width of the Concha.

Results

In total, 250 subjects were recruited, 500 ears were measured as shown in Table 1. There were 131 women (52.4%) and 119 men (47.6%). The average age was 52.07 years (SD 16.41) in men and 47.99 years (SD 17.34) in women. The

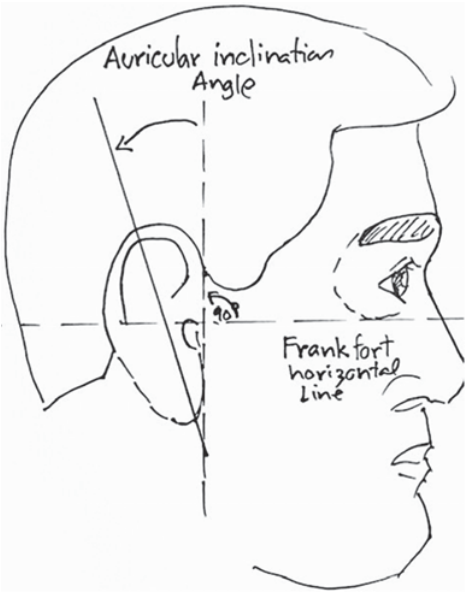

Figure 2. The diagram demonstrated how to measure the auricular angle.

overall age was from 16-89 years, average height was 167.22 cm (SD 7.24) in men and 155.95 cm (SD 5.49) in women, with the range, from143 to 188 cm. The average weight was 68.02 kg (SD 12.71) in men and 56.71 kg (SD 11.54) in women with the range from 35 to 124 kg. The mean Body Mass Index (BMI) was 24.33 (SD4.81) in men and 23.30 (SD 4.44) in women.

In comparison, men's ears were significantly longer, wider and more protruded than women's. Moreover, the auricular inclination angle, the distance from lateral palpebral commissure to the helical root, and the lobular insertion in men were longer than women in all age groups (Table 2).

All indices exhibited decreasing trends with advancing age in both male and female groups which demonstrated the increase in the length more than the width.

The comparison of the average mean length and width between both ears found the length of the auricle was 66.4 mm on the right auricle and 66.6 mm on the left side. The width of the auricle was 33.0 mm on the right side and 33.2 on the left side. The lobular length was 20.3 mm on the right side and 20.4 mm on the left side. The lobular width was 20.2 on the right side and 20.3 on the left side. There was no significant difference in all dimensions between both ears (Table 6).

The average height of the men and women in our sample was 167.2 and 155.9 cm respectively, the average weight was 68.0 and 56.7 kg respectively, and the average

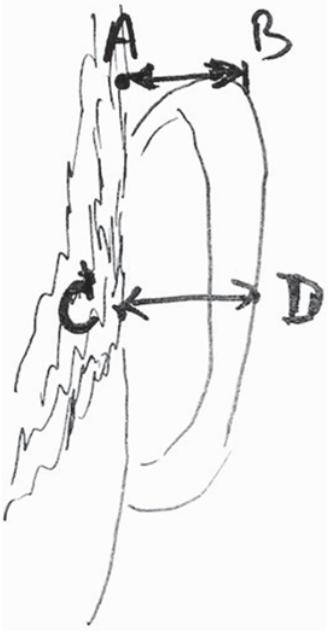

Figure 3. The diagram demonstrated how to measure the protrusion of the auricle at the most superior part of the helix level (Line A to B) and the protrusion at the tragus level (Line C to D).

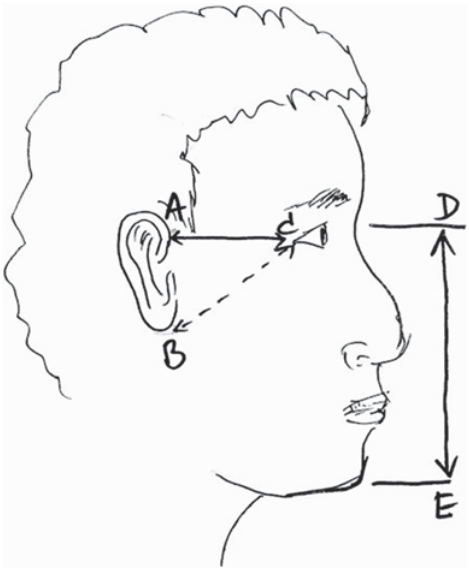

Figure 4. The diagram demonstrated how to measure the distance from the lateral palpebral commissure to the helical root (A to C), the distance from lateral palpebral commissure to lobular insertion (B to C), and the lower facial height (D to E).

Table 1. The summary data of the recruited studied volunteers

Variable	Summary (n=250)		
Age (year)	Mean (SD)	49.9 (17.1)	Range 16 to 89
Sex	Male:Female	119:131	48:52 (%)
Weight (kg)	Mean (SD)	62.1 (13.4)	Range 35 to 124
Height (cm)	Mean (SD)	161.3 (8.5)	Range 143 to 188
BMI (kg/m^2)	Mean (SD)	23.8 (4.7)	Range 16 to 61

Table 2. Comparison of the mean of ear dimensions and distance to the palpebral commissure regarding the sex

Variables	Male ears (n=238) mean (SD)	Female ears (n=262) mean (SD)	p-value
Length of the auricle (mm)	68.9 (5.7)	64.3 (5.5)	<0.001
Width of the auricle (mm)	34.9 (3.2)	31.5 (3.0)	<0.001
Lobular length (mm)	20.9 (3.5)	19.9 (3.2)	<0.001
Lobular width (mm)	21.2 (2.8)	19.4 (3.0)	<0.001
Conchal length (mm)	29.6 (2.7)	28.0 (3.4)	<0.001
Conchal width (mm)	17.5 (2.4)	17.5 (2.5)	0.978
Auricular inclination angle (degree)	7.0 (5.6)	5.2 (5.6)	<0.001
The protrusion at the most superior part of the helix level (mm)	19.2 (3.1)	17.4 (3.1)	<0.001
The protrusion at the tragal level (mm)	23.5 (3.5)	20.4 (3.6)	<0.001
Distance from lateral palpebral commissure to the helical root (mm)	80.0 (5.4)	74.2 (6.8)	<0.001
Distance from lateral palpebral commissure to lobular insertion (mm)	91.0 (6.8)	85.2 (6.7)	<0.001
Facial height (mm)	118.9 (7.6)	111.6 (6.0)	<0.001

body mass index (BMI) was 24.3 and 23.3 correspondingly.

The mean measurement of the ear dimensions of the men divided into the different heights (Table 7) showed an increasing trend with advancing height but did not reach a significant difference. However, the women group could not demonstrate this trend.

The weight and BMI in both sexes exhibited significantly the increasing trend of the ear dimensions with advancing value (Table 8, 9).

Discussion

The ear pinna is an important structure of the facial complex. Its aesthetic appearance is more important than the hearing function in humans. Patients with abnormal ears lose of self-confidence. They usually look for some corrections. Knowing the normal dimension and position of the ear is a useful guideline for the plastic surgeon to rectify possible defects and achieve the ultimate result. The ear dimensions vary in the different ethnic groups, so the surgeons should base their observation on the specific data of their ethnic group. At this moment, there is no normal value of the Thai ear dimension. The surgeons usually use the normal side as a template for reconstruction but this Thai ear dimension data is helpful in bilateral ear anomaly which has no normal side for reference. This local data also suggests the hearing aid instrument company producing the product which perfectly fits our population instead of using the universal size.

Our study included as much ear dimension as possible to have more information to apply, however, some data could be adapted in an individual case. The difference in ear dimension between sex also guides the surgeon who looks for a better aesthetic result. Although we rarely performed ear reconstruction in the aging, we have included their data in the study to know the long-term change of the ear pinna.

Regarding the sex-related difference of the ear dimensions, the total ear length and width, the earlobe length and width, and the protrusion at the tragal level showed larger in men than in women in many ethnicities[5,7,8,10]. This study also showed significantly larger dimensions in many parameters of the male ear (the length of the auricle, the width of the auricle, the lobular length, the lobular width, conchal length, protrusion at the most superior part of helix level, and protrusion at the tragal level) (Table 2). The facial dimensions measurement in our study, the distance from the lateral palpebral commissure to both the helical root and insertion of the lobule and lower facial height are significantly longer in men than women (Table 2); As well as the study of Brucker, et al[8].

Furthermore, the auricular size is continuing to increase in adulthood[11]. Both the cartilaginous and lobular portions shares in this phenomenon[12]. The increase is attributable to reduce resilience and elasticity of the skin, the diminutive tensile strength of the connective tissue, and gravitational forces. This study shows an increasing trend of the auricular length and width with advancing age (Table 3).

The auricular length of the young Thais (16 to 25 years) is comparable with the young Turkish (18 to 25 years) and Italian, but larger than the Indian. Interestingly, the auricular width is similar to that exhibited by Turkish, and Indians, but smaller than Italian of the same age group.

According to Farkas and Lindsay[3], the auricular length and width can be part of the disease presentation of the syndromes including microsomia and craniofacial syndromes that may present with disproportionately wide or narrow ears. The wide ears could be observed in Apert and

Table 3. The comparison of the mean length of each dimension of the ears between the sexes regarding age group (male)

Variables(mm)	Male, age group (year)/mean (SD)							
	16 to 25 n=22	26 to 35 n=18	36 to 45 n=46	46 to 55 n=42	56 to 65 n=62	66 to 75 n=30	≥76 n=18	p-value
Length of the auricle	63.8 (3.9)	66.6 (5.9)	65.2 (4.4)	69.3 (4.5)	70.7 (5.2)	72.3 (5.5)	74.1 (3.7)	<0.001
Width of the auricle	32.9 (3.1)	34.7 (3.3)	33.6 (2.5)	34.9 (3.4)	35.7 (2.8)	36.1 (3.5)	37.1 (3.8)	<0.001
Lobular length	19.7 (3.6)	18.8 (3.1)	19.0 (3.2)	21.6 (3.5)	21.9 (3.5)	22.3 (2.4)	23.0 (2.5)	<0.001
Lobular width	19.5 (2.4)	20.0 (2.8)	21.3 (3.1)	21.0 (2.5)	21.6 (2.4)	22.1 (3.6)	22.5 (2.7)	0.004
Conchal length	28.7 (2.0)	28.9 (2.5)	28.7 (2.2)	29.6 (2.2)	29.8 (3.1)	31.7 (3.0)	31.0 (2.1)	<0.001
Conchal width	19.2 (2.6)	19.2 (2.1)	17.3 (1.9)	17.0 (2.5)	17.6 (1.9)	17.1 (1.8)	16.6 (3.2)	<0.001
Auricular inclination angle (degree)	7.1 (4.9)	12.1 (7.5)	8.8 (4.2)	6.7 (5.6)	6.2 (5.7)	6.7 (4.9)	2.2 (4.0)	<0.001
The protrusion at the most superior part of the helix	18.3 (3.0)	19.7 (2.4)	18.6 (2.5)	19.9 (4.5)	19.3 (3.1)	19.7 (2.5)	19.5 (1.9)	0.361
The protrusion at the tragus	22.2 (3.9)	23.1 (2.6)	23.4 (2.5)	23.4 (4.3)	24.4 (3.6)	23.8 (3.7)	22.4 (3.1)	0.159
Distance 1*	77.6 (4.6)	80.7 (6.1)	78.7 (5.0)	78.6 (5.5)	80.7 (5.7)	82.8 (5.3)	82.2 (3.9)	0.001
Distance 2**	86.0 (4.6)	89.2 (4.6)	87.2 (6.8)	90.8 (5.2)	93.2 (7.9)	94.2 (4.8)	97.0 (2.5)	<0.001
Facial height	118.5 (6.9)	119.1 (8.1)	119.4 (7.7)	117.6 (6.7)	118.5 (7.3)	119.3 (9.2)	121.8 (8.3)	0.629

* Distance 1 = distance from the lateral palpebral commissure to the helical root (mm)
** Distance 2 = distance from lateral palpebral commissure to the lobular insertion (mm)

Table 4. The comparison of the mean length of each dimension of the ears between the sexes regarding age group (female)

Variables (mm)	Female, age group (year)/mean (SD)							
	16 to 25 n=34	26 to 35 n=48	36 to 45 n=28	46 to 55 n=52	56 to 65 n=56	66 to 75 n=30	≥76 n=14	P-value
Length of the auricle	59.4 (2.8)	59.9 (3.3)	62.0 (2.9)	64.5 (4.0)	67.0 (3.6)	69.6 (4.9)	74.5 (4.4)	<0.001
Width of the auricle	30.3 (2.7)	29.9 (2.5)	31.0 (2.2)	31.7 (2.4)	32.1 (3.4)	33.1 (2.1)	34.2 (3.4)	<0.001
Lobular length	18.1 (2.8)	17.7 (2.5)	18.4 (1.7)	20.0 (2.2)	21.1 (2.7)	23.1 (3.3)	23.7 (4.0)	<0.001
Lobular width	18.0 (2.5)	18.2 (2.9)	19.8 (3.7)	19.2 (2.7)	20.1 (2.8)	21.6 (2.9)	20.7 (1.5)	<0.001
Conchal length	26.1 (1.8)	27.6 (3.7)	27.2 (2.8)	27.6 (4.2)	28.9 (2.1)	30.1 (4.5)	30.5 (2.5)	<0.001
Conchal width	17.5 (1.9)	17.2 (2.6)	18.1 (2.5)	17.4 (3.2)	17.8 (2.2)	16.7 (1.8)	19.9 (2.9)	0.007
Auricular inclination angle (degree)	5.5 (4.7)	7.2 (5.6)	6.2 (3.8)	6.1 (5.9)	5.1 (5.5)	2.2 (6.4)	0.6 (5.3)	<0.001
The protrusion at the most superior part of the helix	16.0 (2.0)	16.7 (3.5)	17.5 (2.3)	18.4 (3.1)	18.4 (2.8)	17.8 (3.4)	15.8 (4.6)	0.001
The protrusion at the tragus	19.5 (2.4)	19.4 (3.4)	19.8 (2.9)	20.7 (3.9)	21.2 (3.6)	21.7 (4.5)	20.2 (5.1)	0.043
Distance 1*	74.5 (4.7)	72.7 (5.1)	75.0 (5.9)	72.3 (8.4)	73.0 (6.6)	78.3 (7.1)	81.5 (5.1)	<0.001
Distance 2**	82.5 (4.4)	81.1 (6.9)	84.1 (4.6)	85.4 (4.6)	86.2 (6.3)	91.2 (8.2)	91.4 (5.2)	<0.001
Facial height	110.9 (5.7)	110.7 (5.60	111.1 (5.0)	113.4 (5.9)	112.5 (6.9)	119.9 (5.8)	107.6 (5.4)	0.031

* Distance 1 = distance from the lateral palpebral commissure to the helical root (mm)
** Distance 2 = distance from lateral palpebral commissure to the lobular insertion (mm)

Table 5. Comparison of the index regarding age group of each sex

	Male age group (year)							
	16 to 25	26 to 35	36 to 45	46 to 55	56 to 65	66 to 75	≥76	p-value
AuricularIndex	51.7	53.2	51.7	50.3	50.6	50.0	50.0	0.4
Lobular index	102.2	108.9	116.0	99.1	100.2	100.1	99.0	0.002
Conchal index	67.2	67.1	60.7	57.5	54.4	54.4	53.6	<0.001
	Female age group (year)							
	16 to 25	26 to 35	36 to 45	46 to 55	56 to 65	66 to 75	≥76	p-value
AuricularIndex	51.1	50.0	50.0	49.3	48.0	47.7	45.9	0.001
Lobular index	101.3	105.2	108.1	97.3	96.6	95.2	89.5	0.007
Conchal index	67.0	63.4	67.6	66.9	61.8	56.9	65.3	0.141

Table 6. Comparison of the mean length of the ear between right and left side (t-test)

	Right ears (n=250) Mean (SD)	Left ears (n=250) Mean (SD)	p-value
Length of the auricle (mm)	66.4 (6.1)	66.6 (5.9)	0.732
Width of the auricle (mm)	33.0 (3.6)	33.2 (3.5)	0.614
Lobular length (mm)	20.3 (3.4)	20.4 (3.4)	0.737
Lobular width (mm)	20.2 (3.0)	20.3 (3.1)	0.623

Crouzon syndromes. However, the cleft lip and palate patients might have narrow ears.

The auricular and conchal index is the tool for comparing the proportion of the auricle which varied in size. The auricular index exhibits a decrease with age, indicating a faster increase in length than in width with aging (Table 5). Farkas reported that the auricular index for 18-year-old North American white males was 56.7[9]. In our study, although the index is not calculated age-wise, the values are 51.7 in 16 to 25-year-old Thai males.

The conchal length and width have been reported by Purkeit with an increase in size with age[13]. In our study, the conchal length and width are also exhibited this increasing trend with advancing age. The dimensions of the concha in the aging who commonly suffers from a hearing problem are also helpful in designing the proper size of the hearing aid instrument.

Regarding the ear lobule, our results found that it continues to elongate with age (Table 4). The lobular index also supports the preceding observation, exhibiting a decreasing trend with advancing age (Table 5). Brucker et al[8] reported a decrease in lobular width with age in their mixed American data which was different from other studies and our study that did not show any decrease in lobular width with age[5,13]. Moreover, we found an increasing trend of the lobular length with advancing age (Table 3,4).

The lobular length of the young Thais (16 to 25 years) is larger than the Jewish's[5], Indian[13], Turkish[7], and American[8]. But lobular width is comparable with the Indian, American, Turkish males[7,8,13].

The normal auricular inclination angle is 9 to 29 degrees. In the current population, the mean is 7.0 degrees in males and 5.2 in females. The cleft lip and palate patients may have a larger angle[3]. This posterior inclination angle is an important factor for aesthetic outcome in total ear pinna reconstruction.

The normal value of the auricular protrusion is helpful when planning to correct the prominent ear of which the distance at the most superior part of the helix to scalp are greater than 20 mm. Our study found 17.4% of our subjects have a prominent ear while 9% are in Turkish and 11.4% in Indian[13]. Our protrusion at the most superior part of the helix range from 20.0 to 27.0 mm in males and 16.6 to 24.0 mm in the female which was greater than the Indian ethnic[13].

According to the difference between both sides of the ears, our study showed no significant difference between the length and width of the auricle and lobules (Table 6).

Regarding the difference of the ear dimensions between the groups of weight, height, and BMI, the mean measurement of the ear dimensions in our data had increasing trends with advancing weight, height, and BMI. The differences can demonstrate statistical significance in the weight and BMI, however, for the height not all of the dimensions reach the statistical significance (Table 7 to 9).

The proper position of the auricle also depending on the judgment of the plastic surgeon. The position of the reconstructed ear is usually designed by transferring the distance of the opposite normal side. However, when there is no such reference in the bilateral abnormal ear, our data can be the guidance. The distance from lateral palpebral commissure to the helical root and insertion of the ear lobule is increase by age in both sexes which is possibly related to loosening skin in aging. The ear reconstruction was rarely done in the aging, so this factor might be less important than

Table 7. The comparison of mean length of the ear regarding height in each sex

	Height (cm), male/mean (SD)				
	<150 n=6	151 to 160 n=40	161 to 170 n=126	≥170 n=66	p-value
Length of the auricle (mm)	65.7 (7.3)	69.8 (4.4)	68.2 (5.7)	69.9 (5.9)	0.071
Width of the auricle (mm)	33.0 (5.0)	35.5 (2.7)	34.3 (3.2)	36.0 (3.2)	0.022
Lobular length (mm)	21.3 (1.9)	20.9 (2.7)	20.6 (3.6)	21.5 (3.7)	0.428
Lobular width (mm)	20.5 (2.8)	20.9 (2.7)	21.0 (2.8)	21.8 (2.9)	0.251
	Height (cm), female/mean (SD)				
	<150 n=52	151 to 160 n=170	161 to 170 n=38	≥170 n=2	p-value
Length of the auricle (mm)	64.5 (5.8)	64.8 (5.7)	62.2 (3.7)	60.4 (0.4)	0.047
Width of the auricle (mm)	31.3 (2.9)	31.6 (3.0)	31.0 (2.9)	28.2 (1.1)	0.277
Lobular length (mm)	20.2 (2.7)	20.2 (3.4)	17.9 (2.8)	18.3 (0.1)	0.001
Lobular width (mm)	19.5 (3.3)	19.8 (2.9)	18.1 (2.5)	17.1 (0.4)	0.011

Table 8. The comparison of mean length of the ear regarding weight group in each sex

Age	Weight (kg) male/mean (SD)				
	≤50 n=16	51 to 60 n=54	61 to 70 n=80	≥71 n=88	p-value
Length of the auricle (mm)	63.7 (3.0)	67.4 (5.1)	68.6 (5.9)	70.9 (5.3)	<0.001
Width of the auricle (mm)	33.3 (2.8)	33.9 (3.1)	34.5 (3.4)	36.3 (2.8)	<0.001
Lobular length (mm)	18.5 (2.4)	19.9 (3.2)	20.8 (3.7)	22.1 (3.2)	<0.001
Lobular width (mm)	18.4 (2.9)	20.7 (2.5)	21.2 (2.9)	21.9 (2.6)	<0.001
Age	Weight (kg) female/mean (SD)				
	≤50 n=78	51 to 60 n=100	61 to 70 n=54	≥71 n=30	p-value
Length of the auricle (mm)	63.8 (6.1)	64.1 (5.4)	64.4 (4.8)	65.9 (5.4)	0.380
Width of the auricle (mm)	30.9 (3.0)	31.2 (3.0)	32.0 (2.7)	32.9 (2.7)	0.007
Lobular length (mm)	19.4 (3.2)	19.7 (3.2)	19.7 (2.7)	22.0 (3.5)	0.003
Lobular width (mm)	18.4 (2.9)	19.2 (2.4)	20.2 (3.3)	21.5 (3.0)	<0.001

the young. The location of the ear in the young male (16 to 25 years) is a little farther from the lateral palpebral commissure than the female (77.6 mm in male, 74.5 mm in female). This could be associated with a wider face in males.

The measurement of the auricle dimension is difficult to standardize because the reference points are imaginary points on the ear and also parts of the ear the movable soft tissue. To reduce the measurement bias, we did the double measurement and used the mean value to reduce these errors. However, to reduce such a bias, it should be measured by two well-trained examiners and used the agreement of the committees in case of conflict was occurring. Although this study was done by one researcher and we try to standardize our measurement as much as possible. The variation of the ear anthropometry from other studies may occur from the measurement technique. Our Anthropometric data is helpful for plastic surgeons to have more information for their ear reconstruction surgery.

Conclusion

The ear dimensions are different among ethnicity and the auricular size is increasing throughout life in both the

Table 9. The comparison of mean length of the ear regarding BMI in each sex

Age	BMI (kg/m^2), male/mean (SD)			
	<21 n=40	21 to 25.99 n=138	≥26 n=60	p-value
Length of the auricle (mm)	66.0 (4.8)	69.1 (5.8)	70.2 (5.2)	0.001
Width of the auricle (mm)	33.6 (3.3)	35.0 (3.4)	35.7 (2.7)	0.007
Lobular length (mm)	19.5 (4.1)	20.9 (3.2)	21.9 (3.3)	0.001
Lobular width (mm)	20.1 (3.4)	21.0 (2.6)	22.2 (2.6)	0.001
Age	BMI (kg/m^2), female/mean (SD)			
	<21 n=86	21 to 25.99 n=118	≥26 n=58	p-value
Length of the auricle (mm)	63.4 (5.9)	64.6 (5.0)	65.1 (5.6)	0.134
Width of the auricle (mm)	31.0 (3.1)	31.3 (3.0)	32.4 (2.5)	0.027
Lobular length (mm)	19.2 (3.2)	19.8 (3.0)	21.2 (3.3)	0.001
Lobular width (mm)	18.1 (2.9)	19.5 (2.5)	21.3 (3.0)	<0.001

cartilaginous and lobular parts. The male's ear is larger than the female's ear in almost all dimensions excepted the conchal width. Weight, BMI, and height have positive correlations with the ear dimension. The axis of the reconstructed ear pinna should be posteriorly inclined 5 to 7 degrees.

What is already known on this topic?

There is no data about ear dimensions of Thai people. This is the first study of the ear in the Thai population.

What this study adds?

There is no data about ear dimensions of Thai people before, so our study has added such data which is useful for the involved stakeholders.

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Potential conflicts of interest

The authors declare no conflict of interest.

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