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Assessing Facial Beauty of Sabah Ethnic Groups Using Farkas Principles

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Abstract
The human face is a unique structure allowing each person to possess a distinctly recognizable facial identity. The face is formed through a complicated process of continual growth and remodelling till puberty. The face is the common element in defining beauty of individuals although the perception of beauty may vary among the beholders. Generally, the attractive faces are known to present with ideal facial proportions based on the divine or golden proportions of 1.618. Ancient Greeks had developed "*Neoclassical Facial Canons*" as a guide to assess facial beauty. In medical practice, the precise measurement of the head and face is important in the diagnosis, treatment planning, and monitoring of operative outcomes for aesthetic and reconstructive surgical procedures. As such, *Neoclassical Canons* are used as a guidance in facial reconstructive and aesthetic surgical procedures. This study was conducted in the Northern districts of Borneo Island in which several ethnic groups of Sabah, Malaysia resides. The ethnic people of which Kadazan-Dusun forms the majority (17.8%) are known for their attractive faces. Although their facial characteristics are quite distinct and readily distinguishable, a few studies had attempted to assess their facial characteristics scientifically. This study measured the facial characteristics of Bajau, Sungai and Rungus (a descendent of Kadazan-Dusun) ethnic groups residing in eight geographical areas of Sabah and compared their vertical and horizontal facial ratios. Using Farkas facial Cannons, the beauty of the three ethnic groups were scientifically assessed. The results revealed that the upper portion of the face for both sexes was significantly longer among Rungus and the relative nose width was significantly greater among Bajau ethnic group. Naso-facial canon for Sungai females and orbital cannon for all ethnic groups regardless of gender follows the Farkas principles. Other facial proportions of all three ethnic groups deviate from Farkas definition of facial beauty.

1. Introduction

The human face is a unique structure allowing each person to possess a distinctly recognizable facial identity. The face is formed through a complicated process of continual growth and remodelling till puberty. Human face is the common element in defining beauty of individuals although the perception of beauty may vary among the beholders. Being attractive is becoming trendier in recent society and studies have shown that the perfect physical appearance is related to self-confidence. [1, 2] The incidents of

human beings taking aesthetic treatment had increased by 75% in the past decades. [3] Although the beautiful and attractive faces are influenced by ecological, biological, geographical, racial and age factors [4], the plastic surgeons generally define beauty in relation to the specific proportions involving facial height, width and symmetry. The attractive faces have the ideal facial proportions that are based on the divine proportion or golden proportion. The numerical value of divine proportion (phi = ϕ) is 1.618033988 and the knowledge of divine proportion was applied since ancient Greek sculptor Phidias. It was scientifically described by Filius Bonacci who discovered the numerical value of divine proportions. [5, 6, 7] Jefferson presented a beautiful face of female model and claimed that the facial form and balance is directly related to divine proportion. [7] He proposed that a face is beautiful if the length of the face (tr-me) is 1.618 times that of face width between lateral borders of right and left cheeks (zy-zy). (Figure 1).

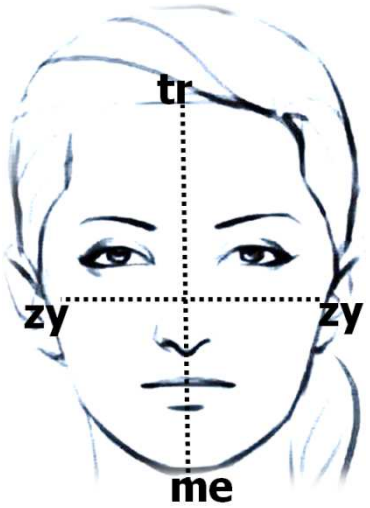


Figure 1. *Divine proportion of the face.*

Table 1. *The Neoclassical Facial Canons.*

Four vertical canons			
No	**Name**	**Characteristics**	**Description**
1	Cannon 1	Two section facial profile v-en = en-me	Special head height should be equal to special face height. Vertex(v) to endocanthion (en) = endocanthion (en) to menton (me)
2	Cannon 2	Three section facial profile tr-n = n-sn = sn-me	Forehead height II = nasal length = lower face height. Trichion (tr) to nasion (n) = nasion (n) to subnasale (sn) = subnasale (sn) to menton (me)
3	Cannon 3	Four section facial profile v-tr = tr-g = g-sn = sn-me	Height of calva = forehead height I = special upper face height = lower face height. Vertex(v) to trichion (tr) = trichion (tr) to glabella (g) = glabella (g) to subnasale (sn) = subnasale (sn) to menton (me)
4	Cannon 4	Nose ear comparison n-sn = sa-sba	Nose length = ear length Nasion(n) to subnasale (sn) = superaurale (sa) to subaurale (sba)
Four horizontal canons			
No	**Name**	**Characteristics**	**Description**
1	Cannon 5	Eye nose comparison en-en = al-al	Intercanthal width = nose width entocanthion(en) to entocanthion(en) = alare (al) to alare (al)
2	Cannon 6	Eye eye comparison en-en = ex-en	Intercanthal width = eye width (right or left eye fissure width) entocanthion(en) to entocanthion(en) = exocanthion(ex) to entocanthion(en)
3	Cannon 7	Mouth nose comparison ch-ch = 1 ½ al-al	Mouth width = nose width cheilion(ch) to cheilion(ch) = 1 ½ alare (al) to alare (al)
4	Cannon 8	Nose face comparison al-al = ¼ zy-zy	Nose width = ¼ facial width alare (al) to alare (al) = ¼ zygion(zy) to zygion(zy)

If the length and width ratio is more than 1.618, it would be categorized as long face and if the ratio is below 1.618, it would be short face. Most of the morphological human face studies utilized this concept and assumed that the adult human face must conform to the divine proportions to be beautiful and biologically efficient. [7] The precise measurement of the head and face is useful for the clinicians in the diagnosis, treatment planning, monitoring and evaluation of operative outcomes as in aesthetic and reconstructive surgical procedures. [7, 8] Facial measurements taken from living subjects had been used by the renaissance artists like Leonardo da Vinci and Bergmulle in calculation of neoclassical facial canons. These canons introduced by Ancient Greeks describe the aesthetic proportional relationships of the face and provide the foundation to facial analysis. [9] The use of facial canons thus set the standards of beauty for facial reconstructive and aesthetic surgical procedures. [9, 10] The underlying concept of determining beauty by neoclassical facial canons was to match a facial proportion with a set of defined ratios. Farkas et al summarizes those ratios into four vertical and four horizontal neoclassical canons. [10, 11, 12, 13, 14] The following table and figures in "Annex 1" describes those cannons.

This study was conducted in the Northern districts of Borneo Island which is located in the center of the Maritime Southeast Asia. This third largest island in the world is being shared by Malaysia, Indonesia and Brunei. The Malaysia part of Borneo Island is occupied by majority ethnic groups of Sabah and Sarawak. Sabah, the second biggest state of Malaysia, is home for several indigenous ethnic groups (over 32 groups) forming a multicultural state. It is located in the northernmost part of Borneo Island and the majority of population are of Kadazan-Dusun descent (17.8%) followed

by Bajau (13.4%), Malay (11.5%), Murut (3.3%) and other Bumiputras including Sungai (14.6%). [15] Rungus ethnic people included in this study are the sub-group of Kadazan-Dusun ethnic group. Generally, the facial characteristics are quite distinct and readily distinguishable among the major ethnic groups of Sabah. However, a few studies had attempted to scientifically assess their facial characteristics. In order to establish a general understanding of their beautiful facial patterns, the facial characteristics of three ethnic groups (Rungus, Bajau and Sungai) from eight areas of Sabah were measured and their average facial parameters were determined. The vertical and horizontal facial ratios were compared and the beauties of the three ethnic groups were scientifically assessed by utilizing Farkas facial Cannons. It is expected that the study results would form a basis for future research on beautiful facial patterns of indigenous ethnic groups of Northern Borneo.

2. Materials and Methods

2.1. Subjects and Study Areas

The study was focused on 15 rural areas in 8 selected districts of Northern Sabah (Figure 2), namely Kota Kinabalu, Kota Belud, Sandakan, Kudat, Pitas, Tawau, Semporna and Kuala Penyu. A total of 440 healthy volunteers from three ethnic groups (Rungus, Bajau & Sungai) had been included in this study. The villagers of mixed ethnic origin, with known congenital abnormalities and those presenting with previous history of trauma or surgical intervention on face, head and neck were excluded in this study.

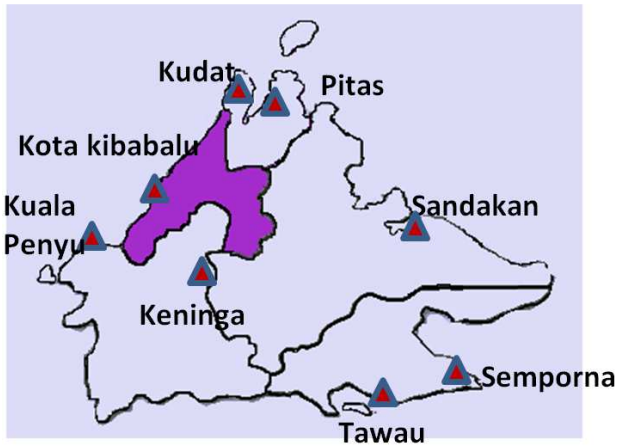


Figure 2. *Eight Selected districts of Sabah.*

2.2. Detailed Methodology

STEP I: Identifying the specific land marks on the face

After obtaining informed consent, each subject underwent questionnaires and craniofacial measurements. For each subject the 13 facial anatomical landmarks (as described in Figure 3 and Table 2) were located by inspection and/or palpation and a pinpoint mark on the skin was made on each landmark using eyeliner. During marking, the subjects sat on a chair in a relaxed condition with their heads in the anatomical position and the mouth closed. The same room and chair were used with consistent lighting throughout the study.

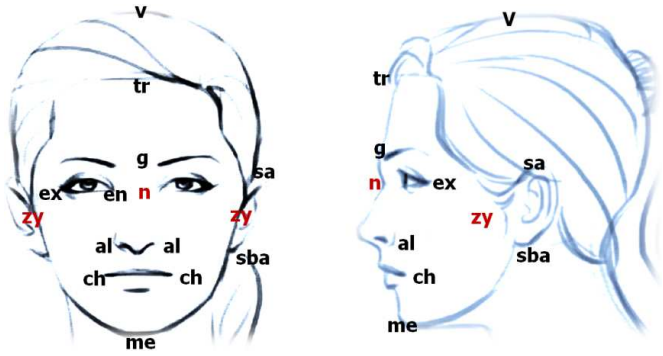


Figure 3. *Anatomical facial landmarks.*

Table 2. *Anatomical facial landmarks.*

No	Landmark	Measurement definition
1	Vertex (v)	The highest point of the head
2	Glabella (g)	The most prominent point in the median sagittal plane between the supraorbital ridges
3	Naison (n)	The point in the middle line located at the nasal root
4	Trichion (tr)	The sagittal midpoint of the forehead that borders the hairline
5	Zygion (zy)	the most lateral point of the cheek
6	Subnasale (sn)	In the midline, the junction between the lower border of the nasal septum and the cutaneous portion of the upper lip
7	Alar (al)	The most lateral point of the alar contour of the nose.
8	Menton (me)	In the midline, the lowest point on the lower border of the chin
9	Cheilion (ch)	The corner of the mouth
10	Entocanthion(en)	The inner corner of the eye fissure where the eyelids meet
11	Exocanthion (ex)	The outer corner of the eye fissure where the eyelids meet
12	Superaurale (sa)	The uppermost point of helix
13	Subaurale (sba)	The lowest point of lobule of the ear

STEP II: Measuring the facial parameters using anatomical facial landmarks

Table 3. *Facial parameters.*

	Facial parameters	Measurement definition
1	v-en (vertex-entocanthion)	Special head height
2	en-me (entocanthion-menton)	Special face height
3	v-tr (vertex-trichion)	Height of calva
4	tr-g (trichion-glabella)	Forehead height I
5	tr-n (trichion-nasion)	Forehead height II
6	n-sn (nasion-subnasale)	Nose length
7	g-sn (glabella-subnasale)	Upper face height
8	sn-me (subnasale-menton)	Lower face height
9	sa-sba (superaurale-subaurale)	Ear length
10	en-en (entocanthion- entocanthion)	Intercanthal width
11	ex-en (exocanthion-entocanthion)	Eye fissure width
12	al-al (alare-alare)	Nose width
13	ch-ch (cheilion-cheilion)	Mouth width
14	zy-zy (zygion-zygion)	Facial width

The 14 facial parameters as described in Table 3 were measured by using sliding calipers, spreading calipers and measuring tape in accordance to the methods well-established by Farkas. [12] The tip of the caliper was placed on one facial landmark and the caliper was steadied. And then the other tip was placed on other facial landmark. Every parameter in millimetres was measured by the same person for two times and recorded. The average of the two measurements was taken for analysis.

STEP III: Developing facial ratios in relation to Farkas facial cannons

A total of 11 facial ratios based upon Farkas *two section, three sections and four section facial profiles* were calculated in order to make the statistical comparisons possible. The detailed description of facial ratios together with the underlying Farkas concept of facial beauty is shown in Table 4.

Table 4. *Facial ratios in relation to Farkas Facial Canons.*

No	Name	Characteristics	Underlying concept
1	Facial Ratio 1	Ratio between two section facial profile v-en / en-me	According to Farkas Cannon 1, special head height (v-en) should be equal to special face height (en-me) in order to label a face as ideal beauty Vertex(v) to endocanthion (en) = endocanthion (en) to menton (me)
2	Facial Ratio 2a	Ratio between three section facial profile tr-n / n-sn	According to Farkas Cannon 2, forehead height II (tr-n) should be equal to nasal length (n-sn). Trichion (tr) to nasion (n) = nasion (n) to subnasale (sn)
3	Facial Ratio 2b	Ratio between three section facial profile sn-me / n-sn	According to Farkas Cannon 2, lower face height (sn-me) should be equal to nasal length (n-sn). nasion (n) to subnasale (sn) = subnasale (sn) to menton (me)
4	Facial Ratio 3a	Ratio between four section facial profile v-tr / g-sn	According to Farkas Canon 3, height of calva (v-tr) should be equal to special upper face height (g-sn). vertex (v) to trichion (tr) = glabella (g) to subnasale (sn)
5	Facial Ratio 3b	Ratio between four section facial profile tr-g / g-sn	According to Farkas Canon 3, forehead height I (tr-g) should be equal to special upper face height (g-sn). trichion (tr) to glabella (g) = glabella (g) to subnasale (sn)
6	Facial Ratio 3c	Ratio between four section facial profile sn-me/g-sn	According to Farkas Canon 3, lower face height (sn-me) should be equal to special upper face height (g-sn). subnasale (sn) to menton (me) = glabella (g) to subnasale (sn)
7	Facial Ratio 4	Ratio between ear length and nose length sa-sba / n-sn	According to Farkas Canon 4, ear length (sa-sba) should be equal to nose length (n-sn). Superaurale (sa) to subaurale (sba) = nasion (n) to subnasale (sn)
8	Facial Ratio 5	Ratio between nose width and intercanthal width al-al / en-en	According to Farkas Canon 5, nose width (al-al) should be equal to intercanthal width (en-en). Alare (al) to alare (al) = entocanthion (en) to entocanthion (en)
9	Facial Ratio 6	Ratio between eye fissure width and intercanthal width ex-en / en-en	According to Farkas Canon 6, eye fissure width (ex-en) should be equal to intercanthal width (en-en). entocanthion(en) to entocanthion(en) = exocanthion(ex) to entocanthion(en)
10	Facial Ratio 7	Ratio between mouth width and nose width ch-ch = 1 ½ al-al	According to Farkas Canon 7, mouth width (ch-ch) should be 1 ½ times of nose width (al-al). cheilion(ch) to cheilion(ch) = 1 ½ alare (al) to alare (al)
11	Facial Ratio 8	Ratio between nose width and facial width zy-zy = 4 al-al	According to Farkas Canon 8, facial width (zy-zy) should be 4 times of nose width (al-al). zygion(zy) to zygion(zy) = 4 alare (al) to alare (al)

STEP IV: Statistical Analysis

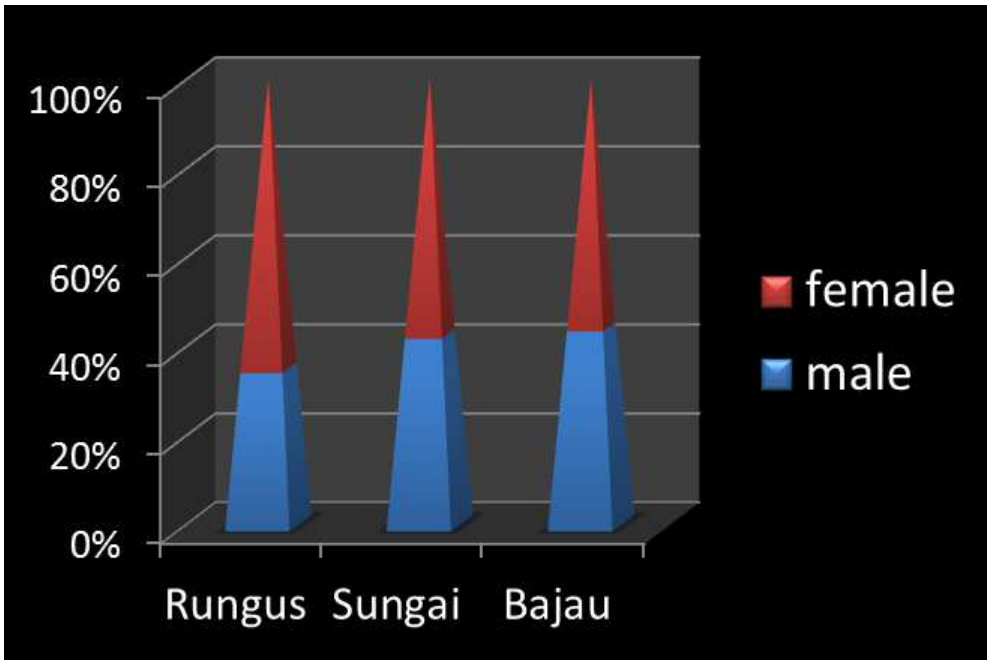
The summary measures of facial parameters were calculated and the facial ratios of three ethnic groups (Rungus, Sungai and Bajau) were compared using SPSS (Statistical Package for Social Sciences) software.

3. Results

3.1. General Characteristics of the Subjects Under Study

In the present study of 440 subjects, 173 were males and

267 were females. 217 (76 males and 141 females) were of Rungus ethnic group, 129 (57 males and 72 females) were Bajau and 94 (40 males and 54 females) were Sungai. Gender distribution among three ethnic groups as shown in the following figure was more or less similar (Chi-Square = 3.371, p < 0.185). The age of the studied subjects ranged from 18 to 76 years and the mean age for male and female was 43.64 and 42.27 years respectively.



(Pearson Chi-Square = 3.371, p < 0.185)

Figure 4. *Gender and ethnicity of people under study.*

3.2. Comparison of Facial Ratios

Table 5. *Vertical Facial Ratios among three Sabah ethnic groups.*

Vertical facial ratios	Gender	Ethnic groups			p value
		Rungus Mean ± SD	Sungai Mean ± SD	Bajau Mean ± SD	
Facial ratio 1 v-en / en-me	Male	1.55 ± 0.20	1.37 ± 0.27	1.22 ± 0.11	S < 0.0001
	Female	1.60 ± 0.17	1.58 ± 0.29	1.32 ± 0.12	S < 0.0001
Facial ratio 2a tr-n / n-sn	Male	1.82 ± 0.32	1.90 ± 0.30	1.94 ± 0.22	S < 0.048
	Female	1.94 ± 0.32	1.89 ± 0.24	2.04 ± 0.22	S < 0.014
Facial ratio 2b sn-me / n-sn	Male	1.44 ± 0.20	1.58 ± 0.74	1.60 ± 0.16	S < 0.042
	Female	1.41 ± 0.20	1.40 ± 0.20	1.54 ± 0.18	S < 0.0001
Facial ratio 3a v-tr / g-sn	Male	1.45 ± 0.24	1.15 ± 0.30	1.13 ± 0.17	S < 0.0001
	Female	1.38 ± 0.22	1.36 ± 0.49	1.15 ± 0.16	S < 0.0001
Facial ratio 3b tr-g / g-sn	Male	0.98 ± 0.15	1.00 ± 0.14	0.96 ± 0.12	<0.310
	Female	1.05 ± 0.17	1.03 ± 0.14	1.04 ± 0.12	<0.661
Facial ratio 3c sn-me / g-sn	Male	0.93 ± 0.12	0.99 ± 0.53	0.95 ± 0.10	<0.465
	Female	0.90 ± 0.11	0.90 ± 0.10	0.94 ± 0.10	<0.076
Facial ratio 4 sa-sba / n-sn	Male	1.41 ± 0.16	1.43 ± 0.21	1.44 ± 0.12	<0.410
	Female	1.45 ± 0.18	1.41 ± 0.20	1.48 ± 0.12	<0.063

p value based on one way ANOVA
[S] Statistically significant difference

When comparing the *vertical facial ratio1* which involves special head height (*v-en*) and special face height *(en-me),* Rungus showed the highest value denoting that special head height (*v-en*) was 1.5 times (among males) and 1.6 times (among females) of special face height *(en-me)*. The Bajau ethnic group showed the lowest ratio and their special head

heights was only 1.2(males) and 1.3(females) times of special face height. The difference between the three ethnic groups was statistically significant ($p < 0.0001$). However all ethnic groups did not follow the Farkas principle of facial beauty based upon *two section facial profile* according to which a beautiful face should possess equal values of "*v-en"* and *"en-me"*. Similar findings were observed in *vertical facial ratio 3a* with highest results among Rungus of either sex showing height of calva *(v-tr)* was about 1.4 times of upper face height *(g-sn)*. The difference between three ethnic groups was also statistically significant. ($p < 0.0001$)

Bajau ethnic groups showed highest values for *vertical facial ratio 2a* and *vertical facial ratio 2b.* Those ratios assessed the fore head height and lower face height in relation to nose length. The nose length was relatively shorter than the forehead height II *(tr-n)* or lower face height *(sn-me)* in all three ethnic groups. Bajau people showed that their forehead height II *(tr-n)* was almost twice of nose length and the lower face height *(sn-me)* was about one and a half times of the nose length. The difference between the ethnic groups was significant (Table 5).

The nose length was used in assessing ear length as in *vertical facial ratio 4*. In all ethnic groups under study, ear length was about 1.4 times of nose length suggesting a pattern of relatively shorter nose among all these people. Comparison between the three ethnic groups showed no significant difference. ($p > 0.05$).

Table 6. *Horizontal Facial Ratios among three Sabah ethnic groups.*

Horizontal facial ratios	Gender	Ethnic groups			P value
		Rungus Mean ± SD	Sungai Mean ± SD	Bajau Mean ± SD	
Facial ratio 5 al-al / en-en	Male	1.30 ± 0.21	1.28 ± 0.16	1.32 ± 0.16	<0.527
	Female	1.24 ± 0.13	1.24 ± 0.18	1.20 ± 0.11	<0.205
Facial ratio 6 ex-en / en-en	Male	0.98 ± 0.16	0.97 ± 0.09	1.01 ± 0.12	<0.297
	Female	1.0 ± 0.27	0.96 ± 0.13	0.97 ± 0.09	<0.284
Facial ratio 7 ch-ch / al-al	Male	1.21 ± 0.10	1.26 ± 0.12	1.23 ± 0.11	<0.059
	Female	1.22 ± 0.12	1.23 ± 0.16	1.26 ± 0.14	<0.149
Facial ratio 8 zy-zy / al-al	Male	3.76 ± 0.39	3.68 ± 0.39	4.19 ± 0.38	S < 0.001
	Female	3.89 ± 0.45	4.0 ± 0.41	4.26 ± 0.42	S < 0.001

p value based on one way ANOVA
[S] Statistically significant difference

The *horizontal facial ratio 5 and 6* estimate the nose width and the width of eye fissure in relation to intercanthal width. The result for *horizontal facial ratio 6* among the three ethnic groups are more or less equal to the value "1" indicating that the intercanthal width is almost equal to the width of eye fissure and the Farkas principle is closely followed. The *horizontal facial ratio 5* indicated that the nose width was about 1.3 times of intercanthal width for all ethnic groups. The mouth width in relation to nose width was also assessed in *horizontal facial ratio 7*. It was found that the mouth width was only about 1.2 times of nose width among all ethnic groups under study. Farkas suggested that it should be about 1.5 times to be classified as beautiful. The nose width was assessed in relation to the face width in *horizontal facial ratio 8*. According to Farkas, a beautiful face presents with a nose occupying only about 25% of the face width. This principle was only followed by Sungai female group with a value of 4 for *horizontal facial ratio 8.* Other ethnic groups gave values greater than or less than 4. Comparison between the three ethnic groups showed significant difference. ($p < 0.001$).

4. Discussions

During renaissance times, scholars and artists like Durer, Alberti, Cousin, Audran, Francesca, Pacioli, and da Vinci had documented and publicized the classical canon of facial proportions even though it was of Greek origin. Leonardo Da Vinci (1452-1519) reported comprehensively on those proportions when presenting his famous human figure in a circle. L. G. Farkas (1985) placed special emphasis on the modern facial soft-tissue anthropometry and neoclassical canons to translate the measurements into beauty. Farkas et al [11] used North American White data as a standard for ideal facial aesthetics.

4.1. Two Section Vertical Facial Canon (*v-en = en-me*)

Farkas proposed that, in order to be the ideal beauty, the special head height (*v-en*) should be equal to special face height *(en-me)*. That principle was not met with in the current study as all Sabah ethnic groups under study showed longer special head height (*v-en*) than the special face height (*en-me*). Two section vertical facial canon was rarely used by other researchers that no valid comparison could be made with other study results.

4.2. Three-section Vertical Facial Canon (*tr-n = n-sn = sn-me*)

According to Farkas, those three sections of face namely forehead height II (*tr-n*), nose length (*n-sn*) and lower face

height (*sn-me*) should be equal for the ideal beauty. In our study, all three ethnic groups do not conform with this Farkas principle. The forehead height II *(tr-n)* was 1.9 to 2 times of nose length *(n-sn)* regardless of gender. The lower face height (*sn-me*) was also 1.4 to 1.5 times of nose length. The comparison among three ethnic groups showed significant difference with Rungus providing highest values for those vertical ratios. This was consistent with the findings by Zacharopoulos et al [9] and Maisa O Al-Sebaei [18] as they reported to find the forehead height II and lower face height are greater than nose length. But for Malaysians, it was reported that 56% of women had nose length greater than the lower face height. [20] When the nose length (*n-sn*) was compared with ear length (sa-*sba*), Farkas stated that those two should be equal for an ideal beauty. The Sabah ethnic groups showed a longer ear of 1.4 times to the nose length. It was in conformity with the findings among the Greek people by Zacharopoulos et al [9] and among young Turkish subjects by Bozkir MG et al. [20] Nearly three fourth of Malaysian women followed this Farkas naso-aural canon. [19]

4.3. Horizontal Facial Canon (*en-en = al-al = ex-en*)

The face width was analysed in terms of intercanthal width, width of the eye fissure and nose width. Farkas categorized a face as an ideal beauty if the above three are equal. Sabah ethnic people in our study showed similar values of intercanthal width and the width of the eye thus following Farkas principle. This is supported by Kusugal et al findings in which 80% of Malaysian women showed eye fissure width equal to intercanthal width. [19] Maisa O Al-Sebaei found that intercanthal width was larger than the eye fissure width among Saudi Arabians. [18] But in Greeks and 50% of Turkish under study, the intercanthal width was smaller than eye fissure width. [9, 20]

Zacharopoulos et al [9], Maisa O Al-Sebaei [18] and Bozkir MG et al [20] stated that majority people regardless of gender possessed a wider nose (*al-al*) than the intercanthal width (*en-en*). Similar results were found in our study showing nose width showing 1.3 times of intercanthal width in all three ethnic groups. According to Kusugal et al, 46.66% of Malaysian women had wider nose width than the intercanthal width while 43% followed this orbito-nasal canon of Farkas. [19] The intercanthal width was measured at the root of the nose and the nose width was measured at the lower end of the nose. The discrepancy between our results and Kusugal et al could be explained by ethnic variability as this study was based on the Malaysian ethnic groups of Sabah Northern Borneo.

The mouth width in relation to nose width was also not following the Farkas principle. The mouth width in our study was only about 1.2 times of nose width although the ideal value should be 1.5. This was similar to the findings of Zacharopoulos et al and Kusugal et al in which 60% of Greek males and 73% of Malaysian women had mouth width smaller than 1.5 times of nose width. [9, 19]

For ideal facial beauty, the face width (*zy-zy*) should be 4 times of nose width *(al-al)*. A beautiful face should have a nose occupying only about 25% of the face width. Only the Sungai females group of our study showed results consistent with this principle. It was highlighted by Zacharopoulos et al that 38.3% of Greek male and 20.5% of Greek female followed this nasofacial canon. [9] The face width of Rungus people were less than 4 times of nose width (the expected beauty values) and Bajau ethnic group showed larger face width (4.1 and 4.3 times of nose width). In actual appearance, the Rungus people possessed a more or less oval face and the rounded face shape represented the Bajau ethnic group.

5. Conclusion

Of all the facial cannons assessed, some validity of horizontal facial cannon was seen in this study. The results from all three ethnic groups showed conformity with the ocular cannon which stated the equality of intercanthal width *(en-en)* and the width of eye fissure *(ex-en)*. The Sungai females under this study follows the principle of Farkas naso-facial cannon as their facial width showed 4 times that of the nose width. The results suggested that the facial proportions of Sungai females conformed to at least two requirements of ideal beauty and would be classified more beautiful than the other two ethnic groups.

The overall results of horizontal facial ratios indicated that the nose width was relatively greater than the intercanthal width and also disproportionately large for the mouth. The vertical facial ratios revealed that the forehead height II *(tr-n)* as well as lower face height *(sn-me)* was longer than the nose length in all three ethnic groups. The comparison between the facial ratios of three ethnic groups was possible as this is the first study to introduce the *horizontal and vertical facial ratios* using the concept of facial cannons. Significant differences among three ethnic groups were observed in *two section and three section vertical facial ratios* and also in one *horizontal facial ratio (for* naso-facial cannon). These findings supported the applicability of horizontal and vertical facial ratios in assessing the facial beauty of human beings.

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Annex 1

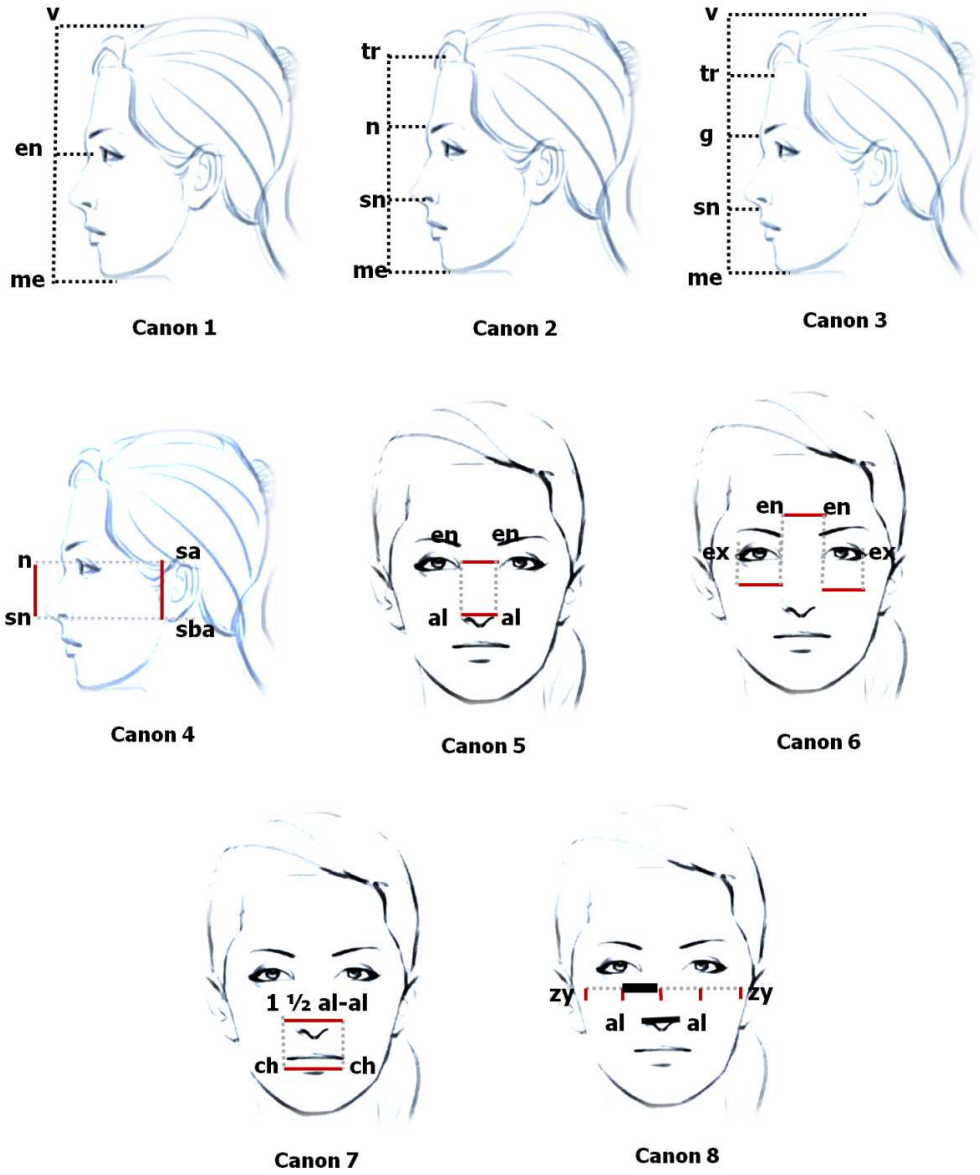

Figure A1. *Farkas' Neoclassical canons.*

References

[1] M. Bashour. History and current concepts in the analysis of facial attractiveness. Plastic and Reconstructive Surgery, 2006; 118 (3): 741–756.

[2] C. Borelli and M. Berneburg, Beauty lies in the eye of the beholder? "Aspects of beauty and attractiveness," Journal of the German Society of Dermatology, 2010; 8 (5): 326–331.

[3] R. Edler, P. Agarwal, D. Wertheim, and D. Greenhill, "The use of anthropometric proportion indices in the measurement of facial attractiveness," European Journal of Orthodontics, 2006; 28 (3): 274–281.

[4] M. Bashour. "History and current concepts in the analysis of facial attractiveness," *Plastic and Reconstructive Surgery*, 2006; 118 (3): 741–756.

[5] Pancherz H, Knapp V, Erbe C, Heiss AM. Divine proportions in attractive and non-attractive faces. World Journal of Orthodontics, 2010; 11 (1): 27–36.

[6] O. F. Husein, A. Sepehr, R. Garg, M Sina-Khadiv, S Gattu, J Waltzman, Edward C. Wu, M Shieh, Gregory M. Heitmann, S E. Galle. Anthropometric and aesthetic analysis of the Indian American woman's face. Journal of Plastic, Reconstructive and Aesthetic Surgery, 2010; 63 (11): 1825–1831.

[7] Jefferson Y. Facial beauty: Establishing a universal standard. International Journal of Orthodontics, 2004; 15 (1): 9–22.

[8] Deutsch CK, Farkas LG. Quantitative methods of dysmorphology diagnosis. In: Farkas LG, ed. Anthropometry of the Head and Face. New York: Raven Press; 1994; 151–158.

[9] Georgios Vasileiou Zacharopoulos, Andreas Manios, Eelco De Bree, Chung How Kau, Markos Petousis, BE, Ioanna Zacharopoulou and Nikolaos Kouremenos. Neoclassical Facial Canons in Young Adults. The Journal of Craniofacial Surgery, 2012; 23 (6): 1693- 1698.

[10] Le TT, Farkas LG, Ngim RC, Levin LS, Forrest CR. Proportionality in Asian and North American Caucasian faces using neoclassical facial canons as criteria. Aesthetic Plastic Surgery, 2002; 26: 64–69.

[11] Farkas LG, Hreczko TA, Kolar JC and Munro IR. Vertical and horizontal proportions of the face in young adult North American Caucasians: revision of neoclassical canons. Plastic Reconstructive Surgery, 1985; 75: 328–338.

[12] Leslie G Farkas. Anthropometry of the Head and Face. New York, NY: Raven Press; 1994: 241-335, 347-352.

[13] Leslie G Farkas: Anthropometry of the Head and Face in Medicine. New York, Elsevier, 1981.

[14] Farkas LG and Munro J R: Anthropometric Facial Proportions in Medicine. Springfield, Charles C. Thomas, 1987.

[15] Sabah Tourist Association, People and Culture, 2015. http://www.sta.my/people_culture.cfm

[16] Johan P. Reyneke, Carlo Ferretti. Clinical assessment of the face, Seminars in Orthodontics, 2012; 18 (3) (September): 172-186.

[17] Farkas LG, Katic MJ, Forrest CR. Comparison of craniofacial measurements of young adult African-American and North American white males and females. Annals of Plastic Surgery, 2007; 59 (6): 692–698.

[18] Maisa O Al-Sebaei. The validity of three neo-classical facial canons in young adults originating from the Arabian Peninsula. Al-Sebaei Head & Face Medicine, 2015; 11 (4):

[19] Kusugal P, Ruttonji Z, Gowda R, Rajpurohit L, Lad P, and Ritu. Three-dimensional facial analyses of Indian and Malaysian women. Contemp Clin Dent, 2015; 6(3): 332–336.

[20] Bozkir MG, Karakas P, Oguz O. Vertical and horizontal neoclassical facial canons in Turkish young adults. Surgical and Radiologic Anatomy, 2004; 26 (3): 212-219.