ASSESSMENT OF PROSOPIC PHENOTYPES IN PURANA (OLD) INHABITANTS AT SIGIRIYA SUBURBS, SRI LANKA

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Abstract - The face is the part of the front of the head between the ears and from the chin to the hairline. Prosopic index is the length of the face from the root of the nose to the bottom of the chin, expressed as percentage of the greatest breadth across the cheek bones. The present study was designed to assess the face anthropometry of Purana (old) inhabitants at Sigiriya Suburbs, Sri Lanka, whose ancestry goes back to the times of the Sinhalese Kings of the 5th century A.D. (1,450 YBP). Prior written informed consent was obtained from the subjects. The facial length, breadth were measured by following the standard procedures and prosopic index was calculated. From the study it was calculated that mean facial length was 12.56cm in male and 12.00cm in female. Facial breadth was 12.00cm in male and 10.99cm in female. The prosopic index (mean) was 92.01 in male and 89.99 in female. The dominant type of face shape in male was leptoprosopic (30.09%) followed by mesoprosopic (23.80%), hyperleptoprosopic(21.90%). In females dominant type of face was leptoprosopic (34.43%) followed by hyperleptoprosopic (23.46%), mesoprosopic (22.16%) Considering male and female as a single population group (common adult) irrespective of gender, the common prosopic phenotype of the Purana population was leptoprosopic (37.66%). The date of the study will be useful to anthropologists, plastic surgeons, anatomists and forensic experts.

Keywords - Anthropometry, Prosopic Phenotypes, Purana Inhabitants.

I. INTRODUCTION

Anthropometry is derived from the Greek words "anthrop" meaning human and "metron" meaning measure[3]. Anthropometry is the study of the measurements of the human body in terms of dimensions of the bone, muscles and adipose tissues[9,24]. The field of anthropometry is composed of variety of human body measurements. Head measurements, facial measurements, weight, stature, circumferences (head, limb, waist, hip etc) limb lengths and breadths (shoulder, thorax etc) are some of the examples for the anthropometric measures[14].Several indices and ratios have been derived from the anthropometric measurements. The cranial index, nasal index, facial index, body mass index, waist/hip, waist/height are some of the anthropometric indices and ratios commonly used in the field[10,14]. Anthropometric data are used in determining the variations of populations, identification of diseased individual in forensic medicine, assessments of nutritional status, evaluation of health and dietary status, disease risk and the body composition changes that occur over the adult life span etc[14, 24].

The face is the part of the front of the head between the ears and from the chin to the hairline. It includes the forehead, eyes, nose, mouth and chin. The shape of the face of human populations was reported to be different among different races and ethnic groups[8,25,18]. World populations have been grouped as Hypereuriprosopic (< 79.9 %), Euriprosopic (80 – 84.9 %), Mesoprosopic (85 – 89.9 %), Leptoprosopic (90 – 94.9 %) and Hyperleptoprosopic (>95 %) according to the percentage values of facial breadths and lengths (Williams et al., 1995). Anthropometrics of face is also useful in peadiatrics, forensic medicine, plastic surgery, diagnostic comprehension between patient and normal individuals,[24].

Sigiriya is situated in the central Sri Lanka in the intermediate climatic zone in Matale district. This region is known to have been occupied by Homo sapiens as far back as Mesolithic period of Sri Lanka[1].Presently, Purana population whose ancestry runs back to the times of the Sinhalese Kings of the 5th century A.D. (1,450 YBP) is mostly genetically and biologically isolated from the rest of the modern Sinhalese population living in the surroundings[2].Today, they face an imminent threat of extinction because of isolation and breeding, thus a detailed study of physical anthropology and genetics of the Purana population living at Sigiriya is a timely need.

In view of differences observed in other studies based on racial and ethnic differences, this study was designed to determine the types of prosopic (face) phenotypes in adult males and females of Purana population at Sigiriya suburbs.

II. MATERIALS AND METHODS

The Purana villages: Talkote, Pidurangala, Diyakepilla and Nagalaweva at Sigiriya suburbs (Figure 1) were selected as study sites. One hundred and seven male and 206 female adult Purana inhabitants living in four Purana villages and who gave informed written consent were included in this study and subjects showing any craniofacial injury or

deformity were excluded from the study. The age of the subjects ranged from 20 – 37 years.

The individual selection was based on the Purana pedigree recorded in the survey conducted at Purana villages in Sigiriya suburbs in 1981[2]. The survey launched in 1981 on population density, clans and castes of Purana villages of Sigiriya suburbs revealed that Talkote, Pidurangala, and Diyakepilla Purana population represented their surnames such as Gamagedara, Aluthgedara, Undiyagedara, Beddegedara and Nagalaweva population was represented their surnames such as Millagahagedara, Kongahagedara and Aluthgedara[2]. These surnames belonging to population at the Sigiriya suburbs were identified as Purana surnames. The selected Purana pedigrees such as Gamagedara, Aluthgedara, Undiyagedara, Liyanagedara, Beddedara represented in the Purana population at Talkote, Pidurangala and Diyakepilla were traced back at least three generations. Millagahagedara, Kongahagedara and Aluthgedara in Nagalaweva were too traced back for three generations.

2.1. Anthropometric Measurements

The measurement of facial height (facial length) was taken from the nasion at the root of the nose to the lowest point of the chin in the mid line by using spreading caliper (Fig. 2).

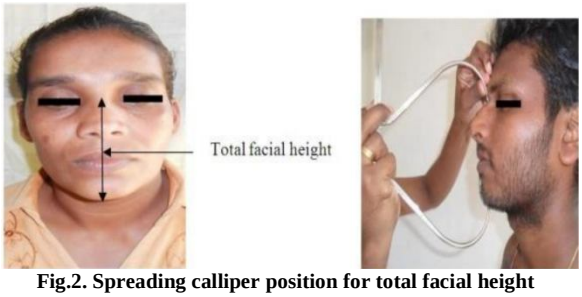


Fig.2. Spreading calliper position for total facial height

The distance between the most lateral points on the zygomatic arches in the plane at right angle to the sagittal plane was measured as facial breadth by using spreading caliper (Fig. 3).

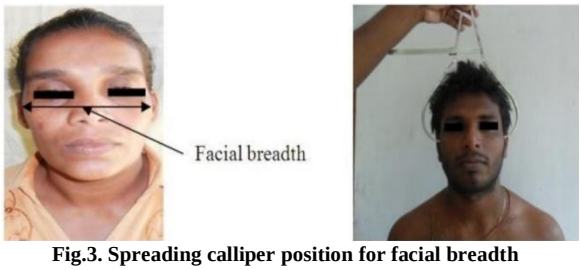


Fig.3. Spreading calliper position for facial breadth

The prosopic index of each individual was calculated by using measured facial length and facial breadth of the individual adopting the equation mentioned in Williams et al (1995)[24].

$$\text{Prosopic Index} = \frac{\text{Facial breadth}}{\text{Facial length}} \times 100$$

The prosopic phenotype of each individual was identified as hypereuriprosopic (<79.9), euriprosopic (80 -84.9), mesoprosopic (85- 89.9), leptoprosopic (90 -94.5) and hyeperleptoprosopic (>95) according to percentage value of prosopic index[24].

All the measurements were carried out after careful palpation of the face for anatomical landmarks and measurements were taken to the nearest 1mm. The above measurements were recorded at a fixed time between 9:00 – 12:00 hours to eliminate discrepancies due to diurnal variation. All the measurements were repeated thrice and the mean was taken for further analysis. Furthermore, the measurements were recorded by the same person to minimize the errors in methodology.

The measured and calculated quantitative anthropometrical parameters taken from male and female adult Purana populations were statistically analyzed separately by applying Turkey's pair wise tests after one-way ANOVA (Minitab version 15) to determine the mean ±SD, range in parenthesis and the significant differences among gender. P value of < 0.05 was considered statistically significant. The mean facial index of Purana population irrespective of the gender was calculated by using same statistical package.

The facial phenotype of the each individual was categorized as hypereuriprosopic (<79.9), euriprosopic (80 - 84.9), mesoprosopic (85 - 89.9), leptoprosopic (90 - 94.5) and hyeperleptoprosopic (>95) according to percentage value of prosopic index[24].

III. RESULTS AND ANALYSIS

The mean facial length was 12.56cm in male and 12.00cm in female. Facial breadth was 12.00cm in male and 10.99cm in female. The mean facial length, facial breadth were found to be significantly larger in males compared to females (P<0.05). The mean prosopic index of male and female Purana population was (92.01 ± 5.10) and (89.99 ± 6.20) respectively. The mean prosopic index of male was significantly higher than the female (P<0.05) (Table 1 and 2). The mean prosopic index of Purana population was 90.6 ±6.411irrespective of the gender. Facial phenotyping according to the prosopic index showed that the large majority of the study male subjects belong to leptoprosopic (30.09%) category followed by mesoprosopic (23.80%), hyperleptoprosopic (21.90%) and female of the Purana population belong to leptoprosopic (34.43%) category followed by hyperleptoprosopic (23.46%), mesoprosopic (22.16%). Considering male and female as a single population group (common adult) irrespective of gender, the common prosopic phenotype of the Purana population was

leptoprosopic (37.66%) (Table 3). The rare type of prosopic phenotype was Hypereuriprosopic (6.88%).

Table 1. Facial measurements and cephalic indices of the Purana male population (n=107)

	Mean	S. D	P Value	Range Minimum	Maximum
Facial length	12.56	0.93	0.000	10.40	16.00
Facial breadth	12.00	0.64	0.000	10.00	14.00
Prosopic Index	92.01	5.10	0.004	71.87	99.18

Table 2. Facial measurements and cephalic indices of the Purana female population (n=206)

	Mean	S. D	P value	Range Minimum	Maximum
Facial length	12.00	0.64	0.000	10.00	14.00
Facial breadth	10.99	0.77	0.000	8.50	12.80
Prosopic Index	89.99	6.20	0.004	68.00	100.00

Table 3. Frequency of facial phenotypes among the Purana population (n=213)

Prosopic phenotypes	Male	Female	Common adult group
Hypereuriprosopic (<79.9)	6.66%	6.89%	6.88%
Euriprosopic (80 - 84.9)	9.52%	9.85%	9.74%
Mesoprosopic (85-89.9)	23.80%	22.16%	22.72%
Leptoprosopic (90 - 94.5)	30.09%	34.43%	37.66%
Hyeperleptoprosopic (>95)	21.90%	23.46%	23.05%

IV. DISCUSSION

The facial framework is expressed as the facial index, which is the ratio of facial length and facial width[24]. Variations offacial phenotypes among human species have been reported[5,6,16,17,11,15,22,19].

Present study revealed that mean prosopic index of Purana males was 92.01. Prosopic index of Onges of Andaman and Nicobar Island (75.25)[17], Indian population (86.34)[23], Albanian Kosova population (90.38)[20], Malaysian population (85.72)[22], Andra region students in India (89.50)[21], Haryanvi Banias (86.09)[13], Northeast Irann's Fars (71.9) and Turkman (78.15)[11]is lower than that of Purana male population.

The mean prosopic index of Purana females was 89.99 which was higher than that of Indian females (86.75), Malaysian females (87.71)[22], Andra females in India (86.72)[21] and Haryanvi females in India (84.84)[13]. Prosopic index of Albanian Kosova female (90.27)[20] was higher than that of females in Purana population in Sri Lanka.

Many researchers have worked on various ethnic groups to find prosopic indices and to know different face types found in referred community irrespective of gender. Coon in 1939 reported that the prosopic index of middle Europe (86 – 90), North Europe (>90), Meditarian Africa (89.2), India (86 – 90), Turkey (86.5), Arabia (85.1) and Middle East (88.9) which were different from the studied prosopic index(90.6 ± 6.411) of Purana population at Sigiriya suburbs in Sri Lanka[5]. Joseph in 1996 reported that the average prosopic index of Eskimos (73.4), Negros (68.5), Breton Gallots (68.5), Auvergnats (67.5), New Caledonians (66.2), Persians (65.9), Australians (65.6), Tasmanians (62.0)which were also different from the Purana population at Sigiriya suburbs (91)7.

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The mean prosopic index of Purana population (90.6 ± 6.411) was different from reported mean prosopic indices of Indians (North Indians – 82.33, West Indians – 84.52, East Indians – 86.27, Central Indians – 87.45, and South Indians – 86.61)[4]. This confirmed that there is variation in facial index across the populations.

The dominant type of facial phenotype (long face) of the Purana population (30.09% in males, 34.43%in females) was leptoprosopic type. Similar finding were observed in Males in Kosova (31.2%) and Sidhi community in Rajasthan (46%)[20,12]. This differs from the mesoprosopic facial phenotype found in Haryanvi male (49.66%) and female (35%)[13], euriprosopicfacial phenotype in Malaysian male and mesoprosopicfacial phenotype found in Malaysian female and Indian male and females[22].

Prosopic indices or facial phenotypes of other Sri Lankan males such as Sinhalese, Tamils and Muslims have not been reported. Therefore it was not possible to find out similarities or differences among present day communities and studied Purana population in Sri Lanka.

Comparing previous records of facial phenotype of different races with present results indicates that Purana population living in Sigiriya suburbs is different from most of other races in the world. The Purana populations in Sigiriya represented by having Purana surnames such as Aluthgedara, Gamagedara, Undiyagedara, Beddegedara, Millagahagedara, Kongahagedara etc, maintain their caste system by strictly practicing their marriages among themselves. They are considered as isolated breeding units with extended family endogamy[2]. This might be the reason for Purana population having different facial phenotypes than that of others.

Studying maternally inherited mitochondrial DNAandY chromosomescanreveal underlying genetic affinities among populations moreeffectively than the morphological and morphomertical assessments. Further study of genetics of Purana population is needed to be employed to determine the genetic distances between different populations and phylogenetic assessments.

CONCLUSIONS

From the study we can conclude that the mean facial index of Purana population has been identified as 90.6 ± 6.41. The mean prosopic index of male and female Purana population was (92.01 ± 5.10) and (89.99 ± 6.20) respectively.There is a significant difference present in prosopic index between the males and females (P<0.05).The predominant face phenotype for Purana population is leptoprosopic (30.09% for males and 34.43%for females).

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