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# Facial Dimensions and Facial Index in Relation to *Dehaprakriti* and Geographical Regions among Ayurveda Students of Gujarat

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## ABSTRACT

**BACKGROUND:** *Prakriti* represents the Ayurvedic concept of an individual's innate psychosomatic constitution and is believed to influence phenotypic traits, including facial morphology. The Facial Index (FI), an established craniofacial anthropometric parameter, offers an objective approach to evaluate facial phenotypes; however, its relationship with *Prakriti* remains inadequately explored.

**OBJECTIVE:** To evaluate variations in the Facial Index among studying Ayurveda students with different *Prakriti* coming from different geographical regions of Gujarat.

**METHODS:** A cross-sectional observational study was conducted among studying Ayurveda students of GJPIASR, The CVM University, Anand, Gujarat. *Prakriti* was assessed digitally using the AyuPraSara Android application. Morphological facial anthropometric height and bizygomatic width were measured to calculate the Facial Index. Participants with different face types were categorized as per *Prakriti* and geographical locations of Gujarat. Comparative analyses (ANOVA and Chi-Square) were performed to evaluate variations across constitutional types and geographical regions.

**RESULTS:** Hyperleptoprosopic was the predominant facial type across the study population. FI distribution showed no distinct constitutional pattern among different *Prakriti* groups ANOVA,  $p > 0.05$  and Chi-square statistics  $\chi^2 = 10.797$ , p-value 0.213. Whereas significant and notable regional variations in facial morphology with Chi-square statistics  $\chi^2 = 62.186$ , p-value  $< 0.001$ , were observed among participants from different geographical regions of Gujarat. These findings indicate that epigenetic modification and ethno-anthropometric diversity contribute more substantially to facial morphology than constitutional type alone.

**CONCLUSION:** Facial morphology appears to be influenced by multiple interacting constitutional, developmental, genetic, and environmental factors. Although *Prakriti* alone was not associated with distinct FI patterns, geographical variation demonstrated measurable effects on facial morphology.

**Key Words** *Prakriti*; Facial Index; Facial Phenotype; Craniofacial Anthropometry; Gujarat

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## INTRODUCTION

*Prakriti*, the unique concept of psychosomatic constitution in Ayurveda, underpins personalized

healthcare and represents an individual's morphological, physiological traits, disease susceptibility, and therapeutic response.

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Fundamentally determined by the predominance of *Doshas* since conception and remains relatively stable throughout life<sup>1</sup>. Anthropometry – *Pramana* is the scientific measurement of body dimensions and proportions. Ayurveda advocates relative anthropometrics (*Praman Pariksha*) using *Swa-Anguli* to measure various dimensions such as *Ayama* (Height/Length/Stature), *Vistara* (Breadth/Width), *Parinaha* (Circumference), and *Utsedha* (Projection/Depth/Thickness) of different bodily organs and structures<sup>2</sup>. Acharya Sushrut quotes 12 *Angula* as the dimension of *Mukhaayama*<sup>3</sup>.

The facial phenotypic traits vary with different ethnic groups, body form, and proportions<sup>4</sup>. The shape of the face even depends on factors like gender, socio-economic status, nutritional and genetic factors, and climate<sup>5</sup>. Among the various craniofacial parameters, the Facial Index (FI), derived through facial height (FH) and facial width (FW), is widely used to classify facial morphology. The Facial Index is calculated as:  $FI = \frac{\text{Morphological Facial Height}}{\text{Bizygomatic Width}} \times 100$ . Based on FI values, faces may be classified as Hyper-Euryprosopic, Euryprosopic, Mesoprosopic, Leptoprosopic, and Hyper-Leptoprosopic (Martin & Saller, 1957)<sup>6</sup>.

Since facial morphology is influenced by genetic, developmental, environmental, and constitutional factors, the Facial Index may serve as a measurable biomarker reflecting the phenotypic expression of Ayurvedic *Prakriti*. However, scientific evidence to support this relationship between FI and *Prakriti* remains limited.

*Prakriti* (Phenotypic traits) in Ayurveda suggests well-developed, broad structures by dominant *Kapha*, moderate anthropometric dimensions by *Pitta*, and thin, elongated, and narrower features by *Vata Dosha*.

Therefore, the current study was undertaken in students of Ayurveda to evaluate facial index variations among different *Prakriti* types.

## AIMS AND OBJECTIVES

To assess the association of facial index with *Prakriti* and geographical regions among Ayurveda students of Gujarat.

## MATERIALS AND METHODS

### Study Design

Observational cross-sectional analytical study

### Study Site

Govindbhai Jorabhai Patel Institute of Ayurvedic Studies & Research (GJPIASR), The Charutar Vidya Mandal (CVM) University, Anand, Gujarat, India.

### Sample size and Study Population

360 UG Ayurveda students aged 18 – 20 years were included in the current study.

### Group Distribution

*Dosha* dominant *Prakriti* – Three

Geographical regions of Gujarat – Five

### Methods

#### *Prakriti* Assessment

Self-evaluation of *Prakriti* was done digitally using an Android app, AyuPraSara<sup>7</sup>.

#### Facial Anthropometric Measurements<sup>8</sup>

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Facial dimensions were recorded by the scholars using a standard vernier calliper in an upright seated position, in a well-lit room, with the head in Frankfurt plane.

The methodology for the facial measurements was adopted from the NHANES Anthropometric Protocols and the Sushruta Samhita. The facial dimensions were recorded only after confirming the exact location of a phenotypic facial trait as per Sushruta's *Anguli Praman* and mapping it to the modern anthropometric equivalent. The variables recorded were age, sex, locality, facial height, and facial width.

**Facial Height (FH) in cm:** Distance from the Nasion (n) (the point in the nose crossed by the mid-sagittal plane and naso-frontal sutures) to the Gnathion (gn) (the lowest point of the mandible where the mid-sagittal plane intersects the lower margin of the lower jaw).

**Facial Bizygomatic Width (FW) in cm:** Distance between the right and left Zygion (the lateral-most point on each zygomatic arch).

**Facial Index:** Facial index (FI) was then calculated by using the formula ( $FI = (FW/FH) \times 100$ ). The obtained values were then categorized into five different face types using Banister's classification as shown in Table No. 1.

### Inclusion criteria:

- Participants who had no craniofacial asymmetry
- Participants who had no history of major orthodontic reconstructive surgery

- Participants who had no history of accidents involving facial bone fractures
- Participants aged 18 years and above, who consented and were devoid of any major systemic illness.

**Table 1** Table showing Banister Classification of Facial Index of Facial Types

| Sr. No | Facial Types        | Face Shape        | Facial Index |
|--------|---------------------|-------------------|--------------|
| 1      | Hyper-Euryprosopic  | Very Broad Face   | < 79.9       |
| 2      | Euryprosopic        | Broad Face        | 80 – 84.9    |
| 3      | Mesoprosopic        | Medium Round Face | 85 – 89.9    |
| 4      | Leptoprosopic       | Long Face         | 90 – 94.9    |
| 5      | Hyper-Leptoprosopic | Very Long Face    | > 95         |

### Exclusion criteria:

- Craniofacial asymmetry, facial trauma, and fracture
- Participants who had undergone orthodontic reconstructive surgery
- Participants below 18 years, with any major systemic illness, and who did not consent.

The collected data were later summarized, analysed, and presented using descriptive statistics, Anova, and Chi-Square test.

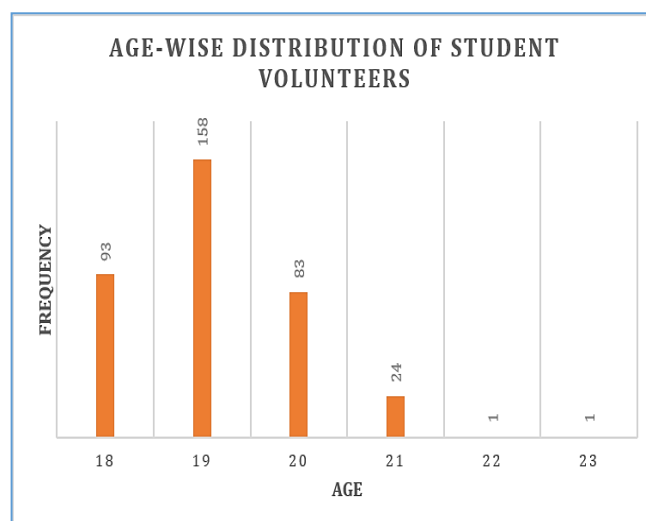


**Figure 1** Bar diagram showing the age-wise distribution of the data

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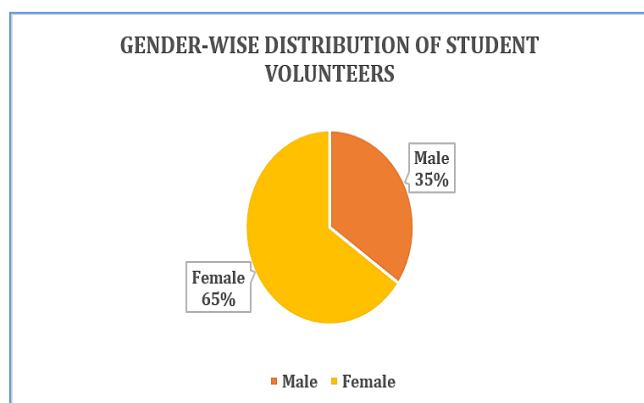


**Figure 2** Pie chart showing Gender-wise representation of data

## OBSERVATIONS AND RESULTS

### Age-wise distribution:

The age distribution as shown in Fig.1 demonstrates that the sample predominantly comprised late-adolescent and early-adult individuals, with the majority belonging to the 19-year age group (43.89%), followed by 18 years (25.83%) and 20 years (23.06%), thereby providing a relatively homogeneous age profile.

### Gender-wise distribution:

The sample exhibited female predominance (235, 65.28%), whereas male volunteers accounted for (125, 34.72%) of the study population, as represented in Fig.2.

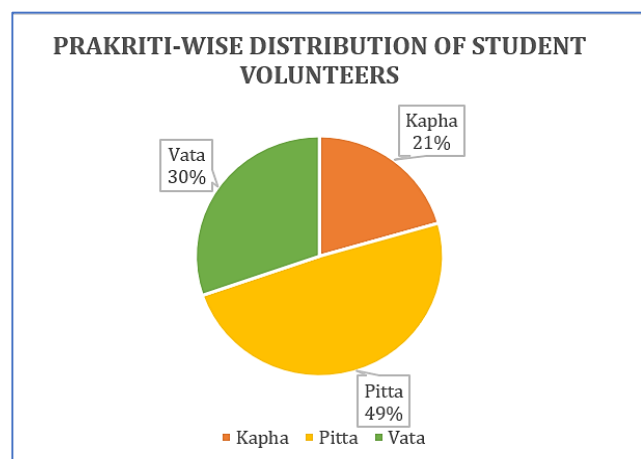


**Figure 3** Pie chart representing *Prakriti*-wise distribution of data

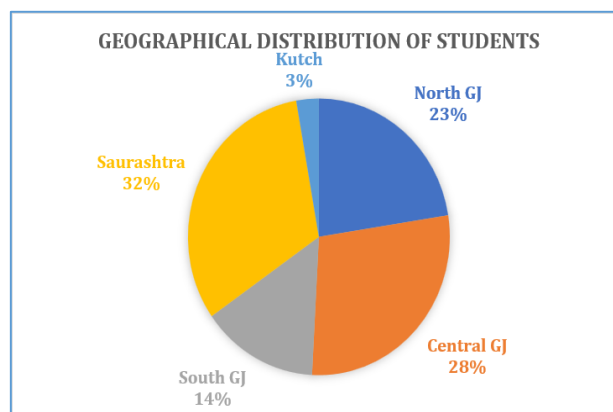


**Figure 4** Pie chart showing geographical distribution of student volunteers

### *Prakriti*-wise distribution:

The constitutional assessment, as shown in Fig. 3, revealed that *Pitta Prakriti* was the most prevalent, 177 (49.17%), followed by *Vata Prakriti*, 109 (30.28%), whereas *Kapha Prakriti* constituted 74 (20.56%) of the study population.

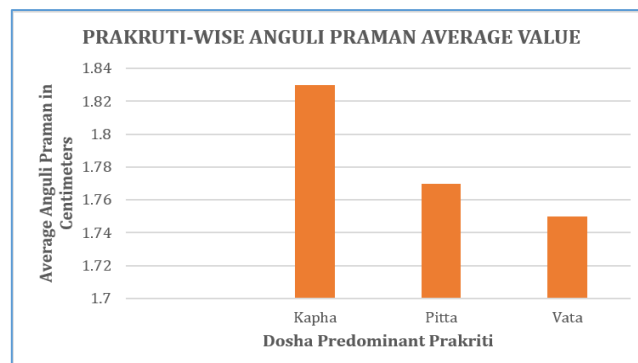


**Figure 5** Bar diagram showing average Swa-Anguli Praman across different *Prakriti* individuals

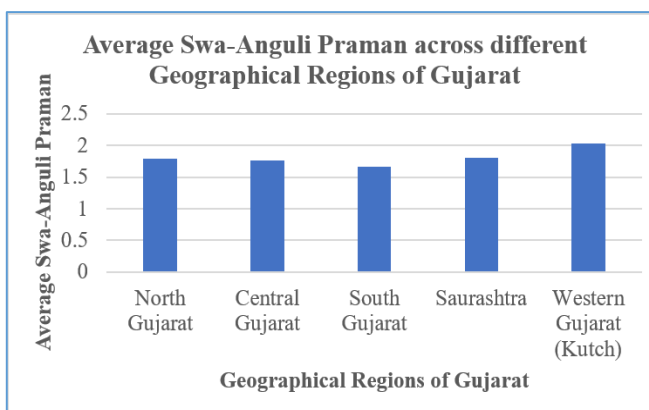


**Figure 6** Bar diagram showing average Swa-Anguli Praman in individuals across different geographical regions of Gujarat

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### Geographical region-wise distribution:

The study population comprised participants from all major geographical divisions of Gujarat, demonstrating broad regional representation, as shown in Table No. 2 and Fig. 4. Saurashtra contributed the highest proportion of participants (32%), followed by Central Gujarat (28%), North Gujarat (23%), South Gujarat (14%), and Kutch (3%). This diverse inclusion across geographical regions of Gujarat minimizes the likelihood of region-specific sampling bias.

### Prakriti and Anguli Praman:

The gradual increase in the average value of *Anguli Praman* from *Vata* (1.75) to *Pitta* (1.77) to *Kapha* (1.83), as shown in Fig. 5, indicates a subtle constitutional tendency toward relatively greater body dimensions among *Kapha* individuals, consistent with the anthropometric characteristics expected in different constitutional phenotypes.

### Swa-Anguli Praman across Geographical regions of Gujarat:

The descriptive analysis of *Swa-Anguli Praman* shown in Fig. 6 demonstrated minimal regional

variation in the observed values. The highest mean was recorded in Kutch (2.03), followed by Saurashtra (1.81), North Gujarat (1.79), Central Gujarat (1.77), and South Gujarat (1.67). Overall, the findings suggest that *Swa-Anguli Praman* remains fairly consistent across different geographical regions of Gujarat.

### Prakriti-wise Facial dimensions:

*Kapha Prakriti* individuals exhibited the highest average of facial length (14.99 cm) and facial width (13.18 cm), whereas *Vata Prakriti* individuals showed the highest average facial index (114.87), as shown in Table No. 3. Considering the individual variability, with subtle differences in mean values, suggests constitution-specific trends in craniofacial morphology, supporting further inferential statistical analysis.

**Table 2** Geographical distribution of the student volunteers

| Division of GJ       | Frequency | Percentage |
|----------------------|-----------|------------|
| North Gujarat        | 81        | 23         |
| Central Gujarat      | 102       | 28         |
| South Gujarat        | 52        | 14         |
| Saurashtra           | 115       | 32         |
| West Gujarat (Kutch) | 10        | 3          |
| Total                | 360       | 100        |

**Table 3** Descriptive statistics of facial dimensions as per different *Prakriti*

| S. N | Prakriti | Facial Length |      |       | Facial Width |      |       | Facial Index |        |        |
|------|----------|---------------|------|-------|--------------|------|-------|--------------|--------|--------|
|      |          | Min.          | Max. | Ave.  | Min.         | Max. | Ave.  | Min.         | Max.   | Ave.   |
| 1    | Vata     | 10            | 21   | 14.54 | 8            | 16   | 12.74 | 72.37        | 170.83 | 114.87 |
| 2    | Pitta    | 10            | 21   | 14.81 | 7.9          | 20.5 | 13.14 | 55           | 168.18 | 113.36 |
| 3    | Kapha    | 8.5           | 20.5 | 14.99 | 8.4          | 20   | 13.18 | 59.44        | 184.52 | 114.62 |

### Facial dimensions across different geographical regions of Gujarat:

The comparison of facial dimensions across the five geographical regions of Gujarat demonstrated only minor regional variations, as shown in Table

No. 4. North Gujarat exhibited the highest average facial length (15.11 cm), while Western Gujarat (Kutch) showed the lowest average facial length (13.69 cm). Regarding facial width, North Gujarat again recorded the highest mean value (13.25 cm),

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whereas Kutch demonstrated the lowest mean facial width (12.40 cm).

The calculated facial index revealed relatively comparable mean values across all geographical regions, ranging from the lowest 111.82 in Kutch to the highest 115.38 in Central Gujarat. Considerable individual variability was evident from the wide minimum and maximum facial index values within each region, with the overall range extending from 55.00 in Saurashtra to 184.52 in Central Gujarat.

These observations suggest a relatively homogeneous craniofacial morphology across the state's diverse geographical populations, with variations occurring primarily at the individual rather than regional level.

### **Prakriti-wise different Face types and Facial index:**

The Hyperleptoprosopic face type, which accounted for 275 (76.39%) individuals of the

entire study population, was the most common facial phenotype across all three *Prakriti* groups, according to the distribution of facial index categories as shown in Table No.5, Fig. 7.

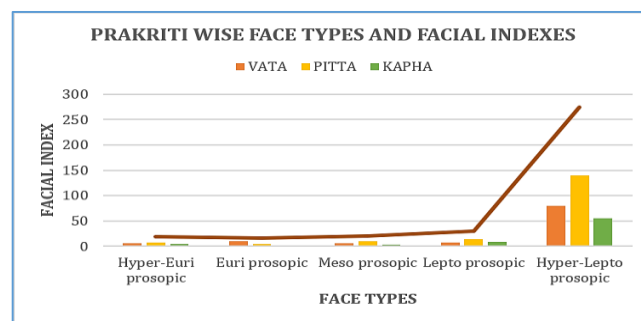


**Figure 7** Bar diagram with trend line showing *Prakriti*-wise face types and Facial Indices

Hyper-Euryprosopic, Euryprosopic, Mesoprosopic, and Leptoprosopic facial forms were found in relatively fewer people. The minimal proportional variation among the remaining facial categories indicates the existence of constitution-related differences in facial morphology, inviting more statistical analysis.

**Table 4** Descriptive statistics of Facial dimensions across different Geographical regions of Gujarat

| Geographical Regions of Gujarat | Facial Length |      |       | Facial Width |      |       | Facial Index |        |        |
|---------------------------------|---------------|------|-------|--------------|------|-------|--------------|--------|--------|
|                                 | Min           | Max  | Ave   | Min          | Max  | Ave   | Min          | Max    | Ave    |
| North Gujarat                   | 8.5           | 20   | 15.11 | 7.9          | 16.5 | 13.25 | 59.441       | 166.67 | 114.37 |
| Central Gujarat                 | 10            | 21   | 14.62 | 8.4          | 20   | 12.76 | 71.724       | 184.52 | 115.38 |
| South Gujarat                   | 10            | 21   | 14.94 | 8            | 17   | 13.08 | 74.265       | 170.83 | 114.02 |
| Saurashtra                      | 10.5          | 21   | 14.76 | 9            | 20.5 | 13.15 | 55           | 160    | 112.95 |
| West Gujarat (Kutch)            | 10.3          | 19.5 | 13.69 | 10.3         | 14   | 12.4  | 79.845       | 156    | 111.82 |

**Table 5** *Prakriti*-wise Face types and Facial Indexes

| Face Type & Facial Index<br><i>Prakriti</i> | Hyper-Euri prosopic (<79.9) | Euri prosopic (80 - 84.9) | Meso prosopic (85 - 89.9) | Lepto prosopic (90 - 94.9) | Hyper-Lepto prosopic (>95) | TOTAL |
|---------------------------------------------|-----------------------------|---------------------------|---------------------------|----------------------------|----------------------------|-------|
| VATA                                        | 6                           | 10                        | 6                         | 7                          | 80                         | 109   |
| PITTA                                       | 8                           | 5                         | 10                        | 14                         | 140                        | 177   |
| KAPHA                                       | 5                           | 1                         | 4                         | 9                          | 55                         | 74    |
| TOTAL                                       | 19                          | 16                        | 20                        | 30                         | 275                        | 360   |

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**Table 6** Face types and Facial Indexes as per different geographical regions of Gujarat

| Face Type & Facial Index | Hyper-Euri prosopic (<79.9) | Euri prosopic (80 - 84.9) | Meso prosopic (85 - 89.9) | Lepto prosopic (90 - 94.9) | Hyper-Lepto prosopic (>95) | Total |
|--------------------------|-----------------------------|---------------------------|---------------------------|----------------------------|----------------------------|-------|
| Regions                  |                             |                           |                           |                            |                            |       |
| North Gujarat            | 4                           | 3                         | 5                         | 3                          | 66                         | 81    |
| Central Gujarat          | 5                           | 5                         | 5                         | 12                         | 75                         | 102   |
| South Gujarat            | 3                           | 2                         | 5                         | 3                          | 39                         | 52    |
| Saurashtra               | 38                          | 3                         | 5                         | 3                          | 66                         | 115   |
| West Gujarat (Kutch)     | 0                           | 0                         | 0                         | 1                          | 9                          | 10    |
|                          | 50                          | 13                        | 20                        | 22                         | 255                        | 360   |

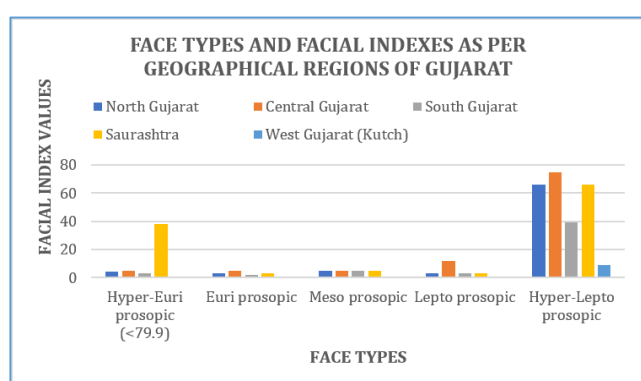


**Figure 8** Bar diagram with trend line showing Face types and Facial indexes as per geographical regions of Gujarat

The descriptive analysis tabulated in Table No. 6 and represented in Fig. 8 demonstrates that, despite minor regional differences in the distribution of individual facial index categories, Hyperleptoprosopic morphology represents the predominant facial phenotype across all geographical regions of Gujarat. These findings indicate relative uniformity in the overall facial index pattern among the studied population.

### Face types and Facial index as per different geographical regions of Gujarat:

**Table 7** Table showing statistical analysis using Chi-square test of independence on Prakriti Vs Facial index, and Geographical region vs Facial index

| Particular Comparison                     | $\chi^2$ | df | p      | Cramer's V | Interpretation                   |
|-------------------------------------------|----------|----|--------|------------|----------------------------------|
| Prakriti $\times$ Facial Index            | 10.797   | 8  | 0.213  | 0.122      | Not significant weak association |
| Geographical Region $\times$ Facial Index | 62.186   | 16 | <0.001 | 0.208      | Significant weak association     |

### Statistical interpretation:

Initially, the Facial Index (FI) was compared among the six *Prakriti* (KPV-KVP, PVK-PKV, VKP-VPK) groups using one-way ANOVA. As no statistically significant difference was observed, the six groups were subsequently consolidated into three dominant *Prakriti* groups (*Kapha*, *Pitta*, and *Vata*) according to the predominant *Dosha*. However, even after

regrouping, the average FI did not differ significantly among the three dominant *Prakriti* groups (ANOVA,  $p > 0.05$ ).

To further evaluate whether the distribution of facial morphology differed according to constitutional type, the continuous FI values were categorized into standard anthropometric facial index categories (Hypereuryprosopic, Euryprosopic, Mesoprosopic, Leptoprosopic and

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Hyperleptoprosopic). The association between dominant *Prakriti*, different geographical regions of Gujarat, and facial index category was assessed using the Chi-square test of independence.

The Chi-square statistics ( $\chi^2 = 10.797$ , p-value 0.213) shown in Table No. 7 demonstrated that the association between dominant *Prakriti* and facial index category is not statistically significant. This suggests that the facial index by itself may not capture the complex constitutional phenotypes of an individual. Cramer's V value 0.122, which estimates the strength of association between dominant *Prakriti* and facial index categories, indicates a small effect size.

The Chi-square statistics ( $\chi^2 = 62.186$ , p-value <0.001) shown in Table No. 7 also demonstrated that the association between different geographical regions of Gujarat and facial index categories is statistically significant. This supports the influence of population diversity, environmental factors, and developmental adaptation in the constitutional build-up and facial morphological characteristics. However, Cramer's V value of 0.208 indicates a weak association, suggesting that although geographical region significantly influences facial index distribution, the magnitude of this relationship is modest.

So, the overall study population predominantly included 19-year-old female students with *Pitta*-dominant *Prakriti*. Anthropometric evaluation demonstrated modest variations in *Anguli Pramana* and facial dimensions across constitutional groups. *Kapha Dosha* predominant individuals tend to have larger facial dimensions,

whereas *Vata Dosha* predominant individuals showed a marginally higher mean facial index. This parallels the Ayurvedic notion of phenotypic traits – *Suvibhakta*<sup>9</sup>, *Prasanna-Darshan-Aanana*<sup>10</sup> and *Alpa Sharira*<sup>10</sup> (short statured), *Dirghakruti*<sup>11</sup> (elongated, long, thin, narrow)<sup>12</sup> traits in *Kapha Dosha* and *Vata Dosha* predominant *Prakriti*, respectively.

## DISCUSSION

Anthropometric research is primarily undertaken to determine the phenotypic traits (*Prakriti*) of ethnic groups residing in a specific geographic area; this research not only helps in comprehending the variation in human body types but also serves as a foundation for comparing different racial groups. Anthropometry deals directly with sex, shape, and morphological traits, which are interlinked with each other and influenced by environmental and genetic factors. *Prakriti* is the external morphological characteristic of an individual, which is a phenotypic manifestation of the inherent predominance of *Dosha*. The *Dosha* itself represents the functional expression of specific *Mahabhuta* and their associated *Guna*.

During embryogenesis, the constitutional predominance established once at conception influences the qualitative and quantitative development of body structures. The development of the craniofacial structure stems from intricate interactions involving the movement of neural crest cells, the growth of the skeleton, hormonal

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factors, and functional adjustments during growth and maturation<sup>13</sup>.

So, the facial morphological features, including their dimensions and proportions, may therefore be interpreted as expressions of the cumulative influence of *Dosha*-mediated *Guna* acting throughout growth and development.

Many studies report on the racial and ethnic differences in craniofacial traits<sup>14</sup>. Farkas (2005) is recognized for one such extensive study on various ethnic groups and races globally<sup>15</sup>.

Epigenetic modifications, in contrast to genetic mutations, do not change the DNA sequence but involve reversible changes such as DNA methylation, histone modifications, and the activity of non-coding RNAs, which can affect how genes are expressed. These alterations play a crucial role in regulating the correct timing and location of developmental genes vital for the formation of craniofacial structures, including the jaw, nose, and facial bones<sup>16</sup>.

This conceptually parallels the unchangeable nature of *Prakriti* corresponding to Genotype, whereas the changes in gene expression pattern reflect the Phenotype influenced by *Jatyadi Prakriti*.

Ayurveda accepts that constitutional characteristics are influenced by *Kala*<sup>17</sup> - environmental conditions recognised as *Deshanupatini* and *Kalanupatini Prakriti*<sup>18</sup>

Where the geographical habitat - *Desha*, climatic conditions - *Kala*, dietary habits - *Ahara*, and lifestyle - *Vihara*, contribute to phenotypic adaptation; however, the innate constitutional

framework remains preserved. Gujarat encompasses a diverse ecological zone, including the arid landscapes of Western Gujarat (Kutch) and North Gujarat, the fertile plains of Central Gujarat, the humid coastal belt of South Gujarat, and the peninsula of Saurashtra<sup>19</sup>.

In the current study, except for a minor variation in the distribution of individual facial index categories across geographical divisions of Gujarat, major regions predominantly represented Hyperleptoprosopic facial morphology.

Studies have also enlightened the role of *Kapha Dosha* in developing prominent – enlarged – broader bodily features, like *Pruthupina Vaksha*<sup>20</sup> and *Pralamba Bahu*<sup>21</sup>.

The structural phenotype of the face may be conceptualized as the integrated expression of interacting *Gurvadi Guna* rather than the effect of any individual *Guna*.

*Vata*-dominant combinations of *Guna*, particularly – *Ruksha-Shita*, *Laghu-Khara*, favour reduced tissue mass and may represent relatively greater longitudinal than transverse growth, resulting in narrower, elongated, angular facial morphology with higher facial index values. *Pitta*-dominant combinations of *Guna* particularly – *Ushna-Tikshna*, *Snigdha-Drava*, and *Snigdha-Ushna*, facilitate tissue differentiation, remodelling, uniform nourishment and proportional growth, contributing to a balanced facial morphology with well-defined facial contours and a moderately full face. *Kapha*-dominant combinations of *Guna* particularly – *Snigdha-Shita*, *Guru-Manda*, *Guru-Sthira*,  
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promote hydration, extracellular matrix deposition, and structural stability, with sustained anabolic growth, producing larger, broader, globular or rounded and hydrated facial dimensions and lower facial index values.

However, these interpretations represent a plausible theoretical model grounded in Ayurvedic constitutional principles and developmental biology, as direct experimental evidence linking specific *Guna* combinations to facial anthropometry is currently lacking.

## CONCLUSION

*Kapha Dosha*-predominant individuals tend to have larger facial dimensions, whereas *Vata Dosha*-predominant individuals showed a marginally higher mean facial index. However, the study also revealed that facial index alone may not sufficiently discriminate different *Prakriti* categories within the present study population.

This study found no statistically significant association between *Prakriti* and facial index, indicating that constitutional type alone does not substantially influence facial morphology.

Conversely, geographical region demonstrated a significant association with facial index, highlighting the contribution of epigenetic modification and ethnographical influence in anthropometric variation within Gujarat.

Irrespective of the *Prakriti* or geographical region, the most recorded face type was Hyperleptoprosopic.

These findings suggest that facial morphology in the students across different regions of Gujarat is shaped predominantly by regional and developmental influences, while *Prakriti* may contribute only modestly.

The study supports future studies incorporating multiple craniofacial measurements, sex-stratified analyses, and multivariate statistical approaches, which may better elucidate any direct relationship between facial morphology and Ayurvedic *Prakriti*.

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**Conflict of Interest:** Nil

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