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# Discrimination of Two Communities of Punjab on the Basis of Craniofacial Measurements

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## *Abstract:*

*Somatometry is a type of anthropometry which includes measurements of living beings as well as cadavers of the body including head and face. In cases where the body is mutilated/ decomposed and it is difficult to recognize the person from the face, it can be possible to identify the person from the bones of the skull and face. The present study is conducted on two different communities of Punjab state that are JATT SIKHS and BRAHMINS. The sample size comprises 400 healthy males including 200 of each community between the age of 25-35 years. The present study aims to find different indices which include different cranial measurements such as maximum head length, maximum head breadth, maximum head height, the circumference of the head, minimum breadth of the frontotemporal, maximum breadth of zygomatic breadth, maximum breadth of bigonial, physiogonic facial height, morphological facial height, nasal height, nasal breadth, lip length, lip breadth, ear length and ear breadth of the right ear. The study revealed that both the communities follow the almost same trend in all calculations. Very few differences can be seen in the comparative values of both communities. According to different indices, the shapes of both communities fall under the same category. The detailed study is presented below. The data obtained in the present study may be useful to distinguish the two major communities of Punjab (India) and can be used in anthropological research, forensic cases.*

***Key Words:*** *Somatometry, Zygomatic Breadth, Anthropometry, Cranial measurement*

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## Introduction

Somatometry is the technique used for individualization since every person is different in various aspects. It gives an idea about the general physique, the appearance of an individual & one can be distinguished between two races, natives of two countries, state or two communities. As many studies conducted on the Punjabi population, but there is no study carried on the differences between two major communities of Punjab, i.e., Jatt Sikh and Brahmins. So, the present study is an approach to study the differences in craniofacial measurements and their indices of the above-named communities. For the study, 14 measurements (Maximum. Head Length, Maximum. Head Breadth, Head Height, Minimum Breadth Of Frontotemoral, Maximum Breadth Of Zygomatic Arch, Maximum Breadth Of Bigonial, Physiognomic Facial Length, Morphological Facial Length, Nasal Length, Nasal Breadth, Height Of Integumental Lips, Lip Length, Ear Length, and Ear Breadth) and 10 indices (Cephalic Index, Length Height Index, Breadth Height Index Jugo Frontal Index, Jugo Mandibular Index, Physiognomic Facial Index, Morphological Facial Index, Nasal Index, Lip Index, And Ear Index) of the measurements are the basis of the differentiation of two communities.

Craniometry and facial measurements are useful in making of different equipment such as goggles, headphones, helmets, etc. and also in medical lines for accidental surgeries, plastic surgeries, etc.

## Material & Methodology

Total 400, healthy subjects were selected. Out of the 200 were males belonged to JATT SIKH community and 200 males belonged to the BRAHMIN community from the Punjab population. Total of 14 different measurements were taken from 400 subjects with the help of standard instruments (Measuring Tape, Spreading Caliper, Sliding Caliper and Steel Tape). The subjects were requested to stand erect for height measurement and then sit straight looking in the eye ear plane for taking the rest measurements. Different measurements of anthropometric landmarks were recorded for each participant. The measurements were taken 3 times and the final value was recorded as the average of the 3 values. The above mentioned 14 measurements and 10 indices of the craniometry were used for the study.

## Observations & Results

The present study was undertaken to know whether the significant variations present in the two major communities (Jatt Sikh and Brahmins) of Punjab.

In the current analysis statistics on anthropometric measurements of craniofacial landmarks of 400 people of two different communities of Punjab in which 200 subjects belonged to Jatt Sikh community and 200 subjects belonged to the Brahmin community with the age group, 25-35 years were collected. Observations are as follows:

**Table No. 1 – Shows the comparison between Sikh and Brahmin community based on 14 different Craniofacial Parameters**

| VARIABLES | COMMUNITIES | TOTAL | MEAN | MAX. | MIN. | S.D. | VARIANCE | z-stat | p-VALUE | SIGNIFICANCE |
|---|---|---|---|---|---|---|---|---|---|---|
| Max. Head Length | Brahmin | 3863.7 | 19.3185 | 20.9 | 17.6 | 0.575031352 | 0.330661055 | -2.022181911 | 0.021578781 | Significant |
| | Jatt Sikh | 3888.4 | 19.442 | 20.7 | 18 | 0.644447486 | 0.415312563 | | | |
| Max. Head Breadth | Brahmin | 3034.2 | 15.171 | 16.5 | 13.8 | 0.584093164 | 0.341164824 | -2.365494546 | 0.009003004 | Significant |
| | Jatt Sikh | 3061.8 | 15.309 | 16.5 | 14 | 0.582680515 | 0.339516583 | | | |
| Head Height | Brahmin | 4827.7 | 24.1385 | 26.2 | 21.8 | 0.898445195 | 0.807203769 | 0.138192262 | 0.445044235 | Not Significant |
| | Jatt Sikh | 4825.2 | 24.126 | 26.2 | 22.2 | 0.91058764 | 0.829169849 | | | |
| Minimum Breadth of Frontotemoral | Brahmin | 2507.2 | 12.536 | 13.9 | 10.9 | 0.515687569 | 0.265933668 | -2.588604817 | 0.004818272 | Significance |
| | Jatt Sikh | 2537.4 | 12.687 | 14.4 | 11.3 | 0.643897523 | 0.41460402 | | | |
| Maximum breadth of Zygomatic Arch | Brahmin | 2831.05 | 14.15525 | 15.5 | 12 | 0.623138383 | 0.388301445 | -1.969361248 | 0.024455811 | Significance |
| | Jatt Sikh | 2855.42 | 14.2771 | 16 | 12.9 | 0.614287666 | 0.377349337 | | | |
| Maximum Breadth Of Bigonial | Brahmin | 1890.2 | 9.451 | 11.2 | 7.5 | 0.763092755 | 0.582310553 | -2.97108435 | 0.001483751 | Significance |
| | Jatt Sikh | 1938.5 | 9.6925 | 12.5 | 8 | 0.85970297 | 0.739089196 | | | |
| Physiognomic Facial Length | Brahmin | 3619.3 | 18.0965 | 20 | 16.3 | 0.76140425 | 0.579736432 | -1.007045655 | 0.156956418 | Not Significance |
| | Jatt Sikh | 3636.5 | 18.1825 | 20.4 | 15.7 | 0.937463567 | 0.87883794 | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Morphological Facial Length | Brahmin | 2264.9 | 11.3245 | 13.2 | 9.9 | 0.592032314 | 0.350502261 | -3.707862205 | 0.000104508 | Significant |
| | Jatt Sikh | 2315.9 | 11.5795 | 13.5 | 9.9 | 0.771626065 | 0.595406784 | | | |
| Nasal Length | Brahmin | 937.5 | 4.6875 | 5.3 | 4 | 0.257341941 | 0.066224874 | -3.246926726 | 0.000583292 | Significant |
| | Jatt Sikh | 956.9 | 4.7845 | 5.7 | 3.7 | 0.335068807 | 0.112271106 | | | |
| Nasal Breadth | Brahmin | 696.9 | 3.4845 | 4.3 | 3 | 0.234488109 | 0.054984673 | -1.773016698 | 0.03811297 | Significant |
| | Jatt Sikh | 705.9 | 3.5295 | 4.2 | 2.9 | 0.271751716 | 0.073848995 | | | |
| Height Of Integumental Lips | Brahmin | 365.8 | 1.829 | 2.4 | 1.1 | 0.241559007 | 0.058350754 | 1.671258191 | 0.047335345 | Significant |
| | Jatt Sikh | 357 | 1.785 | 2.6 | 1.2 | 0.28333087 | 0.080276382 | | | |
| Lip Length | Brahmin | 985.6 | 4.928 | 5.6 | 4.1 | 0.370543537 | 0.137302513 | -3.185370571 | 0.000722844 | Significant |
| | Jatt Sikh | 1009.3 | 5.0465 | 6.2 | 4.3 | 0.373477142 | 0.139485176 | | | |
| Ear Length | Brahmin | 1072.1 | 5.3605 | 6.5 | 4.6 | 0.400740207 | 0.160592714 | 1.27213967 | 0.101661749 | Not Significant |
| | Jatt Sikh | 1061 | 5.305 | 6.5 | 4.3 | 0.469121921 | 0.220075377 | | | |
| Ear Breadth | Brahmin | 719.8 | 3.617085 427 | 4.5 | 2.9 | 0.29182385 | 0.085161159 | -2.684351242 | 0.003633536 | Significant |
| | Jatt Sikh | 740 | 3.7 | 4.4 | 3 | 0.324385774 | 0.105226131 | | | |

**Table No. 2 – Shows the comparison between Jatt Sikh and Brahmin community on the basis of 10 different Craniofacial Indices**

| VARIABLES | COMMUNITIES | TOTAL | MEAN | MAX. | MIN. | S.D. | VARIANCE | Z-STAT | P-VALUE (1 TAIL) | SIGNIFICANCE |
|---|---|---|---|---|---|---|---|---|---|---|
| Cephalic Index | Brahmins | 15641.13 732 | 78.5986 8002 | 87.7005 3476 | 70.5 | 3.532616 809 | 12.47938152 | -0.608120179 | 0.271553885 | Not Significant |
| | Jatt Sikh | 15765.07 389 | 78.8253 6943 | 88.9502 7624 | 67.63285 024 | 3.905062 664 | 15.24951441 | | | |
| Length Height Index | Brahmins | 25001.31 966 | 125.006 5983 | 138.888 8889 | 112.2549 02 | 4.701022 375 | 22.09961137 | 1.634821042 | 0.051043284 | Significant |
| | Jatt Sikh | 24837.11 813 | 124.185 5906 | 138.461 5385 | 109.9009 901 | 5.323666 434 | 28.3414243 | | | |
| Breadth Height Index | Brahmins | 31872.77 459 | 159.363 8729 | 182.608 6957 | 137.8881 988 | 8.388315 402 | 70.36383529 | 1.889502877 | 0.029412239 | Significant |
| | Jatt Sikh | 31560.55 797 | 157.802 7899 | 180.851 0638 | 137.8881 988 | 8.133462 811 | 66.15321729 | | | |
| Jugo Frontal Index | Brahmins | 17740.20 882 | 88.7010 4412 | 106.976 7442 | 74.65753 425 | 4.810867 842 | 23.14444939 | -0.595199927 | 0.27585492 | Not Significant |
| | Jatt Sikh | 17803.77 307 | 89.0188 6537 | 107.692 3077 | 75.33333 333 | 5.820754 75 | 33.88118586 | | | |
| Jugo Mandibular Index | Brahmins | 13359.87 616 | 66.7993 8082 | 78.6259 542 | 54.30463 576 | 5.019010 882 | 25.19047023 | -2.070338785 | 0.019210315 | Significant |
| | Jatt Sikh | 13589.61 | 62.3376 6 | 89.2857 1 | 52.98013 | 6.030998 | 36.37294 | | | |
| Physiognomic Facial Index | Brahmins | 25608.43 678 | 128.042 1839 | 148.461 5385 | 112.5827 815 | 6.945607 966 | 48.24147002 | 0.664617497 | 0.253147588 | Not Significant |
| | Jatt Sikh | 25509.72 | 127.548 6 | 146.153 8 | 103.9735 | 7.877668 | 62.05766 | | | |
| Morphological Facial Index | Brahmins | 16030.56 16 | 80.1528 0799 | 99.1666 6667 | 67.80821 918 | 5.441619 923 | 29.61122738 | -1.871053735 | 0.030668817 | Significant |
| | Jatt Sikh | 16242.73 658 | 81.2136 8292 | 100.746 2687 | 66.875 | 5.889401 701 | 34.68505239 | | | |
| Nasal Index | Brahmins | 14918.76 747 | 74.5938 3733 | 100 | 60.78431 373 | 6.902572 088 | 47.64550143 | 0.694093875 | 0.24381167 | Not Significant |
| | Jatt Sikh | 14893.86 | 74.0988 3 | 95.4545 5 | 53.57143 | 7.353805 | 54.07845 | | | |
| Lip Index | Brahmins | 7467.166 897 | 37.3358 3448 | 53.6585 3659 | 21.15384 615 | 5.781264 488 | 33.42301909 | 3.043598516 | 0.001168834 | Significant |
| | Jatt Sikh | 7107.414 132 | 35.5370 7066 | 56.5217 3913 | 20.96774 194 | 6.035971 824 | 36.43295586 | | | |
| Ear Index | Brahmins | 13560.12 812 | 67.8006 4059 | 91.4893 617 | 46.77419 355 | 7.197424 84 | 51.80292433 | -3.082615209 | 0.001025951 | Significant |
| | Jatt Sikh | 14070.78 | 70.3539 2 | 100 | 46.15385 | 9.241658 | 85.40823 | | | |

***p-value ≤ 0.05 has been considered to be statistically highly significant.**

**Discussion & Results**

The technique somatometry of anthropology used in forensic science is very useful for the personal identification of an individual. This technique is used in cases such as mass disaster, the decomposed dead bodies, on skulls for individualization. As the landmarks are fixed anatomical points on the human body, the measurements of craniofacial landmarks are taken for different parameters such as head length, head breadth, their index, i.e., cephalic index, etc. In forensics, this technique is a tool to identify a person's age, stature, race with precision even in the cases where the body is mutilated/ decomposed and it is difficult to recognize the person from the face, it can be possible to identify the person from the bones of skull and face.

The present study was conducted to determine the differences between two major communities of Punjab Jatt Sikh and Brahmins based on craniofacial measurements. For this, the craniofacial landmarks based measurements of the subjects were taken and recorded along with the names, age, profession, city of the subjects. For all the recorded parameters, the indices were calculated, and then the descriptive statistical analysis, charts of all data to show differences in both communities, and z-test was applied. The values less than or equal to 0.05 can be calculated as highly significant.

As head length is the first parameter it was observed that based on this parameter, it is possible to distinguish both the communities as the p-value is 0.02 less than the 0.05. Similarly, head breadth, maximum breadth of the zygomatic arch, maximum breadth of bigonial, morphological facial length, nasal length, nasal breadth, the height of integument lips, lip length, and ear breadth considered as useful parameters to differentiate the Jatt Sikh and Brahmins communities as their p values are less than or equal to the value 0.05.

The parameters by which one can't find the difference in the given communities are head height, physiognomic facial length, and ear length.

Now, if we talk about the indices that are calculated from these measurements and can predict the difference between both the communities as their p values are less than or equal to 0.05 are length height index, breadth height index, jugo mandibular index, morphological facial index, lip index, and ear index.

The indices which by which one can't decide the community whether the person belongs to Jatt Sikh or Brahmin community are cephalic index, jugo frontal index, physiognomic facial index, nasal index because their p values are more than the significant value 0.05.

If we look upon the other values such as a total sum of a particular parameter of all subjects, mean, maximum value, minimum value, standard deviation and variance of particular parameters of both the communities, the values don't follow any trend as some values are larger in the case of Jatt Sikh community and some values are larger in Brahmin community such as the total sum value, mean value of head length is higher in Jatt Sikh community but the maximum value is higher in Brahmins. In the case of Head Breadth maximum value for both communities is similar.

The comparison of the present study's values with the literature, the findings for the cephalic index for different populations are:

| Research Workers | Population | Cephalic Index |
|---|---|---|
| Shah & Jadhav | Gujarati Population | 80.81 |
| Oladipo & Oluto | Ijaw | 80.98 |
| Oladipo & Oluto | Igbo | 79.04 |
| Anupama et al. | Punjabi Students | 81.34 |
| Anitha et al. | North Indian | 79.1 |
| Present Study | Jatt Sikh of Punjab | 78.83 |
| | Brahmin of Punjab | 78.6 |

Similarly, the face type or facial index or prosopic index's value compared with the previous studies, the observations are as under:

| Research Workers | Population | Prosopic Index |
|---|---|---|
| Singla Mukesh et al. | Jatt Sikh of Punjab | Euryprosopic |
| Pandey AK | Onges of Andaman & Nicobar Islands | Hypereuryprosopic |
| Ghosh & Malik | Santhals of West Bengal | Hypereuryprosopic |
| Meka & Rexhepi | Albanian Kosova Population | 90.38 |
| Present Study | Jatt Sikh | Euryprosopic |
| | Brahmin | Euryprosopic |

Now, if we talk about the nose type or say nasal index, according to the literature, the Indo-African population is having Platyrrhine nose type (Sparks & Jantz), Jingo people of China have Mesorrhine nose type (Xu et al.), Kosovo Albanian population's nose type is Leptorrhine (G. Staka et al.) and according to the present study, the nose type of Jatt Sikh and Brahmin community is Mesorrhine.

With the help of the above statistics and discussion, the community or say individualization of the deceased can be an estimate and this knowledge can be play important role in forensic cases.

**Conclusion**

The study revealed that some parameters such as maximum head breadth, minimum breadth of the frontotemporal, maximum breadth of bigonial, nasal length, lip breadth, lip index, ear breadth, and ear index are useful to differentiate Jatt Sikh and Brahmin communities for the personal identification in` the forensic investigation.

From all the observations, results (Tables and charts), analysis, and discussions, the conclusion can be drawn that both the communities follow the almost same trend in all calculations. Very few differences can be seen in the comparative values of both communities. According to different indices, the shapes of both communities fall under the same category. The head shape of Brahmins and Jatt Sikh communities as per the mean values of Cephalic Index 78.6 and 78.83 respectively is Mesocephalic. The mean value of Physiognomic Facial Index for Brahmin is 128.04 & Jatt Sikhs are 127.55. The face shape according to the morphological facial index is Euryproscopic and the mean value for Brahmins is 80.15 and for Jatt Sikh is 81.21. Jugo frontal index and jugo mandibular index's mean values for Brahmins are 88.7 & 66.8 and Jatt Sikh is 89.01 & 62.34 respectively and categorized as broad and very narrow. Mesorrhine is the type of nasal index for both communities and the mean value for Brahmins is 74.59 and Jatt Sikh is 74.09. The mean values of lip index and ear index for Brahmins are 37.34 & 67.8 and for Jatt Sikh are 35.54 & 70.35.

The data obtained in the present study may be useful to distinguish the two major communities of Punjab (India) and can be used in anthropological research, clinical surgeries, and forensic cases.

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