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# Anthropological Assessment of Ear Lobe Types in Chhattisgarh: Genetic and Morphological Insights

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***Abstract:*** *Ear lobes not only present aesthetic importance to a person but are important for people's identification for forensic uses, ethnicity and sometimes clinical importance. There are 6 genetic variations associated with earlobe attachment. Some studies have reported that the circumference of earlobe increases with age, this enlargement is likely associated with aging changes of collagen. The Indian traditional knowledge also states about the relation of earlobe and wisdom, and ancient surgeons Sushruta and Vagbhatta also gives importance to painless ear piercing rituals for children. In Ancient Chinese medicine wearing ear ornaments were regarded beneficial for health. The Diagonal earlobe crease is sometimes associated with coronary artery diseases. Ear lobe variations were studied, and a survey was conducted in ethnic Population of Chhattisgarh state in central India, known for its tribal population. Ear lobes of adults 452 subjects (109 males and 343 females) were studied with their consent. Their Age ranged from 18- 80. All subjects were natives of Chhattisgarh, hailing from Durg -Bhilai district. No one of study subjects has any known history of migration from any other state. All subjects and their families have lived in the Chhattisgarh state since they know their family history, so they can be considered native people of Chhattisgarh origin. The shape of ear lobe, attachment to face, thickness and diagonal crease were taken in consideration. The result showed the uniqueness of each individual. The attached type of earlobe was found to be rare in this area. Most common were the round and free type. The survey was done in ethnic people, no consideration of tribes, caste or religion was taken into account, as done by some previous workers. Mobile camera of volunteers was used for photography and analysis was done in lab.*

***Keywords:*** *Identification, ear lobes, round, free, attached, tongue shaped, Diagonal crease.*

## 1. INTRODUCTION:

The ear lobe (Lobium auriculae) is a soft fleshy flap of skin situated at the lower part of pinna. It is an important aesthetic feature and unique to the individual. Even the ear prints of human ears are also individualistic (Krishan and Kanchan2016). Three inter-connected ridges of cartilage make up the internal structure of the ear. Ear lobe is made up of connective tissues, fat cells, aerola tissues, rich nerve endings and blood supply (Snell 92, John 17). Earlobes contain no cartilage. The shape and attachment of earlobe is genetically determined. (Adhikari, 2015). Covered by protective layer of epithelial skin, they do not perform any other function other than providing warmth to the ears. It can be free or attached or may be in mid between (Purkait 2007, Raef 2009 and Robert 2009). Though it is believed that free earlobe was due to single dominant gene and free earlobe was result of recessive gene but recent studies describes that 6 genetic variations are associated with earlobe attachments (John Shaffer et al 2017). Some studies reported that ear circumference also increases by average 0.5 mil per year, due to collegen aging, as people age. (Heathcote, 1995). Ear lobe is a unique and individualistic character which can be used in personal identification (Avijit Mathur 2013, Krishan and Kanchan2016.) in different situations. Earlobe variations may be congenital, for attachments, clefts, duplications and skin tags achrochordons. Apart from direct aesthetic and cosmetic value they are important for forensic identifications, Anthropologic identifications and for clinical importance. (Emrsic 2017, Purkait 2008, Yuan lee, 2012). Earlobe crease indicates it as a warning signs of cardiovascular diseases. (Cumberland, 1987, Cheng, 1991). Some studies with sleeping positions for earlobe crease have also been done. (Heathcote, 1995). Worldwide studies on ear lobe structures have been done. Some on Indian racial groups as on Goans, (Dinkar and Sambyal, 2012). With caste

and religion Ghosh, (1970), (Verma, 1957, Bhowmik, 1971) and some studies on racial groups of Fiji (Gable, 1958), Turkish (Gurbuz and Mesut 2005). These studies show that ear dimensions, including ear lobes are metrically variable in individuals and populations.

Darwin's tubercles are a unique congenital prominent feature found sometimes on the posterior helix of ear, thought to be the remnant from the evolutionary past. Ayurveda the ancient Indian science of wellbeing, believes ear is one of the 5 organs of wisdom. Old Indian belief is that pulling ear lobe increases brains ability to remember more, hence the common school punishments. Ayurveda emphasizes on two important rituals for ear. Karna Purana (oiling of the ear) which nourishes the Acoustic nerve and improves signal quality of brain, thus enhancing the interpretation of sound and hearing improves. Karna vedhna sanskar- earlobe of a child is pierced. Sushruta the ancient surgeon known for Rhinoplsty and Vagbhatta has also explained in detail the right method of painless ear piercing, that no blood should be shed in the process. (Aarshi, 2004). Karnvedhana is performed on right ear first in male child and left ear first in female child, which is to balance and harmonize the male and female energy flow in the body organ system subsequently (Mishra 2015). There are beliefs that ear piercing is beneficial in regulating the menstrual cycle in female child and also beneficial in terms of safe guarding against hysteria and the flow of electric current in human body (Abhilash 2014).

## 2. LITERATURE REVIEW:

In traditional Chinese medicine, wearing earrings has been regarded beneficial for health and long ears predict longitivity (Khaw1996). It is said that piercing the ears has an acupuncture-effect on the body (James 2007). In ancient China, ear ornaments had been developed for the health purposes rather than female embellishment purpose with the hope for the acupunctural effect. Meanwhile, the father of Western medicine, Hippocrates, wrote about ear piercing and wearing earrings around 470 B.C. as a remedy and treatment for menstrual problems. Galen also wrote about the same thing. In ancient times, if there was a deficiency in energy or chi, gold earrings would be placed in a pierced acu-point for stimulation. Silver earrings were used if energy flows in excess. Gemstones were added for their therapeutic importance. (Dherbs). Ancient people treated diseases of feminine Yin organs via earrings in the left ear and diseases of the male Yang organs via the right ear. The left side of the body is the feminine side and the right side of the body is masculine (Dherbs) (Abhilash2014) (Aarshi 2004). In many cultures adorning the earlobes presents unique cosmetic purposes. Earlobes are vulnerable to injury, infection, and many conditions leading to deformity like Sunburns, split earlobes, sebaceous cyst, bacterial infections, cellulitis, contact dermatitis, photoallergic dermatitis, frost bites, gangrene, skin cancer, Elmos fire etc. (Frances 1978). Abnormalities of the ear tend to be stimuli for undue attention. For the child with microtic, protruding, or lop ears, for instance, such an abnormality may be a source of intense shame and anguish. (Frances78). Earlier studies have indicated towards polygenic architecture. In Multiethnic samples 6 associated loci and in total 49 significant loci showed strong evidence of genes involved in ear development and polygenic nature of ear lobe (Barnes 1976) of earlobe attachments. It has generally been observed that older people have bigger ears and noses (Heathcote, 1995). Certain cultures have identified bigger ears to be associated with greater wisdom and in some instance, longevity (Khaw, 1996). Study supports the view that as people age, their ears get larger. (Kenny1989, Koshihra 94, Khaw 96 and Heathcote 95). The circumference of the ear increases on average of about 0.51 mm per year. (Tan 97) This change is likely associated with aging changes in collagen. As tissues mature and age, collagen fibres increase in number and in size. Cross-linkages also develop between fibres with the aging process. Solubility of collagen is reduced, and the structure becomes more stable (Kenney, 1989). A subject's approximate age can be calculated based on his ear size: Age=1.96× (ear circumference in millimeters−88.1 (Tan 97). Though ear lobe study on Indian population has been done by some workers as Singh and (Purkait, 2009), but with no mention about variations in population of Chhattisgarh. Thus the study was undertaken and felt necessary to know about ear lobe variations present in Chhattisgarh. This work will impact on Anthropological studies, forensic studies, Health studies and will also open new areas for research.

## 3. OBJECTIVES / AIMS :

**Aim:**

To investigate the distribution, morphological variation, and genetic correlates of earlobe types (free, attached, intermediate) among diverse population groups in Chhattisgarh, and to assess how these traits relate to demographic, familial and environmental factors.

**SPECIFIC OBJECTIVES:**

1. **Describe prevalence and distribution**
    - Estimate the prevalence (%) of earlobe types (free, attached, partially attached/intermediate) across sampled individuals in Chhattisgarh, stratified by sex, age group, and district/ethnic group.

2. **Quantify morphological variation**
   - Measure and compare continuous morphological parameters (e.g., lobe length, width, projection angle) using standardized anthropometric methods and digital images; report means, SDs, and ranges for each earlobe type.
3. **Assess intra- and inter-population differences**
   - Test for statistically significant differences in earlobe type frequencies and morphological measures between defined population strata (e.g., caste/tribal groups, rural vs urban, districts) using $\chi^2$ tests and ANOVA / nonparametric equivalents.
4. **Estimate familial aggregation and heritability**
   - Collect pedigree/family data (at least parent–child pairs and siblings where possible) to estimate concordance rates and calculate a simple heritability estimate (e.g., Falconer's formula or logistic mixed models) for earlobe types.
5. **Identify genetic associations (pilot / candidate approach)**
   - In a subsample (e.g., n = 200–500), genotype selected candidate SNPs or use a microarray panel to explore associations between genetic variants and earlobe phenotype, controlling for population structure. Report allele frequencies and odds ratios with 95% CIs.
6. **Model multivariable predictors**
   - Build multivariable logistic (or multinomial) regression models to evaluate independent associations of age, sex, ethnicity, anthropometric measures (e.g., BMI, head circumference), family history, and selected genetic markers with earlobe type.
7. **Document methodological reproducibility**
   - Assess intra- and inter-observer reliability for morphological measures and categorical classification (Cohen's kappa / ICC) and refine the measurement protocol accordingly.
8. **Create a regional reference dataset**
   - Produce an anonymized dataset and catalogue (frequency tables, morphometric norms) that can serve as a baseline for future anthropological or forensic work in Chhattisgarh.

## 4. METHODOLOGY:

For the study of earlobe variations 452 adult subjects (109 males and 343 females) were selected randomly, with their written consent. The research started only after approval by the institutional ethical committee. The design and aim of the study was explained to the participants. Their names and identity would not be revealed during the experiment process, but if necessary would be disclosed to experts for further study. It was explained to them that this data will be communicated further. All the participants were residents of Durg district that is almost central part of Chhattisgarh state of India. All participants were necessarily Chhattisgarh natives as their families have lived for generations in this state and have no history of migration from any other part of country. Camera from mobiles was used for the photographs. The pictures were analyzed in lab and calculations were done. The shape of ear lobes was clearly visible. The Attachment was considered on the basis of attachment angle of ear lobe to the face. Thickness of earlobes was also studied.

**Observations:**

Total 452 participants were studied on variations of ear lobes of which 109 were males and 343 females.

**Table-1: Ear lobe variations:**

| | Ear lobes variations (452 subjects) | | Male (109) | Female (343) |
|---|---|---|---|---|
| **A. Attachments** | | | | |
| **1** | **Free** | **386** | **88** | **298** |
| **2** | **Partially attached** | **13** | **8** | **5** |
| **3** | **Attached** | **53** | **13** | **40** |

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| | | | | |
|---|---|---|---|---|
| **B. Shapes**<br>**1.** | **Tongue shaped** | **56** | **12** | **44** |
| **2.** | **Square shaped** | **25** | **8** | **17** |
| **3.** | **Arched** | **73** | **28** | **45** |
| **4.** | **Triangular** | **31** | **18** | **13** |
| **5.** | **Round** | **267** | **43** | **224** |
| **C. Diagonal crease** | **Diagonal crease** | **5** | **3** | **2** |

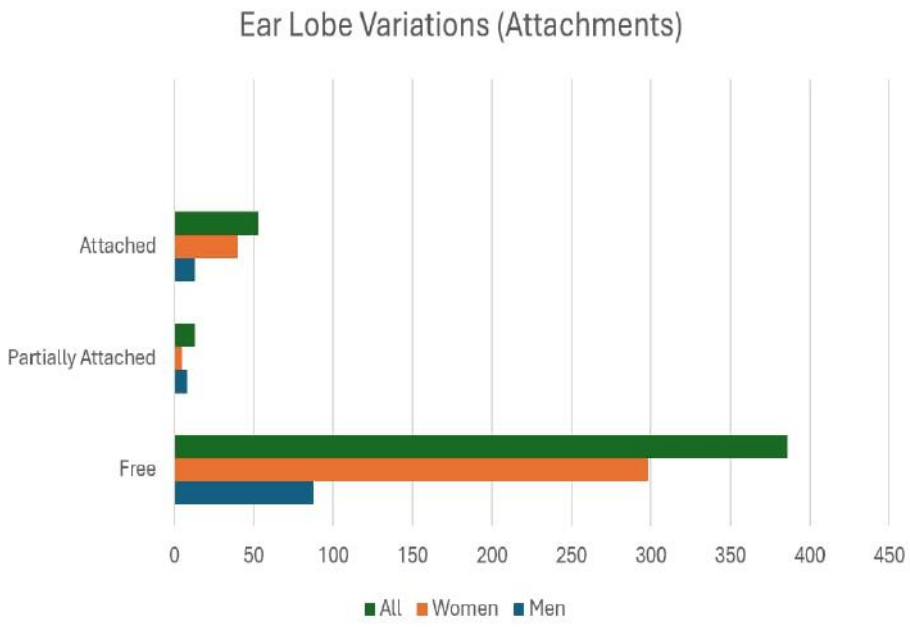
## 5. RESULTS AND DISCSSION:

All the 452 participants were of Native Chhattisgarh, living in the Durg Bhilai area. They were told about the survey, photographs and paper publishing. They were photographed only after their written consent.
The earlobe variations studied were according to their attachments, shape and Diagonal ear crease.

A. **Attachments**: Attachment of ear lobe to face may be free, partially attached or attached. The angle of attachment to face was studied and angle of less than $10^0$ was considered attached type, more than$10^0$ to $15^0$ was considered partially attached more than $15^0$ were considered type of earlobe.
B. **Shapes:** Shapes of earlobes varied from Round, Square, Arched, Tongue shaped.
C. **Diagonal ear crease:** As it is found only in ear lobes, it was also taken in consideration.

These variations are associate with a gene known as ectodysplacin. A receptor gene (EDER). This is a key regulator gene of the embryonic skin appendages development. (Adhikari 2017).

**Figure.1. Graph**: **1**. **Ear Lobe Attachment**




1. Free earlobes are the maximum in the studied Chhattisgarh population which is 85.40% of total subjects, in which males had 80.73 % of total males and female had 86.88% of total females studied.
2. Partially attached earlobes were only 2.88 % of total subjects, of which 7.34% were males and 1.46 % of females.
3. Attached earlobes were also in small numbers 11.73% of total surveyed population of which males and females had almost equal percentage.

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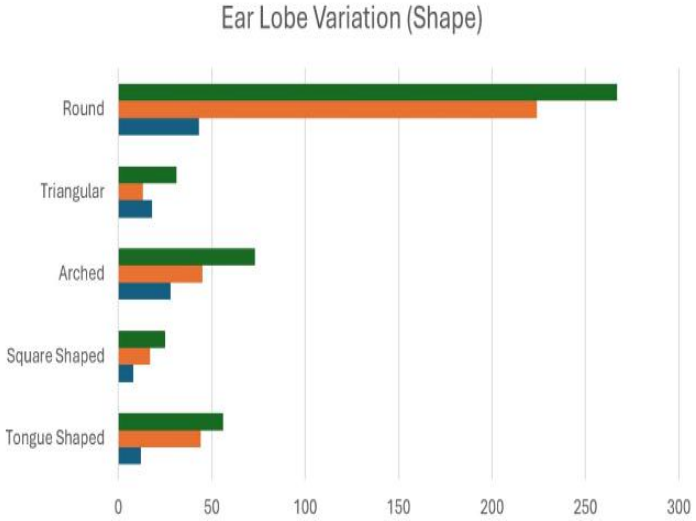
**Figure. 2. Graph.2. Shapes**

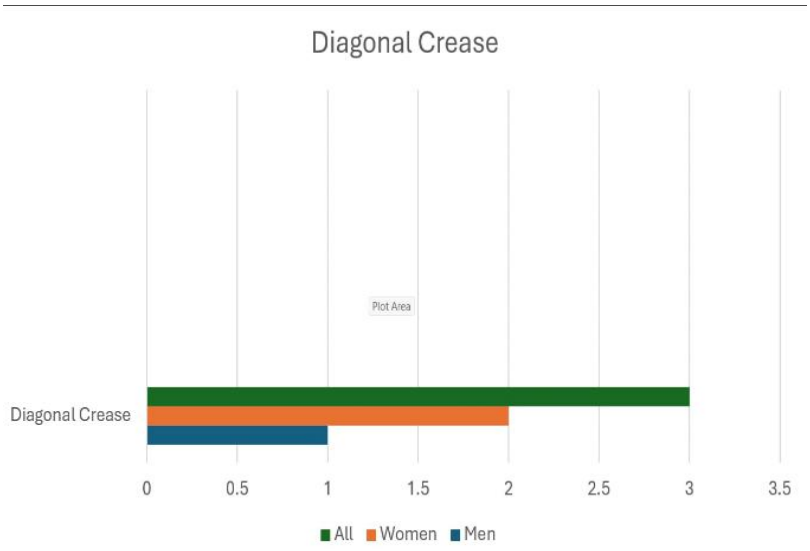



**B. Shape of earlobes:**

**(Graph II)**

1. **Tongue shaped**: was only 12.39% of total subjects, where males were more and females were nominal with this shape.
2. **Square**: only 5.53 % had this type of shape.
3. **Arched**: Almost 16.15% had this type of shape where it was more in males than in females.
4. **Triangular**: Are only 6.86% of total subjects studied. In males it was only16.51 % of total males and in females this shape was only3.79% of total females.
5. **Round**: Largest variation was found to be Round shape of ear lobe. It was found in 59.07% of total subjects, where male had 39.45% of total male studied and females had 65.31% of total females studied.
6. **Split**: only 1 subject with split earlobe was found which makes it .22% of total subjects studied.

**Fig.3.Graph.3.Diagonal Ear Crease:**




It was very rare in the surveyed population, only 1.11 %, of which1 was male and 2 females.1 male and 1 female were of 80 yrs. of age and 1 female was of 20 yrs. only. The subjects with 80 yrs. Showed all the properties of old age ear lobe, but did not have any history of heart disease. Similarly, female 20 yrs. had the diagonal ear crease but did not report any heart disease. Ear lobe crease has been defined as a deep wrinkle that extends backwards $45^0$ from Targus to auricle. The possible association between ear lobe creases and coronary artery disease garnered attention when a study by Dr. William Elliott was published in **The American Journal of Medicine** more than a decade ago. Results of his

study indicated that 19 out of 20 people with risk factors for coronary artery disease also had **diagonally creased earlobes. (Elliot 1983).** Dr. Elliott completed a larger study. Of the 373 people with ear lobe creases, 275 (74%) had coronary artery disease and 98 (26%) did not. Of the 627 people with no ear lobe creases, 101 (16%) had coronary artery disease, and 526 (84%) did not. Numerous subsequent studies have been reported in the medical literature, with the largest involving 1,000 unselected patients. The ear lobe is richly vascularized, and a decrease in blood flow over an extended period of time is believed to result in collapse of the vascular bed. This leads to a diagonal crease. (Elliot 1983). An article published in the 1996 American Journal of Medicine stated that ear lobe creases were shown to be associated with higher rates of cardiac events in this study of 264 consecutive patients. (Am J Med 1996 02/01; 100:0205) The presence of a diagonal ear lobe crease has been recognized as a sign of cardiovascular disease since 1973. ((Cheng,2000, Claudia2015, Eber1993, Frank1977, Gibson1986, Gutiu 1986, Haines 1977, Kaukola 1979, Kristensen1980, Kenny 1989, lichstein1974, Motamed 1998, Miric 1998, Rhoads1977, Shoenfeld1980, Tranchesi1992). The prevalence of crease increases with advancing age. It is absent at birth and appears later in life. These are related to loss of elastin fibre. A study by Kaukola (1978) biopsies of ear lobes revealed tears of elastic fibres in subjects with crease except. Autopsy study showed that subjects with crease present bilaterally on both ears crease had more coronary artery disease than unilateral (Koukola 1978). The attached ear lobe in our study was only in11.73% of total subjects studied a very small number where percentage wise both male and female had around 11% of total attached population.

Genealogical study was not done but by asking the participants it was known that 1 female with attached earlobe has a male sibling with similar attached earlobe, and all other siblings had small free lobes. Another female with attached earlobe had all children with small free lobe. Another female with attached and square lobe had mother with attached lobe, one female sibling with attached lobe and one son of sister with attached lobe. Similarly, one male with attached lobe had a paternal grandfather with similar feature one male and one female sibling with attached type ear lobe. Earlier workers have done studies related to different countries and race also. Racial studies have been done on Fijians (Gable 1958). Studies on ear structure of Guans were also done and were successful in determining the uniqueness of ear pattern for person identification and in designing and testing software for recognition of ear patterns from side profile photograph (Dinkar, Sambayal 2012). Study on Indians were done by Singh and Purkait (2009) in way back in 2009 and found that In India, free ear lobes were found to be more frequent among the Brahmin (77.5%) and the Muslim males (78.4%) as reported by Bhowmik (1971), and were more frequent among Hindu and Muslim convicts in northern India (Verma, 1957) than among the Thakur males (53.71%) in the current study. According to Tyagi and Gupta (1973), the percentage of attached ear lobes was higher among the four caste groups such as Brahmins, Rajput, Agarwal and Shrivastav of northern India (41–55%) and among the Kota Tribe (58–62%) of southern India as reported by Ghosh (1970), than among the than among the Thakurs in the present study (19–24%). Among Haryana College students the frequency distribution of the shape of the left and right earlobe among the shape of the earlobe is different types such as arched, tongue shaped, square, and triangular. Arched earlobe was found to be common (R- 70% and L- 62.5% in males while in females the percentage was R- 78.82% males and L-70.11%) among both sexes in the studied population. The square type and triangular types of the earlobes were the rare variants reported in the study. (Pawan kumar, 2021). Some workers have studied the Turkish people for variations of Auricle tubercle (Gurbuz et al 2005). Racial studies have been done on Fijians (Gable 1958). Darwin's tubercles are a unique congenital prominent feature found sometimes on the posterior helix of ear, thought to be the remnant from the evolutionary past, whose function is still unclear, was also seen in some subjects. This study did not consider any caste or race but only criteria that all the subjects were of native Chhattisgarh.

## 6. CONCLUSION:

Total 452 participants were studied on variations of ear lobes of which 109 were males and 343 females of native Chhattisgarh population. The study concludes that simple **round shaped** earlobe is present in maximum. It was found that round shape earlobe was present in 59.07% of total subjects, where male had 39.45% of total male studied and females had 65.31% of total females studied. **Free earlobes** are the maximum in the studied Chhattisgarh population which is 85.40% of total subjects, in which males had 80.73 % of total males and female had 86.88% of total females studied. The study provides information on the earlobe variability of native Chhattisgarh population. It does open new frontiers for Anthropological and forensic researches.

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