International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 08 Issue 10 October 2025
DOI: 10.47191/ijcsrr/V8-i10-03, Impact Factor: 8.048
IJCSRR @ 2025
www.ijcsrr.org

Differences in the Mean Cephalic Index between the Timorese Ethnic Group and the Mixed Timorese Ethnic Group in Kupang City, East Nusa Tenggara Province

Aviany Kurniati Hanna Taneo[1]*, Regina Marvina Hutasoit[2], Iswaningsih[3], Herman Pieter Loius Wungouw[4]
[1]Faculty of Medicine and Veterinary Medicine, Nusa Cendana University
[2]Department of Anatomy, Faculty of Medicine and Veterinary Medicine, Nusa Cendana University
[3]Department of Public Health and Community Medicine, Faculty of Medicine and Veterinary Medicine, Nusa Cendana University
[4]Department of Radiology, Faculty of Medicine and Veterinary Medicine, Nusa Cendana University

ABSTRACT: The cephalic index is a head measurement technique by determines the ratio of head size from the maximum length of the skull bone (glabella-opisthocranion) to the maximum width of the skull bone (euryon-euryon). Ethnicity is one of the factors that can affect the shape and size of a person's head. The Timorese are a tribe that lives on the island of Timor in East Nusa Tenggara Province. Intermarriage between different ethnicities can affect the next generation's shape and type of head. This is due to the combination of different genetic information from each individual. This study aims to determine whether there is a difference in the mean cephalic index between the Timorese and the mixed Timorese in Kupang City, East Nusa Tenggara Province. This study uses a comparative analytical research design with a cross-sectional design. The sampling technique used was a non-probability sampling method with a consecutive sampling type, with a sample size of 100 people. The data were collected using a screening sheet and measuring the cephalic index directly on research subjects using a spreading caliper. The data analysis used was the independent t-test. The result showed that using an independent t-test, there was no significant difference in the mean cephalic index between the Timorese and mixed Timorese in Kupang City, East Nusa Tenggara Province with p-value = 0.38.

KEYWORDS: Cephalic Index, Timorese, Mixed Timorese, Kupang City

INTRODUCTION

The cephalic index is a cranial measurement technique that determines the ratio between the maximum cranial length and the maximum cranial breadth [5],[6]. The measurement of the cephalic index holds significant importance in the fields of anthropology, forensic science, and craniofacial plastic surgery planning. It can also assist in identifying and classifying populations based on age, race, sex, nutritional status, geographical location, living environment, and ethnic background. Moreover, it may be employed to monitor growth and developmental patterns in diverse populations, as well as to detect cranial abnormalities [5–7]. According to the International Descriptions, the measurement of the cephalic index (head shape) is classified into four types: dolichocephalic, mesocephalic, brachycephalic, and hyperbrachycephalic [7]. In Nigeria and other regions of Africa (Negroid race), the average head shape of the population is predominantly dolichocephalic [11],[12]. In contrast, studies in Iran, Chile, and several European populations, all categorized under the Caucasoid race, reported a similar predominance of the brachycephalic type [11],[13].

In Indonesia, research conducted by Maria Istiqomah Marini et al. (2016) demonstrated that the Dayak Kenyah ethnic group predominantly exhibits a mesocephalic head type. Meanwhile, a study by Khanifatu Zahroh et al. (2018) reported that the Dayak Ngaju, Dayak Bukit, and Dayak Banjar Hulu ethnic groups—belonging to the Proto-Malay race—share a common characteristic of dolichocephalic head type [14]. Furthermore, a study by Ananda et al. (2021), revealed that the Balinese population (Deutero-Malay race) predominantly exhibits a hyperbrachycephalic head type, whereas the NTT population (Melanesian race) predominantly exhibits a brachycephalic head type [15]. The shape and size of an individual's head are influenced by multiple factors, both internal and external. Internal factors refer to inherent characteristics that cannot be altered, such as ethnicity, race, genetics, sex, and age. In contrast, external factors are derived from the environment, including nutrition, living conditions, and geographical location [1],[8],[17]. Ethnicity is one of the internal factors that can influence cranial shape and size due to variations in genetic information among individuals from different ethnic groups [2],[9].

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 08 Issue 10 October 2025
DOI: 10.47191/ijcsrr/V8-i10-03, Impact Factor: 8.048
IJCSRR @ 2025
www.ijcsrr.org

The Timorese ethnic group resides on Timor Island in East Nusa Tenggara Province. Their predominant physical characteristics include dark brown to blackish skin, curly hair, distinctive cranial shape, narrow zygomatic bones and mandible, a relatively high total facial index, a face proportionally taller compared to zygomatic width, and a forehead that is relatively broader compared to cranial breadth [18]. The majority of the Timorese population exhibit a rounded head shape, corresponding to the brachycephalic type [19]. Interethnic marriages contribute to the combination of genetic information from both parents, whether from the same or different ethnic backgrounds, thereby influencing the head type and cranial morphology of their offspring. This genetic admixture provides the rationale for the present study [2],[20].

METHOD

The study was conducted directly in five districts of Kupang City. A total of 100 participants were recruited, consisting of 50 individuals from the Timorese ethnic group and 50 individuals from the Mixed-Timorese ethnic group (with at least one parent of Timorese origin). The inclusion criteria required participants with no history of cranial surgery, craniofacial plastic surgery, or specific medical conditions that could alter cranial morphology, and no history of severe head trauma.

RESULT

The characteristics of 50 Timorese Ethnic respondents can be seen in the figure below

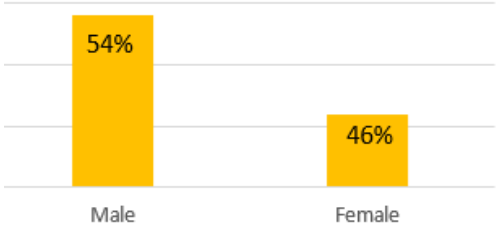

Figure 1. Characteristics of Respondents Based on Gender

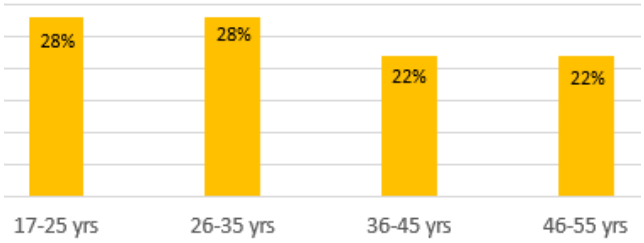

Figure 2. Characteristics of Respondents Based on Age

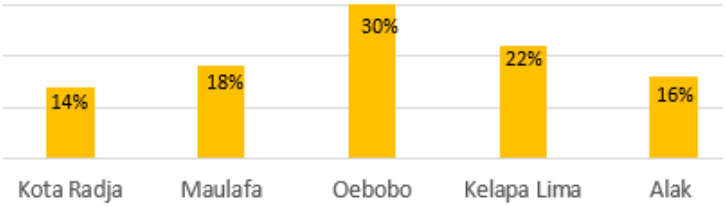

Figure 3. Characteristics of Respondents Based on Address

Based on gender, the majority of respondents were male, totaling 27 individuals (54%). According to age groups, the largest proportions were found in the 17–25 years and 26–35 years groups, each comprising 14 respondents (28%). The smallest proportion was observed in the 36–45 years and 46–55 years groups, with 11 respondents (22%). The oldest respondent was 50 years old, while the youngest was 18 years old. In terms of residential sub-district, the highest number of respondents was from Oebobo sub-district, comprising 15 individuals (30%), whereas the smallest number was from Alak sub-district, with 8 respondents (16%).

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 08 Issue 10 October 2025
DOI: 10.47191/ijcsrr/V8-i10-03, Impact Factor: 8.048
IJCSRR @ 2025
www.ijcsrr.org

The characteristics of 50 Mixed-Timorese Ethnic respondents can be seen in the figure below

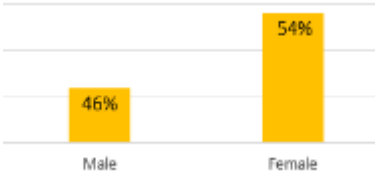

Figure 1. Characteristics of Respondents Based on Gender

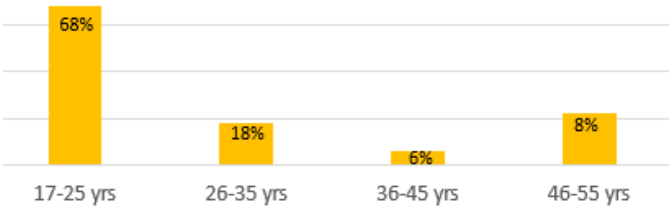

Figure 2. Characteristics of Respondents Based on Age

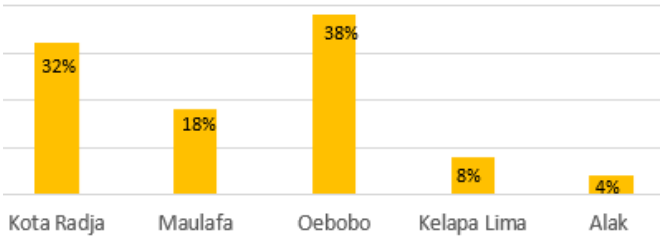

Figure 3. Characteristics of Respondents Based on Address

Based on gender, the majority of respondents were female, totaling 27 individuals (54%). According to age groups, most respondents were in the 17–25 years group, with 34 individuals (68%), while the smallest proportion was found in the 36–45 years group, with 3 individuals (6%). The oldest respondent was 50 years old, and the youngest was 18 years old. In terms of residential sub-district, the largest number of respondents came from Oebobo sub-istrict, with 19 individuals (38%), whereas the smallest number came from Alak sub-istrict, with 2 individuals (4%).

Univariate Analysis

Table 1. Mean Cephalic Index of the Timorese and Mixed-Timorese Ethnic Groups

	Dolicocephalic	Mesocephalic	Brachycephalic	Hyperbrachycephalc	Mean
Timorese Ethnic	71,50	77,33	81,95	88,00	82,76
Mixed-Timorese Ethnic	72,00	77,43	81,76	87,71	83,62

Based on Table 1, most respondents from the Timorese ethnic group exhibited the brachycephalic head type, with 22 individuals (44%), while the least common was the dolichocephalic type, with 2 individuals (4%). The overall mean cephalic index in this group was 82.76. In contrast, among respondents from the Mixed-Timorese ethnic group, the majority exhibited the hyperbrachycephalic head type, with 24 individuals (48%), while the dolichocephalic type was the least common, with 2 individuals (4%). The overall mean cephalic index in this group was 83.62

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 08 Issue 10 October 2025
DOI: 10.47191/ijcsrr/V8-i10-03, Impact Factor: 8.048
IJCSRR @ 2025
www.ijcsrr.org

Bivariate Analysis

Table 2. Statistical Test of the Mean Cephalic Index in the Timorese and Mixed-Timorese Ethnic Groups

No	Suku	Mean Cephalic Index	P-Value
1	Timorese Ethnic	82,76	$P = 0,38$
2	Mixed-Timorese Ethnic	83,62	$P = 0,38$

The statistical test results presented in Table 2 show that the comparison between the Timorese and Mixed-Timorese ethnic groups yielded a significance value of $p = 0.38$ ($p > 0.05$). Therefore, the difference between the two groups was not statistically significant.

DISCUSSION

The results of the independent t-test between the Timorese and Mixed-Timorese ethnic groups showed that $p > 0.05$, indicating no significant difference in the mean cephalic index. This outcome may be influenced by several factors, such as genetics, nutritional status, environment, and geographical location.

According to Walter Sutton's theory (1903) regarding Mendel's principles of heredity, genes are located on chromosomes. Genes situated on the same chromosome tend to be inherited together and are less likely to assort independently during gamete formation. The genetic process involved is referred to as germinal gametic mutation, as it occurs in gamete cells and can be passed on to offspring. If such a mutation results in a dominant trait, the genetic characteristic will be expressed in the phenotype of the offspring. Conversely, if the mutation produces a recessive trait, the genetic characteristic will remain unexpressed.

The offspring may inherit more genetic characteristics from either the father or the mother, or may exhibit new genetic traits that differ from both parents, known as recombinants. When the father and mother come from different ethnic backgrounds, each contributes distinct genetic traits that can influence cranial morphology in their descendants. In this study, respondents from the Mixed-Timorese ethnic group were defined as individuals with one parent originating from another ethnic group outside of Timor. The descendants of the Mixed-Timorese group were found, on average, to inherit genetic traits from the Timorese parent, whether paternal or maternal. This finding is supported by the results of the present study and consistent with Mendel's principles, indicating that there was no significant difference in the mean cephalic index between the Timorese and Mixed-Timorese groups. This is explained by the predominance of Timorese genetic traits over those inherited from the non-Timorese parent, rendering the latter recessive or unexpressed.

Furthermore, a study conducted by Roseann E. Peterson, Karoline Kuchenbaecker, et al. in 2015, entitled "Genome-wide Association Studies in Ancestrally Diverse Populations: Opportunities, Methods, Pitfalls, and Recommendations", suggested that several ethnic groups across the world may share inherited genetic factors due to common ancestry, ancestral migration, mutation and recombination, genetic drift, and natural selection. These processes can result in descendants who are physically similar or nearly identical, as reflected in the DNA inherited from their ancestors. In the case of the Mixed-Timorese group, having one parent of Timorese origin indicates shared ancestry with the Timorese group through one parental line, thereby explaining why the difference in mean cephalic index between the two groups was not statistically significant.

In a study conducted by Gilang M. Fauzan et al. (2019), entitled "Differences in the Mean Cephalic Index and Frontoparietal Index between the Minangkabau and Javanese Ethnic Groups", a significant difference in the mean cephalic index was reported. The researchers compared the cephalic index between two distinctly different ethnic groups, with no shared genetic traits between them, which explains the significant difference observed [3]. In contrast, the study conducted by Roseann E. Peterson, Karoline Kuchenbaecker, et al. (2015) with the same title emphasized that environmental factors remain closely linked to inherited ancestral genetics, as individuals often reside within the same local environments (family or community). Furthermore, there is an interaction between hereditary factors and sociocultural aspects such as race and ethnicity [21]. Consequently, the results of the present study revealed no significant difference. Geographical location also plays an important role. According to Rick A. Kittles and Kenneth M. Weiss (2003), in their study entitled "Race, Ancestry, and Genes: Implications for Defining Disease Risk", genetic differences between populations are roughly proportional to the geographical distance separating them. This relationship can be observed

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 08 Issue 10 October 2025
DOI: 10.47191/ijcsrr/V8-i10-03, Impact Factor: 8.048
IJCSRR @ 2025
www.ijcsrr.org

globally as well as regionally. However, in geographically closer or intermediate populations, genetic differences decrease proportionally. Thus, the absence of significant differences in the present study can be explained by the shared population history of genes within the same geographical region [9]. There is also a correlation between variants found in one region relative to those in another, which further contributes to the nonsignificant difference in the mean cephalic index observed between the Timorese and Mixed-Timorese ethnic groups.

In addition to environmental and geographical factors, nutritional status can also determine an individual's cephalic index. This is because nutritional status influences brain development and bone growth, including cranial bones [23]. Similarities or differences in growth patterns among ethnic groups may therefore reflect variations in nutritional status. Identification of growth across ethnic or tribal groups is often assumed to be solely due to inherited biological or genetic factors [24].

Based on the results of the independent t-test, no significant difference was found in the mean cephalic index between the Timorese and Mixed-Timorese ethnic groups, with a significance value of $p = 0.38$ ($p > 0.05$). These findings are influenced by the factors discussed above, with the most prominent being genetic traits inherited from the parents, where one tends to be more dominant than the other. In addition, shared ancestral genetic backgrounds, as well as the influence of environmental conditions, geographical location, and nutritional status, also contribute to the nonsignificant difference observed.

CONCLUSION

The conclusion drawn from this study are there was no significant difference in the mean cephalic index between the Timorese and Mixed-Timorese ethnic groups, as indicated by the acceptance of H_0 with a significance value of $P = 0.38$. The mean cephalic index of the Timorese ethnic group in Kupang City was 82.76%, corresponding to the brachycephalic head type. The mean cephalic index of the Mixed-Timorese ethnic group in Kupang City was 83.62%, also corresponding to the brachycephalic head type.

REFERENCES

1 Mandal GC, Acharya A, Bose K. Relationship of cephalic index with some anthropometric variables among the rural preschool children of West Bengal, India. *Hum Biol Rev*. 2016;5(3):296-308.
2 Irsa R, Syaifullah, Tjong DH. Variations of cephalometry in several ethnic groups in West Sumatra. *J Bio UA*. 2013;2(2):130-7.
3 Fauzan GM, Manela C, Hidayat T. Differences in mean cephalic index and frontoparietal index between Minangkabau and Javanese ethnic groups. *J Kes Andalas*. 2019;8(1):96-101.
4 Zahroh K, Irnamanda DH, Aflanie I. The differences of head shape characteristics in Kalimantan tribes using frontoparietal index. *Dentino J Dent*. 2018;3(1):96-100. Available from: https://ppjp.ulm.ac.id/journal/index.php/dentino/article/view/4610
5 Kumar K, Sabarigirinathan C. Cephalic index – a review. *Int J Med Rev Case Rep*. 2019;3:1-5.
6 Yagain VK, Pai SR, Kalthur SG, Chethan P, Hemalatha I. Study of cephalic index in Indian students. *Int J Morphol*. 2012;30(1):125-9.
7 Jervas E, Ihejihuka AT, Greg I, Osuchukwu IW. Cephalic index of the Igbos, Nigeria. *Anthropol Open J*. 2016;1(1):23-6.
8 Ilayperuma I. Evaluation of cephalic indices: a clue for racial and sex diversity. *Int J Morphol*. 2011;29(1):112-7.
9 Doni PKR, Janaki CS, Vijayaraghavan V, Raj UD. A study on measurement and correlation of cephalic and facial indices in males of South Indian population. *Int J Med Res Health Sci*. 2013;2(3):439-46.
10 Orish CN. Cephalic index in sexual dimorphism and racial diversity: a mini review. *MOJ Anat Physiol*. 2018;5(1):10-3.
11 Liebenberg L, Stull KE, L'Abbé EN, Botha D. Evaluating the accuracy of cranial indices in ancestry estimation among South African groups. *J Forensic Sci*. 2015;60(5):1277-82.
12 Golalipour MJ. The effect of ethnic factor on cephalic index in 17-20 years old females of North Iran. *Int J Morphol*. 2006;24(3):319-22.
13 Herliani SM, Irnamanda DH, Alfanie I. Differences of head form characteristics using cephalic index on Kalimantan tribe. *Dentino J Dent*. 2018;3(2)

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 08 Issue 10 October 2025
DOI: 10.47191/ijcsrr/V8-i10-03, Impact Factor: 8.048
IJCSRR @ 2025
www.ijcsrr.org

14 Herliani SM, Irnamanda DH, Alfanie I. Differences of head form characteristics using cephalic index on Kalimantan tribe. *Dentino J Dent*. 2018;3(2):[pages not available].
15 Ananda RN, Yulianti K, Henky, Rustyadi D. Differences in mean cephalic index and body height between Balinese and East Nusa Tenggara (NTT) ethnic groups in Denpasar. *J Medika Udayana*. 2021;10(4):51-6.
16 Rivani R, Rusman AA, Linasari D. Comparison of cephalic index among populations. 2017;15-6. [Journal source not available].
17 Jadav R, Kariya VB, Kodiyatar BB, Pensi CA. A study to correlate cephalic index of various caste/races of Gujarat state. *Natl J Integr Res Med*. 2011;2(2):18-22.
18 Artaria M. Comparative study of cephalometric traits in various ethnic groups in Indonesia. *Universitas Airlangga*. 2010;1-24. [Grey literature].
19 Feka AY. General overview of Atoni Dawan people in Manusasi Village. Kupang: Universitas Katolik Widya Mandira; 2018. [Undergraduate thesis].
20 Yunus E, Tan HT, Rahardja K. *Basic genetics textbook*. Jakarta: Universitas Al Azhar Indonesia; 2015.
21 Peterson RE, Kuchenbaecker K, Walters RK, Chen CY, Popejoy AB, Periyasamy S, et al. Genome-wide association studies in ancestrally diverse populations: opportunities, methods, pitfalls, and recommendations. *Cell*. 2019;179(3):589-603. doi:10.1016/j.cell.2019.08.051
22 Kittles RA, Weiss KM. Race, ancestry, and genes: implications for defining disease risk. *Annu Rev Genomics Hum Genet*. 2003;4:33-67.
23 Ivanovic DM, Leiva BP, Pérez HT, Olivares MG, Díaz NS, Urrutia MS, et al. Head size and intelligence, learning, nutritional status and brain development. *Neuropsychologia*. 2004;42(8):1118
24 Scholl TO, Karp RJ, Theophano J, Decker E. Ethnic differences in growth and nutritional status: a study of poor schoolchildren in southern New Jersey. *Public Health Rep*. 1987;102(3):278-83.

Cite this Article: Hanna Taneo, A.K., Hutasoit, R.M., Iswaningsih, Loius Wungouw, H.P. (2025). Differences in the Mean Cephalic Index between the Timorese Ethnic Group and the Mixed Timorese Ethnic Group in Kupang City, East Nusa Tenggara Province. International Journal of Current Science Research and Review, 8(10), pp. 4902-4907. DOI: https://doi.org/10.47191/ijcsrr/V8-i10-03