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DIFFERENCES OF HEAD FORM CHARACTERISTICS USING CHEPALIC INDEX ON KALIMANTAN TRADE

(Identification Study of Male and Female Head Shape In Dayak Ngaju tribe, Dayak Bukit tribe and Banjar Hulu tribe)

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ABSTRACT

Background: *The island of Borneo is inhabited by various tribes such as Dayak Ngaju tribe, Dayak Bukit tribe and Banjar Hulu tribe. According to Radam (1987) the Dayak Bukit and Banjar Hulu tribes have the closest kinship, while the theory of Tjilik Riwut (1979) says Dayak Bukit tribe is part of Dayak Ngaju tribe. The difference between the two theories is still debatable so it needs to be identified. Identification of all three groups is by using the chepalic index.* ***Objective:*** *To find out the average head width, head length and chepalic index between men and women in the three groups of tribes in Kalimantan.* ***Method:*** *This study was an observational analytic study with cross sectional design, using respondents of 180 people consisting of 60 people in each tribe groups. Characteristic of head shape was measured by using chepalic index.* ***Results:*** *Research data were analyzed using Kruskal Wallis test. The Kruskall Wallis test of head width, head length and chepalic index yielded p = 0,000 (p <0.05). It showed significant differences in head width, head length and chepalic index between the three ethnic groups in Kalimantan, while the chepalic index of the three tribes produced p > 0,05 which showed no difference in mean value of chepalic index between male and female in all three groups.* ***Conclusion:*** *Based on the comparison of head width, head length and chepalic index, it can be concluded that there is a possibility of kinship relationship between Dayak Bukit tribe and Banjar Hulu tribe.*

Keywords:*Banjar Hulu, chepalic index, Dayak Bukit, Dayak Ngaju tribe*

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INTRODUCTION

Indonesia is a country with high risk for natural disasters such as earthquakes, tsunamis, landslides, floods, accidents on land, sea and air. According to BPNB (2017), South Kalimantan has flood-prone areas, forest fires, tornadoes and landslides that increase every year and have devastating impacts on communities. This disaster resulted in many victims in the form of bodies that are still intact, rotting, half burned, separated in the form of fragments, buried and a combination of the other two. The condition of the bodies under these conditions may complicate the identification of forensics[1,2,3].

In Forensic science the identification of the sexes in individuals is the first step in determining the identity of individuals[2]. Factors that influence an identification in anthropometry are among others which is limited to the specification data in head measurement in the form of chepalic index,

against the tribes in Indonesia. This is why it is important to measure using anthropometry.

In the field of Dentistry, such as Orthodontics, anthropometric measurements are useful to describe the proportions of faces in which the shape of face and head type is essential for the planning and prognosis of orthodontic treatment, determining the growth and development of head shape. In Maxillofacial science the chepalic index is useful for knowing the complex anatomy of the head and face consisting of the dentoalveolar anatomy and the anatomy of the masticatory muscle which is useful for reconstructing the facial and head shape[4,5]. Head shape measurements can be used as a media specification on race and ethnicity. Sex identification in individuals using a head shape morphology method can be used as a measurement of the chepalic index[9,10].

The chepalic index and frontoparietal index is one of the branches of the measurement of the cephalometry index which may indicate the variation of human form of various tribes. The value of the cephalometry index can be determined from the chepalic index, facial index, nasal index and frontoparietal index. The chepalic index research is very minimal in Indonesia especially in Kalimantan consisting of Dayak Ngaju, Dayak Bukit and Banjar Hulu. The tribe is a distinct ethnic group, where ethnic groups are different from one another because it is influenced by individual variations. The existence of chepalic index is easier to classify people into groups that have the same characteristics. This study aims to see whether there is a difference in head shape characteristics using chepalic index on Dayak Bukit tribe, Dayak Ngaju tribe and Banjar Hulu tribe [6,7,8]

MATERIALS AND METHODS

The type of this research was an observational analytic research using cross sectional method. This study aimed to analyze the different characteristics of head shape using chepalic index. The tribal groups observed in this study consisted of three ethnic groups namely Dayak Ngaju, Dayak Bukit and Banjar Hulu. Respondents numbered 180 people consisting of 60 respondents for each tribe. Each tribe consists of 30 respondents consisting of men and women. The respondents were Dayak Bukit tribe located in Hinas Kiri Village, Batang Alai Timur Subdistrict, Dayak Ngaju tribe located in Bukit Bamba Village, Central Kahayangan District, while Banjar Hulu tribe was located in Banua Kapayan Village, Subdistrict South Labuan Amas. The population was selected by using purposive sampling method in which the selection of samples or respondents is in accordance with the criteria of inclusion and exclusion. This research should conduct ethical clearance test No.061 / KEPKG-FKGULM / EC / IX / 2017 from Faculty of Dentistry.

The inclusion criteria to include the respondents in the study as sample was as follow: male and female, respondents aged between 19-50 years old, descendants of indigenous Dayak Ngaju tribe, Dayak Bukit tribe and Banjar Hulu tribe. For the exclusion criteria in this study was as follows: never performed surgery on the skull bone and have been or are experiencing injury trauma to the bones of the skull. The tool used in this research was the informed consent sheet, the information sheet to match the respondent's identity with the research criteria, Stationery, spreading caliper and meter band as second alternative tool if the spreading calipers do not exist.

Measurements were made using a tape measure, measuring the width of the head from the distance between the two euryons (eu-eu), while the head length was measured from the distance of glabella (g) to opisthocranion (op). This measurement was done by asking the respondents to sit in a chair with relaxed conditions and head in an anatomical upright position. The head width and length were measured three times and averages were recorded on the respondent's information sheet. The chepalic index is the ratio between the head width and the maximum head length multiplied by 100. This chepalic index illustrates the shape of the head so it can be formulated as follows[9]:

$$\text{Chepalic index} = \frac{\text{Head Breadth}}{\text{Head Length}} \times 100$$

Differences in head shape characteristics between men and women in the Kalimantan tribe can be done by Kruskal Wallis Test and Mann-Whitney test.

RESULTS

Research results on head width, head length and chepalic index have been performed on the Dayak Ngaju, Dayak Bukit and Banjar Hulu groups shown in the following descriptions and tables.

The mean of head width, head length and cephalic index on Dayak Ngaju tribe is shown in table 1.

No	Gender	Head Width (cm)	Head Length (cm)	Chepalic index *(%)*
1	Men	19,415	29,4175	64,22
2	Women	16,13	27,52	62,87

Table 1 above shows the average size of head width, head length, and chepalic index in Ngaju Dayak tribe men greater than the average width of head size, head length and chepalic index of Dayak Ngaju women.

Based on the measurements, the average head width, head length and chepalic index on Dayak Bukit tribe are shown in table 2.

Table 2 The average size of head width, head length and chepalic index Between men and women Dayak Bukit tribe.

No	Gender	Head Width (cm)	Head Length (cm)	Chepalic index *(%)*
1	Men	18,29	25,24	72,76
2	Women	17,025	23,55	72,39

Table 2 shows that the average size of head width, head length and chepalic index in men of Bukit Dayak tribe is greater than the average of head width, head length and chepalic index of female Dayak Bukit.

Based on the measurements of the research, the average head width, head length and chepalic index in Banjar Hulu tribe can be shown in table 3.

Table 3 The average size of head width, head length and chepalic index between men and women in Banjar Hulu tribe.

No	Gender	Head Width (cm)	Head Length (cm)	Chepalic index *(%)*
1	Men	21,56	32	71,22
2	Women	16,49	23,51	70,00

Table 3 shows that the average size of head width, head length and chepalic index in Banjar Hulu tribe men is greater than the mean size of head width, head length and chepalic index of Banjar Hulu women.

Based on the measurement results, the average of cephalic index on the three groups of tribe Dayak Ngaju tribe, Dayak Bukit tribe and Banjar Hulu tribe can be shown in table 4.

Table 4 The average size of chepalic index of Men and Women in Dayak Ngaju, Dayak Bukit and Banjar Hulu.

No	Tribe	Chepalic index (Man)	Chepalic index (Woman)
1	Dayak Ngaju	64,22 %	62,87 %
2	Dayak Bukit	72,76 %	72,39 %
3	Banjar Hulu	71,22 %	70 %

Table 4 shows that the largest chepalic index in the three tribes is in Dayak Bukit tribe both male and female, while the lowest chepalic index found in Dayak Ngaju tribe both male and female.

Based on the data obtained, the analysis of head width, head length and chepalic index between men and women in Dayak Ngaju, Dayak Bukit and Banjar Hulu are as follows.

Table 5 Normality Test of head width, head length and chepalic index of three ethnic groups in Kalimantan.

No.	Variabel	Tribe	Gender	Sig
1.	Head Width	Dayak Ngaju	Men	0,178
			Women	0,157
		Banjar Hulu	Men	0,000*
			Women	0,151
		Dayak Bukit	Men	0,036*
			Women	0,298
2.	Head Length	Dayak Ngaju	Men	0,231
			Women	0,172
		Banjar Hulu	Men	0,114
			Women	0,030*
		Dayak Bukit	Men	0,038*
			Women	0,481
3.	Chepalic index	Dayak Ngaju	Men	0,678
			Women	0,010*
		Banjar Hulu	Men	0,009*
			Women	0,035*
		Dayak Bukit	Men	0,000*
			Women	0,135

Based on table 5, it can be seen that the Shapiro-Wilk test resulted in data normality test shows that some research data is not normally distributed, because the value of the resulting significance is lower than the standard α (0.05). Homogeneity test was conducted to determine whether the variation between tested groups is different or not. In this study the data were tested using homogeneity test or Levene Test. If the

significance value (p) is greater than 0.05 then the research data is stated to be homogeneous. Homogeneity test results can be seen in table 6.

Table 6 Homogeneity test of head width, head length and chepalic index between the three ethnic groups in Kalimantan.

No.	Variables	Significance Value (p)
1.	Head Width	0,038
2.	Head Length	0,013
3.	Chepalic index	0,015

Based on table 6, it can be seen that the value of significance in the data has a smaller value than the standard α (0.05), so that the research data does not meet the requirements of homogeneity.

Analysis of difference of head width, head length and chepalic index between men and women of Dayak Ngaju tribe was performed using Mann-Whitney test results can be seen in table 7.

Table 7 Differences of head width, head length and chepalic index between men and women in Dayak Ngaju tribe.

No	Gender	Mean Head Width (cm)	P	Mean Head Length (cm)	P	*chepalic* (%)	P
1	Men	19,09	0.00	29,71	0,00	64,37	0,069
2	Women	17,24		27,52		62,71	

The above table shows the value of p <0,05 so it can be concluded that the average size of head width and head length between men and women of Dayak Ngaju tribe has significant difference, while the chepalic index between men and women of Dayak Ngaju tribe has p value = 0.069 is p> 0,05 so it can be concluded there is no difference of chepalic index between men and women of Dayak Ngaju tribe.

Analysis of head width, head length and chepalic index difference between men and women in Banjar Hulu was done by using Mann-Whitney test can be seen in table 8.

Table 8 Differences in head width, head length and chepalic index between men and women of Banjar Hulu tribe.

No	Gender	Mean Head Width (cm)	P	Mean Head Length (cm)	P	*chepalic* (%)	P
1	Men	21,56	0.00	30,33	0,00	71,23	0,539
2	Women	16,49		23,52		70,46	

The above table shows the value of p <0.05 so it can be concluded that the head width and head length between men and women in Banjar Hulu has significant difference, while the chepalic index between men and women in Banjar Hulu has p = 0.539 that is p > 0,05, so it can be concluded that there is no difference of chepalic index between men and women Banjar Hulu.

Mann Whitney test analysis of differences in head width, head length and chepalic index between men and women in Dayak Bukit tribe can be seen in table 9.

Table 9 Differences in head width, head length and chepalic index between men and women of Dayak Bukit tribe.

No	Gender	Mean Head Width (cm)	p	Mean Head Length (cm)	P	*chepalic* (%)	P
1	Men	18,29	0.00	25,24	0,00	71,23	0,192
2	Women	17,02		23,55		70,42	

The above table shows the value of p <0,05 so it can be concluded that the average size of head width and head length between men and women in Dayak Bukit tribe have significant difference, while the chepalic index between men and women in Dayak Bukit have value p = 0,192 that is p> 0,05 so it can be concluded that there is no difference of chepalic index between men and women in Dayak Bukit tribe.

Analysis of head width, head length and chepalic index difference between Dayak Ngaju, Dayak Bukit and Banjar Hulu can be seen in table 10.

Table 10 Kruskall Wallis analysis of differences in head width, head length and chepalic index between Dayak Ngaju, Dayak Bukit and Banjar Hulu.

No	Tribe	Mean Head Width (cm)	p	Mean Head Length (cm)	p	*chepalic* (%)	P
1	Dayak Bukit	18,17	0,10	25,24	0,00	72,55	0,00
2	Dayak Ngaju	19,03		23,55		63,55	
3	Banjar Hulu	17,66		24,39		70,84	

The above table shows the average head length and chepalic index between the three groups of tribes on Kruskall Wallis test which yield p value <0.05. It means that there are differences in head length and chepalic index between the three groups of the tribe. Meanwhile, the result of Kruskall Wallis test of while the head width between the three groups of the tribe yielded a p> 0,05 which means that there was no difference in

head width between the three tribal groups to know the difference of mean value of head length and chepalic index significantly between the three groups of tribe, it is followed by further test using Mann-Whitney.

The result of Mann-Whitney test analysis on head length difference between Dayak Bukit, Dayak Ngaju and Banjar Hulu can be seen in table 11.

Table 11 Mann Whitney test analysis of head length difference between Dayak Ngaju, Dayak Bukit and Banjar Hulu.

No.	Tribe	Sig. (p)
1.	Dayak Ngaju Banjar Hulu	0,027
2.	Dayak Ngaju Dayak Bukit	0,000
3.	Banjar Hulu Dayak Bukit	0,002

Based on the table above, it can be concluded that the comparison of head length between Dayak Ngaju tribe with Banjar Hulu, Dayak Ngaju with Dayak Bukit, and between Banjar Hulu and Dayak Bukit tribe produce p value <0,05. It can be concluded that there is a difference of head length among all the etnic groups.

The result of Mann-Whitney test analysis on the difference of chepalic index between Dayak Bukit, Banjar Hulu and Dayak Ngaju is shown in table 12 .

Table 12 Analysis of the chepalic index difference between the Dayak Ngaju, Dayak Bukit and Banjar Hulu.

No.	Tribe	Sig. (p)
1.	Dayak Ngaju Banjar Hulu	0,000
2.	Dayak Ngaju Dayak Bukit	0,000
3.	Banjar Hulu Dayak Bukit	0.181

Based on the table above, it can be concluded that the comparison of chepalic index between Dayak Ngaju tribe with Banjar Hulu and Dayak Ngaju tribe with Dayak Bukit tribe produce p value <0,05. It can be concluded that there is difference of chepalic index between Dayak Ngaju tribe with Banjar Hulu and Dayak Ngaju tribe with Dayak Bukit tribe, while the chepalic index correlation between Banjar Hulu and Dayak Bukit tribes produce p> 0,05 which can be concluded that there is no difference of chepalic index between Dayak Bukit and Banjar Hulu.

DISCUSSION

The results of this study indicate that there is a significant difference in the average of head size and head length between Dayak Ngaju, Dayak Bukit and Banjar Hulu, with the average head size and head length of the Dayak Bukit, Dayak Ngaju and Banjar Hulu men is bigger than the women of the three tribes. This is in line with the theory of Gravlee (2003) which says that the weight of bones and skeletons of men is heavier and stronger 8% than women (Gravlee, 2003). Other theories relating to the results of this study are the theories according to Golalipur (2006) and Akinbami (2014) who say that one of the factors causing differences in the width and head length of men and women is a hormonal factor in which male hormonal factors are higher than women. Hormones that play a role in the formation of head shape is thyroid hormone, parathyroid, calcitonin, insulin and estrogen and testosterone. Parathyroid hormone and calcitonin play a role in calcium metabolism that has an important role in bone formation so that the bone size in men is greater than women[10,11,12,13].

This study shows that the characteristics of head shape using chepalic index in all three tribes are in Dolicochepalic (oval) category and the mean of chepalic index between ethnic groups has significant difference. This means that chepalic index on male and female group has no significant difference. The significant difference between chepalic index between the three ethnic groups probably occurred because of the related origins of the Banjar tribe conveyed by Aflani Daud (1997) that the Banjar tribe is the result of mixing between Old Malay (Proto Melayu) and Malay (Deutro Melayu), while the Dayak tribe is known as Proto Melayu. This is in line with Fadhilah (2012) research which shows the difference of chepalic index mean value between Java tribe from Deutro substitution of Melayu with Lampung tribe from Sub Proto Melayu[14,16]. The absence of a difference in mean rates of chepalic indexes in men and women is in line with Oladipo et al (2012) study that there is no significant difference between men and women in the Ogu and Ihhwerre tribes in Africa. The chepalic index and head shape can be used as a racial identification process but not significant in identifying gender. This insignificant chepalic index difference occurs because men and women of the Dayak Ngaju tribe, Dayak Bukit

tribe and Banjar Hulu tribe have the same head shape and belong to the same racial group[7,14,15,16].

This study shows the characteristics of head shape using chepalic index in all three tribes is Dolicochepalic (oval) category and the mean of chepalic index between ethnic groups have significant difference, while the mean value of chepalic index on male and female group has no significant difference. The meaningful difference between chepalic index between the three ethnic groups probably occurred because of the related origins of the Banjar tribe conveyed by Aflani Daud (1997) that the Banjar tribe is the result of mixture between Old Malay (Proto Melayu) and Malay (Deutro Melayu), while the Dayak tribe is known as Proto Melayu. This is in line with Fadhilah (2012) research which shows the difference in mean value of chepalic index between Java tribe from Deutro substitution of Melayu with Lampung tribe from Sub Proto Melayu[14,16]. The absence of a difference in mean rates of chepalic indexes in men and women is in line with Oladipo et al (2012) study that there is no significant difference between men and women in the Ogu and Ihhwerre tribes in Africa. The chepalic index and head shape can be used as a racial identification process but not significant in identifying gender. This insignificant chepalic index difference occurs because men and women of the Dayak Ngaju tribe, Dayak Bukit tribe and Banjar Hulu tribe have the same head shape and belong to the same racial group[7,14,15,16].

The results of this study indicate the largest rate of chepalic index among the three groups of the tribe is Dayak Bukit tribe. The third group of tribes is classified as mongoloid race group but the average chepalic index produced has a significant difference. According to William's theory (1914) the shape of the head can be influenced by environmental factors on its genetic traits and the existence of morphological adaptations to the environment such as living habits and the types of food consumed by the tribe population that will affect the structure of the jaw and face over time. This is in line with Amikaramata (2011) who shows the correlation or head and facial type relationship with the shape of the jaw and the type of tooth[11,17].

The results of this study indicate that the difference in mean value of chepalic index among the three groups of the tribe is caused by several factors. According to Cray (2009), the difference or diversity of head shape is generated by the complex interaction of environmental variables consisting of muscle function, genetic factors affecting skull bone growth, brain growth and development, as well as non-genetic factors such as geographical location. According to Anderson (2008) different geographical locations, such as low height of a place, climatic conditions, and humidity will affect the shape of the head in which the population will adapt to the environment such as diet adaptation and respiratory processes in the population. This is in line with the research because the geographical location of the three groups of tribes are in different residence areas. Dayak Bukit tribe resides in mountainous areas of meratus, Banjar Hulu tribe reside in the foot of the mountain area of meratus, while the Dayak Ngaju tribe resides in the river Kahayan[17, 18.19].

The results of this study indicate the difference in mean of chepalic index among the three groups of the tribe. There may be variation of brain shape between respondents research. According to Enlow (1990) the shape of the brain will regulate the basic skull structure under the skull and will indirectly affect the structure of the face and shape of the head. This is what makes the difference in the mean of the chepalic index among the three groups of the tribe. Differences in the mean value of the chepalic index in three tribes shows that there may be different generations between respondents research. Based on Heravi and Zieaee (2002) studies, the head shape may change from one generation to another as revealed in the study where second-generation Japanese immigrants residing in Hawaii experienced a change in head size width and chepalic index higher than their parents[11, 17].

The result of this research shows that there is difference in the mean value of chepalic index, head width and length especially between Dayak Ngaju tribe-Banjar Hulu tribe and Dayak Bukit - Dayak Ngaju tribe. While between Dayak Bukit and Banjar Hulu tribe there is no difference of chepalic index. Based on the comparison of head shape characteristics, it can be concluded that there is possibility of kinship relationship between the Dayak Bukit tribe with Banjar Hulu tribe when viewed from the absence of differences in head shape characteristics in the analysis of research data. The conclusions listed in the above paragraphs are in line with the theory according to Radam (1987) that Dayak Bukit tribe comes from the same clump as Banjar Hulu[19]. Based on the above explanation of the comparison of head width, head length and chepalic index, it can be concluded that there is a possibility of kinship relationship between Dayak Bukit tribe with Banjar Hulu tribe.

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