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Nasal Morphology Anthropological Assessment of the Toraja Regency as Basic Data for Forensic Identification

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Abstract

Background

Indonesia is one of the countries with the most number of susceptible areas to various natural disasters, thus proper and scientific identification process needs to be a major national concern. Personal identification is a significant priority in forensic science to determine the identity of disaster victims. Biological profiling is one method that can be used to determine the sex of an unrecognizable victim. In previous studies, nasal index is one example of facial profiles that can be used to identify race and gender. With nasal index data, it will be easier to classify humans into groups that have the same characteristics. This study can be used to determine nasal morphology of the Toraja Tribe population, in Uluway Village, Toraja Regency, which will be used as basic data for forensic identification.

Methods

This cross sectional study was conducted on the indigenous population of the Toraja tribe. Nasal index data was measured by comparing nasal width with nasal height. Data analysis employed was descriptive statistical techniques using IBM ®SPSS ® Statistics version 24.0.

Results and Discussion

This study was conducted on 280 indigenous TorajaNESE populations, which were determined using simple random sampling technique on 1230 populations of Uluway Village, Toraja Regency. The results of this study indicate that the most common nasal type in men is

the mesorhine type, whilst for women it is the leptorhine type. Similar results were reported by Patil et al, which showed that the mesorhine type was the most common nasal type in males and the leptorhine type in females.

Conclusion

Results of this study indicated that after measuring nasal index, there are many anthropological variations in the morphology of the nasal index (Leptorhine, Mesorhine, Platyrhine, and hyperplatyrhine) based on race, age and sex that can be used to explore the characteristics of the Torajanese ethnic population as basic data in forensic odontology identification.

Keywords: nasal index, nasal morphology, Torajanese ethnicity, forensic identification

Introduction

Indonesia is one of the countries with the most number of susceptible areas to various natural disasters, this is due to the fact that Indonesia's geographical location is at the confluence of three of the world's main tectonic plates, namely Eurasia, Indo-Australia and the Mediterranean, therefore any movement of this three tectonic plates could trigger earthquakes and tsunamis. This various natural disaster events have made the procedure for identifying victims of mass disasters or Disaster Victim Identification an important activity and carried out in almost every event that causes large numbers of casualties.(1) Disaster victim identification is an effort aimed to precisely identify the victim's identity through scientific means thus it can be responsibly accounted for. (2) It is not uncommon to encounter difficulties in identifying disaster victims due to damage to body parts that make victims difficult to identify. The identification process is important not only to analyze the cause of mortality, but also to provide psychological peace to the bereaved family by ensuring the identity of the victim.(3)

Personal identification is a significant priority in forensic science to determine the identity of disaster victims. Victim identification can be done based on different characteristics, which are grouped into primary identification and secondary identification. The primary and most reliable identification tools are fingerprint, dental, and DNA analysis.(4) Meanwhile, secondary identification includes individual descriptions such as scars, gender, jewelry, medical findings, as well as clothing and other evidences found in victims' body. Determination of sex and race is one of the important parameters in forensic identification which are included in secondary identification.(5)

Gender identification is an important first step in the forensic identification process because it can find a 50% probability match in individual identification and can influence several other examination methods, such as estimation of an individual's age and height.(6),(7) Thus, it is necessary to have various methods that are suitable for identifying the sex of the victim. Biological profile is one of the methods that can be used to determine sex of an unrecognizable victim. (5) In previous studies, nasal index is one of the facial profiles that can be used to identify race and gender.(8)

Judging from the history of its development, Indonesia in particular is a multi-ethnic society consisting of 360 ethnic groups. These different ethnic groups tend to have different skull and jaw patterns. With the nasal index data, it is easier to classify humans into groups that have the same characteristics. The Torajanese tribe is one of 360 ethnic groups in

Indonesia. (9) Secondary data for forensic identification in the Torajanese tribe has not been widely studied.

Methods

This cross sectional study was conducted on the indigenous population of the Torajanese tribe, in Uluway Village, Toraja Regency during August-September 2021 (ethical clearance number: UH 17120502). Based on the Slovin formula, the minimum number of samples in this study was 301 people. Determination of sample was done using a simple random sampling technique. A total of 21 people were excluded from this study because they were not willing to take part in the nasal index measurement.

Nasal index determination was determined based on Martin and Saller's formula (Martin and Saller, 1957)

$$\left|\frac{\text{Nasal width}}{\text{Nasal height}}\right| x\ 100$$

Annotation:

a. Nasal width was measured from left ala nasi to right ala nasi (ala-ala)
b. Nasal height was measured from nasion to subnasal (N-Sn)

Table 1. *Nasal Index Category*

Categoty	Nasal Size	Nasal index	
		Face	Skull
Hyperleptorhine	Very narrow	40-54,9	-
Leptorhine	Long and narrow	<70	<47
Mesorhine	Moderate shape	70-84,9	49-50,9
Platyrhine	Broad and short	85-99,9	51-57,9
Hyperplatyrhine	Very broad/wide	>100	>58

Statistical analysis used was descriptive statistical techniques. Data processing was performed using Microsoft Excel, then continued by using IBM ®SPSS ® Statistic version 24.0.

Results

Anthropological research on the nasal morphology of the Torajanese Tribe population has been carried out using an anthropometric approach from 5 to 9 September 2021. The nasal index measurement was carried out using calipers on a randomly selected sample. A total of 280 people were used as samples in this study (Table 4.1).

Table 2. *Distribution of respondents' characteristics (n=280)*

Characteristics		n	%
Age (M ± SD)	(39,28 ± 18,88)		
	<25 years old	79	28,2
	26-45 years old	94	33,6
	>45 years old	107	38,2
Gender			
	Male	129	46,1
	Female	151	53,9

(**Source:** *Primary Data, 2021)*

Table 2 showed the distribution of respondents' characteristics. Based on age characteristics, the average age of the sample in this assessment was 39.28 years. For age characteristics, the highest percentage was found at the age of more than 45 years with a percentage of 38.2%. Based on gender characteristics, it was found that there were more female respondents than male, amounting to 151 people with a percentage of 53.9%.

Table 3 showed a descriptive analysis of the nasal index of the Torajanese population based on demographic characteristics. Based on age characteristics, the highest average nasal index was found in the age range of less than 25 years of 87.16 mm with a standard deviation of 12.28 mm. Based on gender characteristics, the average nasal index in women (88.46 ± 11.91 mm) was greater than that of men (82.56 ± 9.04 mm).

Table 3. *Descriptive analysis of nasal index of Torajanese tribe based on demographic characteristics (n=280)*

Demographic characteristics	n	Min-Max	Mean (mm)	SD
Age				
<25	79	68,1-129,6	87,16	12,28
25-45	94	58,1-114,28	83,62	10,37
>45	107	65,6-113,7	86,56	10,52
Gender				
Male	129	65,6-109,2	82,56	9,04
Female	151	58,1-129,6	88,46	11,91

Table 4. *Nasal index morphology of Torajanese tribe based on sociodemograhic characteristics (n=280)*

Demographic characteristics		Nasal index			
		Leptorhine	Mesorhine	Platyrhine	Hyperplatyrhine
Age					
<25	n	5	42	23	9
	%	1.8	15.0	8.2	3.2
25-45	n	10	45	33	6
	%	3.6	16.1	11.8	2.1
>45	n	5	33	53	16
	%	1.8	11.8	18.9	5.7
Gender					
Male	n	11	74	37	7
	%	3.9	26.4	13.2	2.5
Female	n	9	46	72	24
	%	3.2	16.4	25.7	8.6

Table 4.3 showed the nasal index distribution based on sociodemographic characteristics. Based on age characteristics, for the age category below 25 and 25-45 years, the highest nasal index was found in the mesorhine category, while for the age category above 45 years, the nose index was the highest in the platyrrhine category. Based on gender characteristics, the category of mesorhine was found to be the most in men and platyrhine in women.

Discussion

Nose is one of the facial profiles that can be used as a guide in determining race. Nasal index is one of the most recognized anthropometric clinical parameters in rhinoplasty and medical management. Various studies have shown differences in nasal indices related to race and ethnicity between different populations.(18) According to Ozdemi UA, nasal anthropometric parameters vary by age, sex, and ethnicity.(19) Based on this, data on nasal morphological variations of the Toraja population based on age and gender is presented in this study.

The results of this study indicated that there is a decrease in the average nose index in the 25-45 year age group compared to the under 25 age group and the older age group (>45 years) showed a slight increase in the average nasal index compared to the previous age group. This is in contrast to the study conducted by Hegazy AA et al, which showed that the older age group (>45 years) showed a slight decrease in the average nose index compared to the previous age group (20-45 years). Hegazy AA et al, also observed that the mean value of the nasal index showed a significant difference only after the age of 20 years. At that age, the average nose index value for men and women was 71.46 mm and 64.56 mm, respectively.(18)

In this study, the average nose index was highest in the age group under 25 years of 87.16 mm. Meanwhile, based on gender, the average nose index for women (88.46 mm) was higher than the average nose index for men (82.56 mm). This result is different from the study conducted by Ray et al, which concluded that the average nose index of men was greater than that of women. (20) The same result was also reported by Patil et al, which showed that the nasal index of men was higher than that of women with a score of 84.91 mm for men and 64.75 mm for women, respectively. Ukoha et al, also reported that the nasal index of males was greater than that of females, namely 89.95 mm in males and 85.71 mm in females.(21)

Based on the age group, the most common type of nasal morphology in this study was the mesorhine type in the age group below 25 to 45 years of age. Meanwhile, at older age group (>45 years) the platyrrhine type was the most common type. Based on gender, the most common nasal morphological types in this study were the platyrrhine type in women and the mesorhine type in men. Similar results were reported by Patil et al which showed that the mesorhine type was the most common nasal type in males and the leptorhine type in females. These results indicated that the majority of the nasal morphology in the Toraja population were meshorine and platyrrhine types.(21) The same result was also reported by Asharani SK et al, which showed that the majority of Indian population had a mesorhine nose type followed by platyrrhine and leptorrhine.(22)

Marini MI., (2020), reported that the majority of the population of the Dayak Kenyah tribe also has a mesorhine nose type, which is the same as the Toraja tribe. This is also due to the identical geographical and climatic conditions between these two populations.(7) The various nasal shapes can be influenced by the climate of an environment. In areas with cold and dry climates, the majority of nasal types are found to be narrower, while in areas with hot climates the population tend to have broad and wide noses. This is supported by Sharma et al., (2014), who revealed that the nasal index is an anthropometric parameter that can be used to determine geographic estimates. The differences in nasal morphology variations are based on race, age and sex indicate dimorphism that can be used as part of human identification in forensic science.(8)

Conclusion

The results of this study indicated that after measuring the nasal index, there are anthropological variations in the morphology of the nasal index (Leptorhine, Mesorhine, Platyrhine, hyperplatyrhine) based on race, age and sex that can be used to explore the characteristics of the Toraja indigenous population as basic data in forensic odontological identification.

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