Arch. Biol. Sci., Belgrade, 66 (1), 227-232, 2014 DOI:10.2298/ABS1401227J

NASAL MORPHOLOGICAL CHARACTERISTICS OF THE SERBIAN POPULATION

J. JOVANOVIĆ[1] , D. JEREMIĆ[2], B. JOVANOVIĆ[1], MAJA VULOVIĆ[2], P. SAZDANOVIĆ[2], MAJA SAZDANOVIĆ[3], NEDA OGNJANOVIĆ[2], D. STOJADINOVIĆ[2], KATARINA JEREMIĆ[1], N. MARKOVIĆ[2] and IVANA ŽIVANOVIĆ-MAČUŽIĆ[2]

[1] *Clinical Center Kragujevac,* 34000 Kragujevac, Serbia
[2] *Department of Anatomy and Forensic Medicine, Faculty of Medical Sciences, University of Kragujevac,* 34000 Kragujevac, Serbia
[3] *Department of Histology, Faculty of Medical Sciences, University of Kragujevac,* 34000 Kragujevac, Serbia

Abstract - The aim of this study was to determine the nasal parameters in the population of central Serbia and to compare them with those determined in earlier studies in different populations. The research was conducted on 496 randomly selected persons (262 males and 234 females), aged 18-65 years. The measured parameters were nasal height and nasal breadth and the standard spreading caliper with scale was used for measurements. There were significant differences in the nasal parameters between male and female subjects. The nasal breadth was 34.72 mm in females, and in the male population it was 36.7 mm. The mean values of nasal height were 52.6 mm and 54.32 mm in females and males, respectively. The nasal index in females and males was 66.01 and 67.56, respectively, and the mean value of the nasal index of all respondents was 66.78. After conducting the research it was concluded that the dominant nasal type in the population of the central part of Serbia is leptorrhine. The present study showed the existence of sexual dimorphism in nasal morphology. The data obtained in our study may be useful in anthropological and forensic research, as well as in cosmetic planning and reconstructive surgery.

Key words: Anthropometry, nasal height, nasal breadth, nasal index, nasal type

INTRODUCTION

The prominent characteristics of the human facial profile are lips, nose and chin (Troncoso et al., 2008). The measurement of anatomical parameters of these facial structures is of great importance to anthropology, reconstructive surgery and forensic medicine. The techniques of anthropometry, as a basic tool of biological anthropology, are used for obtaining these data.

The size and the shape of the nose have been used for differentiation of human races, among the other parameters (Leong and Eccles, 2009). The nasal index, as the ratio between nasal height and nasal width, multiplied by 100 is the most commonly used parameter in nasal anthropometry. It is based on both bony and cartilaginous landmarks, which makes it different from most other anthropological indices (Bhargava and Sharma, 1959). Based on the nasal index, the nose has been classified as leptorrhine or fine (NI ≤ 69.90), mesorrhine or medium nose (70.0 ≤ NI ≤ 84.90), or platyrrhine or broad (NI ≥ 850) (Wiliams et al., 1995). The nose of individuals with a high nasal index is broad and those with a low index have a narrow nose.

The differences between nasal shapes of people from different parts of the world in part are the results of evolutionary adaptation to climate (Davies, 1932; Balaresque et al., 2007). The nasal index has been correlated with average temperature and humidity (Thomson and Duddley Buxton, 1923; Weiner, 1954) and nasal size with oxygen consumption (Hall, 2005). A low nasal index was associated with cold and dry climates, while a high nasal index was associated with hot and moist climates. It has not been confirmed whether differences in the size and the shape of the nose between different ethnic groups influences the different nasal physiology or predilection to sinonasal pathology (Leong and Eccles, 2009).

The aim of this study was to determine the nasal parameters in the population of central Serbia and to compare them with those determined in earlier studies in different populations.

MATERIALS AND METHODS

This study was conducted on 496 randomly selected persons (262 males and 234 females), aged 18-65 years. Measurements were performed at the Institute of Anatomy, Faculty of Medical Science, University of Kragujevac, from 2007-2012. All subjects were without past and existing craniofacial trauma, without deformity and facial scars. The measurement process was explained to each subject and written permission was obtained from each tested person before measurement.

All measurements were performed in the same way and under the same conditions. The subjects were in a sitting position, in a relaxed condition, with the head in the correct anatomical position (neutral position of the head). All measurements were performed three times and the mean value was taken for further analysis. The measurements were made with a permissible error of 1 mm.

The standard spreading caliper with scale was used for the measurement of nasal parameters.

The differences in mean values of nasal height, nasal breadth and nasal index were tested for statistical significance by independent sample t-test.

Landmark points used in measuring of the parameters were the nasion (n) – the midpoint of the nasofrontal suture and the subnasale (sn) – in the midline, the junction between the lower border of the nasal septum and the cutaneous portion of the upper lip.

The anthropometric measurements taken were nasal height (NH) – distance between nasion (n) and subnasale (sn) and nasal breadth (NB) – distance between the two alae nasi (al).

The nasal breadth (maximum breadth of the nose) was measured at a right angle to the nasal height from ala to ala. The nasal height was measured from nasion to nasospinale.

Nasal index (NI) presents the ratio between nasal breadth (NB) and nasal height (NH) and can be calculated according to the formula of Romo and Abraham (2003):

Nasal index (NI) = nasal breadth (NB) / nasal height (NH) x 100

According to the nasal index (NI), the nose was classified as leptorrhine – fine (NI ≤ 69.90), mesorrhine – medium (70.0 ≤ NI ≤ 84.90) or platyrrhine – broad (NI ≥ 85.0) (Wiliams et al., 1995).

RESULTS

The present study provides valuable new data pertaining to the nasal indices and nasal types in the adult Serbian population.

The nasal breadth, as a distance between two alae nasi, was found to be 34.72 mm in females, while in males it was 36.7 mm. The nasal height presents the distance between nasion and subnasale point and the mean values were 52.6 mm and 54.32 mm in females

Table 1. Nasal parameters of the studied population

Parameter	Male	Female	Both Sexes	p value
Nasal height (NH) mm±SD	54.32±3.70	52.6±4.61	53.46±4.28	<0.001*
Nasal breadth (NB) mm±SD	36.7±2.86	34.72±3.38	35.71±3.14	<0.001*
Nasal index (NI)	67.56±6.07	66.01±8.12	66.78±7.24	<0.001*

* Significant difference

Table 2. Frequencies of the categories of nasal type according to nasal index of the studied population

Nose type	Male	Female	Both gender	p value
Leptorrhine	68.32% (179)	87.18% (204)	77.22% (383)	<0.001*
Mesorrhine	29.77% (78)	11.97% (28)	21.37% (106)	<0.001*
Platyrrhine	1.91% (5)	0.85% (2)	1.41% (7)	<0.001*

* Significant difference

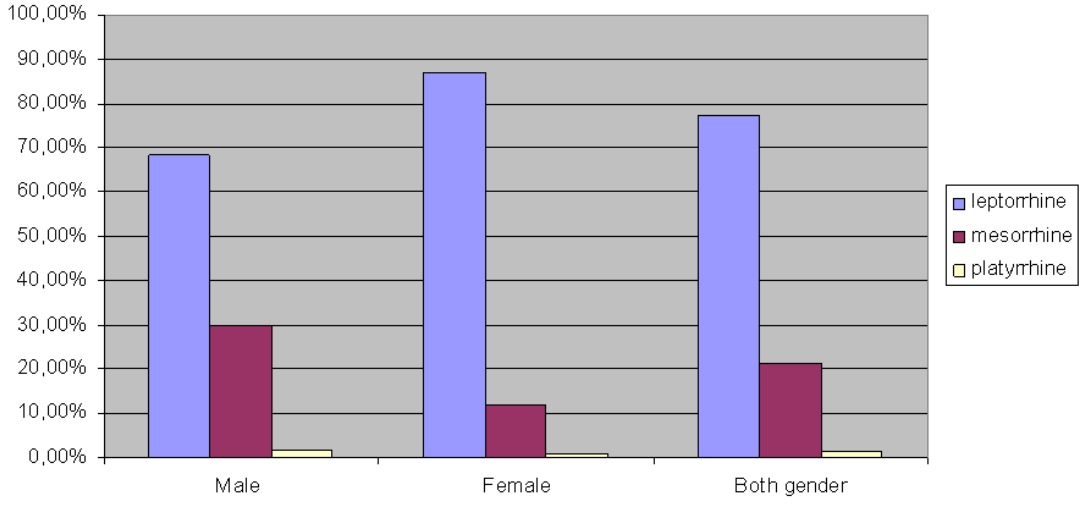

Fig.1. Frequencies of the categories of nasal type according to nasal index of the studied population

and males, respectively. The nasal indices in females and males were found to be 66.01 and 67.56 respectively, and the mean value of the nasal index of all respondents was 66.78 (Table 1). Thus, Serbian males have a significantly higher nasal breadth, nasal height and nasal index than females ($p<0.001$).

The dominant type of nasal phenotype according to the nasal index was leptorrhine with a frequency of 68.32% in males and 87.18% in females; this was followed by mesorrhine (29.77% in males and 11.97% in females) and platyrrhine (1.91% in males and 0.85% in females). Thus, leptorrhine nasal type predominated among males and females with a frequency of 77.22% (Table 2, Fig. 1).

DISCUSSION

The understanding and concept of beauty are different and individual. However, all would agree that the appearance of the nose (shape and the size) significantly affect the appearance of the whole face.

It also can affect the psychological and social functioning of a person (Borges et al., 1998). Therefore, nose surgery is one of the most common surgical procedures in plastic surgery, because it can change the size and shape of the nose and can be of great importance for improved self-confidence and social functioning.

Esthetic surgery uses knowledge of anatomy and facial esthetics, and a distict surgical technique is selected for each individual nose. Rhinoplasty is always based on a detailed preoperative analysis. Nasal index is very useful in this analysis. It is also very useful in forensic research as well as in the study of differences among living populations (Daniel, 2003). The number of variations in nasal shape and size is greater than the variations of any other part of the human body (Proetz, 1941). In the planning of reconstructive surgery of the nose it is very important to take into account the type of nose characteristic for a particular race or ethnic group to suit the final outcome with the proportions of the face. Various studies have indicated the great ethnic sensitiveness of nasal index and have shown racial and ethnic differences in nasal index among different populations. Leptorrhine nose type with a nasal index of 69.9 or less is characteristic for the Caucasian race. Africans have a platyrrhine type of nose, with a nasal index of 85.00 and higher, whereas the Caucasoids of Indo-Aryan ancestry have mesorrhine type noses (Gangrade and Babel, 2012).

The mean nasal index observed in this study (66.78) was higher than that observed in the populations of the following countries: Armenia – 63.80, Damascus – 63.26, Lebanon – 63.30 (Daniel, 2003), Montenegrins of Vojvodina-Serbia – 62.93 males, 60.61 females (Pavlica et al., 2007), North America – 64.85, Azerbaijan – 64.25, Bulgaria – 65, Czech Republic – 65.96, Germany – 62.85, Hungary – 65.8, Italy – 56.85, Poland – 64.6, Portugal – 58.35, Slovakia – 62.35, Turkey – 61.45, Iran – 55.65 and Egypt – 60.55 (Farkas et al., 2005).

This index was similar but lower than those observed in Croatians (66.8) and Russians (67.5) (Farkas et al., 2005). The nasal index of Greek and German populations according to Farkas et al. (2005) was 62.85, which is lower than in our study, but according to another study this index in the Greek population was 68.49 (Daniel, 2003), and in Germans 71 (Akpa et al., 2003), which was higher than in our study.

The mean nasal index observed in this study (66.78) was lower than those observed in various Nigerian populations (81.86-98.50) (Oladipo et al., 2007, 2008a, 2009, 2010), Nigerian Igbos – 116.70 (Akpa et al., 2003), Nigerian Isokos – 90.97±8.26 (Ese et al., 2011), Nigerian Sindhi – 70.7 (Choudhary and Chowdhary, 2012), Africans – 90-100 (Risley, 1969), African Americans – 79.70 (Porter and Olson, 2003), Indian Negroid (Sudroid) – 84.10, Indo-Aryans – 73.25 (Risley, 1969), Indian Onge males – 87.43, Indian Onge females – 90.07 (Ashok, 2006), Arabs – 74.48 (Daniel, 2003), Indians – 72,4, and Singaporeans – 72.4 (Farkas et al., 2005).

Most Western Europeans are leptorrhine, having long narrow noses with a nasal index of 69.9 or less (Romo and Abraham, 2003), corresponding to the findings in the present study. The Bantu and Bushmen African tribes are platyrrhine with a nasal index of 85.0 and above (Risley, 1969). In the present study, the mean nasal indices, both male and female, were lower than those observed for indigenous Australians with a nasal index of 85.0 and above and with platyrrhine nasal type (Romo and Abraham, 2003). In the present study, the largest number of subjects, according to the nasal index, had leptorrhine noses, corresponding to the findings in the Montenegrins of Vojvodina (Serbia) (Pavlica et al., 2007).

The mean value of the nasal breadth in the studied population (both male and female) was one of the highest among white Europeans. It was higher than the nasal breadth of males in Italy (32.1 mm), Slovakia (33.6 mm), Germany (34 mm), North America (34.7), Poland (35.2 mm), Russia (35.8 mm), Azerbaijan (35.7 mm), Greece (35.7 mm), Slovenia (35.9 mm), Bulgaria (36 mm) and Czech Republic (36.2

mm) (Farkas et al., 2005). It is similar to, but higher than, the measured values of Croatians (36.5 mm) and Portuguese (36.6 mm), and similar but lower than that of the Turkish male population (36.8 mm) (Farkas et al., 2005). The nasal breadth of the Serbian respondents of this study was lower than in the Hungarian population (37.3 mm).

The mean value of nasal breadth in the female population of our study (34.72) was higher than the nasal breadth of European and North American females. It was similar to, but higher than the measured values of females in Czech Republic (33.8 mm) and Azerbaijan (33.8) (Farkas et al., 2005). The nasal breadth of Serbian female respondents in our study was lower than in females from India, Singapore, Thailand and Japan (Farkas et al., 2005).

The mean value of nasal height in the studied male population was 54.32. This was higher than the nasal height of males in North America (53), Slovakia (53.5 mm), Germany (52 mm), Poland (53.7 mm), Russia (51.7 mm) and India (47.2 mm) (Farkas et al., 2005). It is similar to, but higher than the measured values in Bulgarian (54 mm), Czech (54 mm) and Croatian populations (53.8 mm) (Farkas et al., 2005). The nasal height of Serbian males was lower than that of males in Italy (56.2 mm) Azerbaijan (55.9 mm), Greece (55.5 mm) Slovenia (56.2 mm), Hungary (55 mm) and Portugal (59.5 mm) (Farkas et al., 2005).

The mean value of the nasal height in the studied female population was 52.6. It was higher than the nasal height of females in North America (48.9), Slovakia (49.4 mm), Croatia (50 mm), Germany (51.4 mm), Poland (51.2 mm), Russia (50.4 mm), India (43.7) and Egypt (47.4) (Farkas et al., 2005). It is similar to, but greater than the measured values in Italian (52.1 mm), Bulgarian (52.1 mm), Czech (52.1 mm), Azerbaijani (52.3 mm), Slovenian (52 mm) and Hungarian populations (52.5 mm) (Farkas et al., 2005). The nasal height of Serbian female respondents of this study was very similar, but lower than in Greek (52.8 mm) and Portuguese (57.8 mm), Iranian (58.5) and Turkish (55.2) females.

After conducting the research, it was concluded that the dominant nasal type in the population of the central part of Serbia is leptorrhine. The present study confirmed the existence of sexual dimorphism in nasal morphology. The data obtained in our study may be useful in anthropological and forensic research, as well as in cosmetic planning and reconstructive surgery.

REFERENCES

Akpa, A.O.C., Ugwu, C. and *S.O. Maliki* (2003). Morphometric study of the nasal parameters in Nigerian Igbos. *J. Exp. Clin. Anat.* **2(2)**, 24-25.

Ashok, K.P. (2006). Cephalo-facial variation among Onges. *Anthropologist* **8(4)**, 245-249.

Balaresque, P.L., Ballereau S.J. and M.A. Jobling (2007). Challenges in human genetic diversity: demographic history and adaptation. *Hum. Mol. Gen.* **16**, R134-R139.

Bhargava, I. and *J.C. Sharma* (1959). The Nose in Relation to Head and Face. An Anthropometric Study. *Indian Journal of Otolaryngology* **11(4)**, 213-218.

Borges, D.P., Dinis, M. and *A. Gomes* (1998). Psychosocial Consequences of Nasal Aesthetic and Functional Surgery: A Controlled Prospective Study in an ENT Setting. *Rhinology* **36**, 32-38.

Choudhary, A. and *D.S. Chowdhary* (2012). Comparative anthropometric study of nasal parameters between two ethnic groups of Rajasthan State. *Int. J. Med. Public Health* **2(2)**, 46-48.

Daniel, R.K. (2003). Hispanic rhinoplasty in the United States, with emphasis on the Mexican American nose. *Plast. Reconstr. Surg.* **112(1)**, 244-56, discussion pp. 257-258.

Davies, A. (1932). Man's nasal index in relation to climate. *J.R. Anthropol. Ins. GB Irel.* **29**, 8-14.

Ese, A., Mabel, O.E., Dennis, E.O.E. and *A. Ogheneyeseno* (2011). Anthropometric study of the nasal parameters of the Isokos in Delta State of Nigeria. *Annals of Biological Research* **2(6)**, 408-413.

Farkas, L.G., Katić, M.J. and *C.R. Forrest* (2005). International Anthropometric Study of Facial Morphology in Various Ethnic Groups/Races. *The Journal of craniofacial surgery* **16(4)**, 615-646.

Gangrade, P.R. and *H. Babael* (2012). Anthropometric study of the nasal index of the Bheel – Meena tribe of Southern Rajasthan. *Int. J. Cur. Res. Rev.* **4(19)**, 88-91.

Hall R.L. (2005). Energetics of nose and mouth breathing, body size, body composition and nose volume in young adult males and females. *Am. J. Hum. Biol.* **17**, 321-330.

Leong, S.C. and R. Eccles (2009). A synaptic review of the nasal index and the significance of the shape and size of the nose in rhinology. *Clin. Otolaryngol*. **34**, 191-198.

Oladipo, G.S., Didia, B.C., Okoh, P.D. and *J.S. Hart* (2008a). Sexual dimorphism in facial dimensions of adult jaw. *J. Expt. and Clin. Anat.* **7(2)**, 10-14.

Oladipo, G.S., Eroje, M.A. and *H.B. Fahwehinmi* (2009). Anthropometric comparison of nasal indices between Andoni and Okrika tribes of Rivers State, Nigeria. *Int. J. Med. Med. Sci.* **1(4)**, 135-137.

Oladipo, G.S., Olabiyi, A.O., Oremosu, A.A. and *C.C. Noronha* (2007). Nasal indices among major ethnic groups in southern Nigeria. *Scientific Research and Essay* **2(1)**, 20-22.

Oladipo, G.S., Oyakhire, M.O. and *A.A. Ugboma Henry* (2010). Anthropometric studies of nasal indices of the Ekpeye and Ikwerre ethnic groups in Nigeria. *Asian J. Med. Sci.* **2(4)**, 167-169.

Pavlica, T., Božić-Krstić, V. and *R. Rakić* (2007). Anthropological characteristics of Montenegrins living in Vojvodina. *Glasnik Antropološkog društva Jugoslavije* **42**, 167-177.

Porter, J.P. and *K.L. Olson* (2003). Analysis of the African American female nose. *Plastic Reconstruct. Surg.* **111(2)**, 627-628.

Proetz, A.W. (1941). *Essays on the applied physiology of the nose*. Annals Publishing Co., St. Louis, U.S.A

Risley, H.H. (1969). *The people of India*. Oriental Books Reprint Corporation, Delhi, 395-399.

Romo, T. and *M.T. Abraham* (2003). The ethnic nose. *Facial Plastic Surg.* **19(3)**, 269-278.

Thompson, A. and L. Dudley Buxton (1923). Man's nasal index in relation to certain climatic conditions. *J. R. Anthropol. Inst. GB. Irel.* **53**, 99-122.

Troncoso, P.J.A, Suazo, G.I.C, Cantin L.M. and M.D.A. Zavando (2008). Sexual dimorphism in the nose morphotype in adult Chilean. *Int. J. Morphol*. **26 (3)**, 537-542.

Weiner J.S (1954). Nose shape and climate. *Am. J. Phys. Anthropol.* **12**, 615-618.

Wiliams, P., Dyson, M., Dussak, J.E., Bannister, L.H., Berry, M.M., Collins, P. and *M.W.J. Ferguson* (1995). Skeletal system. In: *Gray's Anatomy*. 38th Edn, 607-612. Elbs with Churchill Livingston, London