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ABSTRACT

Background: Anthropometric analysis of the midface is essential, especially for rhinoplasty surgeons, medical aesthetics, medical jurisprudence, and anthropology. The aim of this study was to provide data to describe of the anthropometric dimensions of the nose and face among Caucasian young adults in order to establish reference values.

Materials and methods: The study was conducted among 289 Polish students (115 men and 174 women). The mean age in the study group was 20.44 ± 1.93 years. In this study 10 linear measurements of the face and nose were determined, 7 indices were calculated, including Facial Index and Nasal Index. The prevalence of facial and nasal types was determined. The dimensions and indexes were compared in both sexes. The results obtained were compared with the results of other authors on Caucasian groups including the Polish population in similar age ranges. Statistical analysis was performed. The level of statistical significance was taken as $p < 0.05$.

Results: The most common face type in the study group was hyperleptoprosopic (very narrow face) and leptoprosopic (narrow face) 32.17%, 31.30% in the female group and 32.76%, 29.31%, in the male group, respectively. The most common nose type was leptorrhine (narrow nose), 74.76%. All measured linear dimensions were greater in men except for nasal root width. Similar results were obtained among indices with the exception of nasal length index.

Conclusions: The results of the obtained measurements can be used by surgeons when planning reconstructive, corrective and aesthetic nasal surgery to ensure an aesthetically pleasing appearance.

Keywords: anthropometric analysis, nose, anatomy, facial index, nasal index, students

INTRODUCTION

Quantitative assessment of facial morphology by anthropometric measurements is crucial for surgeons when planning operations both reconstructive surgery after trauma and oncological resections and also as aesthetic medicine procedures [9, 17, 28, 45]. Craniofacial morphometry is important in determining congenital craniofacial anomalies and identification of individuals in forensic medicine [15, 41]. Located in the central part of the face, the nose plays a key role in the appearance of the entire face [37, 39]. The ancients knew about 3000 years ago. In the past, crimes were punished by amputation of various body parts, and the nose was one of them. Replacing the nose was one of the more common reasons for using skin grafts. The first description of reconstructive nose surgery is dated to about 750–800 BC by Sushruta, an Indian surgeon [1].

In order to match the shape of the nose during reconstructive surgery, there is a need for craniofacial measurements databases taking into account the external nose in the population. Without the updated norms, incorrect surgical treatment planning may occur [45]. Aesthetic facial features are often assessed subjectively before the rhinoplasty. It is sometimes caused by the lack of normative measurements in age and sex groups [28]. Hence, knowledge of nasal anatomy is crucial for accurate preoperative analysis. Nasal measurements such as height, width or nasal index are also used to differentiate between sexes, different races and ethnic groups.

Studies on the creation of normative bases for facial measurements have been conducted for many years on both North American, African American, Korean, Chinese, Iranian, Indian or other ethnic groups [4–6, 8, 9, 14, 19, 21, 22, 26, 27, 29, 33]. Some of these

studies have been conducted on groups of young people under 30 years of age [3, 12, 13, 16, 24, 31, 33, 36, 40].

The number of studies conducted on Caucasian groups including Polish population is still insufficient [2, 9, 10, 43, 46]. A multicentre anthropometric study carried out by Ferkas et al. [9] nearly 20 years ago on a group of young women and men of Polish nationality was conducted on a small study group of only 30 subjects. A 2013 study by Wyganowska-Świątkowska et al. [43] focused on vocal students. Their results confirmed increased nasal and facial dimensions compared to the reference group created by Ferkas. Zaworski et al. [46] in 2009 made direct measurements of nasal width and nasal index when determining changes in head dimensions and proportions. Antoszewski et al. [2] in 2005 performed a trend analysis of changes in nasal dimensions on a group of Polish children and adults aged 4–25 years. They confirmed that most features (excluding nasal width) showed a statistically characteristic increase between 4 and 14 years of age in both sexes. The authors suggest that any cosmetic surgery of the nose should be performed after the age of 18 years [2]. Winiarska et al. [42] conducted a systematic review of papers concerning measurements, however, of the lower third of the face and mouth of Caucasians.

A 2013 study by Szychta et al. [38] analysed the importance of three-dimensional (3D) imaging using a scanner in the aesthetic assessment of the nose after rhinoplasty surgery on a group of Polish adults up to 45 years of age.

These are just a few studies on Polish population. Thus, there is a need to create up-to-date normative values of the nose.

The aim of our study was to describe the mean values of facial anthropometric dimensions including facial length and width, as well as nasal dimensions in a group of Caucasian women and men up to 35 years of age. In addition, 7 indices were calculated and the frequencies of face and nose types were determined in the study population of young people. Anthropometric features were compared in both sexes. For the purpose of this study, the results obtained were compared with those of other authors for Polish population in a similar age range.

MATERIALS AND METHODS

Study group

The study was carried out on a group of young Caucasian individuals aged from 18 to 35 years. The study group consisted of student volunteers from the Medical University of Silesia in Katowice and The Jerzy Kukuczka Academy of Physical Education in Katowice,

Poland. A total of 289 participants took part in the voluntary study. Inclusion criteria for the study were: normal craniofacial configuration and normal body mass index (BMI). Subjects with a history of trauma to the craniofacial part, with particular emphasis on the nasal region, cleft lip, and palate in childhood, and individuals after facial and nasal plastic surgery were excluded from the study. Only subjects without any visible facial anomalies were eligible for the study.

Methods

Anthropometric measurements were obtained from all included subjects, using standard anthropometric methods and instruments described in literature. Measurements were selected to determine morphological features of the nose and were performed according to the standard procedure described by Farkas et al. and Martin and Saller [10, 23]. In addition, seven aspect indexes were calculated and the frequencies of facial and nasal types were determined in the young population studied.

Anthropometric measurements were taken twice by the same researcher using Mitutoyo® digital caliper with maximal permissible error of ± 0.003 mm and a small spreading caliper (GMP/DKSH). The measurement results were then averaged. Based on the resulting linear measurements, indices were calculated.

All measurements were taken in neutral (normal anatomic) position and in the Frankfurt horizontal plane. The subject was asked to assume a sitting position with the head set straight, breathing calmly through the nose with a relaxed facial expression without lifting the head. The procedure was explained verbally to each subject.

The study was conducted respecting the ethical principles of the Helsinki Declaration. All participants signed an informed consent to participate in the study.

The study was approved by the Bioethics Committee of the Medical University of Silesia in Katowice, decision no. PCN/CBN/0052/KB/5/I/22.

Measurements

For the purposes of this study, linear measurements of the distance between facial and nasal anthropometric landmarks were taken. Facial landmarks used in this study are summarised in Table 1 and Figure 1A, B.

Based on the linear measurements, the following indexes were calculated according to the formulas below:

$$Facial\ Index\,(FI) = \frac{face\ hight\,(n-gn)\,x\,100}{face\ width\,(zy-zy)} \quad (1)$$

$$Nasal\ Index\,(¿) = \frac{nasal\ width\,(al-al)\,x\,100}{total\ nose\ lenght\,(n-sn)} \quad (2)$$

$$Nasal\ widt\ h\ index\ I = \frac{nasal\ root\,(mf-mf)\,x\,100}{nasal\ hight\,(n-sn)} \quad (3)$$

$$Nasal\ widt\ h\ index\ II = \frac{nasal\ root\,(mf-mf)\,x\,100}{nasal\ width\,(al-al)} \quad (4)$$

$$Nasal\ length\ index = \frac{length\ of\ nose\ wing\,(ac-prn)\times 100}{total\ nose\ lenght\,(n-sn)} \quad (5)$$

$$Nasal\ height\ index = \frac{nasal\ hight\,(n-sn)\,x\,100}{face\ hight\,(n-gn)} \quad (6)$$

$$Nasofacial\ transverse\ index = \frac{nasal\ width\,(al-al)\,x\,100}{face\ width\,(zy-zy)} \quad (7)$$

Based on the morphological facial index (*FI*) developed according to Martin, Saller (1957) and Garson, five facial types [10, 11, 23] were distinguished (Tab. 2).

Statistical analysis

The statistical analysis was performed with TIBCO Statistica® 13.3 (TIBCO Software Inc., Palo Alto, CA, USA) and KyPlot 6.0 (KyensLab Inc., Tokyo, Japan). The following descriptive statistics were calculated for each analysed variable: mean, standard deviation, minimum, and maximum. For counts rates and percentages were calculated. Normal distribution was confirmed using the Shapiro–Wilk test, while homogeneity of variance was estimated using the Bartlett test. To compare the sexes, the Student's t-test with the separate assessment of variance was performed. Mann–Whitney U test was used for variables not presenting a normal distribution. To compare the face types among Polish males and females, the chi-squared test was used.

The correlation between nasal and facial measurement was evaluated using Pearson`s correlation coefficient (r_{xy}). The difference between the examination group and other authors' means was evaluated using the statistical test d/sd (two-sided difference d between a sample mean and a population mean method, divided by the standard deviation sd). The p values < 0.05 were considered significant.

RESULTS

Direct anthropometric measurements of the face and nose

A total of 289 physiotherapy students, including 115 men (39.8%) and 174 women (60.2%) took part in the study. The mean age of the subjects was 20.44 ±1.93 years, minimum 18, maximum 32 . The study was anonymous and voluntary. The predominance of women in the study reflects the gender structure of physiotherapy students.

Values of individual linear measures and indexes are summarised in Tables 4, 5.

Analysing the distribution of facial types the most frequently observed facial types were those describing a very narrow face (Hyperleptoprosopic), and a narrow face (Leptoprosopic) with 32.17% and 31.30% of individuals in the female group and 32.76% and 29.31% of individuals in the male group, respectively. There were no statistically significant differences in the prevalence of facial types between the sexes in the analysed group (Tab. 6).

Based on the nasal index, the index was calculated both for the entire study group and separately for men and women. The most common type in the entire study group was the narrow type — Leptorrhine (74.74%). There were statistically significant differences in the prevalence of the described nasal types between the sexes (p = 0.001). The very narrow type was nearly three times more frequent in men compared to women. In contrast, the moderately wide type was twice more frequent in women (Tab. 7).

Comparing the sexes

Most of the measured linear dimensions, except nasal root width (mf–mf), were statistically significantly wider in men compared to women. The dimension of nasal root width (mf–mf) was slightly but statistically significantly wider in women. The only

dimension for which there was no statistically significant difference between the sexes was the anatomical nasal width (ac–ac). The results of these comparisons are summarised in Table 8.

Comparing the index values in both sexes, the following differences were found: Facial Index, Nasal Index, Transverse Nasal, and Head Index were statistically significantly higher in men ($p < 0.001$). Both nasal width indices (I and II) were significantly greater in women. Nasal length index was not statistically significantly different (Tab. 9).

We correlated facial measurements with nasal measurements. Pearson's correlation results are summarised in Table 10.

Positive statistically significant correlations were found between facial and nasal dimensions except for anatomical nasal width and nasal root width. A negative weak correlation was found between facial height and anatomical nasal width. In general, based on the r_{xy} coefficient values, most correlations were weak (low) correlations except the correlations between face height and total nasal length (n–sn), $r_{xy} = 0.59$ and face height and nasal dorsum length (n-prn) $r_{xy} = 0.57$ — high correlations (Tab. 10).

Comparison with the studies of other authors

The present measurements were carried out on a group of young Caucasian individuals up to 35 years of age. In this study selected anthropometric measurements of the face and nose were compared with the results obtained by other authors, using direct anthropometry, who conducted studies on a population similar in terms of age (Caucasian, Polish vocal students, and a group of young people of Polish nationality). The results of the comparisons are summarised in Table 11.

DISCUSSION

The size, shape and proportions of the nose ensure that the face is assessed as 'beautiful' according to beauty canons. The mid-face area is important for the assessment of attractiveness [32]. Each ethnic group has particular nasofacial features that are important in planning surgery especially for patients with trauma, tumour or congenital defect of this area. Dodi emphasised the importance of nasal measurements in nasal surgery [7]. Anthropometric measurements can be helpful in cleft palate surgery, septoplasty, especially in the pediatric population and also in the assessment of dysmorphic syndromes [7, 28].

The main aim of our study was an attempt to develop normative values for selected nasal dimensions in a group of people under 35 years of age. For the purpose of this study, facial and nasal indexes and other indexes describing nasal dimensions were calculated. The most common facial types were Hyperleptoprosopic, Leptoprosopic and Mesoprospic, similar to a study on a population of young Greeks [45]. While determining the Facial Index, it should be noted that it is determined separately by gender. In our study, almost all nasofacial values were higher in males compared to females, confirming the gender difference in Polish population, which is also confirmed by other authors on other populations [20, 25, 39, 40, 43]. The studies Shah et al. showed that nasal airspace surface area and volume were also significantly greater in males [35].

When analysing the dimensions of the nose, the most common type was the narrow type (Leptorrhine), characteristic of the Caucasian race. There are clear anatomical differences between the non-Caucasian nose (Platyrchine, Mesorrhine) and the Caucasian nose (Leptorrhine). In general, in non-Caucasian patients presenting for aesthetic rhinoplasty, the defining ethnic features should be considered during the procedure. Surgeons performing rhinoplasty in those patients population must be familiar with differences in nasal anatomy and use augmentation rather than reduction techniques to achieve the desired functional as well as aesthetic results [21, 34]. Most of the differences between ethnic groups relate to nasal proportions. According to Ferkas et al. a deviation of more than 1 SD from the normal value is considered a disorder of facial proportions [9].

Considering the potential complaints of rhinoplasty patients, consisting not only of reduced nostril function but also of an imbalance of facial structures by mismatching reconstructed structures, it should seem obvious that there is a need for norms regarding the dimensions of facial structures. Currently, much of the work on facial measurements, often using advanced techniques including 3D scanners and dedicated software (Rhinobase®), is carried out on Turkish population. Perhaps it is related to the number of aesthetic medicine procedures including nose correction performed in this country.

In our study, we compared the obtained results only with those for the Caucasian Polish population. When comparing our results with those of the vocal students, all dimensions described in the Table 11 were statistically significantly greater in the vocal students' group, regardless of gender. The exceptions were facial height dimensions (n–gn) in males and nasal morphological width of the nose (al–al) in females. The morphological width of the nose (al–al) was not statistically significantly different in the study group compared to the vocal students group, in both sexes [43]. The second group of comparisons involved,

compared our results with those of the facial measurements carried out by Ferkas et al. [9]. Only the dimensions: total nasal length (n–sn) and nasal morphological width (al-al) were not statistically significantly different between the groups in both sexes. No statistically significant differences between our results and those of Ferkas et al. [10] were noted for facial height (n–gn) and nasal dorsal length (n–prn) in the male group. The dimension of grey-eyedness of the face (zy–zy) was slightly higher in the group participating in the Ferkas et al. study in both the female and male groups. In contrast, the length of the nasal dorsum was statistically significantly smaller in our study compared to Ferkas et al. in the female group. When comparing our data with the mean dimensions obtained for Caucasians for the parameters: facial width and nasal width, these dimensions were smaller than in our study group — female 100.40 mm and 113, 35 mm male, respectively, and for nasal width — 31.67 female and 35.19 male, respectively [30]. When interpreting these data, it should be taken into account that the different techniques of measurements were used in these studies.

Facial dimensions including the nose are important in sex reassignment surgery. There are several well-known anthropometric differences between the male and female facial skeleton and soft tissues [18]. In the case of gender-replacement surgery, the analysis should concern the middle third of the face and, in addition to the orbital region, it should comprise the nasal region including the nasal dorsum, the width of the nasal base (al–al), and the zygomatic width. An important aspect when concerning differences between the sexes is the thickness of the facial adipose tissue. Male subcutaneous tissue is thicker than female, depending on the location [18]. Furthermore, differences in soft tissue aging should always be taken into account when analysing facial dimensions. In our study, the study group is in the range up to 35 years of age. These are young people who do not yet have visible degenerative changes involving the soft tissues.

According to some authors, age-related soft tissue changes can lead to masculinization of the female face [30]. In contrast, according to Ferkas, the size and shape of the nose rarely change after maturity [9]. The nasal angles stop growing at the age of 12 years (females) and 14 years (males) [39]. The morphometric parameters of the lower third of the face also change significantly with aging [42]. In a study by Antoszewski et al. concerning nasal growth, 240 subjects were examined in age groups of 4, 14, 18, and 25 years. The study confirmed that most features (excluding nasal width) showed a statistically characteristic increase between 4 and 14 years of age in both sexes. Up to 18 years of age, there is an increase in nasal vestibule length and nasal septum width in girls and nasal vestibule length

and nasal tip convexity in boys. After 18 years of age, they observed no other significant changes [2].

An important problem in anthropometric measurements, as pointed out by Piombino et al. in a meta-analysis of 138 papers on nasal anthropometry, are the different definitions of anthropometric points. The same distances or angles were given different names in various papers and the same points were placed in different locations [28]. In our work based on direct anthropometry, all points were modeled on the Ferkas methodology.

The studies on face and nose measurements performed by Ferkas, which provide reference values for comparison, were developed quite a long time ago. When referring to results that are nearly 20 years old, it is important to bear in mind the phenomenon of a secular trend, i.e. an increase in body dimensions. Zaworski et al. demonstrated secular changes in the dimensions and proportions of the head in a group of Polish female students over a period of 10 years. They observed a shortening of the head (on average by 1.6 mm) with its simultaneous narrowing (on average by 2.0 mm). No changes were observed in either the height or width of the nose, however, as the authors emphasise the size of the study group may have influenced the results of the measurements. On the basis of the morphological facial index (82.35) and the transverse nasofacial index of the head (69.1), the facial type in this group was defined as Mesoprosopic (medium-faced) and the nasal type as Leptorrhine (narrow-nosed), similar to our study [46].

In our study, the same technique of direct anthropometric measurements was implemented, as in the other studies on the Caucasian race including Polish population, used for comparison the obtained results. Analysing the literature, the techniques used to measure faces comprise photogrammetry, direct anthropometry, 3D imaging, and cephalometry. The authors point out that the results obtained by the different measurement methods are not interchangeable. The 3D methods and photogrammetry gave the greatest variability in the data obtained among some of the oral region parameters analysed [42].

Considering the abovementioned, there is a need to continue studying, implementing all measurement points determined by various authors and the latest image registration techniques. It should be noted that modern anatomical studies should include in-depth morphological analysis and involve a wide range of scientific tools. Such studies are direct anthropometry measurements [44].

CONCLUSIONS

Our study confirmed that the most often nose type in the young Caucasian population was the narrow nose. Facial and nasal dimensions in males were statistically significantly larger compared to females. Our database can be used by surgeons for patients when planning reconstructive and aesthetic nasal surgery to provide patients with an aesthetically pleasing appearance.

ARTICLE INFORMATION AND DECLARAITONS

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Conflict of interest

The authors declare no conflict of interests.

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Table 1. Defining soft tissue linear antropometric measurements.

Measurements	Distance	
Face height (morphological face height = maximum face length)	n–gn	Distance between *nasion* (n) and *gnation* (gn)
Face width (physiological face width = maximum face width)	zy–zy	Distance between *zygion* (zy) and *zygion* (zy)
Nasal root (width of nasal root)	mf–mf	Distance between *maxilofrontale* (mf) points
Nasal width (morphological width of the nose)	al–al	The distance between the *alare* (al) points, situated most laterally on the wings of the nose
Anatomical width of the nose	ac–ac	The distance between the *alacrepidion* (ac) points, the point located where the lower edge of the lateral surface of the nasal wing and the skin of the cheek meet. It corresponds to alar curvature point according to Ferkas
Length of nasal wings	ac–prn	Distance between *alacrepidion* (ac) and *pronasale* (prn)
Nasal root width	pal–pal	Distance between *postalare* points (pal),
Nasal height (overall length of the nose)	n–sn	Distance between *nasale* (n) and *subnasale* (sn) points
Nasal post height (length of nasal base)	sn–prn	Distance between *subnasale* (sn) and *pronasale* (prn) points
Length of nose (length of nasal dorsum)	n–prn	Distance between *nasale* (n) and *pronasale* (prn) points

Table 2. Classification of the Facial types according to Face Index.

Face type	Facial Index (according to Garson)	Facial Index (according to Saller)
	Male	Female
Hypereuriprosopic (very broad, short face)	≤ 78.9	≤ 76.9
Euryprosopic (broad, short face)	79.0–83.9	77.0–80.9
Mesoprosopic (normoprosopic: average face)	84.0–87.9	81.0–84.9
Leptoprosopic (tall, narrow face)	88.0–92.9	85.0–89.9
Hyperleptoprosopic (very tall, narrow face)	≥ 93.0	≥ 90.0

Table 3. Classification of the Nose types according Martin.

Nose type	Nasal Index
	Male and Female
Hyperleptorrhine (excessively tall and narrow)	≤ 54.9
Leptorrhine (tall and narrow)	55.0–69.9
Mesorrhine (medium)	70.0–84.9
Platyrrhine (broad and flat)	85.0–99.9
Hyperplatyrrhine	≥ 100

Table 4. Facial and nasal anthropometric linear measurements of the study population (n = 289).

Parametr [mm]	Mean	SD	Min	Max
FH	113.86	7.21	96.70	131.50
FW	129.11	7.22	109.90	158.00
Nasal root width	13.98	1.85	9.40	19.70
Morphological nasal width	32.60	2,89	26.20	41.70
Anatomical nose width	20.70	3.36	13.30	29.20
Nasal wing length	27.90	2.69	20.40	36.00
Nasal pillar height-nose base length	20.34	2.32	15.20	28.60
Nasal root width	29.18	2.77	22.40	38.20
Total length of nose	52.18	3.91	41.40	68.20
Nose dorsum length	46.32	4.31	23.30	63.40

FH — face high; FW — face width; Min, Max — minimum, maximum; SD — standard deviation.

Table 5. Facial and nasal anthropometric indexes of the study population (n = 289).

Index*	Mean	SD	Min	Max
Facial Index FI (1)	88.34	5.90	72.42	106.59
Nasal Index NI (2)	62.76	6.94	46.84	95.86
Nasal width index I (3)	26.93	4.05	18.89	40.09
Nasal width index II (4)	43.23	6.93	27.10	61.11
Nasal length index (5)	53.69	5.86	39.69	70.58
Nasal height index (nasofacial vertical index) (6)	45.88	2.87	39.04	53.97
Nasofacial transverse index (7)	25.28	2.08	20.10	30.29

*Regardless of gender; Min, Max — minimum, maximum; SD — standard deviation.

Table 6. Classification of the Facial types according to the Facial Index in the study group (n = 289).

Face type	Facial Index (according to Garson) Male (n, %)	Facial Index (according to Saller) Female (n, %)	p
Hypereuriprosopic	2 (1.74)	6 (3.45)	
Euryprosopic	11 (9.57)	17 (9.77)	
Mesoprosopic	29 (25.22)	43 (24.31)	0.0933
Leptoprosopic	36 (31.30)	51 (29.31)	
Hyperleptoprosopic	37 (32.17)	57(32.76)	

Table 7. Classification of the Nose types according Nasal Index in the study group (n = 289).

Nose type	Nasal Index			p
	Total (n,%)	Males (n, %)	Females (n, %)	
Hyperleptorrhine	34 (11.76)	25 (14.37)	9 (7.83)	0.0011
Leptorrhine	216 (74.74)	135 (77.59)	81 (70.43)	
Mesorrhine	38 (13.15)	13 (7.47)	25 (21.74)	Ch^2 =
Platyrrhine	1 (0.35)	1 (0.57)	0	13.69
Hyperplatyrrhine	0	0	0	

Table 8. Comparison of the nosofacial measurements [mm] in males (n = 115) and females (n = 174).

	Males				Females				
	Mean	SD	Min	Max	Mean	SD	Min	Max	p
Age (years)	20.75	2.45	18.00	32.00	20.22	1.47	18.0	25.00	0.165116
Face height (n–gn)	119.09	5.61	106.10	131.50	110.40	5.97	96.7	125.80	0.000001
Width of face (zy–zy)	132.02	7.20	114.80	158.00	127.19	6.58	109.9	145.40	0.000001
Nasal root width (mf–mf)	13.59	1.78	10.20	18.60	14.24	1.87	9.4	19.70	0.001694
Morphological width of the nose (al–al)	34.56	2.55	28.70	41.60	31.31	2.27	26.2	41.70	0.000001
Anatomical width of the nose (ac–ac)	20.29	2.16	15.30	28.00	20.97	3.94	13.3	29.20	0.681899
Nasal wing length (ac–prn)	28.36	2.38	20.40	36.00	27.60	2.85	21.1	35.80	0.011274
Nasal pillar height – nasal base length (sn–prn)	21.17	2.39	15.80	28.60	19.80	2.10	15.2	25.50	0.000001
Nasal root width (pal–pal)	29.62	2.78	22.50	38.20	28.89	2.73	22.4	38.20	0.018486
Total length of nose (n–sn)	53.58	3.82	45.10	68.20	51.25	3.70	41.4	60.20	0.000001
Length of nasal dorsum (n–prn)	47.97	4.08	38.90	63.40	45.23	4.12	23.3	57.80	0.000001

Min, Max — minimum, maximum; p — statistical significance; SD — standard deviation.

Table 9. Comparison of the nosofacial indexes in males (n = 115) and females (n = 174).

	Males		Females		
	Mean	SD	Mean	SD	p
Face index / morphological face index = face height/face width (n–gn × 100/zy–zy)	90.43	5.92	86.97	5.49	0.000001
Nasal index = nasal width/total nasal length (al–al × 100/n–sn)	64.85	6.96	61.43	6.61	0.000043
Nasal root width/total nasal length index (mf–mf × 100/n–sn)	25.48	3.70	27.90	3.98	0.000001
Nasal root width index/nasal morphological width (mf–mf × 100/al–al)	39.54	5.98	45.67	6.42	0.000001
Nasal length index (ac–prn × 100/n–sn)	53.11	4.98	54.08	6.35	0.146955
Nasal–facial transverse index (al–al × 100/zy–zy)	26.22	1.96	24.66	1.93	0.000001

p — statistical significance; SD — standard deviation.

Table 10. The correlation between nasal and facial measurements (correlation coefficient values r_{xy}).

	Facial hight (n–gn)	Facial width (zy–zy)
Facial height (n–gn)	1.0000	0.3883*
Nasal root width (mf–mf)	0.0014	0.1056
Morphological nasal width (al–al)	0.4038*	0.3764*
Anatomical width of the nose (ac–ac)	–0.1530*	0.0962
Nasal wing length (ac–prn)	0.1608*	0.1331*
Nasal pillar height – nasal base length (sn–prn)	0.4052*	0.1310*
Nasal root width (pal–pal)	–0.0021	0.2511*
Total length of nose (n–sn)	0.5916*	0.1247*
Length of nasal dorsum (n–prn)	0.5697*	0.1177*

*Statistically significant difference $p \leq 0.05$.

Table 11. Comparison of selected measurement results between the study group and other authors' results on Polish groups. Sources of data for comparison [9, 42].

	Females			Males		
Measurments [mm]	Study group (ST)	Wyganowska-Świątkowska	Ferkas	Study group (ST)	Wyganowska-Świątkowska	Ferkas
Facial width (zy–zy)	132.02 ± 7.20	144.80 ± 14.12***	139.10 ± 5.30**	127.19 ± 6.58	136.02 ± 13.43***	130.00 ± 4.60*
Facial height (n–gn)	119.09 ± 5.61	117.25 ± 8.03 NS	124.70 ± 5.70***	110.40 ± 5.97	105.08 ± 5.93 ***	111.40 ± 4.80 NS
Total nasal length (n–sn)	53.58 ± 3.82	58.53 ± 6.81***	54.80 ± 3.30 NS	51.25 ± 3.70	53.02 ± 5.87**	50.60 ± 3.10 NS
Nasal morphological width (al–al)	34.56 ± 2.55	33.59 ± 7.57 NS	34.90 ± 2.10 NS	31.31 ± 2.27	31.44 ± 8.03 NS	31.40 ± 2.00 NS
Nasal dorsal length (n–prn)	47.97 ± 4.08	55.31 ± 6.81***	54.80 ± 3.30***	45.23 ± 4.12	48.27 ± 6.80***	44.70 ± 3.40 NS

Scheme of comparisons: ST vs 1; ST vs 2; *$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$; NS — no statistically significant differences between the study group and measurements of other authors, $p \geq 0.05$.

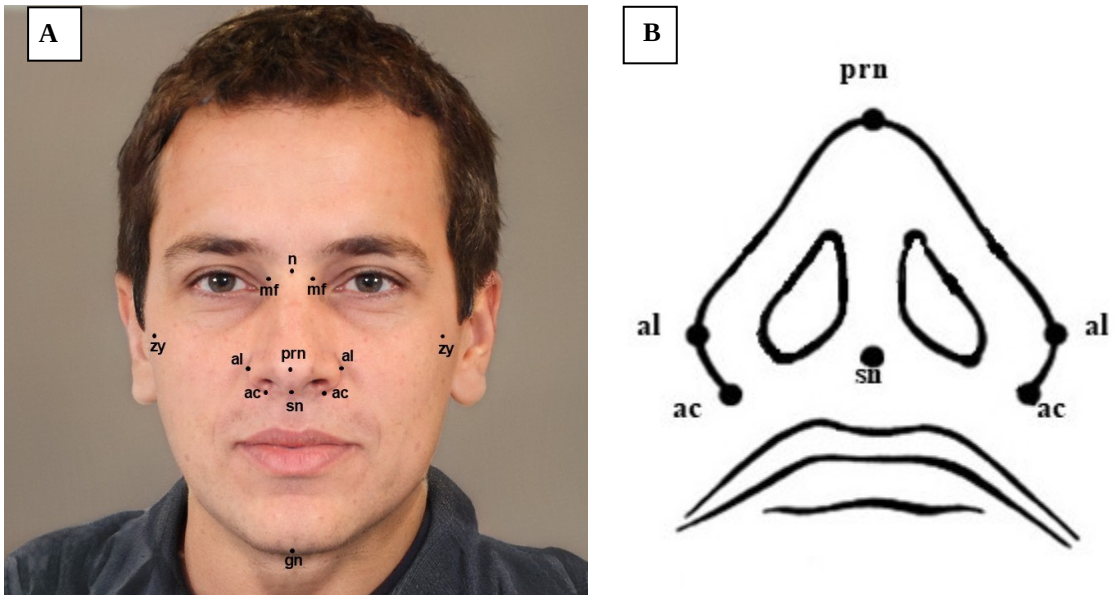

Figure 1A, B. Facial and nasal soft tissue landmarks (abbreviations explained in Tab. 1).