

**HEIGHT AND SEX
DETERMINATION USING
OCULAR AND NASAL
DIMENSIONS AND THEIR
RELATIONSHIP WITH
TRIBE**

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INTRODUCTION

❑ Cephalometry

(Kadri *et al.*, 2018).

❑ Identification – height, sex and tribe

(Jervas *et al.*, 2015).

❑ Association between height, sex and body parts

(Shrestha *et al.*, 2016).

❑ Nasal and Ocular anthropometry

(Oladipo *et al.*, 2009; Kristina and Guyton, 2014).

PRESENT STUDY

□ **Geographical and ethnic variations**
(Farkas *et al.*, 2005).

□ **Dearth of facial data in Ghana**
(Maalman *et al.*, 2017).

AIM

To generate data on nasal and ocular dimensions and their relationship with height and sex among some selected Ghanaian tribes.

SPECIFIC OBJECTIVES

- ❑ To measure the nasal and ocular dimensions of the male and female participants.**
- ❑ To establish the differences in ocular and nasal dimensions of the selected tribes.**
- ❑ To determine the nose types among the tribes using nasal indices.**

SPECIFIC OBJECTIVES

- ❑ To derive models for height and sex determination using nasal and ocular dimensions.**
- ❑ To compare data of the present study with published data.**

MATERIALS AND METHODS

□ Study Design and Location

- Cross-sectional study.
- **Duration:** September, 2018 to May, 2019.
- **Location:** Anatomy Department – SMD, KNUST.
- **Sample size:** 288; males = 173(60.1)% and females = 115(39.9%)
- Akans = 221(76.7%), Ewes = 24 (8.3%), Ga-Dangmes = 16 (5.5%) and Northerners = 27 (9.4%).

MATERIALS AND METHODS

- **Age range:** 17 – 34 years.
- Informed participant consent and Ethics Committee approval.
- Inclusion and exclusion criteria
- **Inclusion criteria:** healthy participants without facial or vertebral column deformities. Participants whose parents and grandparents (both maternal and paternal lines) did not have inter-tribal marriages.
- **Exclusion criteria:** people with facial scars, oedema, tumour, or vertebral column deformities and people who had undergone facial surgeries.

MATERIALS AND METHODS

□ Measurements

➤ Height

➤ Ocular dimensions:

- Left eye fissure, Right eye fissure, Intercanthal width and Biocular width

➤ Nasal dimensions:

- Nasal height, Nasal length, Nasal tip protrusion, Morphological nose width and Anatomical nose width
- Nasal index = nasal length/nasal height × 100

➤ Data analyses: IBM SPSS version 20.0

MATERIALS AND METHODS

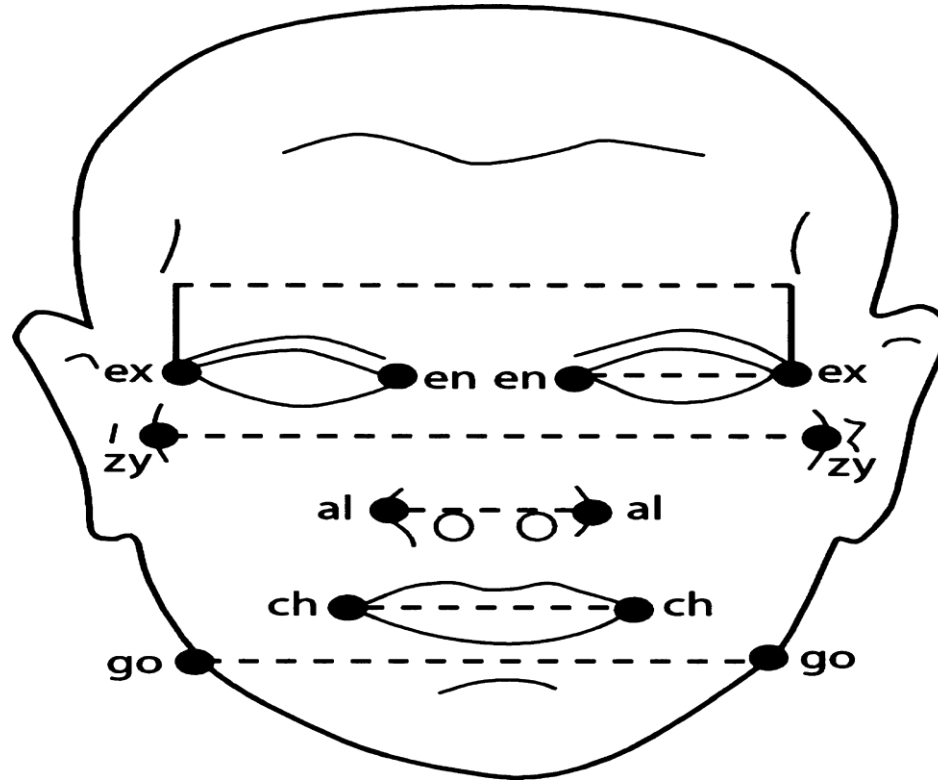


Figure 1: An illustration showing measurement of the ocular dimensions.

en-en (intercanthal width); *ex-ex* (biocular width); *R_en-ex* (right eye fissure length); *L_en-ex* (left eye fissure); *al-al* (morphological nose width).

(Source: Farkas *et al.*, 2005)

MATERIALS AND METHODS

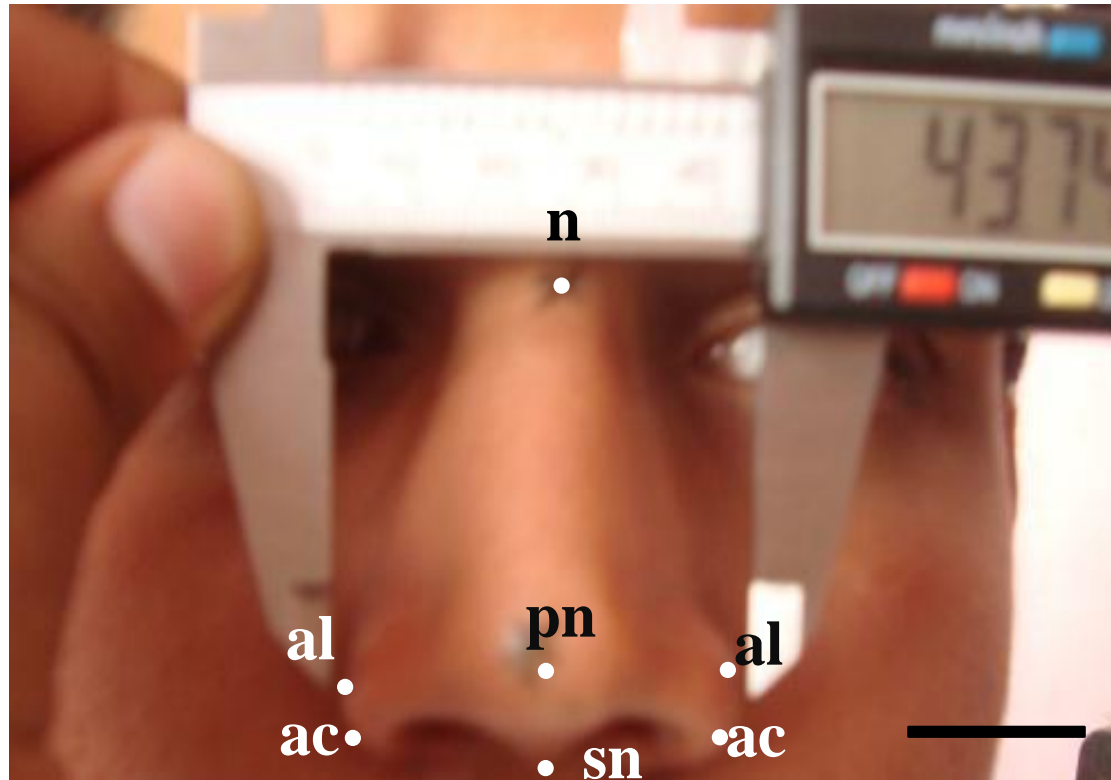


Figure 2: A photograph showing the measurement of nasal parameters (X 0.1).
n-sn (nasale to subnasale); *n-pn* (nasale to pronasale); *pn-sn* (pronasale to subnasale); *al-al* (ala nasi to ala nasi); *ac-ac* (ala curvature to ala curvature)

RESULTS AND DISCUSSION

Table 1: Ocular and Nasal Dimensions of Participants with Respect to Sex.

Parameter	Sex	Mean \pm SD (cm)	Range (cm)	p-value
Left eye fissure	M	3.73 \pm 0.27	3.08 – 4.55	0.026
	F	3.66 \pm 0.26	2.92 – 4.29	
Right eye fissure	M	3.54 \pm 0.25	2.91 – 4.10	0.089*
	F	3.49 \pm 0.24	2.95 – 4.14	
Biocular width	M	10.58 \pm 0.42	9.38 – 11.52	<0.001
	F	10.31 \pm 0.46	9.27 – 11.66	
Intercanthal width	M	3.48 \pm 0.30	2.73 – 4.39	<0.001
	F	3.38 \pm 0.28	2.51 – 4.06	
Nasal height	M	4.43 \pm 0.34	3.33 – 5.18	<0.001
	F	4.26 \pm 0.31	3.33 – 5.03	
Nasal length	M	4.13 \pm 0.33	3.11 – 4.86	<0.001
	F	3.94 \pm 0.27	3.35 – 4.71	
Nasal tip protrusion	M	1.27 \pm 0.19	0.77 – 1.73	0.072*
	F	1.23 \pm 0.21	0.63 – 1.70	
Morphological nose width	M	3.60 \pm 0.38	2.43 – 4.57	<0.001
	F	3.44 \pm 0.34	2.38 – 4.29	
Anatomical nose width	M	4.08 \pm 0.30	3.50 – 5.11	<0.001
	F	3.72 \pm 0.26	3.17 – 4.42	

*M = male; F = female; SD = standard deviation; *not statistically significant; cm = centimetre*

Consistent with Oladipo *et al.* (2010); Shah *et al.* (2016) but not with Sahni *et al.* (2014)

RESULTS AND DISCUSSION

Table 2: Ocular Dimensions of Participants Based on Tribe

	Tribe	N	Mean \pm SD (cm)	Range (cm)	ANOVA p-value
Left eye fissure	Akans	221	3.70 \pm 0.27	2.92 – 4.55	0.651
	Ewes	24	3.73 \pm 0.23	3.2 – 3.82	
	Ga-Dangmes	16	3.68 \pm 0.29	3.21 – 4.15	
	Northerners	27	3.65 \pm 0.28	3.65 – 0.28	
Right eye fissure	Akans	221	3.54 \pm 0.26	2.95 – 4.14	0.165
	Ewes	24	3.51 \pm 0.16	3.20 – 3.82	
	Ga-Dangmes	16	3.43 \pm 0.23	2.91 – 3.79	
	Northerners	27	3.45 \pm 0.23	3.11 – 4.03	
Biocular width	Akans	221	10.49 \pm 0.46	9.27 – 11.66	0.645
	Ewes	24	10.41 \pm 0.38	9.56 – 11.23	
	Ga-Dangmes	16	10.37 \pm 0.50	9.38 – 11.11	
	Northerners	27	10.42 \pm 0.40	9.61 – 11.08	
Intercanthal width	Akans	221	3.45 \pm 0.30	2.51 – 4.39	0.199
	Ewes	24	3.44 \pm 0.24	2.94 – 3.84	
	Ga-Dangmes	16	3.47 \pm 0.37	2.87 – 4.00	
	Northerners	27	3.33 \pm 0.24	2.98 – 3.99	

N = number of participants; *SD*= standard deviation; *cm*= centimetre; *ANOVA*= analysis of variance
Northerners = Dagombas, Dagaabas, Sisaalas, Frafra, Kotokoli , Mampruis, Gonjas

Consistent with Erika *et al.* (2005) Higher values than Kumar and Chandra (2006); Lower values than Oladipo *et al.* (2010)

RESULTS AND DISCUSSION

Table 3: Nasal Dimensions of Participants Based on Tribe

	Tribe	Mean \pm SD (cm)	Range (cm)	ANOVA p- value
Nasal height	Akans	4.37 \pm 0.32	3.33 – 5.18	0.816
	Ewes	4.34 \pm 0.32	3.65 – 4.76	
	Ga-Dangmes	4.29 \pm 0.40	3.44 – 5.01	
	Northerners	4.39 \pm 0.41	3.33 – 5.06	
Nasal length	Akans	4.06 \pm 0.31	3.38 – 4.86	0.863
	Ewes	4.08 \pm 0.31	3.55 – 4.59	
	Ga-Dangmes	3.99 \pm 0.40	3.11 – 4.79	
	Northerners	4.07 \pm 0.39	3.11 – 4.84	
Nasal tip protrusion	Akans	1.27 \pm 0.20	0.63 – 1.73	0.418
	Ewes	1.23 \pm 0.21	0.85 – 1.70	
	Ga-Dangmes	1.20 \pm 0.15	0.95 – 1.45	
	Northerners	1.23 \pm 0.17	0.91 – 1.59	
Morphological nose width	Akans	3.54 \pm 0.36	2.28 – 4.57	0.046
	Ewes	3.67 \pm 0.34	3.04 – 4.37	
	Ga-Dangmes	3.35 \pm 0.41	2.75 – 4.26	
	Northerners	3.31 \pm 0.39	2.84 – 4.18	
Anatomical nose width	Akans	3.93 \pm 0.34	3.17 – 5.11	0.273
	Ewes	4.03 \pm 0.29	3.58 – 4.54	
	Ga-Dangmes	3.82 \pm 0.28	3.46 – 4.49	
	Northerners	3.94 \pm 0.35	3.37 – 4.71	

N = number of participants; *SD* = standard deviation; *cm* = centimetre; *ANOVA* = analysis of variance
Northerners = Dagombas, Dagaabas, Sisaalas, Frafras, Kotokoli, Mamprusis, Gonjas, etc.

Inconsistent with Oladipo et al. (2007)

RESULTS AND DISCUSSION

Table 4: Nasal Indices of Participants Based on Sex and Tribe

	Participants	Mean nasal index \pm SD	p-value	Nose type
Sex	Males	108.27 \pm 4.33	0.043	Platyrrhine
	Females	107.24 \pm 4.14		Platyrrhine
Tribe	Akans	107.63 \pm 4.38	0.992*	Platyrrhine
	Ewes	107.78 \pm 4.37		Platyrrhine
	Ga-Dangmes	107.78 \pm 4.37		Platyrrhine
	Northerners	107.81 \pm 3.80		Platyrrhine

*SD = standard deviation; platyrrhine nose = nasal index > 85; *Not statistically significant*

Contrary to Oladipo *et al.* (2010)

In line with Oladipo *et al.* (2009)

RESULTS AND DISCUSSION

Table 5: Correlation Between Height, Nasal and Ocular Dimensions

Parameter	Pooled data		Males		Females	
	r	p-value	r	p-value	r	p-value
Nasal height	0.259	0.000	0.125	0.000	0.165	0.277
Nasal length	0.297	<0.001	0.179	0.000	0.099	0.291
Nasal tip protrusion	0.134	0.022	0.093	0.022	0.080	0.394
Morphological nose width	0.135	0.023	0.061	0.023	-0.022	0.819
Anatomical nose width	0.327	<0.001	0.067	0.000	0.021	0.822
Left eye fissure	0.235	<0.001	0.235	0.002	0.149	0.111
Right eye fissure	0.187	0.001	0.214	0.005	0.088	0.350
Biocular width	0.362	0.002	0.288	0.000	0.208	0.026
Intercanthal width	0.178	<0.001	0.235	0.096	0.065	0.499

r = Pearson correlation coefficients

RESULTS AND DISCUSSION

Table 6: Linear Regression Models For Height Estimation Using Selected Ocular And Nasal Parameters In Pooled Data

PARAMETERS	r	Adj. R ²	SEE	REGRESSION EQUATION	p-value
EXEX	0.362	0.128	7.33	Height = 101.929 + 6.258 (EXEX)	0.000
ACAC	0.327	0.104	7.43	Height = 137.034 + 7.738 (ACAC)	0.000

EXEX= biocular width (exocanthium to exocanthium); *ACAC*= anatomical nose width (alare curvature to alare curvature); *r*= correlation coefficients; *Adj.R²*= Adjusted coefficient of determination; *SEE*= standard error of estimation

Consistent with Kumar and Chandra (2006); Jervas *et al.* (2015)

RESULTS AND DISCUSSION

- Binary logistic model for sex determination using ocular dimensions;

$$\text{Sex} = 14.17 - 1.321(\text{ex-ex}) - 0.229(\text{en-en})$$

If the result of the equation is > 0.500 it indicates a male and if ≤ 0.500 it indicates a female.

Prediction Accuracy for males = **81.5%**; females = **32.2%**

Overall Accuracy = **61.8%**

(Consistent with Shah *et al.*, 2016)

RESULTS AND DISCUSSION

- Binary logistic model for sex determination using nasal dimensions;

$$\text{Sex} = 20.464 + 0.785(n\text{-sn}) - 1.955(n\text{-pn}) + 0.961(al\text{-al}) - 5.080(ac\text{-ac})$$

If the result of the equation is > 0.500 it indicates a male and if ≤ 0.500 it indicates a female.

Prediction Accuracy for males = **83.8%** ; females = **45.2%**

Overall Accuracy = **60.1%**

(Partially Consistent with Adamu *et al.*, 2016; Jain *et al.*, 2016)

RESULTS AND DISCUSSION

Table 7: Inter-population Comparison of Nasal Index

Population	Males		Females		Nose type
	N	Mean \pm SD	N	Mean \pm SD	
Ghanaians Present study	173	108.27 \pm 4.33	115	107.24 \pm 4.14	Platyrrhine
Yoruba (Anas and Saleh, 2010)	100	100.90 \pm 8.90	97	94.10 \pm 8.00*	Platyrrhine
Bini (Eboh, 2011)	100	99.13 \pm 9.26	100	99.27 \pm 11.67	Platyrrhine
Igbos (Eliakim-Ikechukwu <i>et al.</i> , 2012)	114	107.62 \pm 1.09	114	98.89 \pm 1.30*	Platyrrhine
Hindus (Sharma <i>et al.</i> , 2014)	102	80.59 \pm 9.12*	102	77.29 \pm 8.47*	Mesorrhine
Kosovo Albanians (Staka <i>et al.</i> , 2012)	101	67.07 \pm 6.67*	103	63.87 \pm 5.57*	Leptorrhine
<i>SD= standard deviation; *Statistically significant</i>					19

CONCLUSION

- **The mean nasal and ocular dimensions were significantly higher in males than in females except right eye fissure and nasal tip protrusion.**
- **Only morphological nose width varied significantly among the tribes. Ewes had the highest mean value.**
- **The predominant nose type for all the tribes was platyrrhine (flat nose).**

CONCLUSION

- **Nasal and ocular dimensions were not reliable for height and sex determination.**
- **The results obtained for Ghanaians varied significantly from other populations.**
- **The present study has set the stage for future studies.**

FUTURE STUDIES

- **Equal proportions of males and females as well as tribes should be used to minimize sex and tribal bias.**
- **Other tribes should be included in a future study to obtain a larger normative data for Ghanaians.**
- **Results should be compared with cranial parameters to obtain the best determinants of height and sex for Ghanaians.**

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THANK YOU