



# **Determination of height, sex and facial types using morphological facial dimensions and its relationship with tribe.**

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# INTRODUCTION

- ✓ **The human face**

(Zahra *et al.*, 2006).

- ✓ **Facial features- for distinguishing various races and ethnic groups**

(Farkas *et al.*, 2005).

- ✓ **Facial region for height and sex determination**

(Farkas *et al.*, 2005).

# PRESENT STUDY

- ✓ **Limited metric facial data in Ghana**

(Maalman *et al.*, 2017).

- ✓ **Population-specific standards**

(Maalman *et al.*, 2017).

- ✓ **The exposure of health workers**

(Pouya *et al.*, 2017).

# AIM

**To generate additional data on facial dimensions and determine its relationship with height and sex among the Akans, Ewes, Ga-Adangbes and Northerners of Ghana.**

# SPECIFIC OBJECTIVES

- **To measure the morphological facial dimensions of male and female participants.**
- **To measure the height of males and females.**
- **To determine the differences in morphological facial dimensions among the Akans, Ewes, Ga-Adangbes and Northerners of Ghana.**

# SPECIFIC OBJECTIVES

- **To determine the facial types and relate it with sex and tribe.**
- **To derive models for height and sex determination using morphological facial dimensions.**
- **To compare the data collected with published data.**

# MATERIALS AND METHODS

## Study Design and Location

- ✓ Study design: A cross-sectional study.
- ✓ Location: Anatomy Department – CoHS, KSMD.
- ✓ Informed participant's consent and Ethics Committee approval.
- ✓ Sample size: 379 (230; 60.4% males and 149; 39.6% females)  
(296 Akans, 37 Northerners, 25 Ewes and 21 Ga-Adangbes)
- ✓ Duration: February, 2019 to June, 2019.
- ✓ Inclusion and exclusion criteria.
- ✓ Age range: 16 – 36 years.

# MATERIALS AND METHODS

## Measurements:

✓ 8 facial dimensions were taken with Shahe vernier calliper (Shanghai, China):

Midfacial height one, midfacial height two, lower facial height/mandibular height, morphological facial height, maxillary height, facial breadth, mandibular width and mouth width.

✓ Facial index =  $\frac{\text{Facial height}}{\text{Facial breadth}} \times 100$  (Yesmin *et al.*, 2014).

✓ Measurement of height using Shahe height meter (Shanghai, China).

Data analysis – SPSS version 20.0



# MATERIALS AND METHODS

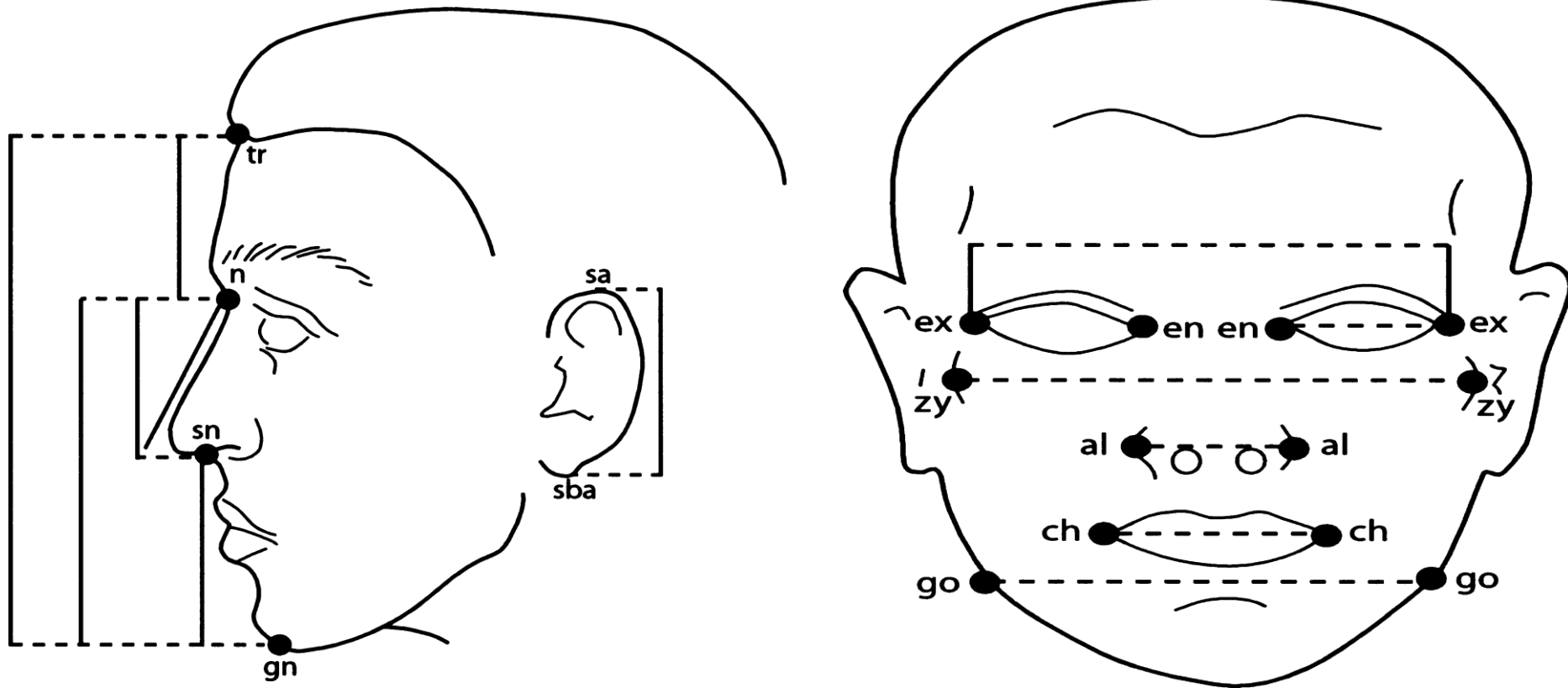
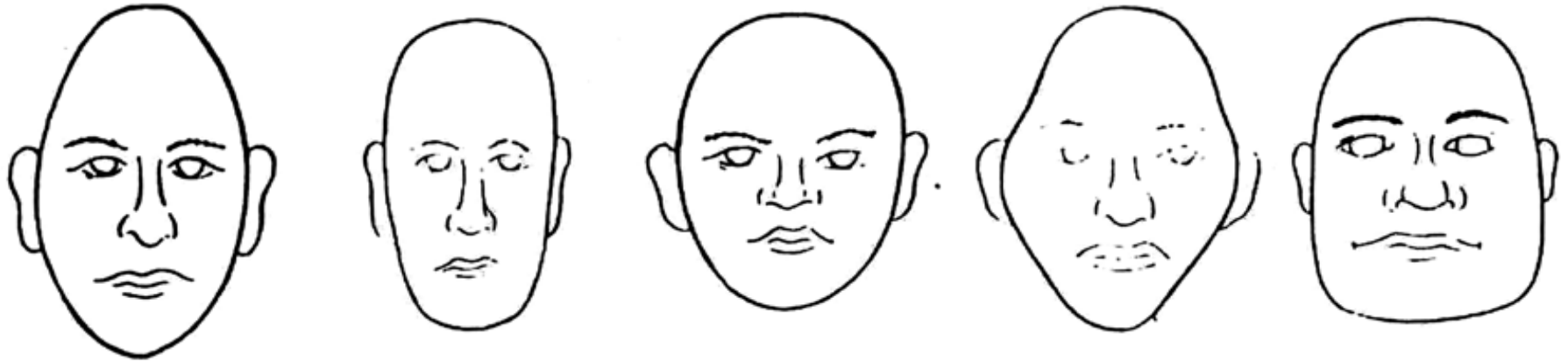


Figure 1: Illustrations showing the lateral and frontal aspects of the face.

*n-st* (mid-facial height one), *g-sn* (mid-facial height two), *st-gn* (mandibular height), *n-gn* (morphological face height), *sn-st* (maxillary height), *zy-zy* (facial breadth), *go-go* (mandibular width) and *ch-ch* (mouth width).

(Farkas *et al.*, 2005).

# MATERIALS AND METHODS



Hyperleptoprosopic

Leptoprosopic

Mesoprosopic

Europrosopic

Hypereuroprosopic

Figure 2: Cartoons showing the face shapes.  
(Johanshahi *et al.*, 2008)

# RESULTS AND DISCUSSION

**Table 1: Morphological facial dimensions of participants based on sex**

FACIAL PARAMETERS	Sex	Mean $\pm$ SD (cm)	Range (cm)	p-value
Midfacial height one (n-st)	M	7.12 $\pm$ 0.57	4.88 - 8.72	<b>0.000*</b>
	F	6.85 $\pm$ 0.57	5.16 - 7.81	
Midfacial height two (g-sn)	M	5.77 $\pm$ 0.75	4.12 - 12.75	0.138
	F	5.66 $\pm$ 0.56	3.56 - 6.91	
Mandibular height (st-gn)	M	4.92 $\pm$ 0.66	2.36 - 6.44	<b>0.000*</b>
	F	4.55 $\pm$ 0.73	2.11 - 8.57	
Morphological face height (n-gn)	M	11.62 $\pm$ 0.75	8.63 - 13.97	<b>0.000*</b>
	F	10.99 $\pm$ 0.71	8.18 - 12.46	
Maxillary height (sn-st)	M	2.26 $\pm$ 0.49	0.57 - 3.43	<b>0.009*</b>
	F	2.13 $\pm$ 0.49	0.60 - 3.20	
Facial breadth (zy-zy)	M	12.99 $\pm$ 1.06	9.92 - 15.63	<b>0.004*</b>
	F	12.69 $\pm$ 0.87	9.65 - 15.10	
Mandibular width (go-go)	M	11.38 $\pm$ 0.88	7.74 - 13.48	<b>0.000*</b>
	F	10.95 $\pm$ 0.78	8.70 - 13.28	
Mouth width (ch-ch)	M	5.48 $\pm$ 0.52	3.84 - 6.70	<b>0.000*</b>
	F	5.13 $\pm$ 0.52	3.05 - 6.07	

*SD* = Standard deviation; *cm* = centimetres; *n-st* = mid-facial height one; *g-sn* = mid-facial height two; *st-gn* = mandibular height; *n-gn* = morphological face height; *sn-st* = maxillary height; *zy-zy* = facial breadth; *go-go* = mandibular width and *ch-ch* = mouth width; \*Statistically Significant Difference ( $P < 0.05$ ); *M* = Males; *F* = Females.

(Consistent with Farkas *et al.*, 2005; Nagle *et al.*, 2005; Maalman *et al.*, 2017)

# RESULTS AND DISCUSSION

**Although the morphological facial dimensions varied among the tribes, none of them showed statistically significant difference.**

# RESULTS AND DISCUSSION

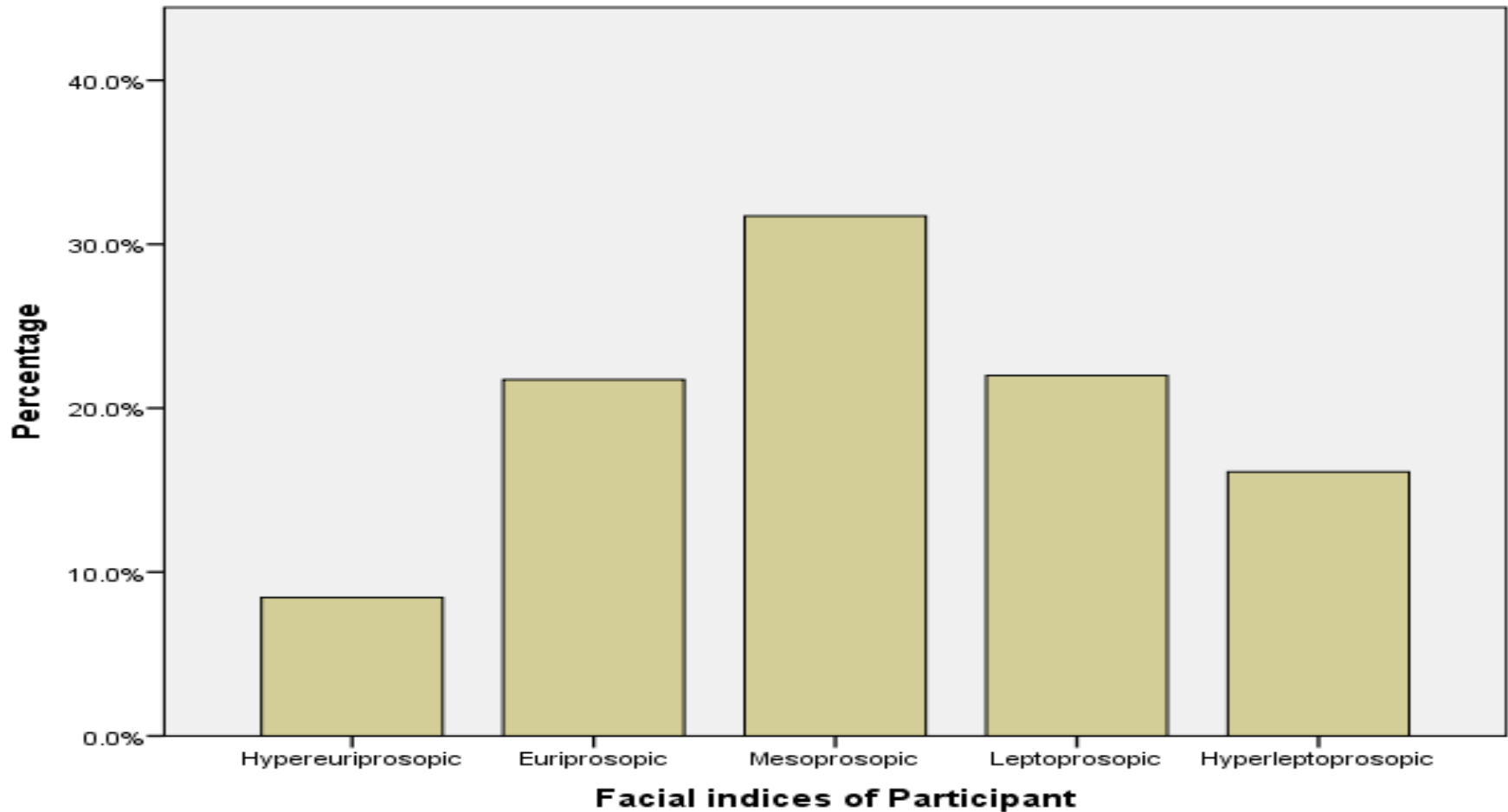


Figure 3: A bar chart showing the distribution of the facial types (facial indices) among the participants. (Consistent with Pouya *et al.*, 2005; but not Eliakim-Ikechukwu *et al.*, 2012 and Jeremic *et al.*, 2013 )

# RESULTS AND DISCUSSION

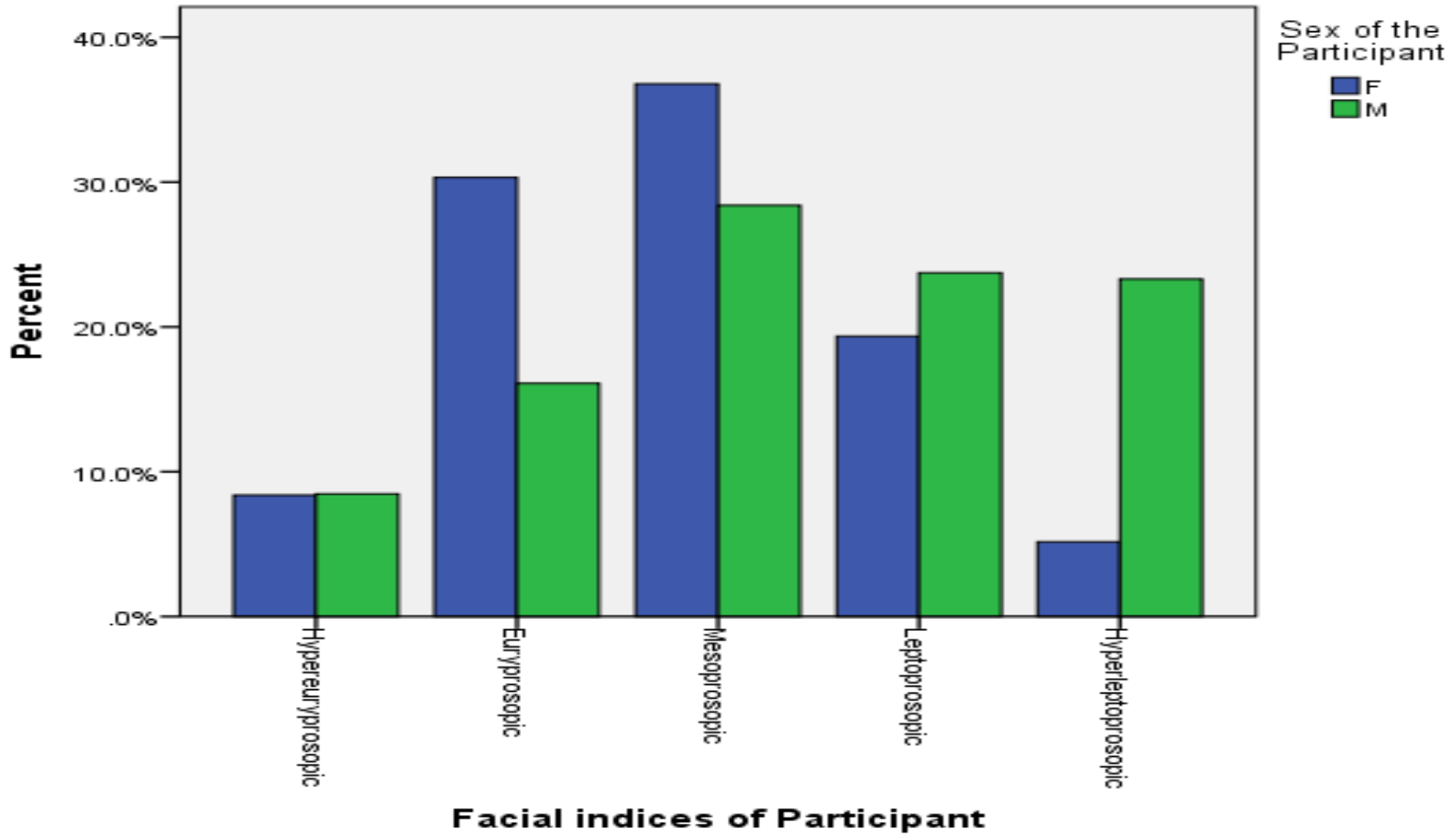


Figure 4: A bar chart showing the distribution of the facial types among the male and females participants. (Consistent with Pouya *et al.*, 2005; but not Eliakim-Ikechukwu *et al.*, 2012 and Jeremic *et al.*, 2013 )

# RESULTS AND DISCUSSION

Table 2: Chi-square distribution of facial types among the tribes.

Facial type	Akans N (%)	Ewes N (%)	Ga-Adangbes N (%)	Northerners N (%)
Hypereuryprosopic	28 (9.5)	0 (0.0)	1 (4.8)	3 (8.3)
Euryprosopic	56 (18.9)	12 (48.0)	3 (14.3)	11 (29.7)
Mesoprosopic	98 (33.1)	6 (24.0)	9 (42.9)	8 (21.6)
Leptoprosopic	69 (23.3)	4 (16.0)	4 (19.0)	7 (18.9)
Hyperleptoprosopic	45 (15.2)	3 (12.0)	4 (19.0)	8 (21.6)

*N = Number; % = Percentage.*

# RESULTS AND DISCUSSION

**Table 3: Correlation between height and morphological facial dimensions.**

Facial parameter	Pooled data		Males		Females	
	r	p value	r	p value	r	p value
Midfacial height one (n-st)	0.300	<0.001*	0.186	0.004*	0.266	0.001*
Midfacial height two (g-sn)	0.245	<0.001*	0.257	0.000*	0.229	0.004*
Mandibular height (st-gn)	0.313	<0.001*	0.201	0.002*	0.277	0.005*
Morphological facial height (n-gn)	0.446	<0.001*	0.279	0.000*	0.333	0.000*
Maxillary height (sn-st)	0.121	<0.001*	0.034	0.600	0.093	0.249
Facial breadth (zy-zy)	0.239	<0.001*	0.188	0.004*	0.202	0.012*
Mandibular width (go-go)	0.280	<0.001*	0.205	0.002*	0.136	0.091
Mouth width (ch-ch)	0.313	<0.001*	0.162	0.012*	0.194	0.005*

*r* = Pearson's correlation coefficient; *n-st* = mid-facial height one; *g-sn* = mid-facial height two; *st-gn* = mandibular height; *n-gn* = morphological face height; *sn-st* = maxillary height; *zy-zy* = facial breadth; *go-go* = mandibular width and *ch-ch* = mouth width; \*Statistically Significant Difference ( $P < 0.05$ ) **(Contrary to Ekezie et al., 2015)**



# RESULTS AND DISCUSSION

## HEIGHT ESTIMATION USING MORPHOLOGICAL FACIAL DIMENSIONS

- ✓ The equation for height estimation using linear regression is;  
**Height = 4.53 (n-gn) +116.16; R<sup>2</sup> = 0.199**
- ✓ Height equations were not determined for males and females as their morphological facial dimensions correlated weakly with height.
- ✓ (In agreement with Krishan *et al.*, 2008 but contrary to Ekezie *et al.*, 2015)

# RESULTS AND DISCUSSION

## SEX DETERMINATION USING MORPHOLOGICAL FACIAL DIMENSIONS

- ✓ The equation for sex determination using stepwise binary logistic regression is;

$$\text{Sex} = 1.70 (\text{st-gn}) + 1.32 (\text{ch-ch}) - 1.16 (\text{sn-st}) - 0.84 (\text{n-st}) - 17.39.$$

- ✓ When the result of the equation is  $> 0.5$  it indicates a male and when  $\leq 0.5$  it indicates a female.
- ✓ The above model correctly predicted the sex of **83.1%** males and **56.8%** females. The overall prediction accuracy of sex was 72.6%.

# RESULTS AND DISCUSSION

## SEX DETERMINATION FOR AKANS USING MORPHOLOGICAL FACIAL DIMENSIONS

✓ The sex determination equation for Akans using stepwise binary logistic regression is;

$$\text{Sex} = -1.74 (n-gn) + 0.94 (g-sn) - 1.52 (ch-ch) + 1.48 (sn-st) - 18.69.$$

✓ When the result of the equation is  $> 0.5$  it indicates an Akan male and when  $\leq 0.5$  it indicates an Akan female.

✓ The above model correctly predicted the sex of **85.6%** Akan males and **56.8%** Akan females. Overall prediction accuracy of sex was 74.2%.

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# RESULTS AND DISCUSSION

**Table 4: Student's t-test comparison of the facial indices recorded in the present study and selected data from other populations.**

Population	Tribe	Prosopic/ Facial index (%)	
		Males	Females
Present study (Ghanaians)	<b>Akans</b>	89.95	86.90
	<b>Ewes</b>	87.76	83.74
	<b>Northerners</b>	90.48	84.21
	<b>Ga-Adangbes</b>	90.92	88.85
Nigerians (Omotoso <i>et al.</i> , 2011)	<b>Bini</b>	<b>87.98*</b>	<b>85.88*</b>
Nepalese (Shah <i>et al.</i> , 2015)	<b>Nepalese</b>	<b>88.47*</b>	<b>89.12*</b>
Malaysians and Indians (Shetti <i>et al.</i> , 2011)	<b>Malaysians</b>	<b>85.72*</b>	<b>87.70*</b>
	<b>Indians</b>	<b>87.19*</b>	<b>86.75*</b>
Northern Iranians (Johanshahi <i>et al.</i> , 2008)	<b>Turkman</b>	<b>87.25*</b>	<b>81.48*</b>
	<b>Fars</b>	<b>88.22*</b>	<b>84.48*</b>

# CONCLUSION

- ✓ The morphological facial dimensions of males were significantly higher than that of females.
- ✓ Males were significantly taller than females.
- ✓ The morphological facial dimensions among the Akans, Ewes, Ga-Adangbes and Northerners showed no significant differences.
- ✓ The predominant facial type among males and females was mesoprosopic.

# CONCLUSION

- ✓ The Akans and Ga-Adangbes were predominantly mesoprosopic whilst most of the Northerners and Ewes were euryprosopic.
- ✓ Morphological facial height was the single best determinant of height and sex.
- ✓ The prosopic indices of Ghanaians varied significantly from other populations.

# RECOMMENDATIONS

- ✓ A larger sample size should be used in future studies to increase accuracy of height and sex determination.
- ✓ Equal proportions of males and females should be used in future studies to reduce sex bias.
- ✓ Equal proportion of each tribe should be used in future studies to reduce tribe-related bias.

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# RECOMMENDATIONS

- ✓ **Similar studies should be conducted for the other tribes to increase the database of facial dimensions among the tribes of Ghana.**
- ✓ **Aside facial parameters, cranial parameters should also be considered to determine the best model for height and sex determination.**



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