# Anthropometric Evaluations of the Condylar Heads of Mandibles in the Nigerians

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## ABSTRACT

**BACKGROUND:** A variation of normal Condylar head morphology and morphometry occurs with age, gender, race, and between right and left sides. We aimed therefore to determine the morphologic and morphometric parameters of condylar heads in different age group and to determine the possible variations males and females.

**METHODS:** This is a descriptive cross-sectional study that recruited surgical wet mandible stored in the stored in the Department of Oral and Maxillofacial Surgery, University of Benin Teaching Hospital from 1999 to 2019. Data were collected and analysed descriptively and statistically. A P-Value greater than 0.05 was considered significant.

**RESULTS:** A total of 101 formalin-preserve human mandibular condyles were sampled. The mean age (SD) of the patients recruited was 43.9(11.2) years with age range between 21 and 70 years. The males recruited were 58(57.4%) while the females were 43(42.2%). The most prevalent anterior, superior and lateral view shapes were round (60.4%), oblong (62.4%) and round (62.4%) shapes respectively. The mean values for CHW, CHL and CHH were 1.92 mm, 8.51mm and 4.23mm respectively. The relationship between gender and morphometric parameters was only statistically significant (P<0.05).

**CONCLUSION:** Fabrication of condylar prosthesis with this anatomical parameters will eliminate the problems of ill-fitting prosthesis thereby reducing complications.

**KEYWORDS** Anthropometry, wet mandible, condylar head, variations

## INTRODUCTION

Craniofacial While the reconstruction of mandibular condylar head with either custom-made prosthesis or microvascular fibular flaps is a common place in developed countries, reconstruction of same is frequently done with prefabricated prosthesis in developing countries, like Nigeria (Alonso *et al.,* 1994; Blackwell *et al.,* 1996; Akinmoladun *et al.*, 2012). In overall, these reconstruction can only be physiologically and functionally successful if the full knowledge of the anatomical morphometry and morphology of the temporomandibular joint is widely known (Kearns *et al.,* 1995).

The mandibular condyle (MC) is a projection in the ramus and consist of two parts: the condylar head (CH) and condylar neck (CN). The CH comprise the condylar head length (CHL), condylar head width (CHW) and the condylar head height (CHH) (Yale *et al.,* 1966). Various shapes of CH in the superior, anterior and lateral views are reported in the literature (Hilton, 1981; Akerman *et al.,* 1984; Whittaker *et al.,* 1985; Ishwarkumar *et al.* 2016; Akhilanand *et al.,* 2017; Ashiwinirani *et al.,* 2018). The average value of the condylar head length (CHL), condylar head width (CHW) and the condylar head height (CHH) are 8-10mm, 15-20mm and 2.01- 4.87mm respectively (Whittaker *et al.,* 1985). A variation of normal CH morphology and morphometry occurs with age, gender, race, and between right and left sides (Chaudhary *et al.,* 2015; Omoregie and Ibhawo, 2018).

The rate of replacement of CH defect due to neoplasms is increasing geometrically in the developing countries due to late presentation, financial constraints, lack of awareness, access to hospital facility and poor policy (Carlson, 2002; Patel and Maisel, 2001). While removal of TMJ is on the increase, replacement are done with prefabricated prosthesis that may not exactly fit and this can result in poor outcome such as poor speech, mastication, temporomandibular pain dysfunction, discomfort, and ultimately poor quality of life(Edetanlen and Saheeb, 2018). Other causes of the rising incidence of condylar disarticulation in developing countries are due to trauma, degenerative diseases, osteomyelitis and congenital and acquired malformations (Hedge *et al.,* 2013). The available reconstruction plates are prefabricated without prior information on morphometry and morphology of the condyle of the recipients.

Studies of the morphology and morphometry of the CH using dry skull, photographic and radiographic images are well documented in the literature globally (Oberg *et al.,* 1971; Wedel *et al.,* 1978; Magnusson *et al.,* 2008; Ribeiro *et al.,* 2015; Matsumoto and Bologne, 1995; Oliveira-Santos *et al.,* 2009; Richard, 1987; Sonal *et al.,* 2016). Images being direct method of measurement may be not be accurate in morphometric analysis. Though several studies (Carlson, 2002; Chaudhary et al., 2015) have shown that dry skull is most suitable for morphologic and morphometric evaluation, none has indicated the effect of shrinkage on the specimen making the studies not generalizable.

In the global literature, most CH morphological studies (Yale *et al.,* 1966; Oberg *et al.,* 1971; Wedel *et al.,* 1978; Magnusson *et al.,* 2008; Ribeiro *et al.,* 2015; Matsumoto and Bologne, 1995; Oliveira-Santos *et al.,* 2009; Richard, 1987; Sonal *et al.,* 2016) were reported but few (Wangai *et al.,* 2013; Krisjane *et al.,* 2009) morphometric studies were seen. More so, there were dearth of these data in African literature with none reported among Nigerians. We aimed, therefore, to determine the anthropometric parameter of Nigerians using wet mandibles.

## METHODS

This was a cross-sectional study design conducted in the Department of Oral and Maxillofacial Pathology at the University of Teaching Hospital, Benin-city, Edo state, Nigeria from January 1999 to December 2019. Ethical permission (ADM/E22/A/VOL VII/ 14716) was granted by the Research and Ethics Committee of the University of Benin Teaching Hospital, Edo state, Nigeria. All formalin-preserved surgical human mandibles (Figure 1) that met the selection criteria where recruited for the study. Included in the study were all well-stored and accurately labelled surgical specimen of human mandibles without any form of morphological distortion in the condylar head. Excluded in the study were all mandibles with poorly recorded demographic information and distorted condyles by tumours or trauma.

Data collected were age, gender, shape, length, width, height, and the side of the condylar head of the mandibles. Information on the age, gender, and the side of the mandible was gotten from name tag on the specimen containers and where information in the container is insufficient, the case-notes was retrieved.

**FIGURE 1. A formalin-preserved surgical human mandible**

### *Morphological recording*

The various shapes of CH were interpreted as given by Wedel *et al.,* (1978) (Table 1). This involves the physical recording of the shape of each sample in an anterior (front), lateral (side) and superior (top) views.

**TABLE 1. Classification system of condylar morphology**

| View point | Designation | Classification | Description of shape |
|---|---|---|---|
| Anterior | 1 | A | Round (Convex) |
| | | B | Plane (Flat or Straight) |
| | | C | Ridge (Pointy or inverted V-shape) |
| Superior | 2 | A | Oblong |
| | | B | Round(Convex) |
| | | C | Pear-shaped with lateral tapering |
| | | D | Pear-shaped with medial tapering |
| Lateral | 3 | A | Round(Convex) |
| | | B | Plane(Flat or Straight) |
| | | C | Ridge(Pointy or inverted-V-shaped) |

(Wedel et al 1978)

### *Morphometric measurements*

The linear measurements and the anatomical landmark definitions were based on previous studies (Oberg *et al.,* 1971; Magnusson *et al.,* 2008). In the anatomical landmarks, the condylar head width (CHW) was defined as distance between the most prominent medial and lateral points of the mandibular condyles, corresponding to the largest dimension of the condylar head in frontal view (Figure 2). The condylar head length (CHL) was defined as distance between most prominent points on the anterior and posterior surfaces of the mandibular condyle, corresponding to the largest dimension of the mandibular condyle in the lateral view. The condylar head height (CHH) was defined as the distance between the most superior points on the head of the condyle to the margin of the condylar head, corresponding to the largest dimension of the condylar head in the lateral view. The measurements were made with calibrated, self-retaining, LCD display digital calliper (Tresna limited, Tokyo, Japan) (Figure 3). It has a resolution power of 0.1mm, accuracy of ±0.1mm, measuring range of 0-150mm and maximum measuring speed of 1.5m/second. Measurements was made to the nearest tenth of a millimetre.

**FIGURE 2. A Calibrated digital calliper**

### *Statistical analysis*

Given that there was single mandibular specimen per patient, the unit of analysis was taken to be patients. Therefore, 1 specimen per patient was selected at random for study inclusion. In order to minimise the risk of false assessment caused by fatigue, no more than 10 mandibular specimen were evaluated at a time. To assess intra-observer agreement, intra-class correlation coefficient (ICC) and Cohen kappa coefficient (CKC) were calculated. All measurements and recordings were made twice at an interval of two days by the researcher and the mean values were used for the analysis. This interval of measurements help to measure the intra-examiner error. To assess the intra-observer agreement between the quantitative variables, the single measurement, absolute-agreement, 2-way mixed effect model was used to calculate the intra-class correlation coefficient (ICC). To assess the intra-observer agreement between the qualitative variables, Cohen kappa coefficient analysis was used to calculate intra-observer agreement. An 1CC and CKC value of 0.9 or more was considered reliable.

**FIGURE 3. Calibrated calliper measuring the condylar head width**


**TABLE 2. Characteristics of the study samples**

| Variables | Values |
|---|---|
| **Superior view shapes (n (%))** | |
| Oblong | 63(62.4) |
| Round | 21(20.8) |
| Pear-shaped with lateral tapering | 9(8.90) |
| Pear-shaped with medial tapering | 8(7.90) |
| **Lateral view shapes (n (%))** | |
| Round | 63(62.4) |
| Plane | 24(23.8) |
| Ridge | 14(13.9) |
| **Anterior view shapes (n (%))** | |
| Round | 61(60.4) |
| Plane | 24(23.4) |
| Ridge | 16(15.8) |
| **Condylar head width(mm)** | |
| Range | 17.2-22.1 |
| Mean (SD) | 19.2(1.27) |
| **Condylar head length (mm)** | |
| Range | 6.61-10.2 |
| Mean (SD) | 8.51(0.97) |
| **Condylar head height (mm)** | |
| Range | 2.26-4.90 |
| Mean (SD) | 4.23(0.84) |

**TABLE 3. Distribution of condylar head morphology and morphometry according to age**

| | Ages (years) | | | | |
|---|---|---|---|---|---|
| **Variables** | **20-30** | **31-40** | **41-50** | **>50** | **P-Value** |
| **Superior view (n (%))** | | | | | |
| Oblong | 9(8.91) | 18(17.8) | 22(21.8) | 14(13.9) | |
| Round | 3(2.97) | 6(5.94) | 5(4.95) | 7(6.93) | |
| Pear-shaped with lateral tapering | 1(1.00) | 1(1.00) | 3(2.97) | 4(3.96) | |
| Pear-shaped with medial tapering | 0(0.00) | 2(1.98) | 4(3.96) | 2(1.98) | 0.81 |
| **Lateral view (n (%))** | | | | | |
| Round | 6( 5.94) | 19( 18.8 ) | 24(23.8) | 14(13.9) | |
| Plane | 5( 4.95) | 6( 5.94) | 5(4.95) | 8(17.8) | 0.46 |
| Ridge | 2( 1.98) | 2( 1.98) | 5(4.95) | 5(4.95) | |
| **Anterior view (n (%))** | | | | | |
| Round | 8( 7.92) | 18( 17.8 ) | 21(20.1 ) | 14(13.9) | |
| Plane | 4(3.96) | 6( 5.94) | 6(5.94 ) | 8(7.92 ) | 0.78 |
| Ridge | 1( 1.00) | 3(2.97) | 7(6.93) | 5(4.94) | |
| **Condylar head width (mm)** | | | | | |
| Range | 17.4-20.3 | 17.2-22.1 | 17.3-21.7 | 17.2-21.5 | |
| Mean (SD) | 18.8(1.16) | 19.3(1.39) | 19.3(1.29) | 19.3(1.18) | 0.57 |
| **Condylar head length (mm)** | | | | | |
| Range | 7.05-10.20 | 6.61-10.2 | 7.19-10.2 | 6.67-9.40 | |
| Mean (SD) | 8.37(0.98 ) | 8.54(1.18) | 8.80(0.86) | 8.19(0.75) | 0.09 |
| **Condylar head height (mm)** | | | | | |
| Range | 3.30-4.91 | 3.26-3.81 | 3.50-4.8 | 3.40-4.43 | |
| Mean (SD) | 3.33(0.84) | 3.21(0.22) | 3.24(0.76) | 3.94(0.72) | 0.38 |

During descriptive analysis, the means and standard deviation of the quantitative data were estimated while proportions or percentages of the qualitative data were also estimated. In the inferential statistics, relationship between CHW, CHH, CHL and the age of patients was assessed with Pearson correlation coefficient. Chi square of association was used to determine the relationship ethnicity, gender and the various shapes of the CH. Data was entered in the computer using spread sheet. All analysis were done with the help of the statistical software package for social sciences (SPSS), version 20(SPSS Inc., Chicago, USA), 95% confidence interval (C.I) was considered for every effect size (ES) estimated, and probabilities of less than 0.05 were accepted as significant.

## RESULTS

A total of 109 formalin-preserve human mandibular condyles were originally found but 8 surgical specimens were excluded based on the study exclusion criteria, making the total samples recruited to be 101 human mandibles. The study sample characteristics is presented in Table 2. The mean age (SD) of the patients recruited was 43.9(11.2) years with age range between 21 and 70 years. The males recruited were 58(57.4%) while the females were 43(42.2%). The most prevalent anterior, superior and lateral view shapes

**TABLE 4. Distribution of condylar head morphology and morphometry according to gender**

| Variables | Gender | | P-value |
|---|---|---|---|
| | Male | Female | |
| **Superior view (n (%))** | | | |
| Oblong | 36(35.6) | 27(26.7) | |
| Round | 12(11.9) | 9(8.91) | 0.99 |
| Pear-shaped with lateral tapering | 5(4.95) | 4(3.96) | |
| Pear-shaped with medial tapering | 5(4.95) | 3(2.97) | |
| **Lateral view (n (%))** | | | |
| Round | 35( 34.7) | 28(27.7) | |
| Plane | 13( 12.9) | 11(10.9) | 0.52 |
| Ridge | 10(9.90) | 4(3.96) | |
| **Anterior view (n (%))** | | | |
| Round | 34( 33.7) | 27(26.7) | |
| Plane | 16( 15.8) | 8(7.92) | 0.53 |
| Ridge | 8(7.92) | 8(7.92) | |
| **Condylar head width (mm)** | | | |
| Range | 17.7-22.1 | 17.2-21.5 | |
| Mean(SD) | 19.9(0.95) | 18.3(1.12) | 0.00 |
| **Condylar head length (mm)** | | | |
| Range | 7.20-10.2 | 6.61-9.80 | |
| Mean(SD) | 8.87(0.83) | 8.02(0.93) | 0.00 |
| **Condylar head height (mm)** | | | |
| Range | 3.40- 4.91 | 2.26-3.34 | |
| Mean(SD) | 3.44(0.80) | 2.86(0.80) | 0.01 |

**TABLE 5. Distribution of condylar head morphology and morphometry according to sides**

| Variables | Side | | P-value |
|---|---|---|---|
| | Right | Left | |
| **Superior view (n (%))** | | | |
| Oblong | 40(39.6) | 23(22.8) | |
| Round | 14(13.9) | 7(6.93) | 0.86 |
| Pear-shaped with lateral tapering | 5(4.95) | 4(3.96) | |
| Pear-shaped with medial tapering | 6(5.94) | 2(1.98) | |
| **Lateral view (n (%))** | | | |
| Round | 40(39.6) | 23(22.8) | |
| Plane | 14(13.9) | 10(9.90) | 0.44 |
| Ridge | 11(10.9 ) | 3(2.97) | |
| **Anterior view (n (%))** | | | |
| Round | 39(38.6) | 22(21.8) | |
| Plane | 17(16.8) | 7(6.93) | 0.64 |
| Ridge | 9(8.91 ) | 7(6.93) | |
| **Condylar head width (mm)** | | | |
| Range | 17.2-22.1 | 17.2-21.4 | |
| Mean(SD) | 19.3(1.16) | 19.1(1.45) | 0.32 |
| **Condylar head length (mm)** | | | |
| Range | 6.67-10.2 | 6.61-10.2 | |
| Mean(SD) | 8.52(0.94) | 8.51(0.99) | 0.95 |
| **Condylar head height (mm)** | | | |
| Range | 3.30-4.90 | 3.26-4.53 | |
| Mean(SD) | 3.12(0.85) | 3.14(0.84) | 0.60 |

were round (60.4%), oblong (62.4%) and round (62.4%) shapes respectively. The mean values for CHW, CHL and CHH were 1.92 mm, 8.51mm and 4.23mm respectively.

Table 3 presented the morphologic and morphometric values according to age distribution. The frequency of round, oblong, and round shapes of CH were highest compared to other shapes in the, lateral superior, and anterior views respectively. The observed differences were not statistically significant (P > 0.05). There was no significant anatomical or statistical association between CHW, CHL and CHH with variations in age (P > 0.05).

Table 4 showed the morphologic and morphometric values according to gender distribution. In the anterior, superior, and lateral views of the CH, the frequency of the round, oblong and round shapes appeared higher than other shapes in both males and females though these observations were not

statistically significant(P>0.05). Morphometrically, the mean values of CWH, CHL and CHH were higher in males than in females and the differences in the mean values were anatomically and statistically significant (P<0.05).

Table 5 showed the morphologic and morphometric values according to side of the mandible. In the anterior, superior, and lateral views of the CH, the frequency of the round, oblong and round shapes appeared higher than other shapes in both left and right sides of the mandible, though this observations were not statistically significant (P > 0.05). . Morphometrically, the variations in the mean values of CWH, CHL and CHH were not statistically significant between the left and right sides of the mandibles (P > 0.05).

For the quantitative variables, there was almost perfect intra-observer reliability among the two measurements with an ICC value of 96, 95%CI 0.92 to 0.99 for mean measurements while for qualitative variables, the reliability found by Cohen kappa coefficient was 91%.

## DISCUSSION

The knowledge of anatomical variations of the mandibular condyle is significant while fabrication of condylar prosthesis or reconstruction of the mandible which help to improve success and decrease the rate of complications (Ribeiro *et al.,* 2015; Matsumoto and Bologne, 1995). In Accordance with the literature reviewed, fabrication of condylar prosthesis or reconstruction of TMJ with wrong specifications will ultimately cause TMJ dysfunction as well as occlusal disharmony (Oliveira-Santos *et al.,* 2009).

The choice of formalinated human mandible was made in this study because: 1) it is only feasible to achieve precise and reliable morphometric data since no shrinkage has taken place, 2) errors from soft tissue effect on CT image is eliminated 3) errors from blurring and magnification of image from OPG is eliminated, 4) reliable patient characteristic information are readily available , 5) the purpose of the study is only fully achievable since both morphological and morphometrical analysis are required for wholesome information on the Nigerian condyle(Richard, 1987).

The mean age (SD) of 43.9 (11.2) years found in this study is an indication of increase occurrence of neoplastic condition at this age. This value is in agreement with the reported 2019 Nigerian life expectancy of around 54.5 years by the WHO, as the 43.9 years observed was lower than the Nigerian life expectancy (Sonal *et al.,* 2016). The higher number of mandibles from the males recruited for the study was not surprising as these group of individuals usually present late for treatments, which warrants extensive surgical procedure such as mandibular disarticulations.

The global anthropometric studies of the mandibular condyles is summarised in table 6. From the anterior view, the round shape was the most prevalent condylar head of the mandibles with a prevalence of 60.4% (Table 2). These findings support other previous studies (Yale *et al.,* 1966; Whittaker *et al.*, 1985; Wedel *et al.,* 1978; Oberg *et al.,* 1971; Magnusson *et al.,* 2008) that reported similar findings (Table 6). However, this finding did not support the studies that reported the plane shape as the most frequent (Ishwarkumar *et al.,* 2018; Matsumoto and Bologne, 1995; Wangai *et al.,* 2013). In the present study, the most common condylar head shape in the superior view was oblong as seen in 62.4 % of the sample. This was, however, different from reports in previous study that found round shape to be the most prevalent (Ishwarkumar *et al.,* 2016). A similar result was reported by Whittaker *et al.* (1985), Wedel *et al.,* (1978); Oberg *et al.,* (1971); Magnusson *et al.,* (2008); Matsumoto and Bologne.(1995) and Wangai *et al.*(2013).

As regard the lateral view, round shaped condylar head of the mandible was the most prevalent shape, with a value of 62.4%. Several previous studies (Yale et al., 1966; Oliveira-Santos *et al.,* 2009; Wangai *et al.,* 1987) in the literature reported similar findings. However, studies conducted by Ishwarkumar *et al.,* (2016) reported that the plane shape was the most prevalent, while Matsumoto and Bologne (1995) found that the ridge shape most common their sample. It could be suggested that existence of a population-specific differences could be responsible for the observed variations.

The mean value of CHW, CHL and CHH in the present study were 19.2mm, 8.51mm and 4.23mm respectively (Table 2). On the CHW, comparable findings were reported by previous studies of Wedel *et al.,* (1978) and Akerman *et al.,* (1984). The CHL of 8.51mm in the present study was not at par from 8.50mm reported by wedel et al., but was at par from 9.20mm reported by Akerman *et al.,* (1984).

The age of the subjects failed to display a statistically significant relationship with either the morphologic or morphometric parameters of CH in the present study. A

**TABLE 6. Global anthropometric studies of mandibular condyle**

| Authors | Years | Country | Anterior view | Lateral view | Superior View | CHW¥ | CHL¥ | CHH¥ |
|---|---|---|---|---|---|---|---|---|
| Yale et al. | 1966 | US | Round | Round | Nil | Nil | Nil | Nil |
| Oberg et al. | 1971 | US | Round | Nil | Oblong | 20.3(m) 19.1(f) | 9.8(m), 9.8(f) | Nil |
| Wedel et al. | 1978 | Sweden | Round | Nil | Oblong | 21.4(m) 19.1(f) | 8.0(m), 7.9(f) | Nil |
| Hinton | 1981 | UK | Nil | Nil | Nil | 20.2(m) 8.4(f) | 8.3(m), 8.0(f) | Nil |
| Akerman* et al. | 1984 | US | Nil | Nil | Nil | 20.5 | 9.20 | Nil |
| Whittaker et al. | 1985 | UK | Round | Nil | Oblong | 21(m) 18.8(f) | 9.2(m), 9.2(f) | Nil |
| Richard | 1987 | Australia | Nil | Nil | Nil | 22.1(m) 20.6(f) | 9.9(m), 9.2(f) | Nil |
| Whittaker et al. | 1990 | UK | Plane | Nil | Oblong | 20.5(m) 18.5(f) | 8.3(m) 7.8(f) | Nil |
| Matsumoto et al. | 1995 | Brazil | Plane | Ridge | Oblong | Nil | Nil | Nil |
| Wedel et al.* | 1998 | Sweden | Round | Nil | Oblong | 20.5 | 8.50 | Nil |
| Magnusson et al. | 2008 | Sweden | Round | Nil | Oblong | 20(m) 18.4(f) | 8.5(m), 8.2(f) | Nil |
| Oliveira et al. | 2009 | Brazil | Nil | Round | Nil | Nil | Nil | Nil |
| Wangai et al. | 2012 | Kenya | Plane | Round | Oblong | Nil | Nil | Nil |
| Ishwarkumar et al. | 2015 | South Africa | Plane | Plane | Round | 18.1(m) 17.7(f) | 9.40(m) 8.70(f) | Nil |
| Ribeiro et al | 2015 | Brazil | Plane | Round | Round | Nil | Nil | Nil |
| Sonal et al | 2016 | India | Nil | Round | Nil | Nil | Nil | Nil |
| Akhilanand et al. | 2017 | India | Nil | Nil | Nil | 19.5(m) 17.9(f) | 7.34(m) 7.21(f) | 9.45(m) 8.87(f) |
| Ashwinirani et al | 2018 | India | Nil | Round | Nil | Nil | Nil | Nil |
| Present | 2019 | Nigeria | Round | Round | Oblong | 19.9(m) 18.3(f) | 8.87(m) 8.02(f) | 3.44(m) 2.86 (f) |

*not divided in males and females; m = male; f = female; ¥ = S I unit in mm

comparison of this findings could not be done due to lack of similar data in the literature. This is one of the limitations of this study.

As regard the gender, there was no significant relationship between sex and morphologic parameter but there was a significant relationship between sex and morphometric parameters (Table 4). Morphometrically, the CHW, CHH and CHL were greater in males than in females. In the present study, the CHW of the male mandibular condyle was 19.9mm, while in females a mean length of 18.3mm were recorded (Table4). Similar findings was reported by Whittaker et al(1985); Hilton(1981); Ishwarkumar *et al.,*(2016) Akhilanand *et al.,*(2017); Wedel *et al.,*(1978); Oberg *et al.*,(1971); Magnusson *et al.*(2008) and Richard,(1984). A statistically significant relationship between CHW and gender was recorded (P = 0.00).

In this study, the CHL was reported to be 8.87mm in the males and 8.02mm in the females. Similarly, this was also reported by previous studies (Whittaker *et al.,* 1985; Hilton, 1981; Ishwarkumar *et al*., 2016; Akhilanand *et al.,* 2017; Wedel *et al.,* 1978; Oberg *et al.*, 1971; Magnusson *et al.,* 2008; Richard, 1987). A statistically significant relationship between CHL and gender was recorded (P=0.00).

With regard to the CHH, the value in males was greater than that in the females and similar findings was reported by Krisjane *et al.,* (2009) who reported a value of 3.80mm and 3.50mm in males and females respectively. There was a statistically significant relationship between CHH and gender of the sample studied (P=0.01).

There was no significant relationship between the morphologic and morphometric parameters of CH and the side of the mandible (Table 5). This study was limited by lack of similar data for comparison.

Other limitation in this study was that symmetry between contralateral sides in same individuals could not be assessed because due to lack of contralateral mandibles in same individuals. However, this study was the first study use the wet mandible as anthropometric study model thereby overcoming the errors from indirect measurements of images as well as shrinkage from dry bones as noted from previous studies.

In conclusion, within the limitation(s) of this study, the most prevalence shape of the condylar head of mandible in the, anterior, superior and lateral views were round, oblong, and round shape respectively. The range and mean condylar head width, length, and height of mandibles were 17.2-22.1mm, 6.61.-10.2mm and 2.26-4.90mm and 19.2(1.27) mm, 8.5(0.97) mm, and 4.23(0.84) respectively. The condylar head width, length and height was statistically significantly greater in males than the females. It is therefore recommendation that condylar prosthesis are fabricated with these baseline information.

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