Mini Review
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Cephalic index in sexual dimorphism and racial diversity: a mini review

Abstract

Craniometry and cephalometry are useful in classification of race and sex of individuals of unknown identity. This is a synoptic capture of cephalic index and cephalic dimensions in different populations. Cephalic index of females was higher than that of males in most populations with mesocephalic head shape in both sexes. Cephalic length and breadth of Indians were higher than those of Nigerians. Cephalic length and breadth were higher in male than female. Cephalic index and dimensions are important parameters in identification of both sexes and races.

Keywords: cephalic index, anthropometry, skull

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Craniometry is the scientific measurement of skulls, especially in relation to craniology while cephalometry is a branch of anthropometry in which the anatomical dimensions of head and face are measured. Cephalometry continues to be the most versatile technique in the investigation of the craniofacial skeleton because of its validity and practicality.[1] Human body dimensions are affected by ecological, geographical, racial, gender, and age factors.[2,3] Indices show the percentage relationship between different dimensions.[4] It is an important parameter for classification of race and sex of individuals of unknown identity. Anthropometric study of head is useful in designing various head and face gadgets like helmets, head phones, goggles etc. by formulating standard sizes.[5]

Cranial index and cranial dimensions are invaluable tools in racial and sexual dimorphism. Cranial index is ratio of the maximum breadth of the bare skull to its maximum length multiplied by hundred.[6] It is classified in to four main types namely dolichocephalic which is less than 74.9, mesocephalic with cranial index between 75 to 79.9, brachycephalic with cranial index between 80 to 84.9andhyperbrachycephalic with cranial index from 85 to 89.9.[6] Maximum head length measures straight distance between glabella and opisthocranion while maximum head breadth measures maximum biparietal diameter and is the distance between the most lateral points on the parietal bones.[6]

In a bid to understand racial differences and sexual dimorphism among various populations metrical studies (cephalic index and cephalic dimensions) have long been studied by several researches in different populations namely Caucasians, Indians, Turkman and native Fars groups, Kosov and Albanians, Iranians Japanese, Serbs, Greek, Bulgarians, Mapuche individuals in Chile, Nigerians[7,8] and all have shown clear differences in cephalic index and cephalic dimensions. This mini review is an update aimed at understanding sexual dimorphism and racial diversity employing cephalic index as a tool.

Table 1 shows different values of cephalic index in various countries and tribes. The variations or differences can be attributed to a complex interaction between genetics and environmental factors.[9] Reports by several workers from different parts of the world, indicate that cephalic index of females was higher than that of males[4,10–17] though the work of[18,19] reported higher cephalic index in males. Majority of head shape was observed to be Mesocephalic. Indifferent studies based in Nigerian population by Orish CN,[4] Odokuma EI et al.,[10] Oladipo GS[18] (Nigerian Igbo) head shape of both sexes was mesocephalic which is in line with studies done in Indian population by Gujaria DIJ,[14] Patro S,[17] Oladipo GS,[19] Bhargava I[20,21] who also reported the head shape to be mesocephalic in both sexes.

Study in Indian population by Kumar M,[13] had head shape as dolichocephalic in both sexes. Similarly[16,22] working in Nigerian population reported head shape as dolichocephalic. Brachycephalic head shape was reported in Gujarat population,[23] Chile population,[24] and Iran population[3] with respect to mean cephalic index of both sexes. Brachycephalic head shape was reported in male while mesocephalic in female by Oladipo GS[19] among Ijaws of Nigeria. Similarly[12,15] documented mesocephalic head shape in males and brachycephalic in females among Indians.

Head shape in Punjab is hyper brachycephalic according to Mahajan A[25] with respect to mean cephalic index while in Nigeria (Ogoni)[18] reported that males have hyper brachycephalic while females have mesocephalic head shapes.

The cephalic length and breadth of different populations is shown in Table 2. In all, male parameters were higher than female parameters but with varying ranges of dimensions. The cephalic length and breadth of Indian population reported by various workers[11,15,17,25] showed higher value than that of Nigerian study by Orish CN[4] However, Nigeria cephalic dimensions do not differ much from the Southern Indian data according to the work of.[13]

Taken together cephalic index and dimensions tend to show sexual dimorphism and can be employed as veritable anthropometric tools in classification of races.

Table 1 Cephalic index/head shapes in different populations

Author	Year of study	Country/people	Cephalic index(M)	Cephalic index(F)	Mean cephalic index	Head shape
Bhargava & Kher[21]	1960	Bhils of Central India			76.98	Mesocephalic
Bhargava & Kher[22]	1961	Berelas of Central India			79.8	Mesocephalic
Shah & Jadhav[24]	2004	Gujarat population			80.81	Brachycephalic
Del Sol[25]	2005	9th Region of Chile			80.42	Brachycephalic
Oladipo & Olotu[19]	2006	Nigeria/Ijaw	80.98	78.24		M: Brachycephalic F: Mesocephalic
Oladipo & Olotu[19]	2006	Nigeria/Igbo	79.04	76.83		Both: Mesocephalic
Golalipour et al.[3]	2006	Gorgan-North of Iran			84	Brachycephalic
Oladipo & Olotu[20]	2009	Nigeria/Ogoni	111.18	75.09		M: Hyper brachycephalic F: Mesocephalic
Mahajan et al.[26]	2009	Medical students of Punjab			85.53	Hyper brachycephalic
Eroje et al.[23]	2010	Nigeria/ Ogbaia			72.96	Dolichocephalic
Odokuma[11]	2010	Nigeria	77.67	78.14		Both Mesocephalic
Ilayperuma[12]	2011	Srilankan	78.04	79.32		Both Mesocephalic
Anitha et al.[13]	2011	Northern India	79.14	80.74		M: Mesocephalic F: Brachycephalic
Gujaria & Salvia[15]	2012	India/Maranthi	77.08	79.02		Both: Mesocephalic
Gujaria & Salvia[15]	2012	India/Andhra	76.28	78.16		Both: Mesocephalic
Gujaria & Salvia[15]	2012	India/Gujarati	80.42	81.2		Both: Brachycephalic
Yagain et al.[16]	2012	India	77.92	80.85		M: Mesocephalic F: Brachycephalic
Kumar & Gopichand[14]	2013	India/Haryanvi	66.67	72.25		Both: Dolichocephalic
Patro et al.[18]	2014	India/Southern Odishia	77.28	78.38		Both: Mesocephalic
Orish & Ibeachu[4]	2016	Nigeria	76.03	76.12		Both: Mesocephalic
Jervas et al.[17]	2016	Nigeria/ Igbo)	68.8	73.6		Both: Dolichocephalic

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Table 2 Cephalic dimensions in different populations

Authors	Year of study	Country/People	Cephalic length		Cephalic breadth	
			Male	Female	Male	Female
Mahajan et al.[25]	2009	Medical students of Punjab(India)	18.58cm	17.92cm	15.68cm	14.72cm
Ilayperuma[12]	2011	Srilanka	180.5±13.22*	175±6.61	147.80±5.53*	141.11±7.41mm
Yagain et al.[16]	2012	India	18.76cm	17.67cm	14.59cm	14.17cm
Kumar & Gopichand[14]	2013	Haryan (Northern India)	18.80±1.06	17.85±0.78	12.96±1.10	12.89±0.82cm
Patro et al.[18]	2014	India/ Southern Odishia	19.5±1.14	19.16±1.53	15.09±0.94	15±1.28cm
Orish & Ibeachu[4]	2016	Nigeria (Skulls)	180.4±8.12*	167.5±7.88	137.2±7.95*	127.5±3.35mm

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Conflict of interest

Author declares that there is no conflict of interest.

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