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Morphometric Analysis of Adult Dry Human Scapulae

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Abstract
Objective: The aim of this study was to record the morphometric values of scapula and determine the scapular index and infraspinous index in a North-Indian population sample.
Materials & Method: The present study was carried out in the Dept of Anatomy, Army College of Medical Sciences, Delhi Cantt. 126 scapulae belonging to North Indian region were taken for the study. Length, breadth and infraspinous length of scapula was measured with the help of vernier calipers and scapular index and infraspinous index was calculated.
Result: Mean scapular breadth was 103.6 ±6.82mm. The breadth range of 98 mm to 104 mm had the maximum number of scapulae (29%) while the minimum numbers (4%) were noted in the 116 to 122 mm range.Mean length of scapula was 141.94 ±12.7mm.Maximum number (29 %) scapulae was in the range of 135mm to 145mm while least number (3%) was in the >165mm group. The correlation between breadth and length of scapula is expressed as scapular index and between breadth and infraspinous length as infraspinous index. The mean scapular index and infraspinous index found in the study were 73.32±4.80 and 99.60±7.26 respectively.
Conclusion: Measurements like scapular length, breadth and infraspinous length and indices like scapular index and infraspinous index can be used in comparative anatomy and also to find out the characteristics of race, sex and age in man.

Keywords: Scapula, Scapular breadth, Scapular length, Scapular index, Infraspinous index

1. Introduction
The scapula (shoulder blade) is a triangular flat bone that lies on the posterolateral aspect of the thorax, overlying the 2nd to 7th ribs. The convex posterior surface of the scapula is unevenly divided by the spine of the scapula into a small supraspinous fossa and a much larger infraspinous fossa. The concave costal surface of the scapula has a large subscapular fossa [1]. In terms of comparative anatomy, the human scapula represents two bones that have become fused together: the (dorsal) scapula proper and the (ventral) coracoid [2]. Although, the scapula has attachment of as many as 15 muscles, the shape of the scapula is not due to the forces applied during the development but is a mammalian character. Scapula plays an important role in the movement of shoulder girdle. Its peculiar shape has always been a point of attraction to many Anatomists [3]. From the evolutionary point of view scapula has undergone modifications especially in its shape. Scapular index which indicates the relationship of breadth to the length of the bone has been used to note of such modifications. The changes in the scapular shape are more in the infraspinous region than the supraspinous region. Hence infraspinous index relating the breadth of scapula to infraspinous length has also been taken into account [4]. This study was carried out with the aim of determining important measurements of scapula like breadth, length and infraspinous length and finding out indices like scapular index and infraspinous index which may be used in comparative anatomy and also to find out the characteristics of race, sex and age in man.

Material and Methods
The present study was carried out in the Dept. of Anatomy, Army College of Medical Sciences, Delhi Cantt. A total of 126 scapulae of unknown age and sex were used for the study. Out of this 71 were of left side and 55 of right side. All the bones were free from any physical deformity and abrasions and were complete in all respects.

Instruments used: Otseometric board, Digital sliding calipers, white paper, lead pencil

Method: A white sheet of paper was pasted on the otseometric board. The scapula was fixed so that points can be marked over it and errors in the measurement were minimised.
Following points were marked on the white sheet as shown in fig 1. [3]
A: Point of intersection of spine of scapula on the medial border
B: Middle of the outer border of the Glenoid cavity
C: Summit of the superior angle
D: Summit of the inferior angle

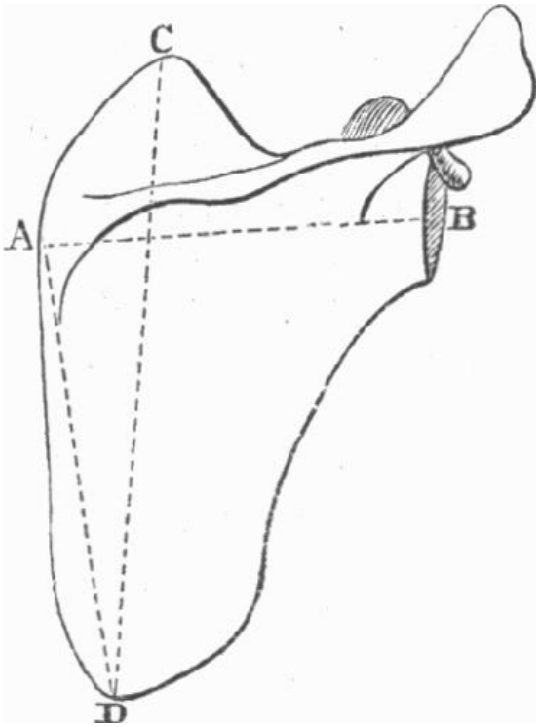

Fig 1: Showing the points on scapula taken for measurements

From the points marked the following measurements were taken:

Scapular breadth: It was taken from point (A) i.e. where the spine intersects the vertebral border to the point (B) middle of the outer border of glenoid cavity

Scapular length: It was taken from point (C) at summit of superior angle to point (D) at summit of inferior angle.

Infraspinous length: It was measured as the distance between point A& D.
From the above measurements the following indices were calculated:-

$$\text{Scapular Index} = \frac{\text{Breadth}}{\text{Length}} \times 100$$

$$\text{Infraspinous Index} = \frac{\text{Breadth}}{\text{Infraspinous length}} \times 100$$

All the measurements were taken with the help of vernier calipers and recorded in millimeters. Data obtained from the study was analyzed with SPSS 15 software.

Results
A total of 126 scapulae were studied. Results of the study are depicted in the following tables:-

Table 1: Shows the range, mean and standard deviation values of various parameters and indices of scapula

Sr No.	Parameters	Range(mm)	Mean(mm)	SD(mm)
1.	Length of scapula	118-176	141.94	12.76
2.	Breadth of scapula	86.5-121	103.65	6.82
3.	Infraspinous length	82-132	104.58	9.97
4.	Scapular index	62.5-89.6	73.32	4.80
5.	Infraspinous Index	82.03-121.74	99.60	7.26

Table 2: Shows the distribution of scapula as per its length (N= 126)

Sr No.	Length in mm	No of Scapulae	Percentage (%)
1.	115-125	16	12.7
2.	125-135	25	19.8
3.	135-145	37	29.4
4.	145-155	29	23.0
5.	155-165	15	11.9
6.	>165	4	3.2

The length of scapula was ranging from118mm to 176 mm.The mean length of scapula and SD observed were 141.94mm and 12.7mm respectively. Maximum number of scapulae (29.4%) were in the range of 135mm to 145mm while least number (3.2%) were in the >165mm group.

Table 3: Shows the distribution of scapula as per its breadth (N= 126)

Sr No.	Breadth in mm	No of Scapulae	Percentage (%)
1.	86-92	7	5.5
2.	92-98	21	16.7
3.	98-104	37	29.4
4.	104-110	36	28.6
5.	110-116	20	15.9
6.	>116	5	3.9

In the present study, the breadth of scapula was ranging from 86.5mm to 121mm. The mean and SD were 103.6 mm and 6.82 mm respectively. The breadth range of 98 mm to 104 mm had the maximum number of scapulae (29.4%) closely followed by 104-110mm range(28.6%) while the minimum numbers (3.9%) were noted in the 116 to 122 mm range.

Table 4: Shows distribution of scapula as per Scapular index (N= 126)

Sr No.	Scapular index	No of Scapulae	Percentage (%)
1.	62-66	4	3.2
2.	66-70	32	25.4
3.	70-74	41	32.5
4.	74-78	29	23.0
5.	78-82	16	12.7
6.	82-86	2	1.6
7.	>86	2	1.6

The correlation between breadth and length of scapula is expressed as scapular index which was in the range of 62.5 to 89.6. Mean and standard deviation were 73.32 and 4.80 respectively. Maximum number of scapulae were found in the scapular index range of 70 to 74 (32.5%) followed by 66 to 70 group (25.4%) The least number i.e. only 2(1.6%) each were found in 82 to 86 and >86 scapular index group.

Table 5: Shows the distribution of scapula as per Infraspinous length (N=126)

Sr No.	Infraspinous Length(mm)	No of Scapulae	Percentage (%)
1.	82-91	9	7.2
2.	91-100	40	31.7
3.	100-109	40	31.7
4.	109-118	27	21.4
5.	118-127	6	4.8
6.	>127	4	3.2

In the present study, the infraspinous length of scapula was ranging from 82mm to 132mm. The mean and SD were 104.58mm and 9.97mm respectively. Maximum number of scapulae, 40each (31.7%) were found in the range of 91 to 100 mm and 100 to 109 mm, while the minimum number 4(3.2%) were noted in the >127mm range.

Table 6: Shows the distribution of scapula as per Infraspinous Index (N=126)

Sr No.	Infraspinous index	No of Scapulae	Percentage (%)
1.	82-89	7	5.6
2.	89-96	31	24.6
3.	96-103	55	43.6
4.	103-110	23	18.2
5.	110-117	7	5.6
6.	>117	3	2.4

Infraspinous index - The correlation between breadth and infraspinous length of scapula is expressed as Infraspinous index which was in the range of 82.03 -121.74 mm. Mean and standard deviation were 99.60 and 7.26 respectively. Maximum number of scapulae (43.6%) were found in the range of 96 to 103mm followed by (24.6%) in the 89 to 96 range. There were only 3 (2.4%) of scapula in >117 infraspinous index range.

Discussion

The breadth, length and, infraspinous length of scapulae of North Indian region was measured. From the measurements obtained scapular index and infraspinous index were calculated. The findings of the present study were compared with various studies carried out on other races and also on Indian population in other geographic areas.

Scapular Length: Mean Scapular length observed in present study was 141.94mm with standard deviation of 12.7mm, while Flower WH's [6] study done on European race showed mean scapular length of 155.44mm. Thus the scapular length of European region is higher than that of our study. The findings of the present study are similar to the studies done by Singhal *et al.* [8] & Krishnaiah *et al.* [9] where they found a mean length and SD of 141.7±8.9 mm and 143.27±11.44mm in Gujarat & Nalgonda region respectively.

Scapular Breadth: Mean Scapular breadth in the present study was 103.65mm with standard deviation of 6.82, while Flower WH's [6] study done on European race showed mean breadth of 101.42mm which is almost correlating with our study. It is also similar to the findings obtained by Krishnaiah *et al.* [9] on Nalgonda region where they found a mean breadth of 105.6±5.08. The findings of the present study are quite different when compared with Singhal *et al.* [8] findings of mean breadth and SD of 96.4 mm and 7mm respectively on Gujarati population.

Infraspinous length: Mean Infraspinous length observed in the present study was 104.58mm with SD of 9.97mm, while Flower W H's [6] study of European race showed mean infraspinous length to be 113.46mm which is more than the present study. The findings of present study coincide with those of Krishnaiah *et al.* [9] findings of infraspinous length of 107.71±7.6mm in people of Nalgonda region.

Scapular index: Mean scapular index observed in present study was 73.32 with standard deviation of 4.80. In other studies, the mean scapular index ranged from a minimum of 57.3 in Peruvian population [6] to a maximum of 73.99 in Nalgonda region [9]. Thus scapular index value found in the present study is similar to the findings of scapular index of 73.99±4.6 as observed by Krishnaiah *et al.* [9] in Nalgonda region. It is also nearer to the scapular index values of Negroes [6]. However the values obtained are slightly higher when compared to that of Gujarat region scapular index of 68.5±4 [8].

Table 7: Comparison of scapular index of present study with other studies

Sr No.	Authors	Scapula observed	Race/Region	Mean scapular index
1.	Broca M 1878[5]	46	European	65.91
2.	Broca M 1878[5]	2	Peruvian	68.02
3.	Broca M 1878[5]	50	Negro	68.16
4.	Flower WH 1879[6]	200	European	65.2
5.	Flower WH 1879[6]	2	Peruvian	57.3
6.	Flower WH 1879[6]	6	Negro	71.7
7.	Flower WH 1879[6]	12	Australian	68.9
8.	Flower WH 1879[6]	21	Andaman	69.8
9.	Turner 1893[7]	25	European	64.9
10.	Singhal 2013[8]	162	Gujarat	68.5
11.	Krishnaiah 2014[9]	50	Nalagonda	73.99
12	Present study 2015	126	North Indians	73.32

Infraspinous index: Mean infraspinous index observed in the present study was 99.60 with SD of 7.26, while this index varies from 75.1 in Peruvian race [5] to 100.9 in Negroes [6]. Present study infraspinous index of 99.60 ±7.26 was more or less corresponding to that of Negroes infraspinous index of 100.9 [6]. It was also similar to Krishnaiah *et al.* infraspinous index of 98.33±5.86 in Andhra Pradesh [9]. However the findings of the present study were quite higher when compared to Singhal *et al.* findings of infraspinous index of 94.6±7.6 on Gujarat region [8].

Table 8: Comparison of infraspinous index of present study with other studies;

Sr No.	Authors	No of Scapula observed	Race/Region	Mean infraspinous index
1.	Broca M 1878[5]	46	European	87.79
2.	Broca M 1878[5]	2	Peruvian	91.74
3.	Broca M 1878[5]	50	Negro	93.88
4.	Flower WH 1879[6]	200	European	89.4
5.	Flower WH 1879[6]	2	Peruvian	75.1
6.	Flower WH 1879[6]	6	Negro	100.9
7.	Flower WH 1879[6]	12	Australian	92.5
8.	Flower WH 1879[6]	21	Andaman	92.7
9.	Turner 1893[7]	25	European	89.4
10.	Singhal 2013[8]	162	Gujarat	94.6
11.	Krishnaiah 2014[9]	50	Nalagonda	98.33
12.	Present study	126	North Indian	99.60

Conclusion

Knowledge of the measurements and indices of scapula such as scapular length, breadth, infraspinous length and scapular index and infraspinous index can be used for comparative anatomy and also for defining the race. These findings will also be useful during surgical procedures such as prosthetic positioning and also for manufacturing of prosthetic products.

References

1. Moore KL, Dalley AF. Clinically oriented anatomy. 4th ed. Philadelphia, USA: Lippincot Williams and Wilkins, 1999, 668-9.
2. McMinn RMH. Last's Anatomy.9th ed. UK edition: Churchill Livingstone, 2009, 53.
3. Barden CR. Skeleton. American Journal of Anatomy. 1905; 4:265-73.
4. Inman, Saunders JB, Abbot. Observation on the junction of the shoulder joint. Journal of bone & joint surgery. 1944; 1:30.
5. The scapular index as a race character in man. Availablefrom:http://19thcenturyscience.org/HMSC/HMSC-Reports/Zool 47/PDFpages/0082.pdf.Accessed May, 25th, 2015.
6. Flower WH, Garson JG. The scapular index as a race character in man. Journal of anatphysiol 1879; 14(1):13-17.
7. Transactions and proceedings of the Royal society of New Zealand, 1868-1961. Available from http://rsnz.natlib.govt.nz/volume/rsnz_26/rsnz_26_00_000470.html Accessed May 25th, 2015
8. Singhal. A study of measurements and indices of human scapula at Jamnagar Medical College. Int J Res Med. 2013; 2(1):65-8.
9. Krishnaiah M, Nagaraj S, Kumar P, Sherke AR. Study of scapular measurements and scapular indices of Andhra Pradesh region. IOSR-JDMS. 2014; 13(6):117-120.