A comparative Study of Anthropometric Variables among Egyptian and Saudi Arabia People

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Submission date: 21-06-2019 Admission date: 07-01-2020 Publication date: 31-03-2020

Abstract

This study presents comparisons of national difference in anthropometric characteristics among Egyptian and Saudi Arabia People. Anthropometric data from the two studied groups (145 subjects in each group) were compared. The means of the total body length, upper limb length, lower limb length, median chest depth and the chest circumference were presented. Also, the correlations between the different measured items were calculated. The results of statistical analyses showed that there is a significant morphological difference among the studied groups. The Egyptian body shape has longer limbs with relative short torso and rounded chest contour. The Saudi Arabia body shape has shorter limbs with relative longer torso and flattened chest contour. The economic development, social environment and type of work all affect the ethnic differences in the body shape and body contour.
Keywords: Anthropometric Variables, Egyptian people, Saudi Arabia People

الملخص:

تقدم هذه الدراسة مقارنات بين الاختلافات الوطنية في الخصائص البشرية بين المصريين والمملكة العربية السعودية. تمت مقارنة البيانات الأنثروبومترية من المجموعتين المدرستين (145 موضوعا في كل مجموعة). تم تقديم وسائل طول الجسم الكلي وطول الطرف العلوي وطول الطرف السفلي وعمق الصدر الوسطي ومحيط الصدر. كما تم حساب الارتباطات بين العناصر المختلفة المقاسة. أوضحت نتائج التحليلات الإحصائية وجود فروق شكلية كبيرة بين المجموعات المدروسة. يحتوي شكل الجسم المصري على أطراف أطول مع الجذع القصير النسبي وكفاف الصدر المستدير. يحتوي شكل المملكة العربية السعودية على أطراف أقصر مع الجذع الأطول النسبي ومحيط الصدر المسطح. تؤثر التنمية الاقتصادية والبيئة الاجتماعية ونوع العمل جميعها على الاختلافات العرقية في شكل الجسم وكفاف الجسم.
الكلمات المفتاحية: المتغيرات الأنثروبومترية ، الشعب المصري ، الشعب السعودي

Introduction

Anthropometry is considered the very ergonomic core of any attempt to resolve the dilemma of 'fitting the tasks to the human' (Sanders and McCormick, 1993). One main concern is that equipment should be designed according to principles of anthropometry, biomechanics and hygiene (Grieco, 1986) and should help to reduce accidents and overuse syndromes in order to promote productivity (Gouvali M.K. et al; 2006). As products are designed for specific types of consumers, an important design requirement is selection and efficient utilization of the most appropriate anthropometric database (Wickens et al., 2004).

It is clear that the anthropometric data are very important for product design and other applications. Great effort has been expended conducting numerous surveys to establish anthropometric databases for different population groups such as the armed forces, students, civilians, and farm workers (Ho and Shuan, 1987; Mououdi, 1997; Bolstad et al., 2001 ; Victor et al., 2002; Wang et al., 2001). These anthropometric data sets provide critical design information for an enormous range of ergonomics-based tasks such as workplace design (Botha and Bridger, 1998; Wang et al., 1999), and sizing for clothes (Meunier and Yin, 2000) and protective wear for motorcycle riders (Robertson and Minter, 1996). Effective utilization of this data, however, requires a thorough analysis of the inherent design problems on the designers' part. Wickens et al. (2004) adopted a systematic approach to utilization of anthropometric data in design. Thus, key issues for design include identification of the target user groups and identification of the most important bodily dimensions (B. - S. Liu, 2008). Pheasant (1996) suggested that

the variations of the body dimensions of the different groups can be observed in terms of overall body size and bodily proportions. The mean anthropometric dimension as standing height is among the most typical distinction between ethnic groups. Another significant ethnic difference lies in the ratios between the body dimensions (bodily proportions). Y. –C. Lin et al., 2004, said that ethnic diversity is always a significant factor that may affect the anthropometric data and the scope of its applications and added that the anthropometric differences between races are greater than among nations. Different nations of the same race may have varied body sizes and bodily proportions due to variations in social and economic environment. Therefore, the aim of the present study was to detect and compare the differences in some anthropometric dimensions and bodily proportions among the North African people (represented by the Egyptians) and West Asian people (represented by Saudi Arabia people).

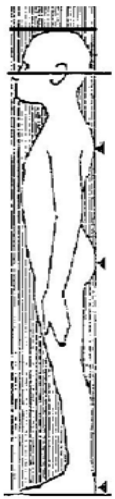
Subjects and Methods

Two samples of 145 subjects aged between 18- 20 years, were randomly chosen from the students of the 2nd year in the faculty of Physical Education – Assiut university – Egypt (the 1st sample) while the 2nd sample was taken from the students of the 1st and 2nd years in the faculty of Physical Education, College of Al-Qunfudhah University College, Umm Al Qura University, Makkah Al Mukarramah, Kingdom of Saudi Arabia. The participant students were healthy volunteers. Each participant was provided with information about the purpose of the study. The confidentiality of the results was guaranteed.

Anthropometric measurements include total body length, length of the upper limb, length of the lower limb, chest depth and chest

circumference. To achieve a greater specific uniformity, measurements were always carried out n the right side of the subject. The measurements were taken to the nearest millimeter. In addition, all the measurements were recorded gust once in the morning between 8 and 12 am. The whole survey was completed in about two months.

Procedures and equipments



Frankfort plane

Shoulder blades,

buttocks and heels touching measurement surface

Fig. (a)

The total body height was measured by a stadiometer according to Frisancho (1993) and Pheasant (1997) as seen in fig. (a):

Fig. (a)

The subject was asked to stand erect on the floor board of the stadiometer with his back to the vertical backboard of the stadiometer. The weight of the participant was evenly distributed on both feet. The heels of the feet were placed together with both heels touching the base of the vertical board. The buttocks, scapulae, and head were positioned in contact with the vertical backboard. The subject ed to inhale deeply and d fully erect without the position of the The head was ied in the Frankfort tal Plane position owering the horizontal he crown of the head ufficient pressure to compress the hair.

The length of the upper limb was measured by a flexible tape according to Singh et al., 1999, from the acromial angle to the tip of the

middle finger of the fully extended limb. Fig. (b)

The length of the lower limb was measured by a flexible tape from the anterior superior iliac spine to the lowest point at the tip of the medial maleolus (V. K. Pillay, 1971). Fig. (c)

The chest circumference was measured at the level of the nipples by a flexible tape while the median chest depth was measured by a pelvimeter also at the level of the nipples according to the manual of measurements edited by National Institute of Bioscience and Human – Technology. Fig. (d)

Statistical analysis

The collected data was analyzed by using spss ver. 18.00 statistical package. The correlations between different anthropometric measurements were calculated. Some bodily proportion indices were performed as upper limb length/total body length, lower limb length/total body length and the median chest depth/chest circumference. T test was applied to compare anthropometric characteristics and bodily proportions by controlling body size differences between the study groups. Statistically significant value was set at the $p < 0.05$.

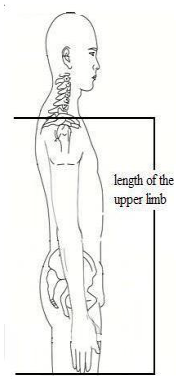


Fig. (b)

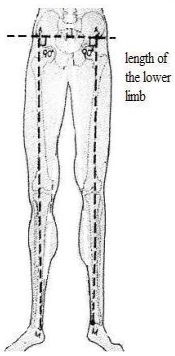


Fig. (c)

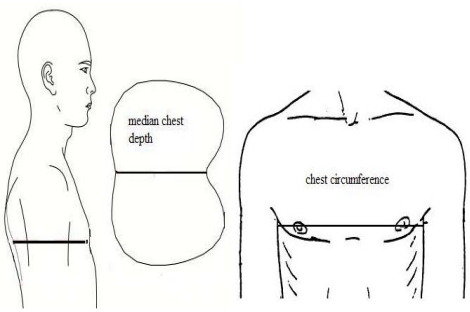


Fig. (d)

Results

- The Body Measurements (tab. 1, chart 1):-

The mean body height of the Egyptian study group was 174.35 cm ±5.24 and that of the Saudi Arabia study group was 173.15 cm ± 6.83. The

change in the mean body height among the studied groups was non significant (P = 0.113).

The mean length of the upper limb was 84.96 cm ± 3.82 in the Egyptian group and was 76.92 cm ± 3.99 in the Saudi Arabia group. This change was highly significant ($p < 0.001$).

In relation to the mean length of the lower limb, there was a highly significant change ($p < 0.001$) between Egyptian group (102.04 cm ± 3.6) and Saudi Arabia group (93.96 cm ± 4.47).

The mean of the median chest depth in Egyptian group was 24.46 cm ± 0.85 and that of the Saudi Arabia group was 19.47 cm ± 2.45. This change in the median chest depth was highly significant ($p < 0.001$).

The change in the mean chest circumference among Egyptian group (98.61 cm ± 2.57) and Saudi Arabia group (89.51 cm ± 7.93) was highly significant change ($p < 0.001$)

Table (1):- The mean ±SD value of the total body length, upper limb length, lower limb length, median chest length and chest circumference of the Egyptian and Saudi Arabia people.

Parameter	Egyptian group		Saudi Arabia group		T-Test	P
	Mean	± SD	Mean	± SD		
Total body length	174.35	5.24	173.15	6.83	1.59	0.113
Upper limb length	84.96	3.82	76.92	3.99	17.21	< 0.001**
Lower limb length	102.04	3.6	93.96	4.47	16.82	< 0.001**
Median chest depth	24.46	0.85	19.47	2.45	21.54	< 0.001**
Chest circumference	98.61	2.57	89.51	7.93	12.43	< 0.001**

Where:-

(**) high significance

Chart (1):- The mean ±SD value of the total body length, upper limb length, lower limb length, median chest length and chest circumference of the Egyptian people compared to Saudi Arabia people.

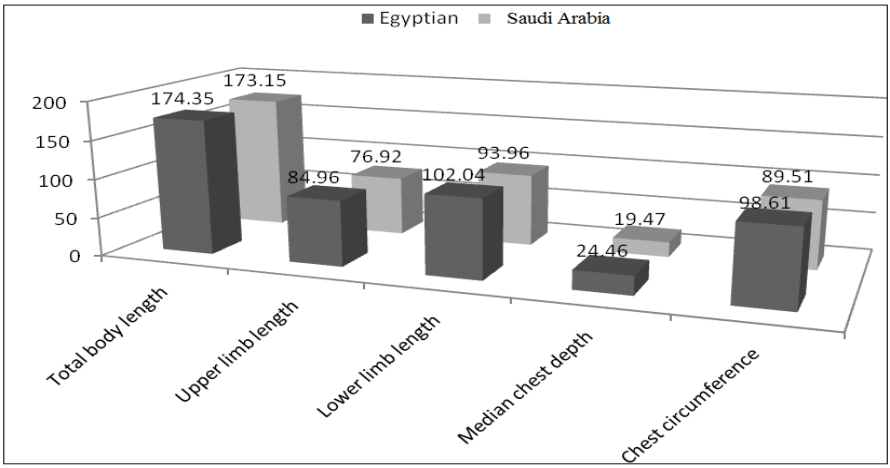


Table (2) shows highly significant correlations between all measured parameters in the Egyptian group. In relation to Saudi Arabia group, there were highly significant correlations between the lengths of the body, upper limb and lower limb in one side and between the chest depth and chest circumference in the other side (table 3)

Table (2):- The correlation between the different measured parameters in Egyptian group

Parameter	Total body length	Upper limb length	Lower limb length	Chest depth	Chest circumference
Total body length					
Upper limb length	.86**				
Lower limb length	.91**	.82**			
Chest depth	.58**	.49**	.53**		
Chest circumference	.40**	.46**	.36**	.71**	

Table (3):- The correlation between the different measured parameters in Saudi Arabia group

Parameter	Total body length	Upper limb length	Lower limb length	Chest depth	Chest circumference
Total body length					
Upper limb length	.69**				
Lower limb length	.75**	.61**			
Chest depth	.14	-.01	.07		
Chest circumference	.16	.17*	.04	.67**	

- The bodily indexes (tab.4, chart 2):-

The change in the LL/TL index between Egyptian group (0.585 ± 0.009) and the Saudi Arabia group (o.543 ± 0.017) was highly significant change (P < 0.001).

The Egyptian UL/TL index was 0.487 ± 0.012 and that of the Saudi Arabia UL/TL index was 0.444 ± 0.016. The change between the indexes was highly significant change (P < 0.001).

The difference between Egyptian Ch. D. / Ch. Cir. index (0.248 ± 0.006) and that of Saudi Arabia index (0.218 ± 0.021) was highly significant (P < 0.001).

Table (4):- The mean ±SD value of LL/TL index, UL/TL index and Ch. D. / Ch. Cir. Index of Egyptian and Saudi Arabia groups.

Where:

LL/TL index = Lower limb length/ Total body length.

UL/TL index = Upper limb length/ Total body length.

Ch. D. /Ch. Cir. Index = Chest depth/ Chest circumference.

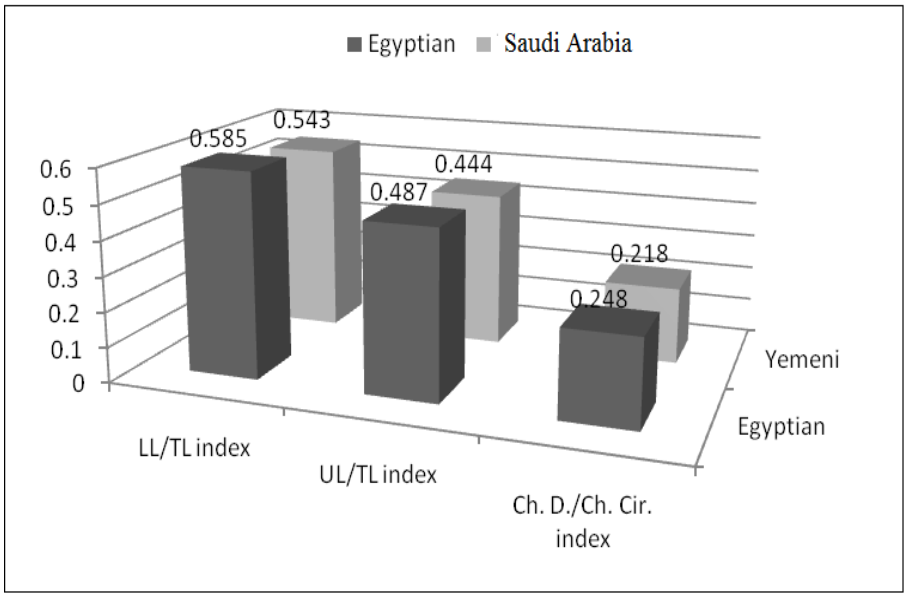
(**) high significance

Discussion

The comparison of the results of the body dimensions showed that the Egyptian people have a longer lower limb length in relation to that of the Saudi Arabia people. Also, the length of the upper limb length is larger in the Egyptian group than that of the Saudi Arabia group. However, there were no significant changes between the two studied groups. On the background of the results, the Saudi Arabia people have a relative longer **torso** (the length of the trunk without head & neck, upper limbs and lower limbs) when compared to the Egyptian people.

Chart (2):- Table (4):- The mean ±SD value of LL/TL index, UL/TL index and Ch. D. / Ch. Cir. Index of Egyptian and Saudi Arabia groups.

Parameter	Egyptian group		Saudi Arabia group		T-Test	P
	Mean	± SD	Mean	± SD		
LL/TL index	0.585	0.009	0.543	0.017	25.78	< 0.001**
UL/TL index	0.487	0.012	0.444	0.016	24.39	< 0.001**
Ch. D./Ch. Cir. index	0.248	0.006	0.218	0.021	.1639	< 0.001**



The Egyptian body showed a significant strong directly proportional relation as regarding the lengths of the upper and lower limbs in comparison to the total body length. As the total body length increases, the lengths of the upper limb and the length of the lower limb increase. Also, there was mild but significant direct proportion between the lengths of the upper limbs and that of the lower limbs. On the other hand, Saudi Arabia body showed the same but less correlation values than that of the Egyptian values. The Egyptian UL/TL index is higher than that of the Saudi Arabia index.

A positive strong significant correlation was detected between the chest depth and circumference in both groups but the correlation was higher n the Egyptian group than that of the Saudi Arabia group. The shape of the chest of Saudi Arabia people is more flattened with a transverse diameter is much longer than the median antero - posterior diameter. On the

other hand the Egyptian chest is more rounded.

However, there is no difference in the total body length in both groups; the Egyptian people have a shorter torso with a relatively rounded chest contour and a longer upper limbs and lower limbs. On the other hand, the Saudi Arabia people have longer torso with relatively flattened chest contour and shorter upper limbs and lower limbs.

At last, the economic development, social environment and type of work all affect the ethnic differences in the body shape and body contour.

References

A.R. Frisancho, *Anthropometric Standards for the Assessment of Growth and Nutritional Status*. The University of Michigan Press, Ann Arbor (1993).

B.-S. Liu, 2008, *Incorporating anthropometry into design of ear-related products*. Appl. Ergon. 39, 115–121.

Bolstad, G., Benum, B., Rokne, A., 2001. *Anthropometry of Norwegian light industry and office workers*. Appl. Ergon. 32 (3), 239–246.

Botha, W.E., Bridger, R.S., 1998. *Anthropometric variability, equipment usability and musculoskeletal pain in a group of nurses in the Western Cape.* Appl. Ergon. 29, 481–490.

Grieco, A., 1986. *Sitting posture: an old problem and a new one.* Ergonomics 29, 345–362.

Ho, B.L., Shuan, S.Y., 1987. *An anthropometry survey of the Chinese air force cadets.* J. Med. Sci. 7 (4), 209.

M.K. Gouvali_, K. Boudolos (2006) *Match between school furniture dimensions and children's anthropometry.* Appl. Ergon. 37, 765–773.

Meunier, P., Yin, S., 2000. *Performance of a 2D image-based anthropometric measurement and clothing sizing systems.* Appl. Ergon. 31, 445–451.

Mououdi, M.A., 1997. *Static anthropometric characteristics of Tehran university students age 20–30.* Appl. Ergon. 28, 149–150.

Pheasant S., 1996. *Body space: Anthropometry, Ergonomics and Design of Work.* Taylor & Francis, New York, pp. 15–45, 174–193.

Pheasant S., 1997. *Body Space: Anthropometry, Ergonomics and Design of work*. Taylor & Francis, London (1997).

Singh, M.; Lindburg, D. G.; Udhayan, A.; Anand Kumar, M.; Kumara, H. N., 1999. *Status survey of slender loris.* Loris tardigradus lydekkerianus in Dindigul, Tamil Nadu, India. Oryx 33 (1): 31-37.

V. K. Pillay, 1971. *Measurement of the length in the lower limb.* Singapore medical journal. 12(3), 144 – 146.

Victor, V.M., Nath, S., Verma, A., 2002. *Anthropometric survey of Indian farm workers to approach ergonomics in agricultural machinery design.* Appl. Ergon. 33 (6), 579–581.

Wang, M.J., Wang, E.M.Y., Lin, Y.C., 2001. *Anthropometric Data Book of the Chinese People in Taiwan.* Ergonomics Society of Taiwan, Taipei.

Wang, E.M.Y., Wang, M.J., Yeh, W.Y., Shih, Y.C., Lin, Y.C., 1999. *Development of anthropometric work environment for Taiwan workers.* Int. J. Ind. Ergon. 23, 3–8.

Yu-Cheng Lin, Mao-Jiun J. Wang, Eric M. Wang, 2004. *The comparisons of anthropometric characteristics among four peoples in East Asia.* Appl. Ergon. 35, 173–178.