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ESTIMATION OF BODY MASS INDEX ON THE BASIS OF SELECTED ANTHROPOMETRIC CHARACTERISTICS OF FEMALE BOXERS

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Abstract:

Purpose: -The first purpose of the study was to find out correlation between Independent Variables (Upper Arm Length, Upper Arm Circumference, Fore Arm Length, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference) and Dependent Variable (Body Mass Index). The second purpose of the research was to study the joint contribution of Independent Variables in estimating Dependent Variable and the third purpose was to establish regression equation for predicting Dependent Variable on the basis of Independent Variables. Selected Variables were Upper Arm Length, Upper Arm Circumference, Fore Arm Length, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference (Independent Variables).

Methodology: - The subjects for this study were selected from 12th Senior Women National Boxing Championship, 2011 at T.T. Nagar Stadium, Bhopal, Madhya Pradesh, India. A total of 78 female Boxers were selected. Age of the subjects was ranging between 16 to 28 years. Selected Variables were Upper Arm Length, Upper Arm Circumference, Fore Arm Length, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference (Independent Variables). Body Mass Index was considered as Dependent Variable. The selected anthropometric characteristics were measured by anthropometric kit. To find out correlation between Independent Variables (Upper Arm Length, Upper Arm Circumference, Fore Arm Length, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference) and Dependent Variable (Body Mass Index), Product Moment Method of correlation was used. To study the joint contribution of Independent Variables in estimating Dependent Variable, Multiple correlation method was used. Regression equation was established for predicting Dependent Variable on the basis of Independent Variables.

Findings: - There exists a significant relationship between Body Mass Index and; Upper Arm Circumference ($r = .765, p > .05$), Fore Arm Circumference ($r = .449, p > .05$), Waist Circumference ($r = .814, p > .05$), Hip Circumference ($r = .657, p > .05$), Thigh Circumference ($r = .787, p > .05$), Calf Circumference ($r = .809, p > .05$) and Ankle Circumference ($r = .547, p > .05$). There exists an insignificant relationship between Body Mass Index and; Upper Arm Length ($r = .155, p < .05$), and Fore Arm Length ($r = .157, p < .05$). Significant relationship was found between criterion variables (Body Mass Index) and Independent variables i.e. Upper Arm Circumference, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference ($r_{1.2345678} = .89, p > .05$). Regression equation ($BMI = - 18.6 + 0.291$ Upper Arm Circumference + 0.026 Fore Arm Circumference + 0.149 Waist Circumference + 0.0255 Hip Circumference + 0.199 Thigh Circumference + 0.257 Calf Circumference + 0.037 Ankle Circumference) was found fruitful in estimating Body Mass Index on the basis of selected Variables (Upper Arm Length, Upper Arm Circumference, Fore Arm Length, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference).

Research Limitations/Implications: - The study might add the new knowledge in the field of Boxing, can be also used for identifying the budding talents in boxing.

KEY WORDS:

Body Mass Index, Anthropometric Characteristics.

INTRODUCTION

Anthropometry refers to the measurement of the size and proportions of the human body and its different parts. It is the comparative study of the dimensions of the human. It involves making precise, highly standardized measurements so that size and shape can be described objectively. Basic anthropometric measurements include those for body mass (weight), stature (height) and skinfold thickness. The procedure for taking the measurements is very strict. Anthropometric techniques are used to measure the absolute and relative variability in size and shape of the human body(Kamlesh M.L.).

Body Mass Index (BMI) is another expression of height and weight to characterize body fat where $(BMI) = \text{weight (Kg.)} / \text{height squared (meters)}$. BMI is a quick and easy method for providing a general guide in determining if one's weight is appropriate for one's height. It has recently been used to quantify an individual's obesity level(Kamlesh M.L.).

Body Mass Index (BMI) is a weight-to-height ratio which is calculated by dividing the body weight in kilograms by the height in meters squared (kg/m^2). Recent attention on the BMI as a quick and easy guide to obesity classification has been growing(Whitley & Rolfes, 1999).

Body Mass Index (BMI) is an average based on population studies. Because it does not differentiate fat and non fat weight, it may overestimate body fat in athletes and others who have a muscular build. In the same way, it may underestimate body fat in older persons and others who have lost muscle mass(Kamlesh M.L.).

OBJECTIVES OF THE STUDY

- 1.To find out correlation between Independent Variables (Upper Arm Length, Upper Arm Circumference, Fore Arm Length, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference) and Dependent Variable (Body Mass Index).
- 2.To study the joint contribution of Independent Variables in estimating Dependent Variable.
- 3.To establish regression equation for predicting Dependent Variable on the basis of Independent Variables.

METHODOLOGY

Subjects:

A total of 78 female Boxers were selected from 12th Senior Women National Boxing Championship, 2011 at T.T. Nagar Stadium, Bhopal, Madhya Pradesh. Age of the subjects was ranging between 16 to 28 years.

Variables:

Following Independent and Dependent Variables were selected:

Independent Variables:

- 1.Upper Arm Length
- 2.Upper Arm Circumference
- 3.Fore Arm Length
- 4.Fore Arm Circumference
- 5.Waist Circumference
- 6.Hip Circumference
- 7.Thigh Circumference
- 8.Calf Circumference
- 9.Ankle Circumference

DEPENDENT VARIABLE:**1.Body Mass Index****Measures:**

Measurement of Height was recorded in centimeters; Weight of the body was measured by weighing machine and recorded in kilogram&Upper Arm Length, Upper Arm Circumference, Fore Arm Length, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference of the body were measured by measuring tape and recorded in centimeters.

Statistical Analysis

- 1.To find out correlation between Independent Variables (Upper Arm Length, Upper Arm Circumference, Fore Arm Length, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference) and Dependent Variable (Body Mass Index), Product Moment Method of correlation was used.
- 2.To study the joint contribution of Independent Variables in estimating Dependent Variable, Multiple correlation method was used.
- 3.Regression equation was established for predicting Dependent Variable on the basis of Independent Variables.

FINDINGS

Table- 1
Correlation between Dependent Variable (Body Mass Index) and Independent Variables (Upper Arm Length, Upper Arm Circumference, Fore Arm Length, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference)

Independent Variables	Correlation Coefficient
Upper Arm Length	.115
Upper Arm Circumference	.765*
Fore Arm Length	.157
Fore Arm Circumference	.449*
Waist Circumference	.814*
Hip Circumference	.657*
Thigh Circumference	.787*
Calf Circumference	.809*
Ankle Circumference	.547*

* Significant at .05 level
r.05 (76) = 0.444

Table - 1 clearly indicates that there exists a significant relationship between Body Mass Index and all selected Independent Variables i.e.Upper Arm Circumference, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference as the correlation coefficient values were found higher than the tabulated value at .05 level of significance. On the other hand there exists an insignificant relationship between Body Mass Index and all selected Independent Variables i.e.Upper Arm Length and Fore Arm Length as the correlation coefficient values were found lower than the tabulated value at .05 level of significance.

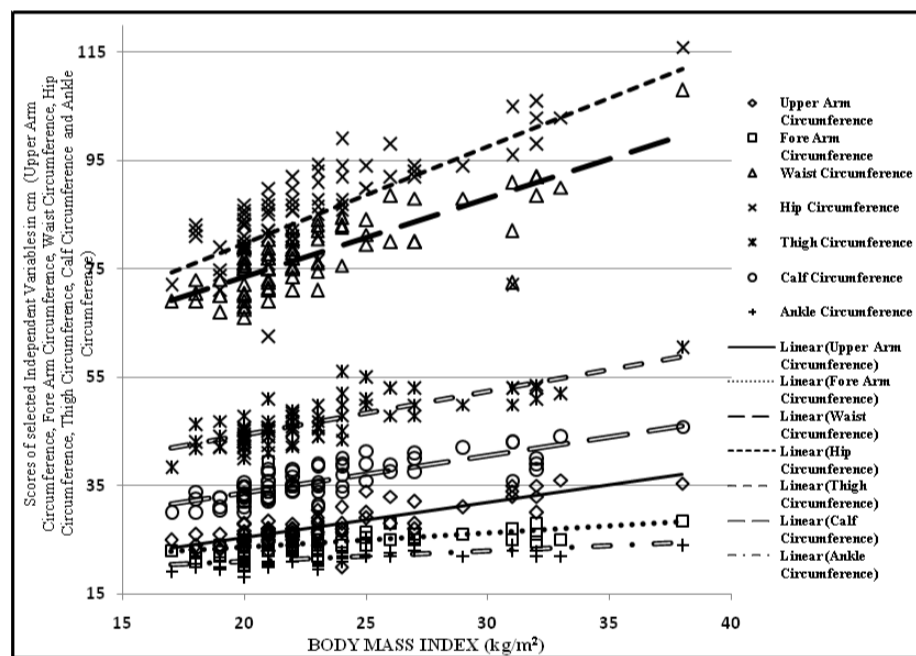
Table – 2
Joint contribution Independent Variables (Upper Arm Circumference, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference) in predicting Dependent Variable (Body Mass Index)

Criterion Variable	Independent Variables	Coefficient of Multiple Correlation
Body Mass Index	Upper Arm Circumference	0.893*
	Fore Arm Circumference	
	Waist Circumference	
	Hip Circumference	
	Thigh Circumference	
	Calf Circumference	
	Ankle Circumference	

* Significant at .05 level.
 $r_{.05(70)}=0.497$

Table- 2 indicates that significant relationship was found between criterion variable (Body Mass Index) and independent variables (Upper Arm Circumference, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference) as coefficient of multiple correlation was found significant which is higher than the tabulated value.

Figure: 1 -Correlation between Dependent Variable (Body Mass Index) and Independent Variables (Upper Arm Circumference, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference)



Multiple Regression Analysis

The regression equation is

$$\text{Body Mass Index} = - 18.6 + 0.291 \text{ Upper Arm Circumference} + 0.026 \text{ Fore Arm Circumference} + 0.149 \text{ Waist Circumference} + 0.0255 \text{ Hip Circumference} + 0.199 \text{ Thigh Circumference} + 0.257 \text{ Calf Circumference} + 0.037 \text{ Ankle Circumference}.$$

CONCLUSIONS

1. Significant relationship was found between Body Mass Index and Upper Arm Circumference ($r = .765, p > .05$).
2. Significant relationship was found between Body Mass Index and Fore Arm Circumference ($r = .449, p > .05$).
3. Significant relationship was found between Body Mass Index and Waist Circumference ($r = .814, p > .05$).
4. Significant relationship was found between Body Mass Index and Hip Circumference ($r = .657, p > .05$).
5. Significant relationship was found between Body Mass Index and Thigh Circumference ($r = .787, p > .05$).
6. Significant relationship was found between Body Mass Index and Calf Circumference ($r = .809, p > .05$).
7. Significant relationship was found between Body Mass Index and Ankle Circumference ($r = .547, p > .05$).
8. Insignificant relationship was found between Body Mass Index and Upper Arm Length ($r = .155, p < .05$).
9. Insignificant relationship was found between Body Mass Index and Fore Arm Length ($r = .157, p < .05$).
10. Significant relationship was found between criterion variables (Body Mass Index) and Independent variables i.e. Upper Arm Circumference, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference ($r = .2345678 = .89, p > .05$).
11. Regression equation ($BMI = -18.6 + 0.291 \text{ Upper Arm Circumference} + 0.026 \text{ Fore Arm Circumference} + 0.149 \text{ Waist Circumference} + 0.0255 \text{ Hip Circumference} + 0.199 \text{ Thigh Circumference} + 0.257 \text{ Calf Circumference} + 0.037 \text{ Ankle Circumference}$) was found fructiferous in estimating Body Mass Index on the basis of selected Variables (Upper Arm Length, Upper Arm Circumference, Fore Arm Length, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference).

DISCUSSIONS

Inese Pontaga & J nis Ž dens (2011) conducted a study on “Estimation of body mass index in team sports athletes” It was concluded that there exist a significant correlation is determined between the BMI and the lean body mass ($r = 0.36, p < 0.05$), as well as, between the BMI and the body fat content in % ($r = 0.54, p < 0.003$) in the football players. This proves that high BMI can be caused by growth of the body fat content and by skeletal muscles hypertrophy. The vertical jumps height is not possible to predict from the value of the BMI because the significant correlation between the BMI and the height of vertical jumps is not determined in team athletes ($p > 0.05$). Muhammad Ghias, Khadija Irfan Khawaja, Faisal Masud, Salman Atiq & Muhammad Khalid Pervaiz (2010) conducted a study on “A new approach for estimation of body mass index using waist and hip circumference in type 2 diabetes patients” It was concluded that there exist a significant linear relationship between BMI, waist and hip circumference in all categories [waist circumference ($r = 0.795, p = 0.000$), hip circumference ($r = 0.838, p = 0.000$)]. Estimated regression models for males and females were $BMI = -10.71 + 0.212(\text{hip circumference}) + 0.170(\text{waist circumference})$; and $BMI = -15.168 + 0.143(\text{hip circumference}) + 0.30(\text{waist circumference})$ respectively. Present study supports the study conducted by Muhammad Ghias, Khadija Irfan Khawaja, Faisal Masud, Salman Atiq & Muhammad Khalid Pervaiz (2010). In the present study significant correlation was found between Dependent variable (Body Mass Index) and independent variables (Upper Arm Circumference, Fore Arm Circumference, Waist Circumference, Hip Circumference, Thigh Circumference, Calf Circumference and Ankle Circumference). This might be due to by growth of the body fat content and by skeletal muscles hypertrophy as revealed by Inese Pontaga & J nis Ž dens (2011).

This study will be a new addition to the earlier developed regression equation models and will be fructiferous to estimate Body Mass Index.

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