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Estimation of total Body Water on the basis of Body Weight, Height and Age in University Players

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Abstract - The aim of the study to develop regression equation on basis of Body weight, Height and Age to predict the Total Body water. Further to find out correlation among selected Independent variables (Body Weight, Height and Age) with Dependent Variable (Total Body water),to study the joint contribution of Independent Variables in estimating Total Body water. Fifty male university players male from LN.I.P.E,N.E.R.C, Guwahati, Assam. The age ranged from 20 to 27 were selected for this study. To achieve the objective of present study, Pearson's Product Moment correlation and multiple correlations was used. Regression equation (Enter method) was established for predicting Dependent variable on the basis of Independent variables. There exists a significant relationship between Total Body water Body weight (.728**), Height (.429**), Age (-.382**).In regression mode , the value of R^2[0.606(Body weight, Height, Age)] developed for prediction of Total Body water. The resulting regression equation is:

Total Body water = 19.444 + 0.310 (Body weight) + 0.073 (Height) - 0.583 (Age)

Keyword - Total Body water, Body weight, Height and Age

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INTRODUCTION

Water is essential part of human body and in entire human body there is 55-75% presence of water, lean and muscular people contain more water in their bodies in comparison to obese peoples, because muscle holds more water than fat and due to which lean peoples are in need of constant water replenishment. If a player lose 2% of water during any physical activity it may negatively affect the player's performance cause tiredness and dull critical thinking abilities while if they lose 10% of their body weight they will be severally dehydrated. Adequate water consumption can help reduce the chance of kidney stones, keep joints lubricated, prevent and lessen the severity of Colds and Flu and help to prevent constipation. Water is necessary to our health. It consists of 60 percent of our body weight. Every system in our body depends upon water. Composition of body also plays an important role to an individual's level of physical fitness for performance, specifically in such sports that require a person to carry his/her body weight over a longer period of time over long distance, which is facilitated by a large proportion of muscle's active tissue in relation to a small proportion of fat tissue. Composition of body is concerned in part with the obesity of the person. Lack of water can results in dehydration, a condition that occurs when we do not have sufficient water in our body to perform normal functions. Even mild dehydration (1- 2 percent loss of your body weight) can sap our energy and make us tired and poses a health risk specific for the very young and old.

TBW can be predicted by several decade old method which was developed by Friis-Hansen derived equations in their study they used infants and children's aged from 1 to 13 years. In present scenario where nutritional pattern, life style and eco system has been drastically changed, equations derived in previous decades may not necessarily valid for contemporary infants and children. Literature suggest that children's are getting more obese due to intake of highly processed food and sedentary life style making condition more complicated, even fat distribution and accumulation is more concentrated in visceral region in such kind of situation anthropometry and TBW is predicted likewise to have changed. However, this issue has not gained attention. Knowledge of total body water (TBW) has implications for many areas of clinical

practice, such as parenteral fluid therapy, pharmacokinetic evaluations, and calculation of the delivered dose of dialysis. There are a number of methods used to determine TBW directly; these include the measurement of distribution of "heavy" water (either D2O or H20), bio impedance analysis (BIA), and estimates from anthropometrically determined fat mass. The accepted criterion standard measurement of TBW is the use of heavy water. Although not difficult to perform and free from radiation risk because the isotopes are stable, the latter studies are time-consuming and expensive. BIA has become an accepted method, but there are some important caveats to performing studies in this manner, and some significant variations in the results are inherent when compared with the heavy water.Knowledge of the total amount of water in the body (TBW) is basic to a full description of human body composition. If TBW values are available, estimates can be made of various body fractions including lean body mass (LBW), fat mass and total body solids. Most TBW prediction equation using anthropometric data as variables have been based on measurements from small samples and often limited to a restricted age group. It is generally accepted that these equations apply only to populations similar to those from which the basic information was obtained. Their general applicability cannot be assumed without an independent test on a different population sample. Due to higher metabolic rate infants and children's have much greater fluid turn over in comparison to adults. As immature kidneys are less able to conserve water than adult kidneys due to which infants lose more fluid through the kidneys.

Total body water can be used for the prediction of lean body mass or fat-free body weight. This Calculation is based on the assumption that fat is anhydrous and that fat-free tissue is approximately 73% water (Pace and Rathbun, 1945). (Mooreet al., 1963).Hume,(1966) proposed an equation for the estimation of lean body mass from height and weight based on the measurement of total body water using anti pyrine space and the Pace and Rathbun equation (1945).This finding is in keeping with the observation that total body water relative to body weight is lower in females than in males (Moore et al, 1963). Although age is also an important factor in determining the relationship between body weight and total body water (Mooreet al, 1963), as has been argued before (Hume, 1966),there seems little merit in introducing another factor when the correlation between height and weight and total body water is so close. Body weight, predicted total body water (TBW), or predicted surface area have been determining factor in pediatric clinical practice for recommendation of medicine. For example, fluid and energy requirements in parenteral nutrition can be estimated based on TBW, as can many pharmacological dosages1 and peritoneal dialysis dosages.A sports players perceived benefits of maintaining lean tissue mass and promoting a reduced level of body adiposity. Body water which occupies approximately 74% of the lean tissue and 25% of adipose tissue may also fluctuate in response to aging and exercise (Ellis, 2000; Martin et al., 1994; Ritz, 2000). The association between body hydration and amount of physical activity is also not certain. When a group of young, elite athletes were compared to recreational sportsmen of similar age, significantly higher levels of TBW and ICW-to-ECW were noted (Battistini et al., 1994). However, in older men who participated in a short-term endurance exercise program only in an increase in plasma volume was observed, and levels of TBW, ICW, and ECW did not appear to change (Pickering et al., 1997). Therefore, observing the felt requirement, we consider it necessary to attempt to test the possibility that reliable total body water prediction equation applicable to Indian university players could be derived from simple anthropometric measurement for use over the whole adult in life as well as to assess body water from simple method.

OBJECTIVES OF THE STUDY

To establish regression equation for predicting Total Body water on the basis of Body Weight, Height and Age of the university players.

MATERIALS AND METHOD

Selection Of Subjects

The subjects for this study were selected from L.N.I.P.E, N.E.R.C, Guwahati , Assam. Total Fifty (50) male University players were selected. The age of the subjects was ranging from 20-27 years.

Selection Of Variables

Following Independent and Dependent Variables were selected:

1. Independent Variables:

- Body Weight
- Height
- Age

2. Dependent Variables

- Total Body Water

MEASURES

For valid and reliable data investigator measured the variables with guidance of domain expert and for this purpose callipered instruments were used. The Total Body water was measured in early morning before the actual involvement of the student in Physical

activities with the help of "Maltron Bioscan 916 Body Composition Analyzer". Weight was measured using platform digital scales with a precision of 0.1 kg, Height was recorded using a "Stadiometer" to the nearest 0.5 cm and chronological age was taken of subjects.

STATISTICAL ANALYSIS

For data, analysis responses were expressed as mean and standard deviation. Pearson Product Moment correlation was performed to find out relationship between the Total body water with Body weight, Height and Age. Further, Multiple Correlation method was used to find joint contribution and Regression equation was established for predicting Total body water on the basis on Independent Variables at $p<0.05$ was considered statistically significant. Data analysis was performed using SPSS 17.0 software under windows.

RESULTS

To have a feel for the data, some descriptive statistics like Mean and Std.Deviation was computed for the above said variables. They are given in table -1.

Further to meet the main objectives of the present study, Pearson's Product moment correlation coefficient given in table no.2 , Model Summary along with the multiple correlation and R^2 by using enter method statistical tools/techniques were computed given in table no.3 and Regression coefficient of selected variables in predicting Total Body water were computed given in table no.5

Table 1: Mean and SD Values of Total Body water and Selected Independent Variable.

Variables	Mean	Std.Deviation	No of subject
Total Body Water	37.91	4.62	50
Body Weight	63.44	9.55	50
Height	168.59	6.92	50
Age	23.70	1.77	50

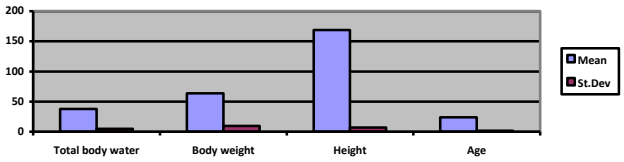

Figure 1: Graphical representation of Mean and standard Deviation of selected variables for University players

Table 2: Correlation between Dependent Variable (Body Water Percentage) and Independent Variables (Body Weight, Height and Age)

Independent Variables	Correlation Coefficient
Body Weight	.728**
Height	.429**
Age	-.382**

****correlation is significant at the 0.01 level.**

***correlation is significant at the 0.05 level.**

Table 2 clearly indicates that there exists a significant relationship between Total Body water with all selected independent variables i.e. Body weight, Height, and Age at .05 level of significance.

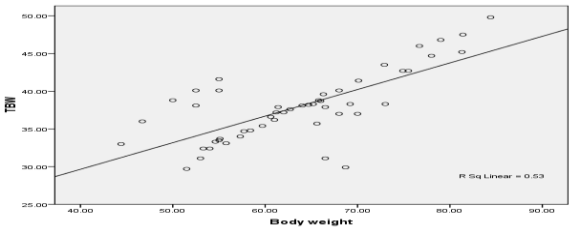

Figure 2: Graphical representation of relationship between Total Body water (liters) and Body weight (kg)

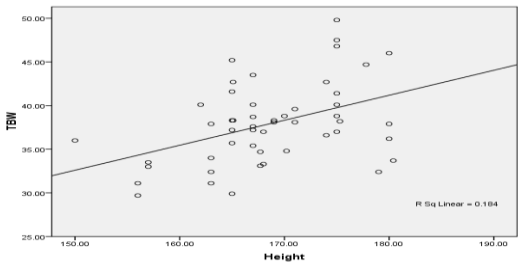

Figure 3: Graphical representation of relationship between Total Body water (liters) and Height (cm)

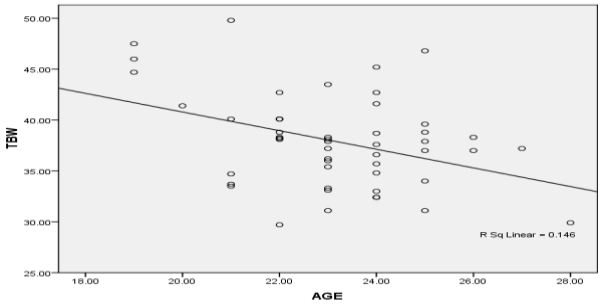

Figure 4: Graphical representation of relationship between Total Body water (liters) and Age (years)

Table 3: Model Summary along with the multiple correlation and R^2 of Body weight, Height and Age in predicting Total Body water

Model	R	R^2	Adjusted R^2	Std. Error of the estimate
1	.778[a]	.606	.580	2.997

a. Predictors (constant), Body weight. Height and Age

The above table showed that R^2 was found .606 considering Body weight, Height, Age as predictor was included in enter method, which means that 60.6% of the variance in Total Body water was associated with Body weight, Height and Age.

Table 4: Analysis of Variance

Model	Sum of squares	Df	Mean square	F	Sig.
Regression	634.903	3	211.634	23.551	.000[a]
Residual	413.364	46	8.98		
Total	1048	49			

a. Predictors (constant), Body weight. Height and Age

ANOVA tests the null Hypothesis that there was no linear relationship between the Total body water and Body weight, Height, Age in university players. For the Model I in above table ,the significance level associated with observed value of F(23.55) was founder greater than the tabulated value. Thus, the null hypothesis could be rejected and we may conclude that there was a significant linear relationship between the Total body water and Independent variables.

Table 5: Regression coefficient of selected variables in predicting Dependent variable (Body water Percentage)

Model	Un-standardized coefficients		Standardized coefficients	T	Sig
	B	Std.Error	Beta		
(Constant)	19.444	13.029		4.492	.005
Body weight	.310	.049	.640	6.275	.000
Height	.073	.069	.409	5.058	.002
Age	-.583	.229	-.243	-2.542	.014

a.Predictors (constant),Body weight. Height and Age

The above table displayed the value of the coefficient in the regression equation and measures the probability that a linear relationship existed between Total body water and the independent variables .In this table 'B' was the slope of line.' SE B' was the standard error of 'B'. Beta was the standardized regression coefficient. 'Sig' was the significance level for the test of the null hypothesis that the value of a coefficient was .005 in the population.

In model I, the significance value for Body weight (.000), Height (.002), Age(.014) was less than 0.05.Therfore,the null hypothesis ,that there will be no linear relationship between predictors and Total body water could not be accepted.

The resulting regression equation is

Total Body water = 19.444 + 0.310 (Body weight) + 0.073 (Height) - 0.583 (Age)

The equation estimates that for the sample survey 60.6% of the variation in Total body water is explained by the area of the Body weight, Height and age.

DISCUSSION

The present study started with aim to estimate the total body water on the simple anthropometric variables i.e. Body weight height and age. Several studies were conducted on prediction of total water volume by various techniques on sedentary subject (Watson et al., 1980), investigators do not publish the prediction /regression for varsity players and there is paucity of information regarding the estimation of water volume of university players. In present study the simple anthropometric measurements i.e. height, weight and age were taken as predictor parameter. Some study conducted on elite player to test the influence of age, weight, height, FM and FFM on the differences between methods. The study revel significant independent variable was age, where a negative association (Matias et al., 2012).

The present study revealed significant correlation between total body water with Body weight (r=.728), Height (r=.429) and negatively correlation with Age (r=-.382). The above table 3 showed that R^2 was found .606 considering Body weight, Height, Age as predictor was included in enter method, which means that 60.6% of the variance in Total Body water was associated with Body weight, Height and Age. Age have the significant role for height, increasing age may contribute for gain of height. If height increase, other body compositional constituents may be increased like, body mass, lean body mass, cell size, limbs etc. Body water, which occupies approximately 74% of the lean tissue and 25% of adipose tissue, may also fluctuate in response to aging and exercise (Ellis, 2000; Martin et al., 1994; Ritz, 2000). The association between body hydration and amount of physical activity is also not certain.

Result showed significant positive correlation between body weight and total body water volume. In present study, the age range of players was 20 to 25 years and players were physically active involving intensive training. This may be probably reason for reducing fat mass and increasing lean body mass, which includes protein, minerals, blood vessels etc. Some study weights are found negative correlation with total body water. This study will be a new addition to the earlier developed regression equation models and will be fructiferous to estimate Total Body water.

CONCLUSION

The main finding of our study is that widely used equations for the prediction of TBW in sports clinical practice and significantly overestimate TBW, especially age of 20 to 25 years and in male players. These results also provide information to the nutritional status and body fatness of adolescent age players. Thus, we argue that the use of anthropometry to predict treatment requirements is confounded by secular trends in the relation in between total body water and body composition. We have produced new equations for the age range 20 to 25 years; however further work is needed to address adolescents female players, particularly given the changes in fatness that are characteristic of puberty. Furthermore, a cross-association of variables indicates that the relation between Total Body water with Body weight, Height and age.

RECOMMENDATION

- The data of this study is useful in preparing the training program for players, which may be designed to suit the particular need of the players of the country at every level.
- The same study can be repeated with some more variables.
- The same study can be repeated with some other games and sports.
- The results of this study would help the coaches and administrators in planning and training of Players for the upliftment of standard of game.

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