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Body composition of male boxer

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A study was conducted to assess the 'body composition of boxers' from the National level competition of male boxers, held at (9th to 16th Jan 2011) the Udaipur city. A total of 119 boxers were selected purposively for the study and they were further classified in three weight categories [45-60 kg below (n=41), 60-80 kg (n=56) and 80 kg above (n=22). Anthropometric measurements indicated that the mean height, weight and BMI of the boxers in each weight category 45-60 kg, 61-80 kg and 80 kg above were 166.72 cm, 174.92 cm 180.39 cm and 52.82 kg, 67.91 kg, 90.22 kg and 22.31 kg/m^2, 22.05 kg/m^2, 23.06 kg/m^2 , respectively. Anthropometric measurements comparison between all categories revealed that they had significant difference. Body composition of the subjects was noticed that the mean percentage of body fat determined as bioelectrical impedence analysis of the subjects at different weight category was 10.83 per cent, 11.10 per cent and 18.49 per cent, respectively. The mean FFM was 48.28 kg, 60.32 kg and 73.32 kg in 45 to 60 kg, 61 to 80 kg and 80 above weight category, respectively mean percentage of TBW and BMR were found 67.37 per cent, 61.81 per cent and 54.95 per cent and 1550.95±128.97 kcal/day, 1855.5±144.44 kcal/day and 2220±159.27 kcal/day, respectively. Comparison between weight categories shows that they had significance difference in each component of body composition. Boxing is weight category sports due to these reason boxers maintain their weight according to their weight category so it may be affect their anthropometry measurements and body composition. A study thus concludes that assessment of body composition is important part of athlete assessment to give idea about what should be the body composition at different weight category and help in improve performance.

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INTRODUCTION

Professional boxing is a combat sport categorized into a series of weight classes. Given the sport's underpinning culture, boxers' typical approach to "making weight" is usually via severe acute and/or chronic energy restriction and dehydration. Such practices have implications for physical performance and also carry health risks (James *et al.*, 2010).

Body composition has become an important part of athlete assessment. The amount of muscle and fat an athlete has, can be predictive of performance. A periodic assessment of body composition also helps the athlete understand if the training regimen is causing the kinds of physical changes that are being sought (Benardot, 2006).

In athletes, body composition measures are widely used to prescribe desirable body weights, to optimize competitive performance, and to assess the effects of training (Sinning, 1996). It is generally accepted that a lower relative body fat is desirable for successful competition in most of the sports. This is because additional body fat adds to the weight of the body without contributing to its force production or energy producing capabilities, which means a decrease in relative strength. It is obvious that an increased fat weight will be detrimental in sporting activities where the body is moved against gravity (*e.g.* high jump, pole vault, volleyball spiking action) or propelled horizontally (*e.g.* running). In running at any sub maximal speed, the oxygen requirement is increased with any increment in body weight that is, oxygen consumption is increased due to the greater energy demand required to

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initiate and sustain movement of a larger weight. Previous research has demonstrated that athletes in all running events have less body fat compared to most other disciplines (Martin and Coe, 1997; Gore, 2000; Matkovic *et al.*, 2003).

Information regarding body composition in relation to specific events is not available. In the present investigation attempt will be made to assess the body composition of boxers with objectives to determine the body composition of boxers, to compare body composition of boxer groups during competition.

METHODOLOGY

A total of 119 professional boxers were selected from the national level competition for the study. Boxers were further classified in three groups (A, B and C) according to weight category 45-60 kg below, 60-80 kg and 80 kg above. Anthropometric measurements were recorded and the body composition was assessed by BIA technique.

Assessment nutritional anthropometry:

The pattern of growth and physical state of the body, and body composition are used for assessing nutritional status. The measurements which were taken are explained below:

Weight:

A digital balance was used for the measuring weight. The zero error of the weight scale was checked before taking their weight and corrected as required.

Height:

The height was measured using vertical anthropometric rod. The subject was asked to stand erect looking straight on a leveled surface without shoes, with heels together and toes apart and hands hanging by sides. The scale was gently placed touching the hair and making its contacts with top of the head.

Waist and hip circumference:

Waist circumference was measured at the level of naval while subject was breathing quietly and hip circumference was measured at interiochantric level (Depress *et al.*, 1990)

Waist to hip ratio:

Waist to hip ratio (WHR) is a measurement of visceral obesity and is a strong indicator of the risk of hypertension, cardiovascular disease and non insulin dependent diabetes. Individuals with increased fat accumulation in the abdominal region, indicated by high waist hip ratio, often have an androgenic lipid profile. That tremendously enhances the cardiovascular risk (Suk *et al.*, 2003).

Body mass index (Quetlete's index):

The index was calculated by dividing the absolute weight (kg) with absolute height (m) squared *i.e.*

$$\mathbf{BMI} = \frac{\mathbf{Weight\ (kg)}}{\mathbf{Height\ (mt^2)}}$$

The values obtained were interpreted as per the seven classes of BMI with their presumptive diagnosis as suggested by WHO/IASO/IOTF 2000.

Table A: BMI classification for Asian adults (WHO, 2012)

BMI classes	Presumptive diagnosis
< 18.5	Under weight
18.5 – 22.9	Ideal BMI
> 23.0	Over weight
> 25.0	Obese grade I
> 30	Obese grade II

Body composition:

Body composition can be defined as the proportion of fat and fat free mass (muscle, bone and water) in the body. In the present study the body composition was assessed by (BIA) using as instruments as body stat dual scan 2005, in term of :

Total body fat (TFB):

Body fat is the amount of fat in a person's body. A high degree of excess body fat, which indicates obesity, has been linked to high blood pressure, heart diseases, cancer and other disability conditions (Craft *et al.*, 1993).

Fat free mass:

All body tissue expect storage fat is fat free mass (FFM). It is made up of structural and functional elements in cells, body water, muscle, bones and other body organs such as the heart, liver and kidneys (Ferrario *et al.*, 1995).

Total body water:

Total body water (TBW) is all the water in the body including water inside and outside the cells, including water in the gastro intestinal and urinary tracts (Wikipedia, 2005) Total body water is distributed in the two major compartments or spaces, based on differential concentration of the two major cations, sodium and potassium. These two major comportments are intracellular water (ICW) and extra cellular water (ECW).

Basal metabolic rate (BMR):

BMR is defined as the daily rate of energy metabolism that needs to be sustained by an individual in order to preserve the integrity of vital functions. It is used to gauge the physiological and biochemical integrity of the individual concerned. Ideally, it should be measured under conditions that are not influenced by external environmental factors such

as ambient temperature, physical exertion and the effects of food or drugs.

Principle:

Body state dual scan 2005, works in electrical bio-impedence (BIA) principle. A small amount of current passed in the body where water acts as a conductor where fat acts as insulation.

Technique:

The subject was lying in a comfortable position relaxed with no parts of body touching one another. Electrodes were attached to the right hand and right foot.

Right hand:

Red lead tucked behind the knuckles and black lead on the wrist next to the ulna head.

Right foot:

Red lead tucked behind the toes and black lead on the ankle at the level of and the between the medial and lateral malleoli.

Analysis of the data:

The data were statistically analyzed as per the objectives of the study. The collected data were coded, tabulated and complied for the interpretation of the results.

Mean ± standard deviation and standard error were calculated for the values of anthropometric measurements and body composition. The data was analyzed statistically using Microsoft excel programmed of windows 98.

Analysis of variance (ANOVA) was applied to determine the significance of the National level competition boxers groups (A, B, C) nutritional anthropometry and body composition.

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as well as relevant discussion have been presented under following heads :

Anthropometric measurements:

Anthropometric measurement refers to the measurements of the individuals for the purpose of understanding physical variation. These measurements of human body serve as a good indicator of post and present nutrition status of an individual. Data regarding to height, weight and BMI of subjects from there different weight categories have been presented in Table 1.

Height:

Height is the distance from the bottom of the feet to the top of the head in a human body standing erect (Anonymous, 2010). The mean height of boxers in A group category was 166.72±5.32 cm, 174.92± 4.70 cm in B group and in group C was 180.39±5.51cm, respectively. There were significant differences between the heights of different weight category boxers.

Weight:

Body weight is used as an indicator of an individual's health. Data revealed that mean weight of boxers was 52.82±3.51kg; 67.91±6.01kg and 90.22±7.89 kg in group A, B and C, respectively. There were significant differences between the weights of different weight categories.

Waist circumference:

Waist circumference may predict intra abdominal fat and abdominal fat as accurately as the wais hip ratio. The mean waist circumference measured for A, B and C categories were 72.39±3.65 cm, 80.34±4.94 cm and 94.05±7.16 cm, respectively. There were significant differences observed between waist circumferences of different weight categories, all over subjects were within normal level of waist circumference.

Hip circumference:

The mean hip circumference was 86.93±3.71cm in A group, where as it was 94.93±3.91 cm in B group and 106.48±5.53 cm in C group, respectively. There were significant differences between hip circumferences of different weight category subjects.

Table 1. Anthropometric measurements (mean±SD) of boxers in different weight categories

Parameters	Group A (n=41)	Group B (n=56)	Group C (n=22)	P-value
Height (cm)	166.72±5.32	174.92± 4.70	180.39±5.51	0.000 A,B&C *
Weight (kg)	52.82±3.51	67.91±6.01	90.22±7.89	0.000 A,B&C *
Waist circumferences (cm)	72.39±3.65	80.34±4.94	94.05±7.16	0.000 A,B&C *
Hip circumferences (cm)	86.93±3.71	94.93±3.91	106.48±5.53	0.000 A,B&C *
Waist to hip ratio	0.82± 0.04	0.84±0.04	0.88±0.04	0.000 A,B&C *
BMI (kg/m^2)	19.51±1.61	22.21±1.87	27.92±3.06	0.000 A,B&C *

* The mean difference is significant at the 0.05 level S.D.= significant difference

Waist to hip ratio:

Waist circumference is considered as more reliable method of assessing obesity. The mean waist to hip ratio found for boxers (45 to 60 kg weight category) was 0.82± 0.04, it was 0.84±0.04 in 60 to 80 kg weight category and where as 0.88±0.04 measured in 80 kg above weight category. Significant differences were found in different weight categories for WHR of boxers.

BMI:

The body mass index (BMI) is statistical measure of the body relative body fatness based on a person's weight and height. Due to ease of calculation, it is the most widely used diagnostic tool to identify weight problems within a population, usually whether individuals are underweight, overweight or obese. Data in Table 1 revealed that BMI of A category was 19.51±1.61kg/m^2, whereas 22.21±1.87 kg/^{m2} in middle weight category B and had 27.92±3.06 kg/m^2 in higher weight category (80 kg above). There were significant differences were observed between BMI of different weight category.

Distribution of subjects according to BMI:

The data on classification of boxers based on BMI is presented in Table 2.

Group A:

It is clearly noticed that around 70.73 per cent of the boxers were in the normal category, by having BMI between 18.5 to 22.9 kg/m^2. About 26.82 per cent were under weight by having BMI <18.5 kg/m^2. Around 2.43 per cent of them were overweight *i.e*., a BMI >23 kg/m^2.

Group B:

It was observed that around 66.06 per cent boxers were having ideal BMI (18.5-22.9 kg/m^2) in this category. About 23.21 per cent were overweight (>23 kg/m^2), followed by obese grade I who were around 10.07 per cent having BMI >25 kg/m^2.

Group C:

Table 2 shows that around 68.18 per cent boxers were grade I obese having BMI >25 kg/m^2 and 18.18 per cent were having BMI >30 kg/m^2 (grade II obese). Rest of the 13.36 per cent subjects were overweight having BMI >23 kg/m^2.

Body composition:

Body composition included body fat per cent, total fat mass, fat free mass and total body water. The mean±SD values of different weight category subjects at competition phase and of local subjects at different phases of competition are presented in the Table 3 and Plate 1a and 1b.

Total body water:

It can be seen from the Table 3 that mean total body water per cent of 45 to 60 kg category was 67.37±5.40, whereas it was 61.81±6.49 in middle weight category and 80 kg above weight category had 54.95±4.79 TBW%. Significant differences were found between TBW percentages of different weight category.

Extra cellular water:

The mean ECW per cent of group A boxers was 26.93±2.87, group B was 24.36±2.43 and group C was 21.58±2.31. There were significance differences between groups A, B and C.

Table 2. Distribution of subjects according to BMI in different weight categories (WHO, 2002)

BMI classes kg/m^2	Presumptive diagnosis	A (n=41)		B (n=56)		C (n=22)	
		F	%	F	%	F	%
<18.5	Under weight	11	26.82	-	-	-	
18.5-22.9	Ideal BMI	29	70.73	37	66.06	-	
>23	Over weight	1	2.43	13	23.21	3	13.36
>25	Grade I obese	-	-	6	10.07	15	68.18
>30	Grade II obese	-	-	-	-	4	18.18

F=Frequency %= Percentage

Table 3. Body composition (mean±SD) of boxers

Parameters	A (n=41)	B (n=56)	C (n=22)	P-Value
TBW%	67.37±5.40	61.81±6.49	54.95±4.79	0.000 A,B&C *
ECW%	26.93±2.87	24.36±2.43	21.58±2.31	0.000 A,B&C *
ICW%	40.89±4.75	37.38±3.66	33.59±3.25	0.000 A,B&C *
BF %	10.83±3.94	11.10±3.63	18.49±5.32	0.000 A&B ^{NS}, A&C*, B&C*
FFM (kg)	48.28±4.05	60.32±6.58	73.32±5.73	0.000 A,B&C *
BMR (kcal/day)	1550.95±128.97	1855.5±144.44	2220±159.27	0.000 A,B&C *

* = The mean difference is significant at the 0.05 level NS= non-significant

(a) (b)

Plate 1(a) & (b): Measurement of body composition

Intra cellular water:

The mean ICW per cent was observed as 40.89±4.75, 37.38±3.66 and 33.59±3.25, respectively in groups A, B and C. There were significances differences between groups ICW per cent.

Body fat percentage:

The mean per cent BF was 10.83±3.94, 11.10±3.63 and 18.49±5.32 in 45 to 60 kg, 61 to 80 kg and 80 kg above weight category, respectively. There was no significant difference were found between 45 to 60 kg and 61 to 80 kg weight category %BF and significance difference were observed between %BF of 45-60 and 80 kg above wt category and 61 to 80 kg and 80 kg above wt category.

Results finding match with mean percentage body fat of Greek pre-Olympic team male amateur boxers male it was 10.1 ± 3.2 (range 5.8–16.2 %) Jeremy (2004). Also match with body fat per cent (12.97%) of trainees Olympic and ironman distance triathletes Bam. (2008).

Chandraprakash and Easwaran (1999) also studied on the nutritional and physical fitness status of selected service athletes. Majority (18 out of 20) of marathon and cross country athletes had acceptable body fat per cent (7-15%) where as majority (7 out of 10) of the walk athletes were lean (*i.e.* <7% body fat). Wan-Nudri *et al*. (1996) also found BFP of athletes from different types of sports were 13.8+4.5 per cent respectively.

Many studies revealed that usually the heavier the fighter, the more body fat they will possess. For example, skinfold measurements of a 66 kg wrestler, equivalent to a lightweight MMA fighter, was found to have a body fat percentage of 9.5 ±1.7%. A 96 kg wrestler, equivalent to a light heavyweight MMA fighter, had a body fat percentage of 11.4 ± 1.9 per cent (Mirzaei, 2009). In contrast, karate practitioners had a mean body fat percentage of 16.5 ± 4.6 per cent (Baker and Davies, 2006). Regardless of the fighter's size, every person competing in a weight class goes through dramatic changes while "making weight" which may compromise their body composition through dehydration tactics.

Fat free mass:

Fat free mass includes muscles, bones body water and organs. The mean FFM was 48.28±4.05 kg, 60.32±6.58 kg and 73.32±5.73 kg in A, B and C weight category, respectively. There were significant differences found between FFM of all weight categories.

Basal metabolic rate:

The mean value of BMR per cent in weight category A was 1550.95±128.97, in B was 1855.5±144.44 and in C was 2220±159.27. There were significant differences were found between groups BMR of different weight category.

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