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## RESEARCH ARTICLE

## STUDY OF BODY COMPOSITION AMONG UNIVERSITY LEVEL JUDO PLAYERS IN RELATION TO DIFFERENT WEIGHT CATEGORIES

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### Abstract

The purpose of this study was to compare the body composition parameters among the judo players of different weight categories. Total fifty male judo players of age 19 to 28 years from different universities of India were analyzed on the basis of different weight categories. The judo players were divided into three groups on the basis of different weight categories i.e. lightweight group, middle weight group and heavy weight group. Body weight of the judo players was measured with a portable weighing machine. Height measurements were taken using the standard anthropometric rod. The skinfolds thicknesses of body parts of the subjects were taken with Harpenden skinfold caliper. Percentage body fat as estimated from the sum of skinfolds was calculated using the standard equations. One-way analysis of variance revealed that the judo players of different weight categories were found to have significant differences in height ( $p < 0.05$ ), Weight ( $p < 0.05$ ) and body mass index ( $p < 0.05$ ). Similarly the judo players were found to have significant differences in percent body fat ( $p < 0.05$ ), total body fat ( $p < 0.05$ ) and lean body mass ( $p < 0.05$ ). The heavy weight judo players reported significantly better body composition components i.e. percent body fat, total body fat and even in lean body mass as compared to middle weight and light weight judo players. The middle weight judo players showed significantly better body composition components than the light weight judo players.

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## INTRODUCTION

Judo, a modern martial art, is a Japanese art and an Olympic sport created in Japan in 1882 by Jigoro Kano. In Judo besides technical skill and tactical strategies, conditional (physical and physiological) characteristics are also indispensable for success in competition and for training. Competitive judo can be described as a combative, high intensity sport in which the athlete attempts to throw the opponent onto his back or to control him during groundwork combat. Both attempts depend on specific techniques and tactical skills with the support of good physical fitness. Being aware of the anthropometric and physiological characteristics of an elite athlete paves the way for his/her success. As judo is a weight-classified sport, high level judo players should have low body fat. It has been suggested that percentage of body fat may be a discriminator for success. During the fighting in the game there are numerous and dynamic situation changes with different grips, clutches and positions of both fighters, which requires good dynamic stereotypes of clutches and throws, and ability to constantly create new programs of offensive, defensive and counterattack activities. The evaluation of physical characteristics is an important part of the training process because it gives information about the variables that need to be improved and about the effectiveness of a given training program.

Changes in lifestyles, nutrition, and ethnic composition of populations lead to changes in the distribution of body dimensions (e.g. the obesity, epidemic), and require regular updating of anthropometric data collections.

Anthropometry is the study and technique of taking body measurements. Specific physique or morphological features play a major role, arguably critical role in competition success. The size, shape and proportions of athletes are important considerations in player performance and better the performance more critical the relationship. Apart from the considerations of body size, the constitutional make up of body composition components are also important. The division of the body weight into various components can well be conceived by considering the major parts of the body, i.e. fat mass, muscle mass and bone mass (Singh and Malhotra, 1989). Body composition is used to describe the percentages of fat, bone, water and muscle in human bodies. Because muscular tissue takes up less space in our body than fat tissue, our body composition, as well as our weight, determines leanness. Body composition is the relative percentage of muscles, fat, bone, and other tissues of the body. Body composition is considered a component of health related fitness but can also be considered a component of metabolic fitness. Fat free body weight also known as the lean body mass, and the fat mass is the total amount of essential and storage fat in the body. Body composition studies have found a high, negative relationship between performance in various activities and the body fat. Physical characteristics and body composition have been known to be fundamental to excellence in athletic performance. Excess body fat is detrimental to performance in most sports whereas, fat free body mass, especially muscle mass, is generally associated with performance. The purpose of the present study, therefore, is to compare the body composition of the of the university level judo players among different weight categories.

## METHODOLOGY

In this study, judo players were purposively selected as subjects between the age of 19 to 28 years, from different universities of India. Total 50 Judo players from different universities of India were analyzed on the basis of different weight categories. The judo players were divided into three groups on the basis of different weight categories. The judo players of 50kg to 70kg were considered as 'lightweight group', judo players of 70kg to 80kg were considered as 'middle weight group' and judo players above <80kg were considered as 'heavy weight group'. The data for the study was collected from the subjects during All India Inter- university championship 2014-15, organized by Guru Nanak Dev University, Amritsar. Body weight of the subjects was measured with a portable weighing machine to the nearest 0.5 kg. Height measurements were taken using the standard anthropometric rod to the nearest 0.5 cm (HG-72, Nexgen ergonomics, Canada). Body mass index was then calculated using the formula weight (kg)/height<sup>2</sup> (m). The skinfold thicknesses of body parts of the subjects were taken with Harpenden skinfold caliper.

### Body Composition

Percentage body fat as estimated from the sum of skinfolds was calculated using equations of Siri (1956) and Durnin and Womersley (1974). The regression equations for the prediction of body density from the log of the sum of skinfold thickness at four sites in mm are as following:

17 to 19 years age group

$$\text{Body Density (gm/cc)} = 1.1620 - 0.0630 (X)$$

20 to 29 years age group:

$$\text{Body Density (gm/cc)} = 1.1631 - 0.0632 (X)$$

Where X = log (biceps+triceps+Subscapular+suprailliac).

$$\text{Percent Body Fat} = [4.95 / \text{body density} - 4.5] \times 100 \quad (\text{Siri, 1956})$$

$$\text{Total Body Fat (kg)} = (\% \text{body fat} / 100) \times \text{body mass (kg)}$$

$$\text{Lean Body Mass (kg)} = \text{body mass (kg)} - \text{total body fat (kg)}$$

### Statistical Analysis

Statistical analysis was performed using SPSS version 16.0 for windows (SPSS Inc, Chicago, IL, USA). All descriptive data was reported as mean and standard deviation. One way analysis of variance (ANOVA) was employed to test for differences among the three groups of judo players. Following the detection of a significant main effect, Scheffe post- hoc analyses were performed to locate where specific mean differences were laid. Significance levels were set at  $p < 0.05$ .

## RESULTS

Table: 1 Comparison of height, weight and body mass index among the different groups of judo players

Variable	Groups	N	Mean	SD	F-value	P-value
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Height (cm)	Light weight	25	167.24	6.02	4.81*	0.012
	Middle weight	15	171.80	4.03		
	Heavy weight	10	172.10	5.15		
Weight (kg)	Light weight	25	60.45	5.18	110.59*	0.000
	Middle weight	15	71.40	3.68		
	Heavy weight	10	90.50	7.79		
Body Mass Index (kg/m <sup>2</sup> )	Light weight	25	21.62	1.70	73.38*	0.000
	Middle weight	15	24.21	1.37		
	Heavy weight	10	30.62	3.13		

\* indicates  $p < 0.05$

Table: 2 Scheffe's post-hoc values of height, weight and body mass index of different groups of judo players

Anthropometric variable	Mean Difference		
	Light Weight Vs Middle Weight	Light Weight Vs Heavy Weight	Middle Weight Vs Heavy Weight
Height (cm)	4.56*	4.86*	0.30
Weight (cm)	10.94*	30.04*	19.10*
Body Mass Index (kg/m <sup>2</sup> )	2.58*	8.99*	6.40*

\*indicates  $p < 0.05$

The height, weight and body mass index of different groups of judo players is presented in table 1. The mean and standard deviation of height of light weight judo players were 167.24 and 6.02 cm respectively. The mean and standard deviation of height of middle and heavy weight judo players were 171.80, 172.10 and 4.03, 5.15 respectively. Significant difference was observed in height of individuals of different groups of judo players ( $F=4.81$ ,  $p < 0.012$ ). Heavy weight judo players were tallest and they were followed by middle weight and light weight judo players respectively. Scheffe's post-hoc analysis (table 2) revealed that the middle weight judo players were significantly taller when compared to light weight judo players. The heavy weight judo players were also significantly taller than the light weight judo players. There were no significant differences in height between the middle and heavy weight judo players. Significant difference was observed in weight of individuals of different groups of judo players ( $F=110.59$ ,  $p < 0.001$ ). Heavy weight judo players were heaviest and they were followed by middle weight and light weight judo players respectively. Scheffe's post-hoc analysis (table 2) revealed that the middle weight judo players were significantly heavier when compared to light weight judo players. The heavy weight judo players were significantly heavier than the light weight and middle weight judo players. Significant difference was observed in body mass index of individuals of different groups of judo players ( $F=73.38$ ,  $p < 0.001$ ). Heavy weight judo players had highest body mass index and they were followed by middle weight and light weight judo players respectively. Scheffe's post-hoc analysis (table 4.6) revealed that the heavy weight judo players were significantly higher body mass index when compared to light weight and middle judo players. The middle weight judo players had also significantly higher body mass index than the light weight judo players.

Table 3 Comparison of various components of body composition among the different groups of Judo players

Variable	Groups	N	Mean	SD	F-value	P-value
Percent Body Fat (%)	Light weight	25	15.29	2.68	21.26*	0.000
	Middle weight	15	19.30	3.96		
	Heavy weight	10	24.17	5.31		
Total Body Fat	Light weight	25	9.27	1.98	53.39*	0.000
	Middle weight	15	13.78	2.91		

(kg)	Heavy weight	10	22.10	5.93		
Lean Body Mass (kg)	Light weight	25	51.18	4.37	56.57*	0.000
	Middle weight	15	57.61	4.02		
	Heavy weight	10	68.39	4.74		

\* Indicates  $p < 0.05$

Table 4 Scheffe's post-hoc values of different components of body composition of different groups of judo players

Anthropometric variable	Mean Difference		
	Light Weight Vs Middle Weight	Light Weight Vs Heavy Weight	Middle Weight Vs Heavy Weight
Percent Body Fat (%)	4.01*	8.88*	4.87*
Total Body Fat (kg)	4.51*	12.82*	8.31*
Lean Body Mass (kg)	6.42*	17.21*	10.78*

\* Indicates  $p < 0.05$

The different components of body composition of the different groups of judo players are depicted in table 3. Significant difference was observed in percent body fat of individuals of different groups of judo players ( $F=21.26$ ,  $p < 0.001$ ). Heavy weight judo players had highest percent body fat and they were followed by middle weight and light weight judo players respectively. Scheffe's post-hoc analysis (table 4) revealed that the heavy weight judo players had significantly higher percent body fat when compared to light weight and middle judo players. The middle weight judo players had also significantly higher percent body fat than the light weight judo players. Significant difference was observed in total body fat of individuals of different groups of judo players ( $F=52.39$ ,  $p < 0.001$ ). Heavy weight judo players had highest total body fat and they were followed by middle weight and light weight judo players respectively. Scheffe's post-hoc analysis (table 4) revealed that the heavy weight judo players had significantly higher total body fat when compared to light weight and middle judo players. The middle weight judo players had also significantly higher total body fat than the light weight judo players. In relation to lean body mass statistically significant difference was found among the different weight groups of judo players ( $F=56.57$ ,  $p < 0.001$ ). The lean body mass was the greatest in heavy weight judo players and they were followed by middle weight and light weight judo players respectively. Scheffe's post-hoc analysis (table 4) revealed that heavy weight judo players had significantly greater lean body mass when compared to light weight and middle weight judo players. However, middle weight judo players had significantly greater lean body mass when compared to light weight judo players.

## DISCUSSION

Physical performance is affected by factors such as; genetic structure, training, nutrition, gender and age (Fuster et al, 1998). Because there is a strong relationship between body composition and physical performance, the anthropometric and physiological factors that affect the success of the athlete should be determined with care (Zar et al, 2008). The main aim of the present study was to evaluate the body composition of the judo players. The judo players were compared on body composition parameters according to their weight categories. The studies on the judo players comparing body composition, anthropometric and physiological characteristics on the bases of weight categories are very scant in the literature. In the present study the heavy weight judo players exhibited better height, weight, body mass index, percent body fat, total body fat and lean body mass than the middle weight and light weight judo players. The middle weight judo players reported better anthropometric and body composition characteristics than the light weight judo players. When the results of body fat percentage of the present study are compared to other studies with World and Olympic level judo athletes, values slightly lower are found in the literature, i.e., values below 10% for males (Franchini et al, 2005; Thomas et al, 1989; Little, 1991; Callister et al, 1991). This seems to confirm the assumption that high level judo athletes must have a very small percentage of body fat compared with an average male of the same height and age (Franchini et al, 2011a). The results of the present study also confirms previous results concerning the low-fat percentage in the lightest weight categories and the high values in the heavy weight categories (Franchini *et al.*, 2011b; Franchini et al, 2014).

## CONCLUSION

The heavy weight judo players reported significantly better body composition components i.e. percent body fat, total body fat and even in lean body mass as compared to middle weight and light weight judo players. The middle weight judo players showed significantly better body composition components than the light weight judo players. It is concluded that the judo players differ in body composition among different weight categories.

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