Effect of Weight Reduction on Selected Physiological Parameters in Male Junior National Boxing Campers

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Abstract

The study was conducted on a total of 24 junior national boxing campers to assess pattern of change in body weight (BW) during the camp and effect of weight reduction on selected physiological parameters. On the day of joining the camp, BW, standing height, grip strength, grip endurance, resting pulse rate, resting blood pressure, body fat percent (BF%) and fat free mass percent (FFM%) were measured using standard techniques. However, BW was measured thrice during 20 days' camp; firstly on the day of joining and subsequently on 10^{th} and 19^{th} (one day before competition) days of camp. Change in BW (as measured on 1st and 19^{th} day) was calculated. Campers who reduced their BW by >1% during the camp were selected and studied further for relative changes in selected parameters. Out of 24 subjects only 10 reduced BW by 4.68% during the camp and weight reduction indicated a gradual pattern. Comparison before and after weight reduction revealed increase in resting pulse rate, resting blood pressure (systolic and diastolic) and BF%. However, only resting diastolic blood pressure indicated significant ($p<0.05$) increase. A non-significant decline in grip strength, grip endurance and FFM was observed after weight reduction. Thus, gradual weight reduction up to 5% of BW to compete on the top of lower weight category may not affect grip strength and endurance.

Key Words: **Weight-Reduction, Boxers, Grip Strength, Grip Endurance, Body Composition, Blood Pressure**

Introduction

In today's world of neck to neck competition, an athlete cannot afford to take a chance as minute fraction of time can deprive him of fame and fortune. In never ending quest for winning, athletes try to use all possible means, which promise to improve their performance. They do not want to leave any stone unturned in getting the extra edge over their counterparts. It has been seen that making weight is common problem in combative sports like judo, wrestling, boxing etc, where athletes are divided into weight categories *(Widerman and Hagon, 1982; Webster, 1990; Hall and Lane, 2001).* In such events, athletes generally intend to compete on top of the lower category, as chances of winning become more. For this purpose they try to reduce weight rapidly by any means. Ideally, weight should be reduced systematically and gradually through a well planned scientific method so that weight is lost mainly through fat. It has a beneficial effect on performance, because it gives extra strength to the player.

It is seen that some boxers gain weight during the off-season. So they reduce weight rapidly only a few days before the competition. As weight reduction cannot be done by diet and exercise planning in few days, athletes depend upon total food and fluid restriction. If desired weight is not achieved by total restriction of food and liquid alone, they use various dehydration techniques to lose weight *(Webster et al., 1990).* State of hypo-hydration and continuous feeling of hunger and thirst may affect the working capacity and psychological condition of athletes *(Horswill et al., 1990; Hall and Lane, 2001).* Dehydration may decrease blood

volume, plasma volume, stroke volume and increase the heart rate which can lead to circulatory distress and *hypotension (Dill and Costill, 1974).* Unplanned weight reduction might further reduce weight through muscles. It decreases the muscular strength and muscular endurance, which in turn, may affect performance during the competition *(Webster et al., 1990; Armstrong, 1992; Oopik et al., 1996).* However, *Widerman and Hagon (1982)* found that planned weight loss of 8% through continuous training and restricted diet did not affect the maximal aerobic power and muscular strength in a wrestler. Similarly, *Kraemer et al (1999)* also indicated that benefits could be gained through well- planned weight reduction programme.

The present study was undertaken to see whether our boxers attending national camp adjust their weights to change their weight categories. Further, effect of weight reduction on some physiological parameters was assessed.

Materials and Methods

Study was carried out on twenty four male junior boxers in the age range of 16-18 years, who came to attend the National junior boxing camp held from 14th January 2003 to 3rd February 2003 in Jawaharlal Nehru Stadium, Delhi. The training camp was held to prepare the boxers for International competition 'ONGC YMCA VIII International Boxing Championship'.

Out of twenty four boxers included in the study, three were from light fly weight, two from fly weight, one from bantam weight, two from feather weight, three from light weight, two from light welter weight, four from welter weight, two from middle weight, three from heavy weight and two were from super heavy weight category.

From the twenty-four subjects included in the study, eleven reduced their weight during the camp and those eleven were selected for the assessment of effect of weight reduction on physiological parameters. However, one boxer left the camp in between due to some injury and was later excluded from the study leaving a total of 10 subjects for further study.

Step 1

The general information including previous level of participation and weight category etc. from all the subjects was collected on the day of joining the camp. Then following measurements were recorded:

Body weight (BW): Body weight was taken with minimum clothing when the boxer was standing erect on the electronic weighing machine of sensitivity of 0.1 kg.

Standing height: Height was taken using standard technique with anthropometric rod with an accuracy of 0.1cm.

Grip strength: **T**he grip strength was taken with the help of grip dynamometer. The subject was asked to hold it with right hand while keeping the arm straight in front of the body in horizontal position. He was instructed to stand erect and press it with maximum force without moving the hand in any direction or touching the body.

Muscular grip endurance: Grip endurance was measured with the help of grip dynamometer and stopwatch. The 2/3rd of the subject's grip strength was calculated and the subject was instructed to hold the dynamometer at this level for the maximum possible time duration in a single stretch. Time was recorded to minimum of 0.01 sec.

Resting pulse rate: The subject was asked to sit in a comfortable position. After giving five minutes rest, the resting pulse rate was counted from radial artery.

Resting blood pressure: The subject was asked to sit in resting position. The systolic and diastolic blood pressure was recorded from the right arm using sphygmomanometer. The blood pressure was recorded to minimum of 2mmHg.

Body composition: Body fat percentage (BF %) and fat free mass percentage (FFM %) was measured using skin fold method. Biceps, triceps, subscapular and suprailiac skin folds were measured using Lafayette skin fold calliper. BF% and FFM % were calculated using the equations given by *Durnin and Wormeslay (1974)* and *Siri (1961).*

Step 2

All the subjects were weighed thrice in all during 20 days' camp; once on the day of joining, then on 10^{th} and 19^{th} (one day prior to competition) days of camp.

Step 3

Percent change in their body-weight during the camp was calculated. Those subjects who reduced their body weight by more than one percent during the camp were taken for further study and following measurements were taken again:

1 Grip strength
2 Muscular grip endurance
3 Resting pulse rate
4 Resting blood pressure
5 Biceps skin fold
6 Triceps skin fold
7 Subscapular skin fold
8 Suprailiac skin fold

Step 4

Changes in all the parameters listed above were calculated before and after weight reduction.

Data analysis: Mean and S.D. values of all physiological parameters of the campers recorded on the day of joining the camp were calculated. Dependent 't' test was computed to check the significance of difference wherever required. The level of significance was set at 0.05 level of confidence.

Results

The male junior national boxing campers included in the study belonged to the age group of 16 to 18 years. Range of their body weight (BW) was from 46 Kg to 116 Kg (n=24), as these campers belonged to different weight categories.

Table 1. Distribution of subjects according to percentage change in their body weight during the camp (n=24)

S. No	Change In Body Weight	N
1.	Lost weight (>1%)	10
2.	Gained weight (>1%)	2
3.	Maintained weight (<1% change)	10
4.	Left the camp in between	2

Table1 shows the distribution of subjects according to change in their body weight during the camp. Change in weight was calculated from the values on 1^{st} and 19^{th} day of joining the camp. Out of twenty-four subjects included in the study, ten subjects reduced their weight by >1% during the camp. Reduction in body weight (4.68%) was statistically significant ($p< 0.05$) (Table 2). Ten subjects maintained

their weight, while two gained >1% and two campers left the camp in between.

Table 2. Percent difference between the means of parameters studied before and after weight reduction (mean ± S.D) (n=10)

S.No.	Parameters	On the day of joining (before weight reduction) A	On 19th Day of Camp (A day before competition) (after weight reduction) B	Difference B-A	Percent change (%)	t-values
1.	Body weight (Kg)	60.23±7.9	57.41±7.4	-2.82	-4.68	6.07*
2.	Grip strength (Kg)	38.56±5.3	38.33±7.2	-0.23	-0.59	0.64
3.	Muscular grip endurance (secs)	7.15±4.7	6.18±4.0	-0.97	-13.56	0.52
4.	Resting pulse rate (pulse/min)	64.9±13.1	67.1±16.8	+2.2	+3.38	1.23
5.	Resting systolic BP (mmHg)	133.4±19.8	136.4±10.6	+3.0	+2.24	1.37
6.	Resting diastolic BP (mmHg)	81.0±8.9	90.4±4.8	+9.4	+11.60	3.88*
7.	Body fat (%)	16.03±3.9	16.34±3.4	+0.32	+0.32	0.30
8.	Fat free mass (%)	83.97±3.8	83.66±3.4	-0.32	-0.32	1.95

All physiological parameters further studied in the subjects who reduced weight during the camp are given in table 2. Values of these parameters as taken on the first day of the camp (before weight reduction), one day prior to competition (after weight reduction) and percent differences have also been presented (Table 2). After reducing mean weight of 4.68%, resting pulse rate, resting blood pressure (systolic and diastolic) and fat percentage showed an increase. While grip strength, grip endurance and fat free mass percentage decreased after weight reduction. The difference was observed to be statistically significant only for body-weight and resting diastolic blood pressure ($p<0.05$). However, the difference was non-significant for rest of the variables.

Discussion

Out of the total number of boxers studied (n=24), ten reduced weight during the camp. The mean weight loss was 2.82 Kg (4.68%; Table 2) over a period of 20 days, which is quite within the acceptable range.

The methods and techniques used by campers to reduce weight were beyond the scope of this study. But their weight was measured three times during the camp at regular intervals to assess the rate/consistency of weight loss. The rapid weight reduction pattern that is generally practiced by wrestlers and boxers did not seem to be followed by the subjects in the present study. Generally it is the practice to reduce weight rapidly through dehydration in the last few days before competition. But in this study, trend of weight change was spread over a period of 20 days indicating gradual weight loss (Table 3).

High BF% and low FFM% besides having long-term health implications, also affect variables related to performance particularly in strength dominating sports. In the present study, although boxers reduced body weight but no significant change was seen in parameters of body composition (BF% and FFM %). However,

the initial BF% (16.03%) values of these campers were already much higher than the suggested normal values of BF% for wrestlers (5-7%) *(Kelly et al., 1978)*. The BF% of the subjects was even towards the higher limit of the range of BF% for sedentary males (11-17%) as suggested by *Verma and Mokha (1994)*. Various other studies have also reported BF% of male boxers as 10-15% *(Bhardwaj et al., 1990, Guidetti et al., 2002)*.

Table 3. Pattern of change in body weight (%) during the camp (n=10)

S.No.	Weight on the day of joining (Kg)	Weight on 10th Day of Camp (Kg)	Percentage change (%)	Weight on 19th Day of Camp (Kg)	Percentage Change (%)
1	51.20	47.6	-7.03	48.05	+0.94
2	52.30	50.4	-3.63	51.00	+1.19
3	52.40	50.6	-3.43	51.05	+0.88
4	60.40	57.6	-4.63	57.02	-1.00
5	62.00	59.0	-4.83	60.00	+1.69
6	65.00	64.2	-1.23	62.00	-3.42
7	76.50	75.1	-1.83	74.00	-1.46
8	66.00	61.5	-6.81	60.00	-2.43
9	55.40	53.7	-3.06	54.00	+0.54
10	61.00	60.0	-1.63	57.00	-5.00

+ refers to Gain, - refers to Loss

Grip strength has been well correlated with boxing ranking. In the present study, mean grip strength was 38.56 $\pm$ 5.3 Kg which is much lower as compared to the reported value of 58.2 Kg for elite boxers *(Guditti et al., 2002)*. The low grip strength of junior boxers may be attributed to their high fat percentage and low fat free mass. However, when compared before and after weight reduction, a non-significant decline of 0.59 percent and 3.56 percent in muscular strength and endurance respectively was observed in the present study. This may be attributed to their slow and gradual pattern of weight reduction. Boxers already possessed high fat percentage, which did not decrease with the reduction in body weight.

All 24 junior boxers in the present study exhibited the normal resting pulse rate. However, their resting blood pressure (systolic as well as diastolic) was observed to be high normal with mean values of 142.84 and 89.21mmHg for systolic and diastolic blood pressure respectively. While studying blood pressure of the individual subjects, eight subjects were found to be hypertensive with diastolic blood pressure of more than 90mmHg. The systolic blood pressure was also noticed to be more than the normal upper limit (140mmHg) in case of twelve subjects.

Due to hypertension, the heart has to expel blood from the left ventricle against a greater resistance. Further, hypertension places great strain on the systemic arteries and arterioles. All the subjects in the present study were less than 18 years old. If the blood pressure remains high, as they grow old, the stress due to hypertension can cause the heart to enlarge and the arteries to become scarred,

hardened and less elastic. Eventually, it can lead to arthrosclerosis, heart attacks, stroke and kidney failure. The blood pressure increases during exercise and during competition due to anxiety. This increase can further enhance risks during the competition.

Those 10 subjects who reduced weight during camp also reported 133.4 and 81mmHg before weight reduction, which increased to 136.4 and 90.4 mmHg for systolic and diastolic pressure respectively. The 11.6% rise in diastolic blood pressure was significant ($p<0.005$). A non-significant increase of 3.38% was noticed in the resting pulse rate as a result of weight reduction.

As the weight reduction was gradual in the present study, pulse rate increase does not seem to be the result of decrease in blood volume. Therefore, the increase in resting pulse rate as well as blood pressure was probably due to the psychological factors like excitement and anxiety related to participation in the International level competition. Anxiety may also be linked with the weight maintenance to participate in the lower weight category. *Hall and Lane (2001)* also established positive relationship between rapid weight loss and increased anger, fatigue and tension. As pulse rate and blood pressure are highly affected by emotional state, above changes in emotional level may be attributed to the increase in these parameters. *Fleck (1988)* observed an increase in the blood pressure with resistance training. Therefore, increase in blood pressure during the camp may also be due to the resistance training given to them.

To avoid risks of hypertension and higher body fat percentage, the boxers need to improve diet pattern and life style. Proper exercise, sleep and rest need to be encouraged and smoking, alcohol and drugs should be restricted. There is a dire need of diet counselling and positive life style changes for these boxers to avoid risk in future life.

The weight, if reduced gradually, to compete on the top of lower weight category does not affect grip strength and endurance which are directly associated with boxing performance. However, to gain benefits with respect to strength and endurance, the boxers should reduce weight from fat. Weight management both during season and off-season should be taken care of by judicious diet and continuos training to avoid long term debilitating effects on health.

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