

Anthropometric Profile of Adult Women as Influenced by Dietary Protein and Exercise

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KEYWORDS High Protein Diets. Body Weight. Body Mass Index. Waist Circumference. Hip Circumference. Adult Women

ABSTRACT The study was conducted to determine the effect of dietary protein and exercise on anthropometric measurements during a weight loss regimen. Sixty-one female employees of Punjab Agricultural University, Ludhiana with Body Mass Index (BMI) in the range of 25-35 kg/m² participated in the study. Culturally accepted hypocaloric (1300-1400 kcal) normal and high protein diets were designed. The subjects were divided into four groups viz. Control, Normal Protein (NP) with 12-15% protein and CHO/Protein ratio of 3.0-3.5, High Protein (HP) with 25-30% protein and CHO/Protein ratio of 1.5-2.0 and High Protein + Exercise (HP+E) with 25-30% protein and CHO/Protein ratio of 1.5-2.0 + Exercise. A significant ($p \leq 0.05$) increase in body weight of the subjects in control group was observed, however HP+E group showed a significant ($p \leq 0.05$) reduction in body weight after the completion of regimen. The Body Mass Index (BMI) of subjects in control group was increased by 1.6% while it was decreased by 1.7, 3.0 and 3.8% in NP, HP and HP+E groups, respectively. An increase in waist hip ratio was observed in control group by 1.4% but the experimental groups showed no change. The study highlighted that exercise along with high protein diet was effective to bring desirable body changes. The study recommended that the designed weight loss exercise regimens if followed properly over a period of time can prove helpful to attain appropriate body mass index.

INTRODUCTION

The most commonly used intervention to lose body mass in humans is restriction of energy intake. However, this approach is rarely successful in the long-term and the lost mass is often regained (Weiss et al. 2007). Generally, selection of a diet high in fiber, low in energy density and glycemic load, and moderate in protein is thought to be particularly important for weight control (Abete et al. 2010).

Proteins have significant role in designing weight loss regimens. According to Anderson and Moore (2004), proteins suppress food intake more than fats or carbohydrates and do so more than which can be accounted for by their energy content alone and also make a stronger contribution to satiety and delay the return of hunger compared with fat and carbohydrates. High-protein diets support the maintenance of lean body mass under circumstances of energy restriction, thereby promoting weight loss primarily as adipose tissue (Brehm and D'Alessio 2008).

Improving body composition by increasing the amount of lean body mass relative to fat

mass is goal of many people for the purpose of increasing physical performance and general health (Cook et al. 2013). Greater muscle mass is associated with increased strength and power, as well as better metabolic health and reduced risk for chronic disease (Volek et al. 2010). Exercise appears to play a critical role in body weight control management however, it is important to consider the duration, intensity and type of exercise that should be recommended for weight loss (Agbonlahor et al. 2009).

High-protein diets have recently been proposed as a "new" strategy for successful weight loss (Santesso et al. 2012). Physical activity in conjunction with moderate dietary energy restriction and behavior modification can be an important component of a successful weight-loss regimen. The present study is an attempt to determine the influence of high protein diet along with exercise on anthropometric parameters during a weight reducing regimen designed for adult women.

MATERIAL AND METHODS

The volunteer women faculty and non-faculty of Punjab Agricultural University, Ludhiana and in the age group of 35-55 years with Body Mass Index (BMI) in the range of 25-35 kg/m² were recruited to participate in the study via wide

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circulation regarding importance of dietary protein and exercise to reduce body weight without losing muscle mass. A total of 61 subjects were enrolled in the study. The subjects were given option to choose one out of three regimens mentioned below according to their preference:

- (a) Group I Normal Protein (NP): 1300-1400 kcal/d, 12-15% protein and CHO/Protein ratio of 3.0-3.5.
- (b) Group II High Protein (HP): 1300-1400 kcal/d, 25-30% protein and CHO/Protein ratio of 1.5-2.0.
- (c) Group III High Protein + Exercise (HP+E): 1300-1400 kcal/d, 25-30% protein and CHO/Protein ratio of 1.5-2.0 + Exercise.

The subjects were asked to follow the regimen for three months. A control group with matched BMI and age with no intervention was also studied parallel to interventional groups.

Normal and high protein hypocaloric diets with specified quantities of culturally accepted foods were designed for selected vegetarian and non-vegetarian subjects. The diets were designed keeping in mind the meal pattern, food habits and preferences of the group as studied by Kaur (2011). The designed diets met the requirements of other essential nutrients as per RDA of ICMR (2010).

During the trial, the subjects attended one meeting each week at Nutrition Research Laboratory of Department of Food and Nutrition with the researcher who provided information about diet and exercise, answered questions and reviewed diet/exercise records for regimen compliance. Continuous motivation to the subjects was made during the meetings. The subjects were given food/exercise check off logs to document adherence to the diet and exercise schedule. The logs were evaluated at the end of 4, 8, 12 weeks. The level of difficulty faced by the subjects in three groups during the adoption of designed diets was assessed by using a 6-point scale.

The subjects were guided to follow the designed diets for at least 5 days a week for achieving desirable results. The exercise schedule in consultation with a professional exercise trainer was designed for the subjects who chose the exercise group. The schedule included 20 min walk at least 5 days a week with 2 sessions per week of resistance/stretch exercises.

Basic anthropometric measurements such as height, waist and hip circumference measure-

ments were taken using standard methods. The body weight of the subjects was taken by TANI-TA Body Composition Analyzer BC-420MA. The derived anthropometric measurements *viz.* body mass index and waist and hip ratio were calculated.

Mean and standard deviation for various parameters were computed. Paired t-test was used to determine significant changes in various parameters of anthropometry after the completion of regimens in each of three experimental groups i.e. Normal Protein (NP), High Protein (HP) and High Protein + Exercise (HP + E) as well as Control group. Analysis of variance was employed to assess the significant differences between control, NP, HP and HP + E groups. The paired t-test and analysis of variance was derived using Microsoft excel (2003) statistical analysis tool pack.

RESULTS AND DISCUSSION

The initial and final values of basic and derived anthropometric measurements of subjects in Control, NP, HP and HP+E groups have been shown in Table 1. The percent changes in anthropometric measurements are shown in Table 2.

The initial body weight of Control, NP, HP and HP+E groups was 72.4, 75.4, 73.0 and 74.4 kg, however it was 73.9, 73.8, 70.8 and 71.5 kg, respectively after the completion of the regimen. The changes in weight were observed in control as well as three experimental groups. An increase of 2.1% was observed in control group, whereas, reduction of 2.1, 3.0 and 3.9% was observed in NP, HP and HP+E groups, respectively after the intervention. A significant ($p \leq 0.05$) increase in body weight of the subjects in control group was observed after the completion of regimen, however HP+E group showed a significant ($p \leq 0.05$) reduction in body weight after the completion of regimen. The average height of subjects in Control, NP, HP and HP+E groups was 160.3, 160.5, 158.2 and 167.9, respectively. The Body Mass Index (BMI) of the subjects calculated from their body weights and height was 28.2, 29.2, 29.2 and 26.6 kg/m² before the intervention while it was 28.7, 28.7, and 25.6 28.3 kg/m², respectively in the four groups. The BMI was increased by 1.6% in Control group, while it was decreased by 1.7, 3.0 and 3.8% in three experimental groups namely NP, HP and HP+E groups,

Table 1: Anthropometric measurements of the subjects in Control, Normal Protein (NP), High Protein (HP) and High Protein + Exercise (HP+E) groups (N = 61)

Anthropometric measurements	Control (n = 16)		NP (n = 15)		HP (n = 16)		HP+E (n = 14)		t values	t values		
	Initial	Final	Initial	Final	Initial	Final	Initial	Final				
<i>Basic</i>												
Weight, kg	72.4±8.5	73.9±9.2	2.90*	75.4±8.2	73.8±8.8	0.2 NS	73.0±8.5	70.8±7.4	0.0002 NS	74.4±7.1	71.5±7.3	4.0**
Height, cm	160.3±7.8			160.5±6.0			158.2±2.9			167.9±4.3		
Waist circumference, cm	93.8±9.0	93.7 ±9.1	0.20 NS	94.4±6.3	93.6±7.1	0.29 NS	94.0±8.9	93.9±7.9	0.4 NS	91.3±12.9	88.6±9.3	0.03 NS
Hip circumference, cm	111.1±5.9	109.4±6.9	0.05 NS	111.2±7.7	110.7±7.4	0.01 NS	114.1±5.4	110.2 ±6.1	0.04 NS	108.0±9.5	107.5±8.5	0.1 NS
<i>Derived</i>												
Body mass index, kg/m ²	28.2±3.0	28.7±3.1	0.01 NS	29.2±2.3	28.7±3.0	0.2 NS	29.2±3.2	28.3±2.8	0.0001 NS	26.6±4.0	25.6±4.1	1.8 NS
Waist and hip ratio	0.8±1.5	0.9±1.3	0.10 NS	0.8±0.8	0.8±1.0	0.65 NS	0.8±1.6	0.8±1.3	0.43 NS	0.8±1.3	0.8±1.1	0.02 NS

* Significant at 5%

** Significant at 1%

NS - Non Significant

Table 2: Changes in anthropometric measurements of the subjects in Control, Normal Protein (NP), High Protein (HP) and High Protein + Exercise (HP+E) groups (N = 61)

Anthropometric measurements	Control (n = 16)		NP (n = 15)		HP (n = 16)		HP+E (n = 14)		Change %	Change %		
	Initial	Change %	Initial	Change %	Initial	Change %	Initial	Change %				
<i>Basic</i>												
Weight, kg	72.4±8.5	+1.5±0.7	+2.1	75.4±8.2	1.6±0.6	-2.1	73.0±8.5	-2.2±1.1	-3.0	74.4±7.1	2.9±0.2	-3.9
Waist circumference, cm	93.8±9.0	-0.1±0.1	-0.1	94.4±6.3	0.8±0.8	-0.9	94.0±8.9	-0.7±0.9	-0.7	91.3±2.9	-2.7±3.5	-3.0
Hip circumference, cm	111.1±5.9	-1.7±1.0	-1.6	111.2±7.7	-1.4±0.3	-1.3	114.1±5.4	-3.9±0.4	-3.4	108.0±9.5	-0.5±1.0	-0.5
<i>Derived</i>												
Body mass index, kg/m ²	28.2±3.0	+0.4±0.0	+1.6	29.2±2.3	-0.5±0.6	-1.7	29.2±3.2	-0.9±0.4	-3.0	26.6±4.0	-1.0±0.1	-3.8
Waist and hip ratio	0.8±1.5	+0.1±0.2	+1.4	0.8±0.8	0.0±0.2	NC	0.8±1.6	0.0 ±0.3	NC	0.8±1.3	0.0±0.2	NC

(-) denotes loss

(+) denotes gain

NC denotes No Change

respectively (Fig. 1). The meta analysis for weight change due to high protein and energy restricted diets revealed a greater weight loss of 1.21 kg (CI-1.88 to 0.57) and a greater decrease in BMI (-0.5 kg/m², CI-0.77 to 0.26) as reported by Santesso et al. (2012). The findings revealed that all the experimental groups showed reduction in weight and BMI, the maximum being in HP+E group followed by HP group indicating that high protein diets were effective in reducing body weights and the exercise enhanced the effect of HP diets.

Due et al. (2004) found that a fat-reduced diet high in protein seems to enhance weight loss and provide a better long-term maintenance of reduced intra-abdominal fat stores. Halton and Hu (2004) also suggested that high protein meals lead to a reduced subsequent energy intake and an increased weight loss and fat loss as compared to diets lower in protein. Ounis et al. (2008) showed that the combined program of diet restriction and individualized exercise training is necessary to improve body mass loss as well as metabolic parameters, in obese girls. An energy-restricted HP diet combined with resistance training achieved greater weight loss and more fa-

vorable changes in body composition (Wycherley et al. 2010). The results observed in the present study are in line with those reported in literature.

The initial waist circumference of the subjects in Control, NP, HP and HP+E was 93.8, 94.4, 94.0 and 91.1 cm while after the completion of regimen, it was 93.7, 93.6, 93.9 and 88.6 cm, respectively. The waist circumference of control and experimental groups showed a little reduction, the values being 0.1, 0.9, 0.7 and 3.0% for Control, NP, HP and HP+E groups, respectively. The results revealed that maximum reduction in waist circumference was observed in HP+E group followed by NP group. Santesso et al. (2012) showed a greater loss in waist circumference (-1.66 cm, CI-2.66 to 0.62) in higher compared with low protein diets. The initial values for hip circumference in control, NP, HP and HP+E groups were 111.1, 111.2, 114.1 and 108.0 cm and final values were 109.4, 110.7, 110.2 and 107.5, respectively. The hip circumference of the subjects was reduced by 1.6, 1.3, 3.4 and 0.5% in control, NP, HP and HP+E groups respectively after the completion of regimen. An increase in waist hip ratio was observed in control group

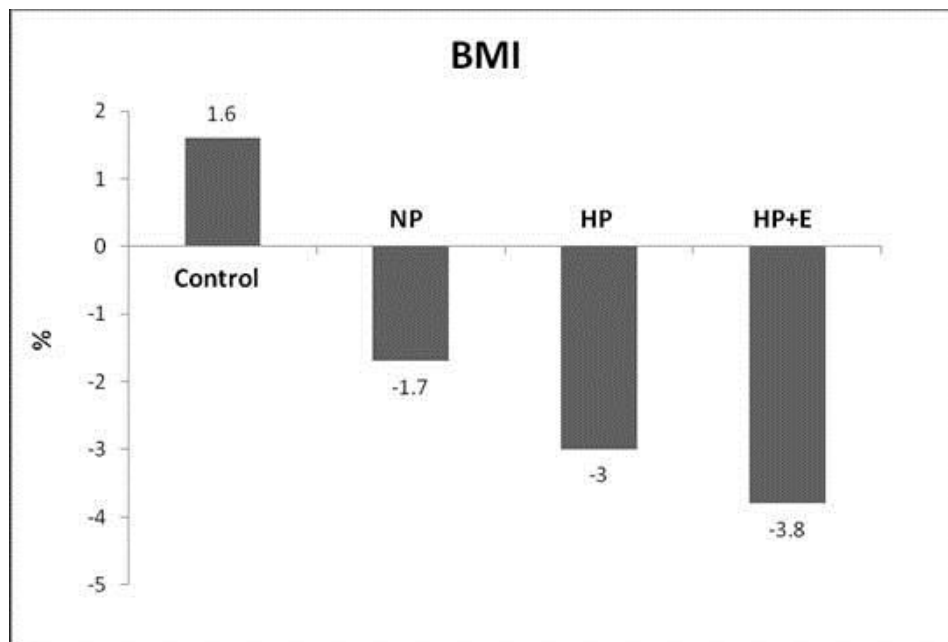


Fig. 1. Percent changes in Body Mass Index (BMI) of the subjects in Control, Normal Protein (NP), High Protein (HP) and High Protein + Exercise (HP+E) groups

by 1.4% and the experimental groups showed no change. Oliver et al. (2010) revealed that diet combined with resistance training promotes decrease in waist and hip circumferences. However, the results of present investigation showed little reduction in waist circumference but no change in hip circumference. A longer period of regimen may be needed to bring desirable changes in waist hip ratio.

CONCLUSION

The study concluded that hypocaloric high protein diets are more effective than hypocaloric diets with normal protein indicating that high protein in diet has positive effect in reducing body weight, however, exercise along with high protein but low calorie diet is the most effective measure to reduce body weight.

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