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## **Effect of Low Calories Diet to Decrease Weight of Obesity**

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**Abstract :** The main objective of the present study was to investigate the effect of restricted calories diets on the treatment of obesity by assessment of weight, body mass index, waist circumference, hip circumference and waist to hip ratio. The study included 90 obese female patients between 30 to 50 years old suffering "only" from obesity ( $BMI \geq 30 \text{ kg/m}^2$ ) followed in obesity and slim clinic in Cairo, Egypt for 12 weeks. Their diet was modified to provide 1250–1350 kcal. The patients were divided into 3 groups ( $n=30$ ) as follows: Group1 was taken a high carbohydrate low fat diet (HCLF) (70% Carbohydrate, 10% Fat and 20% protein), Group2 was taken a high fat low carbohydrate diet (HFLC) (35% Carbohydrate, 45% Fat and 20% protein) and Group3 was taken high protein low carbohydrate diet (HP LC) (30% Carbohydrate, 30% Fat and 40% protein). The results showed the weight of (HP LC) group decreased significantly ( $70.48 \pm 11.47 \text{ kg}$ ) compared with (HCLF) group ( $79.74 \pm 9.36 \text{ kg}$ ) and (HFLC) group ( $78.75 \pm 8.24 \text{ kg}$ ). The BMI of (HPLC) decreased significantly  $27.11 \pm 2.24 \text{ kg/m}^2$  compared with BMI of (HCLF)  $30.98 \pm 2.61 \text{ kg/m}^2$  and (HFLC)  $28.97 \pm 3.56 \text{ kg/m}^2$ . The waist circumference (WC) of (HFLC) and (HPLC) decreased significantly compared with (HCLF)  $103.84 \pm 6.79 \text{ cm}$ . Similar findings were recorded in the hip circumference. Total cholesterol (TC) significantly increased (HCLF) and decreased in (HFLC) and (HPLC). Similar findings were recorded with triglyceride (TG). The level of HDL significantly decreased in (HCLF) compared with (HFLC) and (HPLC) which increased significantly. The results of LDL increased significantly in (HCLF) compared with (HFLC) and (HPLC) which decreased

significantly. This study suggests that low-carbohydrate diets are the best effective than low-fat high carbohydrate diets at reducing weight. The Low-carbohydrate high protein diet is a safe and more effective option for medically supervised weight loss and body composition in severely obese cases.

**Key words:** Obesity, Overweight, Carbohydrate, Fats, Diet, Calories

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### **Introduction**

Overweight and obesity are defined as a process characterized by excessive accumulation of body fat with multiple organ specific consequences that could impair health (**WHO, 2011**). Obesity is an important public health problem worldwide (**Janghorbaniet al., 2007**). The increasing obesity prevalence all over the world has been attributed to industrialization and modernization which created an “obesogenic” environment that encourages sedentary lifestyle and increased calorie intake (**Bell et al., 2005**).

The WHO estimates that in 2005 approximately 1.6 billion people worldwide were overweight and that at least 400 million adults were obese. They further project that, by 2015, approximately 2.3 billion adults will be overweight and that at least 700 million will be obese (**Nguyen and El-Serag, 2010**). Obesity has reached particularly alarming levels in the Middle East and North Africa (MENA) region, especially in Egypt – one of the most populous countries in the world. By the 1990s, Egypt’s prevalence of female obesity (currently estimated at over 40%) had already exceeded that in Europe and the USA. At present, Egypt ranks among the top fifteen countries in the world in terms of age-adjusted diabetes prevalence (17%) and this has worrying capacity and cost implications for future health services (**Aitsi-Selmiet al., 2012**).

Obesity has become one of the major contributors to the global burden of disease and disability. It is one of the main risk factors for a number of life threatening non-communicable disease such as heart disease, type 2 diabetes, hypertension, stroke and certain types of cancers (endometrial, breast and colon) (**Kumanyikaet al., 2002**). About 2000 years ago, Hippocrates observed that death and illness is more common in those who are naturally fat than in the lean (**Bain, 2006**). The health outcomes range from increased risk of premature death to serious chronic conditions that reduce the overall quality of life. Each year, an estimated 300,000 adults in the United States die of causes related to obesity (**Misra, 2013**).

Overweight and obesity are associated with increased mortality and morbidity. Together, they may account for as many as 15–30% of

deaths from coronary heart disease (CHD) and 65–75% of new cases of type 2 diabetes mellitus. In addition, overweight and obesity are associated with an increased risk of disabling conditions such as arthritis, respiratory insufficiency, sleep apnea and impaired quality of life in general (**Seidell, 2005**). Cardiovascular diseases (heart disease and stroke) kill 17 million people globally each year and deaths due to diabetes are predicted to increase by more than 50% worldwide in the next ten years (**WHO 2011**). Obesity also contributes to debilitating conditions such as osteoarthritis, gall bladder disease and respiratory problems often reducing quality of life (**Amador et al., 2008**).

There has been a great deal of research conducted on various options for obesity treatment including nutrition counseling, exercise, cognitive-behavior management, pharmacological therapy and surgery. It is not at all clear whether obesity is a function of genetic predisposition, a response to environmental influences or a combination of both. Often the philosophy of why people are obese dictates the type of treatment that is recommended (**Reever, 2008**).

Increased physical activity is one way of counteracting excessive energy intake, but reducing this intake is also important (**Bessesen, 2008**). Many dietary regimens have been proposed as conducive to weight control, invoking various mechanisms including increased satiety (**Astrup et al., 2010**). The most popular among these diets emphasize reduction of carbohydrate intake, thereby encouraging high protein intake (**Astrup et al., 2004**), as high fat diets are generally avoided in most Western societies. A diet is high protein if it contains over 20% of total energy consumed as protein, and is very high protein if the protein content is greater than 30% of the total energy. A low-carbohydrate diet contains less than 40% of total energy from carbohydrate (**St Jeor et al., 2001**).

several studies have shown that lower energy-density foods such as fruits, vegetables, and whole grains lower energy intake because of increased satiety of the diet (**Ledikweet et al., 2006; Rolls et al., 2010**), that translates into lower BMI (**Bes-Rastrollo et al., 2008**). Trials showed weight loss in the short-term irrespective of whether the diet is low carbohydrate diet or balanced **Naude et al., (2014)**.

Low carbohydrate-high protein diets may have short term effects on weight control (**Bravata et al., 2003**). Although low carbohydrate-high protein diets may be nutritionally acceptable if the protein is mainly of plant origin and the reduction of carbohydrates applies mainly to simple and refined ones, the general public do not always recognize and act on these qualifications.

## **Subjects and Methods**

### **Subjects**

The present study was done on 90 obese female patients between 30 to 50 years old suffering "only" from obesity ( $BMI \geq 30 \text{ kg/m}^2$ ). They were selected among those attending the obesity and slim out patient's clinic, Cairo, Egypt and they were agreeing to involve in this study. The participants were provided with nutritional counseling for 12 weeks. Their diet was modified to provide 1250–1350 kcal. The patients were randomized either to three groups 40 patients in each as follows:

**Group1:** was taken a high carbohydrate low fat diet (HCLF) (70% Carbohydrate, 10% Fat and 20% protein).

**Group2:** was taken a high fat low carbohydrate diet (HFLC) (35% Carbohydrate, 45% Fat and 20% protein).

**Group3:** was taken high protein low carbohydrate diet (HP LC) (30% Carbohydrate, 30% Fat and 40% protein).

The educational brochure was given to each patient contain weight loss instructions and information about obesity and its risk. The Anthropometric measurement Weight, height, body mass index, Waist Circumference and Hip Circumference and Waist to Hip Ratio (WHR) were recorded for each case weekly. Fasting blood samples were obtained from each patient. The blood samples were divided into two parts; the 1<sup>st</sup> part was collected into heparinized tube to measure Automated Complete blood count (CBC). The 2<sup>nd</sup> part was centrifuged at 3500 rpm for 15 min to obtain serum to measure lipid profile. Serum total cholesterol level was assayed by the method of **Naito, (1984)**. The serum level of triglyceride was determined by **Fossati and Prencipe, (1982)**. Serum HDL-c was determined according to **Grove, (1979)**. The low density lipoprotein (LDL) and very low density lipoprotein (VLDL) was calculated using the formula of **Friedewald et al., (1972)**. Free T4 (Thyroxine) according to **Beck-Peccoz et al., (1984)**. Thyroid Stimulating Hormone (TSH) according to the method of **Uotila et al., (1981)**.

### **Results**

The effect of high carbohydrate low fat diet (HCLF), low carbohydrate high fat diet (HFLC) and low carbohydrate high protein diet (HPLC) on the weight of obese women shows that The mean of weight of group 3 (HPLC) decreased significantly to be  $70.48 \pm 11.47 \text{ kg}$  compared with the weight in group 1 (HCLF)  $79.74 \pm 9.36 \text{ kg}$  and group 2 (HFLC)  $78.75 \pm 8.24 \text{ kg}$ . Similar findings were found in BMI, which decreased significantly in group 3 (HPLC) to be  $27.11 \pm 2.24 \text{ kg/m}^2$  compared with of group 1 (HCLF)  $30.98 \pm 2.61 \text{ kg/m}^2$  and group 2 (HFLC)  $28.97 \pm 3.56 \text{ kg/m}^2$ .

Regarding to the results of waist circumference (WC); the WC means of group 2 (HFLC) and group 3 (HPLC) decreased significantly after of the study to be  $96.36 \pm 7.69$  cm and  $93.81 \pm 5.94$  cm, respectively) compared with group 1 (HCLF)  $103.84 \pm 6.79$  cm. The mean values of hip circumference HC of group 2 (HFLC) and group 3 (HPLC) decreased significantly to be  $101.32 \pm 5.73$  cm and  $99.04 \pm 4.86$  cm, respectively) compared with group 1 (HCLF)  $107.56 \pm 6.07$  cm. The results of waist to hip ratio (WHR) indicated that the WHR of group 2 (HFLC) decreased significantly after the study to be  $0.932 \pm 0.052$  compared with group 1 (HCLF)  $0.965 \pm 0.052$ , similar findings recorded in group 3 (HPLC)  $0.946 \pm 0.061$ .

The level of serum thyroid stimulating hormone (TSH) decreased slightly in groups 1 (HCLF) to be  $3.82 \pm 0.59$ ; while the level of TSH in group 2 (HFLC) and group 3 (HPLC) increased slightly compared with group 1. The results of serum free thyroxine fT4 showed slightly increased in group 1  $1.58 \pm 0.28$  ng/dL; while FT4 decreased slightly in group 2  $1.64 \pm 0.38$  ng/dL. Also group 3 (HPLC) decreased to be  $1.48 \pm 0.32$  ng/dL.

The results indicated that serum total cholesterol (TC) of group 1 (HCLF) significantly increased to be  $178.92 \pm 17.81$  mg/dl. However, the level of TC of group 2 (HFLC) decreased slightly to be  $172.84 \pm 28.56$  mg/dl at the end of the study; while the level of TC in group 3 (HPLC) decreased to be  $173.48 \pm 22.67$  mg/dl. Similar findings were recorded with the level of serum triglyceride (TG) which increased significantly in group 1 (HCLF) to be  $180.16 \pm 29.55$  mg/dl compared with group 3 (HPLC) which decreased to be  $150.85 \pm 19.81$  mg/dl. Also group 2 (HFLC) showed increased to be  $167.28 \pm 22.20$  mg/dl compared with groups 3.

In concerning with the level of serum high density lipoprotein (HDL); It was recorded significantly decreased in group 1 (HCLF) to be  $44.52 \pm 8.17$  mg/dl compared with group 2 (HFLC) which increased significantly to be  $49.18 \pm 9.83$  mg/dl; also the level of HDL in group 3 (HPLC) increased significantly to be  $54.76 \pm 10.09$  mg/dl compared with group 1.

The results of serum low density lipoprotein (LDL) increased significantly in group 1 (HCLF)  $98.37 \pm 20.13$  mg/dl compared with group 2 (HFLC) which decreased significantly to be  $90.40 \pm 35.05$  mg/dl. Similar findings also recorded in group 3 (HPLC). Very low density lipoprotein (VLDL) level increased significantly in group 1 (HCLF) to be  $36.03 \pm 5.86$  mg/dl compared with group 3 (HPLC) which decreased to be  $30.17 \pm 3.95$  mg/dl. Also group 2 (HFLC) showed slightly increased to be  $33.46 \pm 4.10$  mg/dl compared with groups 3.

The results of hemoglobin indicated that significant improvement in hemoglobin (Hb) level in group 3 (HPLC) to be  $14.47 \pm 1.29$  g/dl compared with both group 1 (HCLF) which decreased to be  $12.98 \pm 2.04$  g/dl and group 2 (HFLC) which  $13.34 \pm 1.77$  g/dl. The RBCs level increased significantly in group 3 (HPLC) to be  $5.01 \pm 0.63$  mm<sup>3</sup> compared with both group 1 (HCLF)  $4.48 \pm 0.67$  mm<sup>3</sup> and group 2 (HFLC)  $4.45 \pm 0.84$  mm<sup>3</sup>. The results of hematocrit of group 3 (HPLC) increased to be  $46.36 \pm 5.58$  % compared with group 1 (HCLF) which decreased to be  $45.19 \pm 4.38$  %; also group 2 (HFLC) decreased to be  $47.78 \pm 3.90$  %.

The results of MCH, showed improvement in group 3 (HPLC) to be  $29.67 \pm 3.38$  g/dL compared with group 1 (HCLF) which decreased to be  $28.33 \pm 2.65$  g/dL; also the result of group 2 (HFLC) decreased to be  $28.52 \pm 3.57$  g/dL. The results of MCV of group 3 (HPLC) increased significantly to be  $86.22 \pm 5.32$  fL compared with group 1 (HCLF) which decreased to be  $80.30 \pm 7.30$  fL. However the results of group 2 (HFLC) decreased to be  $81.10 \pm 6.36$  fL. However the platelets level of group 3 (HPLC) increased significantly to be  $280.28 \pm 44.92$  mm<sup>3</sup> compared with group 1 (HCLF) which decreased to be  $269.32 \pm 47.85$  mm<sup>3</sup>; also the platelets of group 2 (HFLC) was significantly decreased to be  $247.40 \pm 45.36$  mm<sup>3</sup> compared with groups 1 and 3.

**Table (1):** Effect of high carbohydrate low fat diet (HCLF), low carbohydrate high fat diet (HFLC) and low carbohydrate high protein diet (HPLC) on anthropometric measurements of obese women

	Group 1 (HCLF)		Group2 (HFLC)		Group3 (HPLC)	
	Before	After	Before	Before	After	Before
<b>Weight (kg)</b>	$88.78 \pm 10.33^a$	$79.74 \pm 9.36^a$	$90.40 \pm 9.76^a$	$88.78 \pm 10.33^a$	$79.74 \pm 9.36^a$	$90.40 \pm 9.76^a$
<b>BMI (kg/m<sup>2</sup>)</b>	$33.87 \pm 2.68^a$	$30.98 \pm 2.61^a$	$34.76 \pm 3.37^a$	$33.87 \pm 2.68^a$	$30.98 \pm 2.61^a$	$34.76 \pm 3.37^a$
<b>WC (cm)</b>	$110.88 \pm 7.94^a$	$103.84 \pm 6.79^a$	$107.28 \pm 7.81^a$	$110.88 \pm 7.94^a$	$103.84 \pm 6.79^a$	$107.28 \pm 7.81^a$
<b>HC (cm)</b>	$112.68 \pm 5.47^a$	$107.56 \pm 6.07^a$	$109.87 \pm 6.72^a$	$112.68 \pm 5.47^a$	$107.56 \pm 6.07^a$	$109.87 \pm 6.72^a$
<b>WHR</b>	$0.992 \pm 0.073^{ab}$	$0.965 \pm 0.052^a$	$0.976 \pm 0.058^b$	$0.992 \pm 0.073^{ab}$	$0.965 \pm 0.052^a$	$0.976 \pm 0.058^b$

\*Values are means  $\pm$  SD

\*\* The mean difference is significant at the 0.05 level.

**Table (2):**Effect of high carbohydrate low fat diet (HCLF), high fat low carbohydrate diet (HFLC) and high protein low carbohydrate diet (HPLC) on serum thyroid stimulating hormone (TSH) and free thyroxine (T4) of obese women

	<b>Group 1 (not treated)</b>		<b>Group2 (Iron Drug S)</b>		<b>Group3 (Iron Natural S)</b>	
	Before	After	Before	Before	After	Before
<b>TSH (ng/dL)</b>	3.85± 0.53 <sup>a</sup>	3.82± 0.59 <sup>a</sup>	2.95± 0.47 <sup>b</sup>	3.85± 0.53 <sup>a</sup>	3.82± 0.59 <sup>a</sup>	2.95± 0.47 <sup>b</sup>
<b>T4 (µU/mL)</b>	1.53± 0.41 <sup>a</sup>	1.58± 0.28 <sup>a</sup>	1.67± 0.31 <sup>a</sup>	1.53± 0.41 <sup>a</sup>	1.58± 0.28 <sup>a</sup>	1.67± 0.31 <sup>a</sup>

\*Values are means ± SD

\*\* The mean difference is significant at the 0.05 level.

**Table (3):**Effect of high carbohydrate low fat diet (HCLF), high fat low carbohydrate diet (HFLC) and high protein low carbohydrate diet (HPLC) on serum total cholesterol (TC), triglyceride (TG), HDL-C, LDL-C and VLDL of obese women

	<b>Group 1 (HCLF)</b>		<b>Group2 (LCHF)</b>		<b>Group3 (LCHP)</b>	
	Before	After	Before	After	Before	After
<b>TC (mg/dl)</b>	164.36± 27.49 <sup>b</sup>	178.92± 17.81 <sup>a</sup>	175.68± 23.44 <sup>ab</sup>	172.84± 28.56 <sup>a</sup>	178.56± 20.24 <sup>a</sup>	173.48± 22.67 <sup>a</sup>
<b>TG (mg/dl)</b>	171.32± 26.02 <sup>a</sup>	180.16± 29.55 <sup>a</sup>	164.68± 31.78 <sup>ab</sup>	167.28± 22.20 <sup>b</sup>	158.20± 30.41 <sup>b</sup>	150.85± 19.81 <sup>c</sup>
<b>HDL (mg/dl)</b>	53.24± 12.26 <sup>a</sup>	44.52± 8.17 <sup>c</sup>	45.04± 10.79 <sup>b</sup>	49.18± 9.83 <sup>b</sup>	50.64± 10.81 <sup>a</sup>	54.76± 10.09 <sup>a</sup>
<b>LDL (mg/dl)</b>	76.86± 29.60 <sup>b</sup>	98.37± 20.13 <sup>a</sup>	97.71± 31.82 <sup>a</sup>	90.40± 35.05 <sup>b</sup>	96.28± 25.74 <sup>a</sup>	88.55± 25.11 <sup>b</sup>
<b>VLDL (mg/dl)</b>	34.26± 3.51 <sup>a</sup>	36.03± 5.86 <sup>a</sup>	32.93± 3.36 <sup>ab</sup>	33.46± 4.10 <sup>b</sup>	31.64± 4.08 <sup>b</sup>	30.17± 3.95 <sup>c</sup>

\*Values are means ± SD

\*\*The mean difference is significant at the 0.05 level.

**Table (4):**Effect of high carbohydrate low fat diet (HCLF), high fat low carbohydrate diet (HFLC) and high protein low carbohydrate diet (HPLC)on complete blood count (CBC) of obese women

	Group 1 (HCLF)		Group2 (HFLC)		Group3 (HPLC)	
	Before	After	Before	After	Before	After
<b>Hemoglobin (g/dL)</b>	13.54± 1.87 <sup>b</sup>	12.98± 2.04 <sup>b</sup>	14.21± 1.95 <sup>a</sup>	13.34± 1.77 <sup>b</sup>	12.99± 2.24 <sup>b</sup>	14.47± 1.29 <sup>a</sup>
<b>RBCs (mm<sup>3</sup>)</b>	4.59± 0.57 <sup>b</sup>	4.48± 0.67 <sup>b</sup>	4.72± 0.74 <sup>a</sup>	4.45± 0.84 <sup>b</sup>	4.30± 0.46 <sup>b</sup>	5.01± 0.63 <sup>a</sup>
<b>Hematocrit %</b>	47.12± 3.03 <sup>a</sup>	45.19± 4.38 <sup>a</sup>	48.12± 3.18 <sup>a</sup>	47.78± 3.90 <sup>a</sup>	44.53± 4.62 <sup>a</sup>	46.36± 5.58 <sup>a</sup>
<b>MCH (g/dL)</b>	29.28± 3.74 <sup>a</sup>	28.33± 2.65 <sup>a</sup>	30.11± 4.69 <sup>a</sup>	28.52± 3.57 <sup>a</sup>	27.74± 2.78 <sup>b</sup>	29.67± 3.38 <sup>a</sup>
<b>MCV (fL)</b>	83.11± 9.48 <sup>a</sup>	80.30± 7.30 <sup>b</sup>	85.28± 8.52 <sup>a</sup>	81.10± 6.36 <sup>b</sup>	81.23± 7.31 <sup>b</sup>	86.22± 5.32 <sup>a</sup>
<b>Platelets (mm<sup>3</sup>)</b>	272.60± 52.60 <sup>a</sup>	269.32± 47.85 <sup>b</sup>	275.36± 56.59 <sup>a</sup>	247.40± 45.36 <sup>c</sup>	262.96± 41.27 <sup>a</sup>	280.28± 44.92 <sup>a</sup>

\*Values are means ± SD

\*\* The mean difference is significant at the 0.05 level.

## Discussion

Obesity is a major public health crisis in the United States. Diet strategies for successful long-term weight loss and maintenance remain relatively untested. High-carbohydrate, low-protein, low fat (CHO) diets are often recommended for weight management. Reduced energy intake has long been known to increase longevity in animals and is likely to be beneficial for most persons in economically developed societies (Amador *et al.*, 2008).

The prevalence of overweight (BMI between 25 and 29.9 kg/m<sup>2</sup>) and obesity (BMI ≥ 30 kg/m<sup>2</sup>) among US adults has increased dramatically over the past few decades with currently 34 and 68% of the population, respectively, either obese or overweight/obese (Aitsi-Selmiet *al.*, 2012). Overweight and obesity are associated with high prevalence of metabolic syndrome, a group of risk factors including hypertension, hyperlipidemia, hyperglycemia, and central obesity (Seidell, 2005).

Dietary energy restriction is an effective means to lose weight. Among myriad energy-restricted diets, higher-protein diets (>25% of



energy from protein) are recommended and promoted because they may suppress appetite and help preserve lean body mass, which may lead to a corresponding retention of resting energy expenditure (REE) (**Astrup et al., 2004**).

Weight control is desirable for both medical and aesthetic reasons and diets conducive to weight reduction or weight control have become popular. Many of these diets emphasize reduction of carbohydrate intake and thereby encourage high protein intake, given that, in Western countries, high fat diets are also generally avoided (**Astrup et al., 2004**). Low-carbohydrate, high-protein, high-fat diets (referred to as low-carbohydrate diets) have been compared with low-fat, energy-restricted diets. Several controlled trials showed more weight loss with a low carbohydrate diet than the control diet in the first 6 months but no difference at 12 months. In two head-to-head comparisons of four popular diets, the average weight loss at 6 and 12 months was the same (**Dansinger et al., 2005; Gardner et al., 2007**). Low carbohydrate (LC) diet the best predictor of weight loss for each of the diets was the degree of adherence to the diet (**Cassady et al., 2007**). Low carbohydrate diets have also demonstrated greater loss of fat mass and in particular trunk fat mass, than low fat diets (**Voleket et al., 2004**).

The optimal study for assessing the health effects of a low carbohydrate diet would be a high compliance randomized trial lasting several years and comparing this diet with a usual or a healthy diet. Such a study, however, appears to be unrealistic. Two observational studies have been recently published. In one of them, undertaken in a cohort of female USA nurses, no association between coronary heart disease and diets lower in carbohydrate and higher in protein and fat was found (**Ruth et al., 2013**).

Epidemiologic studies also have suggested that diets high in complex carbohydrates and low in saturated fat may prevent cognitive decline. Together, this evidence suggests that an LCHF diet may adversely influence cognitive function. Considering the lack of well-controlled intervention studies, the purpose of the present study was to compare the effects on mood and cognitive function of a moderately energy-restricted LCHF diet with those of an isocaloric, conventional HCLF diet in overweight and obese persons (**Naude et al., 2014**).

Low carbohydrate–high protein diets may have short term effects on weight control (**DeLany et al., 2014**). Recent studies have shown that diets with increased protein and reduced carbohydrates (PRO) are often more effective, at least for short-term weight loss. PRO diets with protein 1.4g/kg and carbohydrates, 150 g/d tend to increase weight and fat loss and reduce lean mass loss compared with CHO diets (**Savage et al., 2008; Vergnaud et al., 2009**). Although PRO diets appear beneficial

during periods of short-term weight loss, long-term compliance and effect on body weight and composition are unknown.

The results of the present study showed significant weight loss after 12 weeks of low carbohydrate high protein diet (HPLC). This was the best result than low carbohydrate high fat diet (HFLC) and high carbohydrate low fat diet (HCLF). Similar findings were found in BMI, which decreased significantly in (HPLC) more than (LCHF) and (HCLF) diets table (1).

**McAuley et al., (2006)**, compared low carbohydrate diets, which differed in fat and protein content, to high carbohydrate diets. After 6 months, low carbohydrate diets that varied in fat and protein content achieved similar and more superior reductions in body weight, body fat and waist circumference than a high carbohydrate diet. What was also observed by 12 months, there was a rapid regression towards baseline in the high fat group, whereas the high protein group was able to maintain the reductions achieved in the first 6 months.

**Ruth et al., (2013)**, determined the effects of a high fat low carbohydrate (HFLC) diet compared to a low fat high carbohydrate (LFHC) diet on the change in weight loss, cardiovascular risk factors and inflammation in subjects with obesity. The HFLC group had greater mean decreases in serum triglyceride, and hs-CRP, and greater mean increases in HDL cholesterol, and total adiponectin ( $P=0.045$ ) relative to the LFHC. **Tang et al., (2013)** compared the effects of normal and high protein diets towards improving body composition and the incidence of the metabolic syndrome. Results showed that the reductions in body weight and total fat mass were significant for both groups. Lean body mass was more significantly preserved in the HP group. Overweight subjects lost less lean body mass than obese subjects, independent of dietary protein content.

**Naude et al., (2014)**, compared the effects of low carbohydrate diet and isoenergetic balanced weight loss diets in overweight and obese adults assessed in randomized controlled trials (minimum follow-up of 12 weeks), and summarized the effects on weight, as well as cardiovascular and diabetes risk. Trials showed weight loss in the short-term irrespective of whether the diet is low carbohydrate diet or balanced.

The results of this study found no significant changes in the level of serum thyroid stimulating hormone (TSH) and free thyroxine FT4 which were in normal range as shown in table (2).

The results of present study reported that both diets (LCHF and LCHP) also improve lipid profiles compared with HCLF diet. Low-carbohydrate high fat diets resulted in reductions in total cholesterol ( $-2.84$  mg/dL) and LDL cholesterol ( $-7.31$  mg/dL) and an increase in

HDL cholesterol (4.14 mg/dL) from baseline to at least 3 months of follow-up. These findings are consistent with predicted changes associated with weight loss and reduced dietary intakes of total fat, SFA, and cholesterol (**Voleket et al., 2004; Krauss et al., 2006**). Also LCHP diet resulted in reductions in total cholesterol and triglycerides but greater reductions in LDL cholesterol and increases in HDL cholesterol as shown in table (3).

**Layman et al., (2003)** reported that The LCHP diet resulted in increased fat loss, greater improvement in body composition (greater reduction in fat mass (FM) and attenuated loss of lean mass), reduced triglycerides (TAG), and increased HDL cholesterol (HDL-C). Also **Layman et al., (2008)** found The PRO diet also improved blood lipids but with great effects on the characteristics of atherogenic dyslipidemia. Similar findings were reported by **Bazzano et al., (2014)** examined the effects of a low-carbohydrate diet compared with a low-fat diet on body weight and cardiovascular risk factors for 12 months. This study showed the low-carbohydrate diet was more effective for weight loss and cardiovascular risk factor reduction than the low-fat diet.

This study suggests that low-carbohydrate high fat diet (LCHF) and low carbohydrate high protein diets (LCHP) are the best effective than low-fat high carbohydrate diets for reducing weight and improving body fat. The Low-carbohydrate high protein diet is a safe and more effective option for medically supervised weight loss and body composition in severely obese cases.

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