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Effect of consumption supplemented strained yoghurt with vegetables on reducing weight of obese women samples

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Abstract

Obesity during adulthood is a public health problem in modern society, and increasingly universal disease that is turning into an epidemic one. The main cause of the excessive deposition of fat is the destruction of the systems controlling the expenditure of energy. Pathological increase of mass fat leads to disorders of the body, and lipid-carbohydrate parameters, raise the development of vascular diseases and increases the risk of morbidity and mortality. A substantial body of data has elicited over the last five years to show that dairy foods especially low-fat yogurt modulate weight loss and has some unique properties that may enhance its role in maintenance of healthy weight. Regular physical activity is an important as what we eat for losing, maintains weight and keeping our heart healthy. Being active helps burn calories, tone our muscles and control our appetite. The aim of this study is to demonstrate the impact of diet which was restricted in its energy by consuming concentrated yogurt daily and physical activity changes in the body weight, body mass index, and in the parameters lipid- cholesterol of women's adulthood. Low-fat yogurt, restricted energy consumption with at least three times exercises weekly inversely associated with body weight, BMI, and WC (all $p< 0.05$). Also, consumption of low-fat yogurt and exercising daily was associated inversely with blood glucose, cholesterol and lipid parameter (all $p< 0.05$). Within a sample of obese adults women, consumption of low-fat dairy product and increases the physical activity with restricted energy ingestion was associated with more favorable body composition.

Keywords: Obesity, diet-yogurt, physical activity, BMI-blood lipid, parameters

Introduction

People who are overweight and obesity for a long time lead to increase high pressure or diabetes, which are both risk factors for heart disease and stroke (WHO, 2012). The prevalence of overweight and obesity has increased dramatically around the whole world. Thus, weight control is a national and global priority. Diet plays a key role in long-term maintenance of body weight and body composition (Lichtenstein, et al. 2006), but apart from affecting energy balance, we still have a limited understanding of the specific food, nutrients, and other dietary components which might affect weigh maintenance. Many studies have demonstrated that consuming a high milk protein, low fat diet has many health benefits including weight management, maintaining lean muscle mass, healthy aging, control of obesity, and prevention of Sarcopenia. High protein content in strained yogurt is considered to be an important factor in its wide consumer acceptance. It has been concluded that the consumption of dairy product may improve body weight and fat loss (Barr, S. I. 2003), due to its contents of calcium, protein (casein and whey), minerals, and other bioactive compounds that may affect energy balance. It was been concluded that Iso-caloric substitution of yogurt for other foods significantly increased fat loss and reduced central adiposity during energy restriction (Zemel, et al. 2005). In contrast, meta-analysis does not support the beneficial effect of increasing dairy consumption on body weight and fat loss in long-term studies without energy restriction. However, dairy products may have modest benefits in improving weigh loss in short-term or energy restricted (Chen, et al. 2012).

Particularly, yogurt is prepared by adding healthy bacteria to milk, causing fermentation, due to the transformation of lactose into lactic acid. Yogurt also has more lactic acid and galactose but less lactose than milk (Wang, et al. 2013).The process gives yogurt its tart flavor, creamy texture, and also contributes to its many health benefits mainly: ensuring proper digestion, absorption of nutrients, and immune system. The difference in the process between regular yogurt and strained yogurt is that regular yogurt is strained through cheesecloth twice-three times, removing more of the whey part of the milk. Strained yogurt has a thicker consistency as a result, high protein content for a similar calorie count. In addition of that, yogurt has higher concentration of specific peptides and free amino acids than milk (Shahani, and Chandan 1979). The high protein content helps to

control hunger for those are cutting calories or managing their weight. Since the straining process removes some of the lactose, strained yogurt is lower in sugar (Mother Jones Retrieved 2010).Also, the lower carbohydrate in strained yogurt, a benefit for those on carbohydrate-controlled diet in managing diabetes and obesity (Palm, 2006). The available relevant literature concluded that yogurt facilitated the regulation of energy balance. This can be explained by the fact that yogurt consumption may reduce the intake of energy-dense foods that favor hyperphagia. Some studies have also contributed the potential of yogurt nutrients such as calcium and protein to influence appetite control. In addition, the flexibility of yogurts structure enables it to accommodate supplementation of ingredients, e.g., fibers and bacteria that also have the potential to promote negative energy balance. These effects are likely the main determinants of the observed weight loss of several kilograms documented in yogurt consumers tested in clinical interventions and observational studies (Angelo, et al. 2015).

The purpose of this study is to show the effect of daily consumption of stained yogurt supplemented with vegetables and restricted food on the management and maintenance of body weight and composition.

Materials and methods

Two measures important for evaluating overweight and total body fat content are: determining body mass index (BMI) and measuring waist circumference.

1-Body Mass Index (BMI): BMI, which show the relative weight for height, is significantly correlated with total body fat content. So that, BMI should be used to assess overweight and obesity and to monitor changes in body weight. BMI is calculated as weight (kg) over height (m^2). Weight classification by BMI, selected for use in this study, are shown in the table below.

Table 1: Classification of overweight and Obesity by BMI

	Obesity Class	BMI (kg/m^2)
Underweight		**< 18.5**
Normal		**18.5-24.9**
Overweight		**25.0-29.9**
Obesity	**I**	**30.0-34.9**
	II	**35.0-39.9**
Extreme Obesity	**III**	**40**

Source adapted from): Preventing and Managing the Global Epidemic of Obesity. Report of the world Health Organization Consultation of Obesity. WHO, Geneva. June 1997.

2-Waist Circumference: The presence of excess fat in the abdomen out of proportion to total body fat is an independent predictor of risk factors and morbidity. Waist circumference is positively correlated with abdominal fat content. Also, it provides a clinically acceptable measurement for assessing a patient's abdominal fat content before and during weight loss treatment (MedStar Family Choice).

High Risk
Men: > 102 cm (40 in)
Women: > 88 cm (> 35 in)

Assessment of Risk Status

Risk status should be assessed by determining the degree of overweight or obesity based on BMI, the presence of abdominal fat based on WC, and the presence of concomitant of chronic Heart Disease (CHD) risk factors or comorbidities.

***Table 2: Classification of Overweight and Obesity by BMI, WC, and Associated Disease Risk**

	BMI (kg/m^2)	Obesity Class	Disease Risk Relative to Normal weight and Waist Circumference	
			Men 102cm Women 88cm	Men > 102cm Women > 88cm
Underweight	<18.5			
Normal+	18.5-24.9			
Overweight	25.0-29.9		Increase	High
Obesity	30.0-34.9	I	High	Very High
	35.0-39.9	II	Very High	Very High
Extreme Obesity	40	III	Extremely High	Extremely High

***Disease risk for type 2 diabetes, hypertension, and CHD.**

+Increase waist circumference can be a marker for increased risk even in persons of normal weigh.

Other Risk Factor

Physical inactivity

A lack of physical activity imparts an increased risk for both CHD and type 2 diabetes. Physical inactivity enhances the severity of other risk factors, but also has been shown to be an independent risk factor for all-cause mortality or cardiovascular Disease (CVD) mortality.

High triglycerides

In obese patients, elevated serum triglycerides are a marker for increased cardiovascular risk.

Table 3: Classification of Overweight and Obesity by Triglycerides profile.

Category	Serum Triglyceride Level
Normal triglycerides	Less than 200mg/dl
Borderline-high triglyceride	200-400mg/dl
High triglyceride	400-1,000mg/dl
Very High triglyceride	> 1,000mg/dl

Patients with very high triglycerides are at increased risk for acute pancreases and must undergo immediate triglyceride lowering therapy.

Study design

This study was designed to determine whether a fermented strained yogurt will accelerate weight and fat loss induced by caloric restriction and daily physical activity in 40 otherwise healthy obese adult (women). The study was performed on the group of women at the age of 30-60 years with substantial obesity (n= 40) also. Sample was rehabilitated for 2-week period on low-calorie diet and intense physical activity were applied to establish their current caloric requirements and provide an opportunity for baseline dietary regimens for about 3-months (about 13-week): (1) a control diet providing a 500 kcal/day deficit, 0-1 servings of dairy products/day and 400-500 mg calcium; or (2) a strained yogurt diet providing a 500 kcal/day deficit and containing three daily 7-ounce serving of a local fat-free strained yogurt (Labania), to bring the total calcium intake from 500-1100 mg/day. All calcium in both diets was derived from food sources.

Ladies were provided individual instruction, counseling and assessment from the study dietitian regarding dietary adherence and the development and reinforcement for continued success; although the diets were given to achieve a 500 kcal/person/day deficit, comparable advice was given to ladies in both treatment groups and diet

were monitored weekly. In addition of that, all ladies maintained complete diet diaries, and compliance was assessed by weekly subject interview and review of the diet diary product. The meals contained vegetables and fruits, the main source of vitamins, mineral salt and fiber. The proteins in the diet were derived from milk, dairy products, poultry and fish. The total cholesterol in daily ration was not more than 300mg. Essential fatty acid was derived from vegetable oils as shown in table 4. Physical activity had been exercised three times/week monitored by specialist trainers at the body fitness club in our university, they were performing 30-minutes exercise on a cycloergometer, each at an individually matched load to 70% of Vo2max at frequency of 60/min. Also, each day women were advised performing 2-hours walk and 1-hour sport activities (game sports, swimming) the exercise for the rest of the week been done at home.

Body weight and waist circumference were measured monthly, with subjects wearing street clothes with no shoes, outwear or accessories. Body fat was measured at the beginning and at the ending of the study (after 12-weeks). Blood pressure, fasting levels of glucose, and lipids (triglycerides, HDL, LDL, and cholesterol) were measured at the same time points (baseline and after week 12).

Kcal	Protein		Fat		Carbohydrate		Fiber
	energy %	gm	% energy	gm	%energy	gm	gm
1300	21.1	66.5	24.0	33.3	54.9	176.9	31.18

BMI Assessment

Body weight was measured with a calibrated scale and height measured with a wall-mounted stadiometer with subjects in street clothes with no outwear or shoes. BMI was calculated via standard equation (kg/m2). Waist circumferences were measured in the standing position, with measurements obtained midway between the lateral lower rib margin and the iliac crest. The measurements were taken mid-exhalation, and the average of two readings was recorded.

Plasma glucose was determined using a glucose oxidase method via standard radioimmunoassay using commercially available kits (Lico Res. Inc., St Charless, MO, USA).

Fasting lipid profiles (cholesterol, LDL, HDL, and triglyceride) were measured using standard clinical techniques.

Statistical analysis

The Statistical Analysis System- SAS (2012) was used to effect of different factors in study parameters. Chi-square test was used to significant compare between percentage & Least significant difference –LSD test was used to significant compare between means in this study.

Results and Discussion

A result of this study shows the overall distribution of the percent of the overweight and obesity among the sample before and after the dietary restriction regimens, yogurt consumption and physical activity as in table 4. It was found the percent of underweight, normal, overweight, obesity I, obesity II, and obesity III women before the experiment were 2, 24, 30, 24, 20, and 0 respectively, these finding are similar to (Hamdia, 2013) for the prevalence of overweight and obesity in women. While after consumption the concentrated low-fat yogurt and exercising at least 3 times weekly the percent of underweight, normal, overweight, obesity I, obesity II, and obesity III women after the experiment were significantly decreased 0, 40, 24, 20, 16 and 0. This result is comparable to Zemel, et al. (2005) who concluded that Isocaloric substitution of yogurt for other foods significantly augments fat loss and reduce central adiposity during energy restriction. In other hand it has been shown that yogurt consumption and physical activity enhances and maintenance the weight, so it was been clear in the following table the percent of under-weight increased to zero, while at the beginning of the experiment was 2. Also, the percent of normal weight increased to 40, which was been 24 before the exp., this may be due to high-protein snacks like yogurt improves appetite control, satiety, and reduces subsequent food intake in healthy women (Laura, et al. 2014). In contrary of that, the percent of all kind obesity decreased significantly at the end of the experiment as shown clear in table 4, and this attributed may be due to additional dairy bioactive

compounds, such as angiotensin converting enzyme inhibitors, which may act on the adipocyte renin-angiotensin system, as well as to the concentration of branched-chain amino acids in dairy food (Zemel, et al. 2003).

Dairy intake may have an anti-obesity effect. Even if dairy intake does not protect subjects from overweight, dairy products are widely recognized as good sources of calcium and other micronutrients necessary to promote bone health to help reduce the risk of chronic diseases like osteoporosis and to promote overall health (Laura, et al. 2015).

Table 4: shows the distribution of the % of Overweight and Obesity of women at 0 and 12 week among the studied sample.

	%of women 0 week.		%of women after 12 weeks.	
	No.	%	No.	%
Underweight < 18.5	1	2	0	0
Normal+ 18.5-24.9	12	24	20	40
Overweight 25.0-29.9	15	30	12	24
Obesity I 30.0-34.9	12	24	10	20
Obesity II 35.0-39.9	10	20	8	16
Extreme Obesity III 40	0	0	0	0

The degree of obesity was determined on the basis of the values of the body mass index (BMI).Table 5 shows the effect of yogurt consumption and physical activity and dietary restriction regimens on the percent of BMI in different ages of women before and after three months of the experiment. The result of this treatment is statistically important and significant increase of body mass index percent about 1% for underweight women of ages 20-29 and 30-39 respectively. This finding is agreed with (Zhang and Tordoff 2004). While the result of this treatment is statistically significant decrease of body mass index percent from 23.0 to 20.5 for the normal women with 20-29 years, and it was highly decreased significantly from 23.5 to 19.5% for women of the age 30-39 years, and it decreased from 24.5 and 24.0 to 21.5 and 20.5% respectively for women of the 40-49 and 50-59 years respectively. Also, it was found that BMI% of overweight women quiet significant decreased about 2-4% with all ages. The same finding in obese women (I and II) the reduction of BMI was almost 2-3% for all ages due to regular physical activity that can evoke beneficial changes not in terms of weight and BMI, but also lead to enhance quality of life by the efficiency of the circulatory and respiratory systems and the metabolic processes occurring in the working muscle cells (Zbigniew et al. 2010). Also, these finding demonstrated the idea that regular yogurt consumption promotes body weight stability. The simplest explanation is that regular consumption of healthful food such as yogurt results decreased intake of less healthful food full of fat and sugar. There is also evidence proved that high calcium and protein contents of yogurt influence appetite and energy intake (Paul et al. 2014; Angelo, et al. 2015). Zemel, 2005 concluded that increasing dairy intake will facilitate

weight loss independent of energy balance considerations. Nonetheless, their data provide the framework for the development of strategies to utilize dairy products for the prevention of overweight and obesity and, in conjunction with controlling energy balance, for effective weight management. Also, (Laura, et al. 2014) concluded that eating less energy dense, high-protein snack like yogurt improves appetite control, satiety, protein, and reduced subsequent food intake in healthy obese women. Dietary calcium appears to modulate the efficiency of energy utilization, with low calcium diets favoring increased efficiency of energy storage and higher calcium diets reducing energy efficiency and instead favoring increased thermogenesis. This concept is further supported by other observation of reduced energy efficiency and increased core temperature in the transgenic mice fed higher calcium diets (Zemel, et al. 2000).

Table 5: Comparison of the averages of BMI at 0 and 12 week period of different overweight and diff. ages of women.

BMI	Week	20-29 Y	30-39 Y	40-49 Y	50 Y and over	P-value
Underweight (< 18.5)	0 week	17.5	17.0	0	0	0.0149 **
	12 week	18.5	18.0	0	0	0.0142 **
Normal+ (18.5-24.9)	0 week	23.0	23.5	24.5	24.0	0.526 NS
	12 week	20.5	19.5	21.5	20.5	0.489 NS
Overweight (25.0-29.9)	0 week	28.5	29.0	28.9	28.5	0.596 NS
	12 week	26.5	26.0	24.5	26.5	0.572 NS
Obesity I (30.0-34.9)	0 week	33.5	33.5	33.0	32.5	0.862 NS
	12 week	31.0	31.5	31.5	33.0	0.793 NS
Obesity II (35.0-39.9)	0 week	38.0	39.0	38.0	38.0	0.809 NS
	12 week	35.5	36.5	37.5	36.5	0.741 NS
Extreme Obesity III (40)	0 week	0	0	0	0	1.00 NS
	12 week	0	0	0	0	1.00 NS

**** (P<0.01), NS: Non-significant.**

Waist circumference:

Abdomen fat excess out of proportion to total body fat is an independent predictor of risk factors and morbidity. Waist circumference is directly correlated with abdominal fat content (Medstar Health, 2007). Also, it was concluded that quality and distribution of protein may play an excellent role in regulating central abdominal fat CAF, that is a strong independent marker for disease and mortality (Jeremy, et al. 2012).The result shows the effect of daily consumption concentrated low-fat yoghurt, Physical activity and restricted energy positively significantly height correlated with waist circumference as shown in table **6** with all groups of ages. Waist circumference was decreased highly significant in obese, elderly women from 118cm to 99cm, then in women with age 30-39, the WC decreased significantly from 99cm to 90cm. This reduction in WC is considered a good factor of obesity management with eating healthy dairy product, due to its important micronutrients content and calcium sources to promote bone health, to help reduce risk of chronic diseases such as osteoporosis and to enhance overall health and weight maintenance (Gerrior and Bente, 2001; Ilich, and Kerstetter, 2000). Isocaloric substitution of yogurt into diet of obese adults results in a repartition of energy and body composition, resulting in decreasing body weight, total adiposity and central adiposity and an improved metabolic profile during energy

restriction. In vitro data obtained in human adiposity suggest that the partially elective effect on central adiposity may result, in part, from reduction in adipocyte cortisol production secondary to suppression of calcitriol levels on the higher calcium diet (Zemel, et al. 2004). Pathological increase in body fat leads to an increase in the incidence of many diseases associated with it, and correlates to the endocrine lipid-carbohydrate disorder enhances the development of vascular diseases (Goran et al. 2003).Yogurt consumption (g/day) was inversely associated with body fat, abdominal fat, WC, and HC and body fat (all p<o.05). Within a sample of obese adults, consumption of dairy products, dairy protein, and calcium was associated with more favorable body composition (Karen, et al. 2013).

Table 6: comparison of the averages of WC at 0 and 12 week period of different overweight and diff. ages of women.

		20-29 Y	30-39 Y	40-49 Y	50 Y and over
Normal WC (88 cm)	0 week	95	99	118	100
	12 week	91	90	99	90

Biochemical assessment:

The result of this treatment is statistically very important and significant decrease of all blood parameters; all women decreased the blood glucose high significantly among all different ages as shown in table **7**. The high reduction happened in women with age over 50 years which decreased from 120 to 109 mg/dl and with age 40-49 years which decreased from 110 to 105 mg/dl. While, There were a disparity between the extent of augmentation of glucose loss with ages under 40 years by the yogurt diet and physical activity may be attributable to the data that acute consumption of 1-2 serving yogurt daily is able to induce physiologically insulin response in obese women at risk for insulin resistance and facilitates the regulation of energy balance (Angelo, et al. 2015). In addition, high protein diet is accompanied by increased stimulation of glucagon and insulin within the endocrine pancreas, high glycogen turnover and stimulation of gluconeogenesis (Linn, et al 2000). It was concluded that yogurt consumption may have a beneficial role on body weight regulation, cardiovascular health and on the modulation of the gut micro biota and the prevention of obesity and cardio metabolic diseases (Andre and eliane 2014).These finding is comparable to Zemel, et al. 2004, who founded that participants on yogurt diet exhibited a significant increase circulating glycerol , indicating an increase in lipolysis in individuals on this diet, while there was no significant change in circulating glycerol in participants on the control diet.

Clinical concerns have been raised that high dairy consumption may be related with increased risk of cholesterol, all kind of lipid and obesity (Melnik, B. 2009). However, the results of this study give further support to the clinical trial database concluded that low fat dairy foods (such as strained yogurt) may be incorporated into diets without adversely increasing blood lipids (Crichton, et al. 2012, Daly and Noowson, 2009, Todd, et al. 2013).

The cholesterol content consider decreased significantly in women with age 40-49 years from 220 to 205 mg/dl ($p<0.01$), and in women with age over 50 years also decreased significantly from 210 to 200 mg/dl after 3 months of the experiment, due to the effect of physical activity daily and yogurt consumption. While, there were a quiet reduction in cholesterol in women with age less than 40 years as shown in table 7. Triglyceride content decreased significantly in women with age 40-49 years from 220 to 198 mg/dl ($p<0.01$), and in women with age over 50 years also decreased significantly from 230 to 210 mg/dl after 3 months of the experiment, due to the effect of physical activity daily and yogurt consumption. While, there were a quiet reduction in cholesterol in women with age less than 40 years as shown in table 7. In contrast of that, the HDL increased significantly with all ages in women. While LDL decreased significantly in all ages of groups in women ($p<0.01$), as shown in table 7. Also, the LDL significantly decreased for all ages of women as shown clear in table 7 ($p<0.01$). These finding was accordance to that founded by (Renata, et al. 2004; NHALBS) and several studies also provide evidence that overweight, obesity and weight gain are associated with increased cholesterol levels. (138) also was found that in women, the incidence of hypercholesterolemia increases with increasing BMI. Also, fat distribution appears to affect cholesterol levels independently of total weight. Total cholesterol levels are usually higher in persons with predominant abdominal obesity (139).

Table 7: shows the correlation between lipid profiles and WC with diff. ages at 0 and 12 weeks of dairy yogurt exp..

		20-29 Y	30-39 Y	40-49 Y	50 Y and over	P-value
Normal WC (88 cm)	0 week	95	99	118	100	0.0034 **
	12 week	91	90	99	90	0.0029 **
Chol.(up normal>200)	0 week	195	200	220	210	0.0001 **
	12 week	195	195	205	200	0.0001 **
BS(normal=70-100) BS(up normal>100)	0 week	85	99	110	120	0.0001 **
	12 week	82	95	105	109	0.0001 **
TG(up normal >180)	0 week	185	195	220	230	0.0001 **
	12 week	180	190	198	210	0.0001 **
HDL (normal 40-60mg/dl)	0 week	45	38	35	51	0.0041 **
	12 week	50	45	42	40	0.0058 **
LDL (normal 130-159)	0 week	130	140	170	190	0.0001 **
	12 week	120	125	150	170	0.0001 **

** (P<0.01).

Conclusion

The obtainable pertinent reviews suggests that concentrated yogurt assists the regulation of energy balance. This can be explained by the fact which yogurt consumption may decrease the intake of energy-dense foods that support hyperphagia. Many studies have also confirmed the potential of yogurt contents such as protein, calcium that affectively influence appetite control. Also, the stickiness and flexibility of yogurt's structure enable it to adjust incorporation of many ingredients, such as fruit, fiber and different vegetables and probiotics bacteria which also have the effective role to enhance negative energy balance. These effects are likely the main determinants of the weight and BMI reduction of several kilograms proved in yogurt consumers tested in clinical and observational studies. In addition, there were a high significant reduction in weight, body fat mass, lean mass, waist circumference, blood glucose, cholesterol, lipids profile, and enhancing the life style with the physical activity clearly in this study with energy restriction. Finally, the composition of the diet should be modified to minimize other cardiovascular risk factors (MedStar Health). Physical activities can also be helpful in maintaining a desirable weight and in reducing overall CHD risk.

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- تأثير استهلاك اللبن خالي الدسم المركز(Strained yoghurt) المدعم بالخضار في خفض الوزن لعينة من النساء البدينات.

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الملخص

السمنة خلال مرحلة البلوغ هي مشكلة الصحة العامة في المجتمع الحديث، والمرض بشكل عام يتزايد عالميا ويتحول إلى وباء عالمي. السبب الاساسي لترسب الدهون المفرط هو تدمير أنظمة التحكم في صرف الطاقة المتناولة. الزيادة المرضية لكتلة الدهون تؤدي إلى اضطرابات في الجسم، ولمتغيرات الدهون- كربوهيدرات الدم وبدورها تزداد أمراض الأوعية الدموية ويزيد من خطر الإصابة بالأمراض والوفيات. وقد أثارت مجموعة كبيرة من البيانات على مدى السنوات الخمس الماضية لإظهار أن منتجات الألبان وخاصة اللبن قليل الدسم يعدل فقدان الوزن ولديه بعض الخصائص الفريدة التي يمكن أن تعزز دورها في الحفاظ على الوزن الصحي. ممارسة النشاط البدني بانتظام هو من الأهمية لفقد الغذاء الزائد المتناول وللمحافظة على الوزن وللحفاظ على صحة القلب. النشاط البدني يساعد على حرق السعرات الحرارية، لبناء عضلاتنا والسيطرة على شهيتنا. والهدف من هذه الدراسة هو توضيح تأثير النظام الغذائي قليل السعرات الحرارية, تناول اللبن المركز الخالي من الدهن يوميا والنشاط الرياضي المركز ثلاثة أيام في الاسبوع في وزن الجسم ومؤشر كتلة الجسم، ومتغيرات الكولسترول –الدهون لعينة من السيدات البالغات. اللبن الخالي من الدهن، واستهلاك الطاقة المقيد, والنشاط البدني بثلاث مرات على الأقل أسبوعيا يرتبط بعلاقة إحصائية عكسية مع وزن الجسم، ومؤشر كتلة الجسم، وWC ($P < 0.05$). وارتبط استهلاك اللبن الخالي من الدهن, وممارسة النشاط البدني يوميا عكسيا مع مستوى السكر في الدم, ومتغيرات الكوليسترول -الدهون وبواقع إحصائي ($P < 0.05$) لعينة النساء اللواتي يعانين من السمنة المفرطة. ضمن عينة النساء البدينات المدروسة, وجد أن إستهلاك المنتجات اللبنية الخالية الدهن وزيادة النشاط البدني مع الغذاء المقيد في السعرات الحرارية المتناولة يوميا له علاقة وثيقة مرغوب فيها لكثير من مكونات الجسم.

الكلمات المفتاحية: السمنة-الغذاء-اللبن الخالي من الدسم-التمارين الرياضية-مؤشر كتلة الجسم-متغيرات دهون الدم