ORIGINAL ARTICLE

Effects of dairy products consumption on weight loss and blood chemistry in premenopausal obese women

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Abstract

Objectives: To determine the effects of dairy calcium on changes in body weight and body fat mass in obese women on a weight-loss diet.

Methods: The non-randomised controlled study was conducted at Sivas Government Hospital, Turkey, between January and March 2010, and comprised obese women outpatients coming to the Nutrition and Diet Clinic. The participants were assigned to three groups according to their intake of dairy products as control, low dairy and high dairy groups. Measurements of anthropometry, blood pressure and analysis of blood chemistry were done before and after the intervention.

Results: The mean age of the 65 women was 33.10±6.18 years. There were 20(30.7%) women in control group, 22(33.8%) in high dairy group and 23(35.3%) in low dairy group. At the end of the study, body weight, body mass index, waist and hip circumferences, waist/hip ratio, body fat percentage, and fat mass significantly decreased within the groups ($p<0.001$) whereas no difference was determined between the groups. Plasma total cholesterol levels decreased ($p<0.05$, $p<0.001$) and high-density lipoprotein cholesterol levels increased ($p<0.05$) in the two intervention groups. Systolic blood pressure was negatively correlated with dairy calcium (?=0.460, $p<0.05$).

Conclusions: In women following a weight-loss programme, increasing the amount of dairy products was not effective in improving weight-loss compared to calorie restriction alone.

Keywords: Anthropometry, Blood chemistry, Blood pressure, Caloric restriction, Dairy products.

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Introduction

An essential body of evidence has come to light over the past 10 years in support of an anti-obesity effect of dietary calcium (Ca^{2+}) and dairy products.[1-4] The proposed mechanisms for the anti-obesity effect of Ca^{2+} and dairy products can be summarised as follows: (a) Dietary Ca^{2+} modulates circulating calcitriol (1,25-dihydroxyvitamin D) (1,25(OH)2 D) level that in turn regulate intracellular Ca^{2+} (i[Ca^{2+}]) which affects fat metabolism in human adipocytes. Suppression of calcitriol with high Ca^{2+} diets would be expected to reduce adipocytes i[Ca^{2+}], inhibit fatty acid synthase (FAS) and activate lipolysis, thus exerts an anti-obesity effect.[1] (b) increased dietary Ca^{2+} seems to bind more fatty acids in the colon consequently inhibits fat absorption.[2] (c) high-Ca^{2+} diets may affect energy partitioning by suppressing calcitriol levels, thereby permitting increased adipocyte uncoupling protein-2 (UCP2) expression and, possibly, UCP2 mediated fatty acid transport and oxidation[5] (Figure).

Studies claimed that Ca^{2+} in the form of dairy products may be more effective in obesity than elemental Ca^{2+} due to other components in dairy products such as conjugated linoleic acid, whey proteins and branched-chain amino acids.[2,3] However, the latest meta-analysis[6,7] and systematic[4] and narrowed[2] scale reviews indicated that the association of dairy products with anthropometric variables, especially body weight loss, is controversial. Much of the published clinical data supports the claim that Ca^{2+} [4,8] and dairy products[9-12] have favourable effects on weight and fat loss. On the other hand, number of effects of either Ca^{2+} [13,14] or dairy product consumption on weight and fat loss[6,15,16] were detected in some previous trials. In addition, conflicting results concerning the protective effects of dairy products on the parameters such as blood pressure[17-20] and lipids that are directly associated with cardiometabolic disorders have been reported along with the inconsistent results particularly concerning the serum cholesterol indicating no effects[17] or increases,[15] which may lead to the need for further studies to elucidate the role of the dairy products. Although the available results are conflicting, but it was suggested

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that milk and milk products might be beneficial to some population segments.[2]

To our knowledge, this is the first study in Turkey of its kind and was planned to assess the effects of milk and dairy product consumption with calorie restriction on weight loss and some blood variables. Since the consumption of milk and dairy products is lower than international guidelines in Turkey as in many countries,[3] therefore, the study also planned to determine the effects of dairy consumption together with calorie restriction on weight loss, blood pressure and serum lipids in volunteer obese women.

Subjects and Methods

The non-randomised controlled study was conducted at Sivas Government Hospital, Turkey, between January and March 2010, and comprised obese women outpatients coming to the Nutrition and Diet Clinic. Sample size was calculated by taking into account the data previously indicated in literature.[10]

Socio-demographic data (education, marital status, occupation etc.) and physical activity status of the women were obtained in face-to-face interviews and a questionnaire that included 10 items concerning family history and health status of the participants as well as attendance of a previous weight-loss programme. In addition, dietary intake, including dairy products, of the participants was determined with 24-hour dietary recall records prior to the study.

The volunteers included were in premenopausal period aged between 18 and 49 years, having body mass index (BMI) 30-39.9 kg/m^2, not using vitamin and mineral supplements and not having attended any weight-loss programme in the preceding three months. Those using oral anti-diabetic agents or insulin, having a history of endocrine, hepatic and renal disease or malabsorption syndrome, having irregular menstruation, being pregnant, lactating or smokers were excluded.

The subjects were assigned to three groups according to their dairy product intakes obtained with 24-hour dietary recall records. The groups were controls, low dairy (LD) and high dairy (HD). All groups received weight-loss diets. The control group was given no dairy product except 30g low-fat white cheese, while the LD and HD groups consumed 30g low-fat white cheese plus one glass (200ml) and three glasses (600ml) respectively of semi-skimmed milk in a day.

The weight-loss diets were adjusted 1000 kcal/day of calorie restriction by clinic dietician who recommended the amount of macronutrient and dietary fibre according to the dietary guidelines for Turkey.[21] The amounts of nutrients and daily total calcium and calcium derived from dairy foods of weight-loss diets were calculated by a software programme (BeBIS 7.0, Ebispro for Windows, Stuttgart, Germany, Turkish Version). Physical activity status and caffeine intake of all subjects were maintained at baseline levels throughout the study. The subjects were required to visit the clinic weekly and make a telephone call every two days for ensuring dietary discipline.

The study was approved by the institutional ethics committee and the procedures followed were in accordance with the Helsinki Declaration. All of the participants provided written informed consent.

Body weights, fat mass, fat percentage (F%), lean body mass (LBM), total body water (TBW) were measured with a calibrated bioelectrical impedance analysis (BIA) device (Tanita TBF 300A, Tokyo, Japan) and heights were measured with a stadiometer (Seca 220, Medical Scales and Measuring Devices, Seca Corporation, Hamburg, Germany). Subjects were in casual clothes with no outerwear, accessories or shoes during the measurements. Waist circumference (WC) was measured in mid-exhalation and in the standing position and were obtained from midway among the lateral lower rib margin and the iliac crest. Hip circumference (HC) was obtained from the widest part of the hip. The waist/hip ratio (WHR) and BMI (kg/m^2) were also calculated.

Calorie intake of subjects was calculated via World Health Organisation (WHO) equations of basal metabolic rate (BMR), which were then adjusted for activity level to provide an estimate of total daily energy expenditure (TDEE). TDEE was calculated by multiplying the BMR with 1.3 for subjects engaged in mild daily activity, and 1.5 for those engaged in strenuous daily activity.

Venous blood samples were collected after overnight fasting into tubes containing ethylenediaminetetraacetic acid (EDTA) and then immediately centrifuged and analysed via Beckman Coulter DXC 800 Analyser (Beckman Coulter Inc, Brea, CA, USA). Plasma fasting glucose was analysed with glucose oxidase method, triglycerides (TG) with end-point colorimetric method, and total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), very low-density lipoprotein cholesterol (VLDL-C) with cholesterol oxidase/peroxidase method using commercially available kits (Beckman Coulter Inc, Brea, CA, USA). Brachial artery blood pressure was measured two times with 20 min intervals with aneroid sphygmomanometer and stethoscope (Erka Perfect Aneroid, Germany) and mean values were used. All of the samplings were performed in the beginning and at the end of the study.

Data was analysed using SPSS 16 and SigmaStat version 3.5 (Systat Software Incorporation, Chicago, USA). Data was tested with Shapiro-Wilk test for normal distribution. Comparisons of socio-demographic variables were done with Chi-square test. Percentage values were used for qualitative data. One-way analysis of variance (ANOVA) was used to determine the differences between groups, and Tukey test was performed for age values. Since the data obtained was not normally distributed, Wilcoxon t test was performed for the comparison of variables over time, and Kruskal-Wallis test was used to determine the differences between groups, and when the differences were determined, Dunn's multiple comparison tests was performed. Correlations between the variables were determined by Spearman's correlation analysis. Data were presented as median (25th/75th percentiles), mean and standard deviation as well as frequencies and percentages when appropriate. Values were considered significant at $p<0.05$.

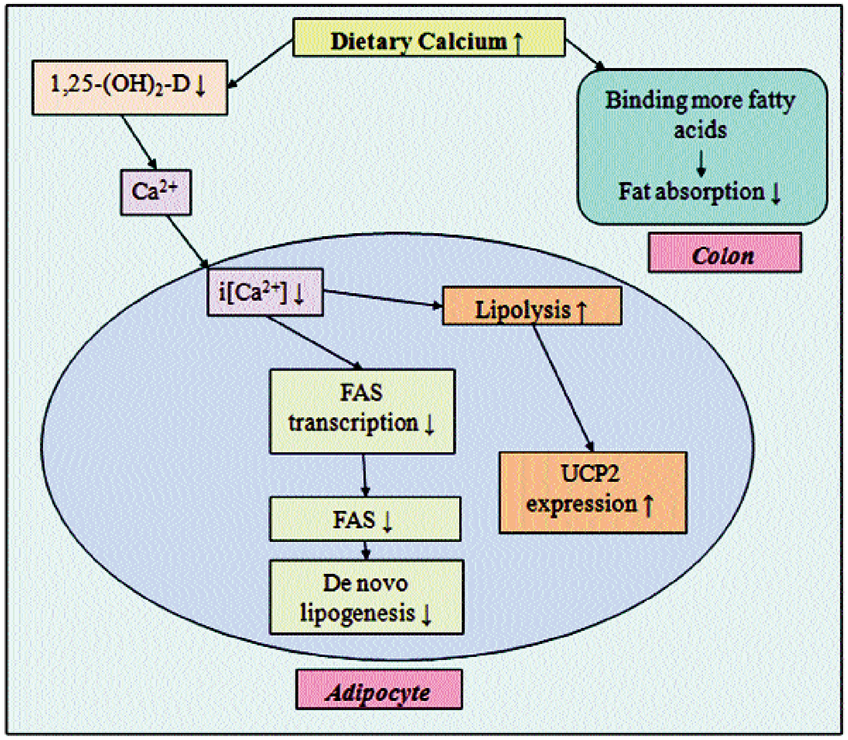

Figure: The effects of dietary calcium on 1,25-$(OH)_2$-D, i[Ca^{2+}] and its mechanism in adipocytes and colon. Adapted from Ref 1.

Results

The study initially had 72 subjects, but 7(9.7%) women could not complete the study due to scheduling conflicts. The final study sample, as such, comprised 65(90.2%). The mean age of the sample was 33.10±6.18 years, and there was significant difference between control and the intervention groups concerning age ($p<0.05$).

There were no significant difference between the groups concerning any of the anthropometric and blood chemistry variables, physical energy expenditure as well as calorie intake prior to the study ($p>0.05$ each). Significant reductions were determined in body weights of subjects in all groups at the end of the intervention ($p<0.001$) but there was no significant difference among the groups ($p>0.05$). Women in the HD group lost 11.5% while those in control and LD groups lost 10% of their body weights (Table-1). At the end of the study, BMI, WC, HC, WHR, body F%, and fat mass significantly decreased within the groups ($p<0.001$ each).

Comparing the values obtained before and after the study, there were no significant difference over time in control group and LD group for systolic blood pressure (SBP) whereas HD group exhibited significant decrease for SBP ($p<0.001$). The decrease in SBP was significantly higher in HD group than other groups ($p<0.001$). Diastolic blood pressure (DBP) significantly decreased within all groups ($p<0.05$), but the decrease in DBP was not significant among the groups ($p>0,05$) (Table-2).

There was no significant relation between intake of daily total calcium and calcium derived from dairy foods and anthropometric and blood chemistry variables. Systolic ($r=-0.492$; $p<0.001$) and diastolic ($r=0.272$; $p<0.05$) blood pressures were negatively correlated with amounts of calcium derived from dairy foods. However, solely SBP was negatively correlated with daily total calcium intake ($r=-0.460$; $p<0.001$) (Table-3).

Table-1: Socio-demographic and anthropometric variables of subjects.

Variables	**Control group (n=20) Median (25th q/75thq)**	**LD group (n=22) Median (25th q/75thq)**	**HD group (n=23) Median (25th q/75thq)**	**p§**
Age (years)∆	36.20±6.31a	31.54±5.31	31.91±6.09	0.024**
Education (%)				
Illiterate	20.0	9.1	4.3	
Primary school	60.0	59.1	47.9	
Secondary school	5.0	18.2	17.4	
University degree	5	9.1	26.1	
Other∆∆	10	4.5	4.3	
Weight (kg)				
Wk 0	87.70 (83.30/91.10)	85.60 (76.90/96.10)	86.90 (83.00/96.42)	0.840
Wk 12	78.15 (72.60/82.05)	76.05 (69.10/86.10)	76.30 (73.35/85.30)	0.898
Wk 12-Wk 0	-8.40 (-10.10/-7.15)	-8.65 (-10.40/-7.10)	-9.90 (-12.42/-7.55)	0.397
p value	<0.001*	<0.001*	<0.001*	
BMI (kg/m^2)				
Wk 0	35.45 (32.75/38.35)	34.65 (31.50/37.20)	35.30 (32.87/36.57)	0.779
Wk 12	31.40 (28.75/34.15)	31.25 (28.10/33.90)	30.50 (29.22/32.75)	0.714
Wk 12-Wk 0	-3.30 (-4.00/-2.80)	-3.50 (-4.20/-2.60)	-3.70 (-4.85/-3.07)	0.331
p value	<0.001*	<0.001*	<0.001*	
WC (cm)				
Wk 0	106.25 (96.25/118.50)	100.90 (95.00/112.00)	103.50 (100.00/110.70)	0.613
Wk 12	98.60 (92.75/109.25)	93.30 (88.50/109.50)	95.50 (89.62/99.25)	0.224
Wk 12-Wk 0	-5.45 (-7.75/-4.50)	-6.70 (-7.80/-5.50)	-7.00 (-10.45/-5.12)	0.228
p value	<0.001*	<0.001*	<0.001*	
HC (cm)				
Wk 0	122.00 (115.50/125.00)	122.00 (113.00/128.00)	119.00 (116.05/122.12)	1.808
Wk 12	118.00 (112.75/120.50)	118.75 (112.00/124.00)	114.80 (110.45/119.12)	2.967
Wk 12-Wk 0	-3.10 (-4.30/-2.25)	-3.50 (-4.80/-2.50)	-4.00 (-6.00/-2.62)	3.058
p value	<0.001*	<0.001*	<0.001*	
WHR				
Wk 0	0.86 (0.84/0.91)	0.86 (0.82/0.90)	0.88 (0.84/0.92)	1.324
Wk 12	0.82 (0.81/0.90)	0.84 (0.78/0.88)	0.82 (0.80/0.87)	0.858
Wk 12-Wk 0	-0.03 (-0.03/-0.02)	-0.03 (-0.04/-0.02)	-0.03 (-0.06/-0.02)	2.027
p value	<0.001*	<0.001*	<0.001*	
Fat mass (kg)				
Wk 0	37.10 (32.90/41.00)	35.30 (30.10/40.70)	36.00 (33.65/39.97)	0.680
Wk 12	29.65 (25.40/35.25)	27.40 (24.40/35.60)	27.70 (24.90/30.62)	0.556
Wk 12-Wk 0	-6.15 (-9.95/-4.95)	-5.80 (-8.70/-3.90)	-8.20 (-10.90/-5.07)	0.106
p value	<0.001*	<0.001*	<0.001*	
Fat per. (%)				
Wk 0	41.95 (40.55/45.20)	41.45 (38.10/43.60)	41.70 (38.65/43.02)	0.315
Wk 12	38.05 (33.55/40.05)	36.50 (31.30/39.00)	35.30 (33.55/38.40)	0.501
Wk 12-Wk 0	-5.10 (-7.50/-3.10)	-4.70 (-6.80/-1.60)	-4.90 (-7.17/-2.45)	0.568
p value	<0.001*	<0.001*	<0.001*	
LBM (kg)				
Wk 0	49.25 (47.00/53.05)	50.90 (46.80/55.60)	52.00 (48.75/55.32)	0.418
Wk 12	48.85 (46.30/50.65)	48.50 (46.00/52.50)	49.00 (47.20/54.00)	0.751
Wk 12-Wk 0	-0.35 (-3.55/1.05)	-1.95 (-4.80/0.40)	-1.80 (-3.25/0.10)	0.565
p value	0.227	0.005**	0.005**	
TBW (kg)				
Wk 0	36.05 (34.40/38.85)	37.25 (34.30/40.70)	38.10 (35.97/40.55)	0.284
Wk 12	35.75 (33.90/37.05)	35.50 (33.20/38.40)	35.90 (34.60/39.52)	0.712
Wk 12-Wk 0	-0.30 (-2.60/0.80)	-1.75 (-3.60/0.30)	-1.40 (-2.50/-0.22)	0.472
p value	0.229	0.003**	0.002**	

Data (except age) are shown as median (25thquartile/75thquartile). Wk 0: baseline, Wk 12: following 12 weeks. (*) Highly significant p<0.001, (**) Significant p<0.05.
(∆) Data are mean± SD. (??) Not completed the primary school education level 1. (a) Significantly different from LD and HD groups.
(p¥) Wilcoxon t test was used to compare statistical significance of medians between Wk 12 and Wk 0.
(p§) Kruskal-Wallis was used to compare statistical significance of nonparametric variables' medians between Wk 12 and Wk 0.
LD: Low dairy. HD: High dairy. BMI: Body mass index. WC: Waist circumference. HC: Hip circumference. WHR: Waist/hip ratio. LBM: Lean body mass. TBW: Total body water.

Table-2: Comparison of blood chemistry and blood pressure variables at week 0 and week 12.

Variables	Control group (n=20) Median (25th q/75thq)	LD group (n=22) Median (25th q/75thq)	HD group (n=23) Median (25th q/75thq)	p§
Plasma glucose (mg/dl)				
Wk 0	89.10 (84.30/99.20)	90.15 (83.60/96.50)	92.60 (78.50/98.37)	0.959
Wk 12	88.55 (84.85/90.00)	89.85 (80.00/95.00)	86.70 (77.10/91.97)	0.388
Wk 12-Wk 0	-3.10 (-6.60/0.95)	-1.75 (-7.60/3.80)	-5.70 (-10.65/-0.10)	0.307
p value	0.043**	0.325	0.003**	
TG (mg/dl)				
Wk 0	160.50 (88.00/184.00)	106.90 (85.00/137.00)	96.00 (78.75/186.12)	0.571
Wk 12	103.40 (73.00/187.50)	104.50 (73.00/142.00)	97.00 (81.12/143.25)	0.803
Wk 12-Wk 0	0.10 (-19.50/6.20)	5.50 (-2.80/14.00)	-0.20 (-13.52/6.87)	0.220
p value	0.504	0.154	0.506	
TC (mg/dl)				
Wk 0	186.00 (177.30/210.00)	196.50 (158.00/221.00)	179.00 (162.50/205.00)	0.442
Wk 12	187.00 (174.60/196.10)	191.00 (166.00/205.00)	164.20 (149.20/190.05)	0.054
Wk 12-Wk 0	-7.90 (-15.00/3.00)	-9.00 (-18.00/1.00)	-13.00 (-27.85/-5.55)	0.231
p value	0.068	0.014**	<0.001*	
HDL-C (mg/dl)				
Wk 0	38.80 (34.10/46.05)	39.50 (29.50/49.00)	38.30 (30.75/44.00)	0.616
Wk 12	40.60 (34.35/49.40)	42.70 (33.60/54.60)	41.40 (33.05/44.75)	0.650
Wk 12-Wk 0	1.30 (-2.80/3.75)	2.85 (0.90/7.50)	2.80 (0.40/5.80)	0.356
p value	0.404	0.010**	0.012**	
LDL-C (mg/dl)				
Wk 0	121.80 (112.70/139.35)	131.65 (98.19/160.60)	121.10 (104.47/139.25)	0.429
Wk 12	116.60 (109.50/134.44)	120.70 (90.60/148.00)	104.00 (97.90/137.95)	0.816
Wk 12-Wk 0	-1.75 (-6.15/2.25)	-5.45 (-17.60/-2.10)	-3.50 (-12.59/3.18)	0.137
p value	0.277	0.001*	0.098	
VLDL-C (mg/dl)				
Wk 0	32.39 (18.40/39.90)	25.60 (9.42/34.20)	19.79 (15.00/34.47)	0.279
Wk 12	28.80 (18.40/43.50)	21.10 (12.60/30.80)	20.81 (15.10/28.82)	0.266
Wk 12-Wk 0	-1.19 (-4.20/1.90)	-1.51 (-6.48/1.20)	-0.20 (-1.60/2.73)	0.366
p value	0.436	0.105	0.899	
SBP (mmHg)				
Wk 0	120.00 (115.00/130.00)	120.00 (110.00/130.00)	120.00 (120.00/130.00)	0.360
Wk 12	120.00 (110.00/130.00)	120.00 (110.00/120.00)	110.00 (100.00/120.00)#	0.035**
Wk 12-Wk 0	0.00 (-2.50/10.00)	0.00 (-10.00/0.00)	-10.00 (-20.00/-2.50)#	<0.001*
p value	0.590	0.125	<0.001*	
DBP(mmHg)				
Wk 0	80.00 (70.00/80.00)	80.00 (70.00/80.00)	70.00 (70.00/80.00)	0.403
Wk 12	70.00 (60.00/80.00)	70.00 (60.00/70.00)	60.00 (60.00/70.00)	0.084
Wk 12-Wk 0	0.00 (-10.00/0.00)	-10.00 (-10.00/0.00)	-10.00 (-20.00/0.00)	0.079
p value	0.016**	<0.001*	<0.001*	

All data are shown as median (25thquartile/75thquartile). Wk 0: baseline, Wk 12: following 12 weeks.

(*) Highly significant p<0.001, (**) Significant p<0.05.

(p¥) Wilcoxon t test was used to compare statistical significance of medians between Wk 12 and Wk 0.

(p§) Kruskal-Wallis was used to compare statistical significance of nonparametric variables' medians between Wk 12 and Wk 0. Dunn's method was used for nonparametric multiple comparisons. (#) Significantly different control and LD group.

LD: Low dairy. HD: High dairy. TG: Triglycerides. HDL-C: High-density lipoprotein cholesterol. LDL-C: Low-density lipoprotein cholesterol. VLDL-C: Very low-density lipoprotein cholesterol. SBP: Systolic blood pressure. DBP: Diastolic blood pressure.

Table-3: Correlation between daily intake of total calcium and calcium derived from dairy foods and blood pressure.

Total calcium intake (mg)	ρ	p
SBP (mm/Hg)	-0.460	<0.001*
DBP (mm/Hg)	-0.224	0.072
Calcium derived from dairy foods (mg)	**ρ**	**p**
SBP (mm/Hg)	-0.492	<0.001*
DBP (mm/Hg)	-0.272	0.029**

(ρ) Spearman's correlation rho for nonparametric variables.
(*) Highly significant p<0.001, (**) Significant p<0.05.
SBP: Systolic blood pressure.
DBP: Diastolic blood pressure.

Discussion

The mean age of the 65 women enrolled in the current study was 33.10 years, and the participants in LD and HD groups were younger than the control group ($p<0.05$) which is consistent with the age distribution of the participants involved in another study.[10] Although there was not a significant difference between groups, the rate of illiteracy among women (20%) in the control group were higher than the LD(9.1%) and HD(4.3%) groups. It was determined that 78.5% (n=51), 12.3% (n=8) and 9.2% (n=6) of the participants were housewives, civil servants and workers respectively. No significant difference was determined among the groups in terms of educational ($p>0.05$) and occupational status ($p>0.05$) of the participants.

At the beginning of the intervention, there were no significant differences in anthropometric and blood chemistry variables, physical energy expenditure and calorie intake, except age. Although the difference between the groups related to amounts of weight lost was not significant, but the participants in all groups lost weight significantly ($p<0.001$) due to weight-loss diets, which indicates the additional consumption of 30g low-fat white cheese plus either 200ml or 600ml of semi-skimmed milk did not promote weight and fat loss after a 12-week intervention in obese women. The finding supports the results of some previous randomised studies.[15,16] A study that was performed on obese adults in normal energy and energy-restricted conditions exhibited no difference between low and high dairy groups in the weight changes of participants.[16] On the other hand, one study[22] reported that the recommended dairy group (>3 servings/day) exhibited greater fat oxidation and was able to consume greater amounts of energy without greater weight-gain compared to the LD group (<1 serving/day). In our study, no significant correlation was found between either daily total calcium or calcium derived from dairy foods and anthropometric variables. Similar with the findings of some previous studies,[7,23] in this study, the lack of the effects of dairy products on body weight and fat loss may result from the duration of the study as indicated in a meta-analysis[6] that the beneficial effect of increasing dairy consumption on body weight and fat loss requires long-term or no-calorie restriction.

It is well known that alterations in blood lipids are directly associated with cardiovascular diseases. Studies have reported inconsistent results concerning the influence of milk and milk product consumption on lipid variables[7,15,17] One study[17] reported no relationship between HD diets and TGs, total and LDL cholesterol as was the case in the current study.

Inadequate consumption of dairy products or intake of calcium leads to increase in blood pressure.[24] In this study, compared to the values obtained in the beginning of the study, consumption of high level of dairy products decreased SBP ($p<0.001$) whereas the same effect was not seen in the participants consuming LD products. On the other hand, DBP decreased significantly within all groups, but there was no significant difference between the groups which is in line with a study[5] that comprised obese subjects and found no significant difference in DBP between the control, high calcium and HD groups during calorie restriction. It also reported a significant decrease in SBP in the HD group. In the present study, SBP was negatively correlated with daily total calcium and systolic and diastolic blood pressures were negatively correlated with amounts of calcium derived from dairy foods. A study[17] also reported an inverse association between three servings of low-fat dairy product intake and SBP. Our finding also supports the results of studies reporting the protective effects of dairy products on blood pressure.[10,25] Conversely, in some studies neither SBP nor DBP was affected by the consumption of dairy products.[7,12,15,22] Although little is known about possible mechanisms for the improvements of blood pressure due to the dairy consumption, it has been speculated that blood pressure and changes in the extracellular matrix of the arterial wall are improved due to the inhibition of angiotensin-converting enzyme by bioactive peptides that are released during the digestion of dairy proteins.[9] In addition, improvements may happen due to the macro-mineral content of dairy product such as sodium, potassium, magnesium and phosphorous.[17]

The current study has its strengths and limitations. The controlled intervention and repeated follow-up and education of the women at every visit enabled us to obtain some realistic comparisons regarding the effects of the diary intake. However, collecting the dairy consumption on record basis can be considered a limitation of the study. The other limitations of the study include the duration of the study which could not allow us to determine the long-term effects of the intervention, and the small number of the participants could not allow us to determine the educational and occupational effects on the dairy consumption prior to intervention, or to determine the effects of age during the intervention course.

Conclusion

Increasing the amount of dairy products was not effective in improving weight or fat loss and blood lipids during energy restriction, but had a positive impact on blood pressure in premenopausal obese women.

Acknowledgments

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