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Original article

Body composition and dairy intake in sedentary employees who participated in a healthy program based on nutrition education and Zumba

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S U M M A R Y

Background & aims: The dairy intake is associated with body composition; however, its effect is controversial and remains unknown in relation to exercise interventions as Zumba Fitness®. Thus, we analyzed the body composition and its relation to dairy intake in sedentary employees who participated in a healthy program based on nutrition education and Zumba Fitness®.
Methods: Sixty-nine sedentary employees (age = 38.41 ± 7.45-yr, 81.16% women) participated in a healthy program (16-weeks) based on nutrition education (2 sessions, 1st and 10th week) and Zumba Fitness® (ZF) exercise programs [2 interventions: a) ZF, 1 h of ZF/3 day/week; b) ZF + BW, 1 h of ZF/3 day/week plus 20 min of bodyweight training]. Body composition (body weight, height, BMI, waist-hip index, ∑6-skinfolds, fat mass and muscle mass), blood pressure and dairy intake (milk, yogurt and cheese) were assessed at baseline and after interventions. Participants were categorized into normal weight (NW, BMI = 18.5–24.9 Kg/m^2) and excess weight (EW, BMI ≥ 25 Kg/m^2). Dairy intake and changes in BMI (ΔBMI = BMI after intervention-BMI at baseline) were divided into tertiles (T).
Results: Only muscle mass (Kg) differed between ZF and ZF + BW (baseline and 16-weeks). Anthropometric indicators of adiposity were lower in NW than EW group (baseline). The ∑6-skinfolds and fat-mass decreased, while muscle mass increased in ZF and ZF + BW, and in NW and EW groups (16-weeks). The most consumed dairy was milk (baseline). Participants of T1 of cheese intake (baseline) had a higher reduction in BMI (0.42 ± 0.56 vs 0.62 ± 1.42 Kg/m^2) and in ∑6-skinfolds (40.23 ± 13.13 vs 23.51 ± 10.84 mm) than individuals in T3 (16-weeks). Employees who presented higher weight loss (T3, BMI decrease > 0.50 Kg/m^2) consumed lower cheese than the weight gain group (T1, BMI increase ≥ 0.33 Kg/m^2) (baseline).
Conclusions: Healthy programs based on nutrition education and Zumba Fitness® improve body composition both in EW and NW sedentary employees. ZF is as effective as ZF + BW. A lower cheese intake, at baseline, but not milk or yogurt, was related to a weight loss.

1. Introduction

The sedentary lifestyle is a growing problem of concern to international organizations [1]. Evidence indicates that sedentary behavior may affect cardiovascular health, metabolic regulation, mortality [2] and cognitive function [3]. Worldwide obesity and overweight epidemic are strongly linked to cardiovascular diseases (CVD) [4], caused by the change of population lifestyle in the last decades due to inadequate eating habits in combination with low

Abbreviations: BMI, body mass index; BW, bodyweight training; CVD, cardiovascular diseases; EW, excess weight; ISAK, International Society for the Advancement of Kinanthropometry; NW, normal weight; RPE, rating perceived exertion; SFA, saturated fatty acid; T, tertile; ZF, Zumba Fitness.

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physical activity levels [1]. Additionally, the majority of the working occupations of nowadays contain a high prevalence of sedentary tasks which contribute to the increase the inactive time [5] and thus, a low calories expenditure. Therefore, several strategies to reduce overall sedentary time and improve body composition and health through physical exercise programs have been tested in the community of employees over the last few years [6]. In this sense, new exercise interventions, such as Zumba Fitness®, which recently has been cataloged as an effective exercise program for the improvement of body composition, aerobic capacity, and general health [7], could be a very attractive and effective program for encouraging physical activity levels in sedentary employees.

Moreover, promoting healthy eating habits is a key factor in the prevention and treatment of non-communicable diseases, and should be combined with exercise, since it has been demonstrated the importance of the physical fitness to the potential impact of weight loss in the fight against obesity and the associated CVDs [8]. It has been recognized that several outcomes of exercise programs, as weight and body fat loss, are more achievable when are accompanied with diet in comparison with their individual application [9]. Regarding diet habits, dairy intake is linked to improvements in body composition and reduction of obesity risk [10], metabolic syndrome [11] and CVD risk factors [12]. However, the results are controversial, while some studies describe the beneficial effects of dairy intake on health [13], others do not support them [14] or detected inverse association [15,16].

Also, under our knowledge, there are no previous studies which included exercise programs in combination with dairy intake, using nutrition education and its monitoring, together with Zumba Fitness® exercise classes as intervention. So, this is the first study that explores the analysis of dairy intake and its association with body composition after an intervention based on nutrition education and Zumba Fitness®. We hypothesized that dairy intake will be linked to the changes in body composition observed at the end of the intervention. Thus, our objective was to analyze the body composition and its relation to dairy intake in sedentary university employees who participated in a healthy program based on nutrition education and Zumba Fitness® exercise classes.

2. Materials and methods

2.1. Participants and study design

A controlled clinical trial design was carried out [17]. National University of Chimborazo Research Committee approved the study design (29-CI-2014-10-17-22). The study meets all the ethical requirements for human studies present in the Helsinki Declaration 2002. Inclusion criteria were adults of both genders, not meeting current minimum physical activity World Health Organization guidelines (i.e., engaging in less than 150 min of moderate to vigorous physical activity per week) and inexperienced at Zumba Fitness® classes. Exclusion criteria were serious illness such as cancer, current skeletal muscle injury or chronic medical conditions such as diabetes or cardiovascular disease. The publicity department of the University collaborated in the promotion of the study in the official website and social network. Additionally, via email from the research team, university employees received an overview of the study, and they were invited to the study information sessions. E-mail invitation was sent to ≈900 university employees. A total of 150 employees attended to the two information sessions organized per university campus. After sessions, interested employees (professor or administrative staff) could be inscribe in a registration sheet, where personal and contact data, and eligibility criteria by the research were asked. A total of 120 employees agreed to participate in the study (80% of eligible participants). If inclusion criteria were met, participants were called by telephone and cited for the initial assessments. There was no racial or gender bias in the selection of participants. Finally, 100 participants (66.7% of eligible participants) met the inclusion criteria but only 69 (46% of eligible participants) could commit to attending the full intervention (Fig. 1). Characteristics of the enrolled participants are shown in Table 1.

2.2. Study protocol

Participants' invitation for the healthy program was performed between October and December of 2014. Invitation was sent to the two campuses of the university (North and South). Information sessions to enroll the participants were done during the second and the third week of January 2015. All participants who accept the participation in this study gave an informed consent. Participants screening was performed during the fourth week of January 2015.

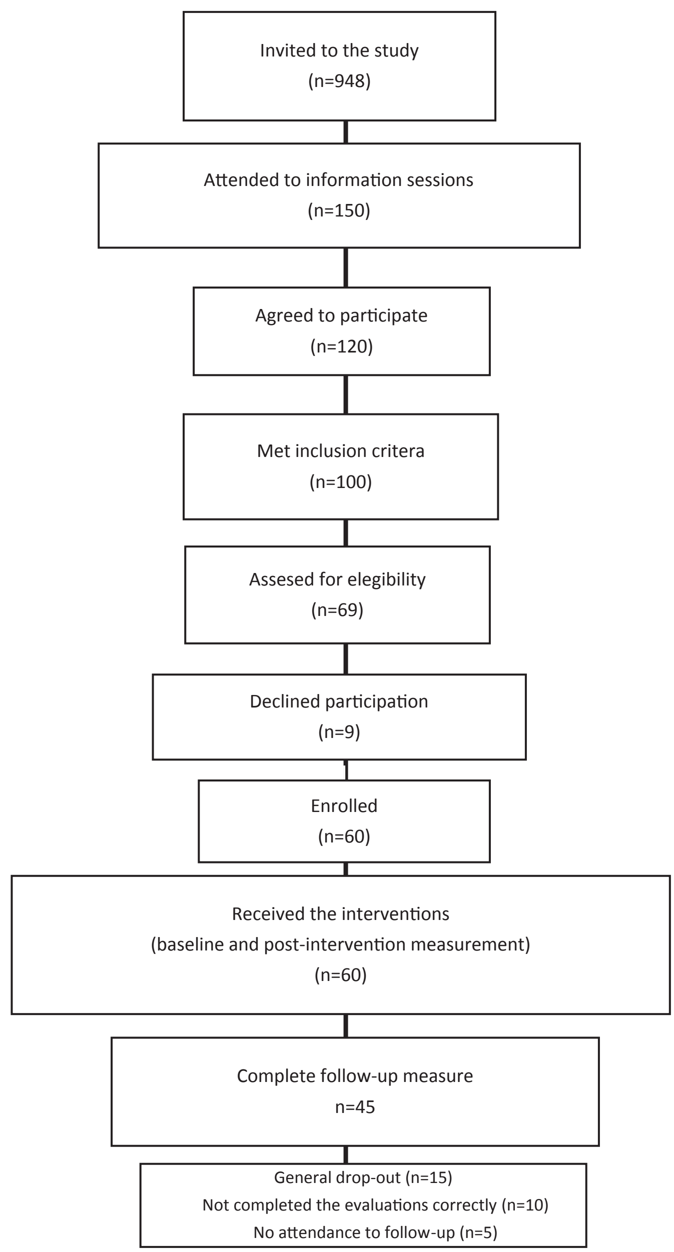

Fig. 1. Flow diagram of participant recruitment.

Table 1
Characteristics of the participants according to type of exercise intervention.

Parameters	n	ZF	*P*	ZF + BW	*P*	All	*P*	*P* (ZF vs ZF + BW)
Sociodemographic characteristic								
Age (years)[1]	69	39.24 ± 8.09		39.32 ± 6.40		38.97 ± 7.45		0.964
Sex (female, %)[2]	69	86.84	**<0.001**	71.43	**0.023**	81.16	**<0.001**	0.120
Height (cm)[1]	68	157.78 ± 82.87		161.79 ± 115.30		159.44 ± 9.77		0.124
Occupation (%)[2]	69		0.052		1.000		0.118	0.197
Academics		34.21		50.00		40.58		
Administrative		65.79		50.00		59.42		
Nutritional status (%)[2]	68		0.052		0.174		**0.011**	0.631
Normal weight		36.84		46.43		41.18		
Overweight		47.37		35.71		42.65		
Obesity		15.79		17.86		16.18		

[1]Results are expressed as mean ± SD. Statistically significant differences (indicated in bold): $p < 0.05$ ([1]Independent-samples t-test and [2]Chi square). ZF: Zumba fitness, ZF + BW: Zumba fitness + bodyweight training.

Assessments took place during 1st and 2nd week of February 2015. Intervention protocol included 16 weeks from middle of February to middle of June 2015. Data collection were performed at baseline and after the intervention. The healthy program intervention combined nutrition education, into 2 sessions (1st and 10th week), and an exercise intervention based on Zumba Fitness. Zumba Fitness® exercise program was performed 3 days per week in 2 groups; a) ZF (n = 38): performed 1 h/3 day/week of Zumba Fitness® classes; b) ZF + BW (n = 28): performed the same classes of Zumba Fitness® (1 h/3 day/week) plus 20 min extra of bodyweight training classes.

2.3. Assessments protocol

Participants were cited at Medical Department of the Faculty of Health Sciences of National University of Chimborazo (approx. 7 participants per day during 2-weeks, in the morning from 7 to 10 am) in fasting conditions and no exercise practice in the last 24-h, in order to evaluate body composition, blood pressure and dietary intake at baseline and after 16-weeks of interventions.

2.4. Outcomes measures

2.4.1. Body composition

All participants underwent an anthropometric assessment by skinfold thickness using procedures described by International Society for the Advancement of Kinanthropometry (ISAK). ISAK Restricted profile was executed for a certificate researcher (ISAK level II) to calculate BMI (body mass index), body fat mass, muscle mass and 6 skinfolds sum.

BMI was calculated as weight (kg) divided by the square of height (m), its classificatory norms were in accordance with the Spanish Society for Obesity Research (*Sociedad Española para el Estudio de la Obesidad*) [18]. Height was measured to the nearest 0.1 cm and body mass was measured to the nearest 0.1 kg cm using for both a mechanical scale with stadiometer (Health o meter Professional, Wellchallyn, México). BMI was used for categorizing the participants according to their nutritional status at baseline (normal weight: NW, BMI = 18.5–24.9 Kg/m^2, and excess weight: EW, BMI ≥ 25 Kg/m^2) for further analysis. Also, to evaluate the dairy intake according to degree of weight variation, we determined the tertiles (T) of the changes in BMI (ΔBMI = BMI after intervention - BMI at baseline): T1: weight gain ≥0.33 Kg/m^2; T2: weight gain 0.32 Kg/m^2 to weight loss 0.49 Kg/m^2; T3: weight loss >0.50 Kg/m^2.

Waist-hip index was calculated from the coefficient between waist and hip perimeters expressed in centimeters and using the protocol reported from Word Health Organization [19]. Percentage of body fat mass was estimated through the Faulkner equation: males' body fat % = 0.153*(A) + 5.783, females' fat % = 0.213*(A) + 7.9, where (A) was the sum of 4 skinfolds (triceps, subscapular, supraspinal, abdomen, expressed in millimeters). Skinfold thickness were recorded to the nearest 0.2 mm at a constant pressure of 10 g/mm by using a Holtain skinfold caliper (Holtain Ltd., Crymych, UK). Kilograms of body fat mass was estimated from the total body weight. Muscle mass were obtained using the methodology of four compartments described by De Rose and Guimaraes in 1980 derived from Matiegka equation used for the study of the body composition in four body fractions [20].

2.4.2. Blood pressure assessment

Blood pressure was measured by trained nurse staff using a sphygmomanometer kit arm no digital and a stethoscope (Riester, Germany).

2.4.3. Dietary intake

To nutritional monitoring, dietary records of 3 representative days of regular intake (2 days of the week and 1 weekend) were applied at baseline and at the end of the healthy program (16-weeks). The dietary intake was determined by a nutritionist researcher, considering the quality and quantity of food and preferences. The dietary records were self-administered, for which reason the participants were previously trained on the correct way to complete the form. The amount of food consumed was indicated using home measures.

The dietary consumption was evaluated considering the mean of food amount consumed of the 3 days recorded, being calculated from the corresponding standard portion size. The dairy intake (milk, cheese and yogurt) was determined transforming these data into food volume/weight (gr or ml), as appropriate. The initial nutritional records were explained and delivered to the participants in this baseline assessment, which were delivered back to the researchers by the participants within a week of beginning the intervention. A simplified food frequency questionnaire was applied at 8 weeks of study, which included the key points of the participants' previous intake. It was developed considering a validated questionnaire [21]. This allowed monitoring compliance with the recommendations provided in the initial stage. The nutritional registers after the healthy program were delivered at the final assessment.

Then, to determine if there were differences in the changes in body composition according to the dairy intake, we calculated the tertiles at baseline and after 16-weeks of interventions. At baseline, the tertiles were the following: a) Milk: T1, ≤133.33 g/day; T2, 133.34–250.00 g/day; T3, >250.00 g/day; b) Cheese: T1, ≤20.00 g/day; T2, 20.01–35.00 g/day; T3, >35.00 g/day; c) Total dairy: T1, ≤226.67 g/day; T2, 226.68–336.67 g/day; T3, >336.67 g/day. At 16-

weeks of interventions, the defined groups were: a) Milk: T1, ≤83.33 g/day; T2, 83.34–217.33 g/day; T3, >217.33 g/day; b) Cheese: T1, ≤22.00 g/day; T2, 22.01–40.00 g/day; T3, >40.00 g/day; c) Total dairy: T1, ≤143.33 g/day; T2, 143.34–301.67 g/day; T3, >301.67 g/day.

2.4.4. Zumba Fitness® classes

All participants were involved in 16-weeks of exercise interventions based on Zumba Fitness® classes outside working hours (three times per week). The healthy program included two different exercise program groups: Zumba Fitness® intervention group (ZF), and Zumba Fitness® plus 20 extra minutes of Bodyweight training (ZF + BW). All participants did the part of Zumba Fitness® at the same time. The ZF + BW group continued with 20 min extra of bodyweight training.

Zumba Fitness® classes: All classes were led by a certified Zumba Fitness® instructor (ZIN). Each training session comprised a standardized warm-up (~10 min) starting with easy Zumba Fitness® dance movement and dynamic stretching, and continuing with fast music to increase heart rate as well as lower extremity exercises. The main Zumba Fitness® part (~40 min) combined different Latin dances such as salsa, merengue, cumbia and reggaeton. Each session ended with a 10-min cool-down period, with slower music and whole-body movements combined with breathing and relaxation. Zumba Fitness® training comprised of forward, sideways and backward steps, spinal rotations, combined with turns and jumps. The Zumba Fitness® choreographies were the same for the 16 weeks of intervention with the progressive increase in the quality and complexity of the movements over time. The exercise intensity was monitored using the 0 to 10 rating perceived exertion (RPE) scale. During the intervention, the RPE rating was obtained immediately after each class. All Zumba Fitness® sessions were conducted in the indoor facility, at the same time every day (from 6 to 7 pm) and under the supervision of the all researchers.

Bodyweight training work out: The bodyweight work-out consisted in 20-min of resistance exercises using bodyweight as the load and led by an instructor. Bodyweight work-out was focused in 4 muscle groups: lower limbs, chest, triceps, and core muscle, exercising always in this order, and composed by main resistance exercises such as squats, push up, triceps dips, back extensions, crunches and plank exercises. Participants carried out one period of 4-min for each main muscle group. During the 4-min, four variations of the main exercises (1-min for each exercise variation) were done at different muscle contraction speed (2:2, 3:1, 1:3 and 1:1). Approximately, 15–20 repetitions for each exercise variation were done. Rest time for each period was only for the change of exercise variation. There was 1-min rest between each period. Bodyweight work out was the same for the 16-weeks of intervention.

2.4.5. Nutrition education

A nutritionist carried out the nutritional intervention. The participants received two group sessions of nutrition education aimed at promoting healthy eating habits and prevention and/or treatment of chronic non-communicable diseases (2 h between exposure and questions, for each one). The first activity was performed at the beginning of the program (1st week), which was based on the main deficiencies and/or needs of the study population. The recommendations were developed from the dietary records information obtained at baseline, being suitable for physical exercise.

The second educational activity was carried out at 9–10 weeks, after processing the information from the food frequency questionnaire applied at 8 weeks. In this session, the results from the questionnaire were presented, and a pamphlet with nutrition recommendations, including the food that should be eaten less often, and an example of menu for a day, was delivered. The objective of this activity was to reinforce the knowledge acquired previously and deepen new concepts, as well as show participants the strengths and weaknesses of their feeding.

2.5. Statistical analysis

IBM SPSS Statistics 22.0 (IBM Corp, Armonk, NY, USA) was used for statistical analyses. Results were expressed as means ± standard

Table 2
Main study variables compared between exercise groups (ZF vs ZF + BW) and measure moments (baseline vs after 16-weeks of interventions) by 2-way mixed ANOVA.

Parameters	ZF		ZF + BW		Pair comparisons				Main effects		Interactions
	Baseline	After 16-weeks	Baseline	After 16-weeks	P^1	P^2	P^3	P^4	Exercise group factor	Measure moment factor	Exercise groups x Measure moment
Body composition											
Weight (kg)	64.68 ± 12.67	64.48 ± 12.43	70.75 ± 13.58	70.34 ± 13.61	0.157	0.168	0.676	0.429	NS	NS	NS
BMI (Kg/m²)	26.21 ± 4.56	25.96 ± 4.28	26.42 ± 3.48	26.43 ± 3.56	0.877	0.714	0.390	0.963	NS	NS	NS
∑6-Skinfolds (mm)	143.48 ± 32.26	115.96 ± 26.54	141.54 ± 26.82	109.23 ± 24.01	0.841	0.414	**<0.001**	**<0.001**	NS	**	NS
Fat-mass (Kg)	14.74 ± 6.01	12.46 ± 4.94	15.26 ± 4.52	12.87 ± 4.44	0.767	0.786	**<0.001**	**<0.001**	NS	**	NS
Fat-mass (%)	22.13 ± 4.48	18.80 ± 3.40	21.36 ± 3.08	17.99 ± 2.91	0.542	0.461	**<0.001**	**<0.001**	NS	**	NS
Muscle mass (Kg)	30.42 ± 3.74	32.61 ± 4.54	33.93 ± 5.47	36.14 ± 5.55	**0.023**	**0.035**	**<0.001**	**<0.001**	*	**	NS
Muscle mass (%)	47.63 ± 4.17	51.04 ± 3.57	48.21 ± 2.86	51.71 ± 2.67	0.620	0.516	**<0.001**	**<0.001**	NS	**	NS
Waist-hip index	0.82 ± 0.10	0.82 ± 0.11	0.83 ± 0.08	0.84 ± 0.07	0.699	0.499	0.510	0.701	NS	NS	NS
Blood pressure											
SBP (mmHg)	115.50 ± 14.32	111.00 ± 15.18	112.22 ± 6.47	110.61 ± 8.73	0.378	0.925	**0.044**	0.483	NS	NS	NS
DBP (mmHg)	62.50 ± 9.11	65.00 ± 8.89	62.22 ± 4.28	62.78 ± 6.69	0.907	0.394	0.185	0.778	NS	NS	NS
Daily intake of dairy											
Milk (mL)	213.27 ± 82.81	182.58 ± 149.09	256.91 ± 160.17	225.16 ± 149.76	0.418	0.480	0.464	0.377	NS	NS	NS
Yogurt (mL)	109.67 ± 29.26	103.33 ± 81.99	66.67 ± 0.00	83.33 ± 0.00	0.107	0.758	0.864	0.776	NS	NS	NS
Cheese (g)	49.62 ± 43.03	29.74 ± 32.10	45.67 ± 48.29	46.00 ± 38.30	0.818	0.228	**0.009**	0.957	NS	**	***
Total dairy (g)	295.97 ± 114.60	231.23 ± 188.73	280.55 ± 177.56	262.37 ± 169.50	0.786	0.634	0.109	0.589	NS	NS	NS

Results expressed as means ± SD. Statistically significant differences (indicated in bold): $p < 0.05$ (Two-way mixed ANOVA); comparisons between: [1]exercise groups at baseline, [2]exercise groups after 16-week of interventions, [3]measure moment in ZF group and [4]measure moment in ZF + BW group; *significant main effect of exercise group factor, **significant main effect of measure moment factor, ***significant interactions between exercise groups and measure moment (significant main effects and interactions are described in results section), NS: no significant. BMI: body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure, ZF: Zumba fitness, ZF + BW: Zumba fitness + bodyweight training. All dependent variables were analyzed for 39 participants, who completed all measures (at baseline and after 16-weeks of interventions), except for SBP (n = 38), DBP (n = 38), milk/day (n = 26), yogurt/day (n = 7), cheese/day (n = 30) and total dairy/day (n = 31).

Table 3
Main study variables compared between nutritional status groups (normal weight vs excess weight) and measure moments (baseline vs after 16-weeks of interventions) by 2-way mixed ANOVA.

Parameters	Normal weight		Excess weight (OW + OB)		All		Pair comparisons					Main effects		Interactions
	Baseline	After 16-weeks	Baseline	After 16-weeks	Baseline	After 16-weeks	P^1	P^2	P^3	P^4	P^5	Nutritional status factor	Measure moment factor	Nutritional status x Measure moment
Body composition														
Weight (kg)	60.67 ± 7.20	60.68 ± 6.70	71.74 ± 14.51	71.25 ± 14.61	67.48 ± 13.28	67.18 ± 13.15	**0.009**	**0.013**	0.991	0.278	0.505	*	NS	NS
BMI (Kg/m^2)	22.61 ± 1.35	22.83 ± 1.38	28.61 ± 3.39	28.27 ± 3.53	26.31 ± 4.05	26.18 ± 3.93	**<0.001**	**<0.001**	0.524	0.203	0.767	*	NS	NS
∑6-Skinfolds (mm)	124.90 ± 15.07	96.33 ± 11.34	153.64 ± 31.12	123.18 ± 26.27	142.58 ± 29.50	112.86 ± 25.30	**0.002**	**0.001**	**<0.001**	**<0.001**	**<0.001**	*	**	NS
Fat-mass (Kg)	11.48 ± 2.06	9.64 ± 1.36	17.16 ± 5.58	14.53 ± 5.02	14.98 ± 5.32	12.65 ± 4.66	**0.001**	**0.001**	**<0.001**	**<0.001**	**<0.001**	*	**	NS
Fat-mass (%)	18.87 ± 2.16	15.87 ± 1.20	23.59 ± 3.60	20.02 ± 3.26	21.85 ± 3.89	18.45 ± 3.38	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	*	**	NS
Muscle mass (Kg)	30.53 ± 3.69	32.41 ± 3.65	32.98 ± 5.36	35.39 ± 5.86	32.07 ± 4.95	34.40 ± 5.25	0.128	0.087	**<0.001**	**<0.001**	**<0.001**	NS	**	NS
Muscle mass (%)	50.35 ± 2.26	53.42 ± 1.66	46.37 ± 3.44	50.05 ± 3.21	47.81 ± 3.59	51.34 ± 3.20	**<0.001**	**0.001**	**<0.001**	**<0.001**	**<0.001**	*	**	NS
Waist-hip index	0.76 ± 0.06	0.77 ± 0.04	0.87 ± 0.08	0.86 ± 0.10	0.83 ± 0.09	0.83 ± 0.09	**<0.001**	**0.001**	0.199	0.191	0.843	*	NS	NS
Blood pressure														
SBP (mmHg)	111.33 ± 6.40	105.33 ± 9.90	115.65 ± 13.43	114.39 ± 12.72	113.95 ± 11.28	110.82 ± 12.39	0.254	**0.025**	**0.019**	0.527	**0.027**	NS	**	NS
DBP (mmHg)	61.33 ± 3.52	62.00 ± 5.61	63.04 ± 8.76	65.22 ± 8.99	62.37 ± 7.14	63.95 ± 7.90	0.478	0.224	0.758	0.218	0.310	NS	NS	NS
Daily intake of dairy[I]														
Milk (mL)	200.93 ± 89.41	235.26 ± 152.67	258.31 ± 149.27	192.25 ± 147.99	223.68 ± 120.47[a]	207.14 ± 148.03	0.303	0.492	0.426	**0.043**	0.551	NS	NS	NS
Yogurt (mL)	96.33 ± 30.92	110.00 ± 78.70	100.00 ± 47.14	66.67 ± 0.00	89.92 ± 56.09[b]	97.62 ± 67.65	0.905	0.495	0.702	0.559	0.768	NS	NS	NS
Cheese (g)	40.53 ± 33.74	28.61 ± 21.25	51.94 ± 52.12	45.85 ± 42.48	45.07 ± 43.00[b]	38.96 ± 36.09	0.509	0.205	0.141	0.351	0.087	NS	NS	NS
Total dairy (g)	262.61 ± 105.90	258.94 ± 194.72	302.44 ± 176.44	243.23 ± 167.37	278.09 ± 142.24[c]	249.31 ± 175.42	0.487	0.813	0.929	0.077	0.235	NS	NS	NS

Results expressed as means ± SD. Statistically significant differences (indicated in bold, $p < 0.05$): a) Two-way mixed ANOVA, comparisons between: [1]nutritional status groups at baseline, [2]nutritional status groups after 16-weeks of interventions, [3]measure moment in normal weight group, [4]measure moment in excess weight group and [5]measure moment in all participants; *significant main effect of nutritional status group factor, **significant main effect of measure moment factor, ***significant interactions between nutritional status groups and measure moment (significant main effects and interactions are described in result section), NS: no significant; b) One-way ANOVA, [I]comparisons between daily intake of dairy in all participants at baseline (means in column with different superscript letters are significantly different, $p = 0.013$). BMI: body mass index, SBP: systolic blood pressure, DBP: diastolic blood pressure, OW: overweight, OB: obesity. All dependent variables were analyzed for 39 participants, who completed all measures (at baseline and after 16-weeks of interventions), except for SBP (n = 38), DBP (n = 38), milk/day (n = 26), yogurt/day (n = 7), cheese/day (n = 30) and total dairy/day (n = 31).

Table 4
Changes in body composition after the interventions according to tertiles of dairy intake at baseline.

Body composition	Milk							Cheese	
	T1 (n = 8)	T2 (n = 12)	T3 (n = 11)	*P*	*d*	CI		T1 (n = 13)	T2 (n = 10)
Weight (Kg)	−0.65 ± 1.68	−0.21 ± 1.45	−0.25 ± 2.95	0.918	−0.18	−1.33	0.96	−0.88 ± 1.29	−0.19 ± 1.56
BMI (Kg/m^2)	−0.23 ± 0.64	−0.09 ± 0.88	0.25 ± 1.49	0.585	−0.37	−1.28	0.54	−0.42 ± 0.56[a]	−0.27 ± 0.73[a,b]
∑6-Skinfolds (mm)	−36.04 ± 6.46	−25.23 ± 18.44	−38.69 ± 11.66	0.108	0.17	−0.44	0.78	−40.23 ± 13.13[a]	−27.28 ± 16.89[a,b]
Fat-mass (Kg)	−2.78 ± 0.89	−1.91 ± 1.62	−2.98 ± 1.83	0.250	0.13	−0.84	1.10	−2.93 ± 1.17	−2.34 ± 2.20
Fat-mass (%)	−4.06 ± 1.12	−2.91 ± 2.28	−3.97 ± 1.41	0.214	−0.05	−0.77	0.67	−4.35 ± 1.48	−2.87 ± 2.26
Muscle mass (Kg)	2.36 ± 1.29	1.85 ± 1.25	2.97 ± 1.92	0.105	−0.37	−1.38	0.63	2.32 ± 0.86	2.29 ± 1.97
Muscle mass (%)	4.10 ± 3.05	3.05 ± 2.17	4.15 ± 1.40	0.211	−0.03	−0.76	0.70	4.37 ± 1.36	2.98 ± 2.39
Waist-hip index	−0.00 ± 0.05	0.00 ± 0.03	0.00 ± 0.02	0.847	−0.13	−1.03	0.77	−0.004 ± 0.04	0.002 ± 0.03

Results are expressed as mean ± SD (difference between values at baseline and after 16-weeks of interventions). Means in a row with different superscript letters are significantly different (indicated in bold), $p < 0.05$ (One-way ANCOVA with Bonferroni post hoc correction adjusted for type of exercise intervention). Cohen's *d* (*d*) and confidence interval (CI) were determined between tertiles 1 and 3. T1: tertile 1, T2: tertile 2, T3: tertile 3. BMI: body mass index. Milk: T1, ≤133.33 g/day; T2, 133.34–250.00 g/d; T3: >250.00 g/d. Cheese: T1, ≤20.00 g/day; T2, 20.01–35.00 g/d; T3, >35.00 g/d. Total dairy: T1, ≤226.67 g/day; T2, 226.68–336.67 g/d; T3, >336.67 g/d.

Table 5
Changes in body composition after the interventions according to tertiles of dairy intake at 16-weeks.

Body composition	Milk							Cheese	
	T1 (n=10)	T2 (n=10)	T3 (n=10)	*P*	*d*	CI		T1 (n=11)	T2 (n=10)
Weight (Kg)	0.03 ± 1.36	−0.41 ± 1.57	−0.12 ± 3.12	0.922	0.07	−0.98	1.12	−0.15 ± 1.53	−0.50 ± 1.54
BMI (Kg/m^2)	−0.11 ± 0.80	0.03 ± 0.65	0.24 ± 1.66	0.721	−0.27	−1.21	0.67	−0.60 ± 0.64	−0.08 ± 1.04
∑6-Skinfolds (mm)	−28.39 ± 13.90	−28.50 ± 9.30	−34.52 ± 18.93	0.700	0.39	−0.60	1.37	−30.92 ± 16.50	−24.50 ± 14.58
Fat-mass (Kg)	−2.44 ± 1.99	−2.43 ± 1.01	−2.12 ± 1.59	0.784	−0.21	−1.32	0.90	−2.43 ± 2.04	−1.80 ± 1.34
Fat-mass (%)	−3.35 ± 1.86	−3.39 ± 1.22	−3.18 ± 2.02	0.902	−0.09	−1.12	0.93	−3.37 ± 2.07	−2.56 ± 1.67
Muscle mass (Kg)	2.54 ± 1.70	2.36 ± 1.29	2.13 ± 1.77	0.886	0.25	−0.75	1.24	2.37 ± 1.91	1.54 ± 0.82
Muscle mass (%)	3.47 ± 2.01	3.66 ± 1.27	3.29 ± 1.87	0.857	0.10	−0.91	1.12	3.42 ± 2.17	2.71 ± 1.55
Waist-hip index	0.001 ± 0.03	0.001 ± 0.03	0.01 ± 0.04	0.848	−0.16	−0.95	0.62	−0.001 ± 0.04	0.01 ± 0.02

Results are expressed as mean ± SD (difference between values at baseline and after 16-weeks of interventions). Statistically significant difference: $p < 0.05$ (One-way ANCOVA with Bonferroni post hoc correction adjusted for type of exercise intervention). Cohen's *d* (*d*) and confidence interval (CI) were determined between tertiles 1 and 3. T1: tertile 1, T2: tertile 2, T3: tertile 3. BMI: body mass index. Milk: T1, ≤83.33 g/day; T2, 83.34–217.33 g/d; T3, >217.33 g/d. Cheese: T1, ≤22.00 g/day; T2, 22.01–40.00 g/d; T3, >40.00 g/d. Total dairy: T1, ≤143.33 g/day; T2, 143.34–301.67 g/d; T3, >301.67 g/d.

deviation (SD), for quantitative variables, and percentage, for qualitative parameters. The Kolmogorov–Smirnov test was used to assess the distribution of variables. Chi-square and independent-sample t-test were carried out to analyze qualitative and quantitative characteristics of participants, respectively. The study of body composition, blood pressure and daily intake of dairy, according to the type of exercise intervention (ZF vs ZF + BW) and the measure moment (baseline vs after 16-weeks of interventions) was performed applying two-way mixed ANOVA. Pair comparisons between the different groups of the interaction factors were adjusted by Bonferroni test. The same analysis was used to explore the study variables considering the nutritional status (NW vs EW) at baseline and the measure moment. The differences in the daily intake of dairy in all participants, at baseline, were determined using one-way ANOVA. To study the changes in body composition after interventions according to tertiles of dairy intake (baseline and after 16-weeks of program), and to evaluate the dairy intake (also in both measure moments) according to the degree of change in BMI (ΔBMI tertiles), one-way ANCOVA was carried out. In both cases, one-way ANCOVA was applied employing Bonferroni post hoc correction and controlling for type of exercise intervention (ZF or ZF + BW). Due to the small sample size, to confirm the results, the Cohen's *d* was determined between T1 and T3 of dairy intake and variation of BMI (ΔBMI), including the confidence interval. For all analyses, two-sided significance was determined at a $p < 0.05$.

3. Results

The characteristics of the sedentary employees who participated in the healthy program according to the type of exercise intervention are presented in Table 1. Regarding all sample, the participant's mean age and height were 38.97 ± 7.45 years old and 159.44 ± 9.77 cm, respectively. Most participants were females (81.16%, $p < 0.001$). No differences were found in occupation. The percentage of obesity was lower than overweight and normal weight participants (16.18%, 42.65% and 41.18%, respectively, $p = 0.011$). The mean of attendance to exercise session was 76.75 ± 7.91% and the mean of RPE was 7.43 ± 0.77, classifying the classes as moderate-to-vigorous intensity. When the participants were divided into ZF and ZF + BW groups, the females proportion remained elevated (ZF = 86.84%, $p < 0.001$; ZF + BW = 71.43%, $p = 0.023$). There were no differences for any of participant characteristics between exercise intervention groups.

In Table 2 the main study variables compared between exercise groups (ZF vs ZF + BW) and between measure moments (baseline vs after 16-weeks of interventions) are presented and analyzed by 2-way mixed ANOVA to explore the possible main effects of the factors and the interactions between them. There were no differences between the exercise groups for the majority of the study variables, both at baseline and after the 16-weeks of interventions. Only a significant main effect of exercise group factor was observed on muscle mass (Kg) [$F(1, 37) = 5.322$, $p = 0.027$, $\eta^2 = 0.126$]; the ZF + BW group showed significantly higher values than ZF group (baseline: ZF = 30.42 ± 3.74 vs ZF + BW = 33.93 ± 5.47 Kg, $p = 0.023$; after 16-weeks of intervention: ZF = 32.61 ± 4.54 vs ZF + BW = 36.14 ± 5.55 Kg, $p = 0.035$). In addition, the measure moment factor presented a significant effect in several variables: 6-skinfold sum [$F(1, 37) = 137.107$, $p < 0.001$, $\eta^2 = 0.787$], fat-mass (Kg) [$F(1, 37) = 88.693$, $p < 0.001$, $\eta^2 = 0.706$], fat-mass (%) [$F(1, 37) = 134.026$, $p < 0.001$, $\eta^2 = 0.784$], muscle mass (Kg) [$F(1, 37) = 67.902$, $p < 0.001$, $\eta^2 = 0.647$], muscle mass (%) [$F(1, 37) = 140.003$, $p < 0.001$, $\eta^2 = 0.791$] and daily intake of cheese [$F(1, 28) = 4.363$, $p = 0.046$, $\eta^2 = 0.135$]. The 6-skinfold sum and fat-

Cheese					Total dairy						
T3 (n = 12)	*P*	*d*	CI		T1 (n = 11)	T2 (n = 11)	T3 (n = 13)	*P*	*d*	*CI*	
0.49 ± 2.85	0.302	−0.64	−1.48	0.20	−0.40 ± 1.64	0.15 ± 1.32	−0.37 ± 2.84	0.838	−0.01	−0.95	0.92
0.62 ± 1.42[b]	**0.026**	−0.79	−1.47	−0.12	−0.27 ± 0.76	0.02 ± 0.86	0.15 ± 1.42	0.587	−0.32	−1.08	0.44
−23.51 ± 10.84[b]	**0.019**	−1.05	−1.68	−0.42	−31.11 ± 10.66	−26.48 ± 19.06	−34.18 ± 15.07	0.511	0.19	−0.51	0.90
−1.74 ± 1.21	0.176	−0.78	−1.43	−0.13	−2.44 ± 0.98	−1.85 ± 1.71	−2.70 ± 1.87	0.433	0.17	−0.68	1.02
−2.71 ± 1.31[b]	0.061	−0.92	−1.58	−0.27	−3.53 ± 1.37	−2.96 ± 2.39	−3.57 ± 1.66	0.677	0.02	−0.71	0.75
2.29 ± 1.97	0.991	0.02	−0.67	0.70	2.19 ± 1.24	2.04 ± 0.99	2.61 ± 2.05	0.646	−0.26	−1.15	0.63
2.95 ± 1.31	0.077	0.79	0.17	1.41	3.57 ± 1.47	3.10 ± 2.23	3.75 ± 1.69	0.682	−0.10	−0.86	0.65
0.008 ± 0.03	0.599	−0.32	−1.06	0.42	−0.00 ± 0.04	0.01 ± 0.04	0.00 ± 0.02	0.630	−0.18	−0.88	0.52

Cheese					Total dairy						
T3 (n=10)	*P*	*d*	CI		T1 (n=12)	T2 (n=10)	T3 (n=10)	*P*	*d*	CI	
0.71 ± 2.87	0.405	−0.40	−1.36	0.56	0.50 ± 1.20	−1.15 ± 1.60	0.33 ± 2.93	0.223	0.08	−0.82	0.97
0.48 ± 1.44	0.423	−0.41	−1.18	0.35	0.10 ± 0.70	−0.27 ± 0.72	0.41 ± 1.60	0.419	−0.24	−1.05	0.58
−30.19 ± 8.08	0.370	−0.05	−0.81	0.71	−26.99 ± 14.38	−32.27 ± 13.48	−30.18 ± 16.49	0.915	0.20	−0.66	1.07
−2.29 ± 1.13	0.553	−0.09	−1.10	0.91	−2.23 ± 2.00	−2.39 ± 0.94	−2.08 ± 1.56	0.924	−0.10	−1.17	0.96
−3.45 ± 1.12	0.382	0.05	−0.82	0.91	−3.24 ± 2.03	−3.28 ± 1.16	−3.09 ± 1.88	0.944	−0.08	−1.07	0.90
3.03 ± 1.38	0.102	−0.40	−1.34	0.53	2.73 ± 1.65	1.61 ± 0.88	2.52 ± 1.72	0.226	0.13	−0.79	1.04
3.75 ± 1.12	0.363	−0.18	−1.08	0.71	3.46 ± 2.15	3.30 ± 1.18	3.33 ± 1.75	0.911	0.07	−0.92	1.06
0.02 ± 0.03	0.429	−0.45	−1.32	0.41	0.01 ± 0.04	−0.001 ± 0.02	0.01 ± 0.03	0.748	−0.09	−0.94	0.75

mass (Kg and %) showed a significant decrease after the 16-weeks of interventions compared with baseline and independently of exercise groups ($p < 0.001$), whereas the muscle mass (Kg and %) increased ($p < 0.001$). Moreover, the SBP decreased in ZF group ($p = 0.044$). Finally, only daily intake of cheese presented a significant interaction between the exercise groups and the measure moment, where ZF group significantly decreased the daily intake of cheese after 16-weeks of intervention compared with baseline (baseline = 49.62 ± 43.03 vs 16-weeks = 29.74 ± 32.10 g, $p = 0.009$), while ZF + BW group not (baseline = 45.67 ± 48.29 vs 16-weeks = 46.00 ± 38.30 g, $p = 0.96$).

Table 3 shows the main study variables compared between nutritional status groups (NW and EW, using BMI values at baseline) and between measure moments (baseline vs after 16-weeks of interventions) analyzed by two-way mixed ANOVA. The nutritional status factor presented a significant main effect on weight [$F(1, 37) = 7.253$, $p = 0.011$, $\eta^2 = 0.16$], BMI [$F(1, 37) = 39.107$, $p < 0.001$, $\eta^2 = 0.51$] and waist-hip index [$F(1, 37) = 18.787$, $p < 0.001$, $\eta^2 = 0.34$]. The measure moment factor had a significant main effect on Kg of muscle mass [$F(1, 37) = 62.675$, $p < 0.001$, $\eta^2 = 0.63$] and SBP [$F(1, 36) = 5.344$, $p = 0.027$, $\eta^2 = 0.13$]. Also, there was a significant main effect of nutritional status and measure moment factors on 6-skinfold sum [$F(1, 37) = 13.755$, $p = 0.001$, $\eta^2 = 0.27$; $F(1, 37) = 124.550$, $p < 0.001$, $\eta^2 = 0.77$; respectively], Kg of fat mass [$F(1, 37) = 14.235$, $p = 0.001$, $\eta^2 = 0.28$; $F(1, 37) = 83.075$, $p < 0.001$, $\eta^2 = 0.69$], % of fat mass [$F(1, 37) = 23.616$, $p < 0.001$, $\eta^2 = 0.39$; $F(1, 37) = 125.702$, $p < 0.001$, $\eta^2 = 0.77$] and % of muscle mass [$F(1, 37) = 16.563$, $p < 0.001$, $\eta^2 = 0.31$; $F(1, 37) = 131.318$, $p < 0.001$, $\eta^2 = 0.78$]. The pair comparisons showed that the 6-skinfold sum and fat-mass (kg and %) significantly decreased, and muscle mass (kg and %) significantly increased, after 16-weeks of interventions, in all participants, and EW and NW groups ($p < 0.001$). Systolic blood pressure diminished in NW group ($p = 0.019$) and all ($p = 0.027$) employees after 16-weeks of interventions. No changes were found for daily intake of dairy, except in milk, where the EW participants reduced its consumption after 16-weeks of interventions (258.31 ± 149.27 mL vs 192.25 ± 147.99 mL, $p = 0.043$). At baseline, the daily intake of milk was higher than yogurt and cheese (223.68 ± 120.47 mL, 89.92 ± 56.09 mL and 45.07 ± 43.00 g, respectively, $p = 0.013$). When the parameters were compared according to nutritional status, we observed that the anthropometric indicators of general and central adiposity were lower in NW than EW groups at baseline ($p < 0.01$) and remained unchanged until the end of the interventions ($p < 0.05$). Conversely, EW group presented lower % of muscle mass compared to control individuals in both measure moments ($p < 0.001$ at baseline, $p = 0.001$ after 16-weeks). In addition, systolic blood pressure was lower in NW than EW participants after 16-weeks of interventions ($p = 0.025$).

Changes in body composition according to tertiles of dairy intake at baseline (Table 4) and after interventions (Table 5) were analyzed. Only cheese consumption showed statistically significant differences, and these were observed in the intake at baseline. The participants of the T1 (lower cheese consumption) had a higher reduction of BMI ($p = 0.026$) and 6-skinfold sum ($p = 0.019$) than the T3 group, independently of the type of exercise intervention (ZF or ZF + BW). In the first case, the effect size was medium (Cohen's $d = -0.79$; 95% CI = −1.47 to −0.12), although very close to being large (Cohen's d reference value = 0.80), while in the second variable was large (Cohen's $d = -1.05$; 95% CI = −1.68 to −0.42). The effect size for % of fat-mass was large (Cohen's $d = -0.92$; 95% CI = −1.58 to −0.27; $p = 0.061$). There were no differences regarding dairy intake after intervention. Yogurt data were not used due to the reduced sample size.

Figure 2 shows daily intake of dairy at baseline and after interventions based on degree of change in BMI. We observed that the participants who presented higher weight loss (T3, BMI decrease > 0.50 Kg/m^2) consumed lower cheese than the weight gain group (T1, BMI increase ≥0.33 Kg/m^2). Those results were found at baseline ($p = 0.038$), independently of type of exercise intervention (ZF or ZF + BW), with a large effect size (Cohen's $d = 1.06$, CI = 0.27 to 1.84). Again, the yogurt results were not analyzed because the sample size was small.

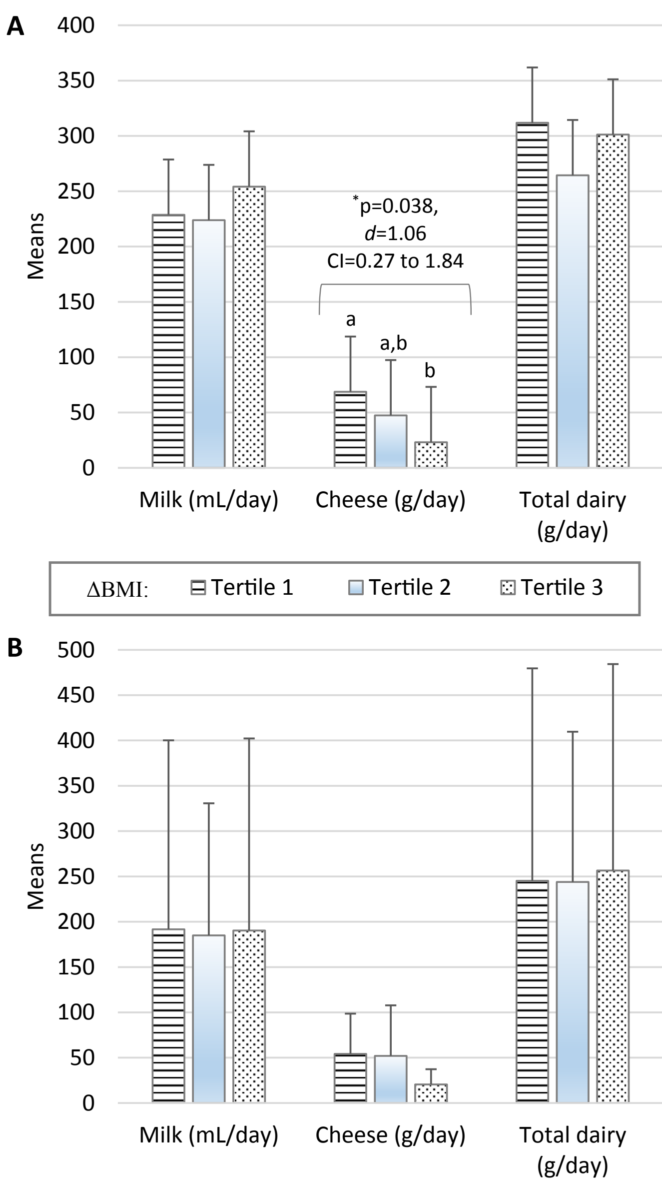

Fig. 2. Dairy intake at baseline (A) and after 16-weeks of intervention (B) based on degree of change in body mass index. Results expressed as means ± SD. *Means in a row with different superscript letters are significantly different, $p < 0.05$ (One-way ANCOVA with Bonferroni post hoc correction adjusted for type of exercise intervention). Cohen's *d* (*d*) and confidence interval (CI) were determined between tertiles (T) 1 and 3. ΔBMI: variation of body mass index; T1: weight gain ≥0.33 Kg/m^2; T2: weight gain 0.32 Kg/m^2 to weight loss 0.49 Kg/m^2; T3: weight loss >0.50 Kg/m^2. At baseline: milk, n = 9/11/11 (for T1, T2 and T3, respectively); cheese and total dairy, n = 11/12/12. After 16-weeks of interventions: milk, n = 10/10/10; cheese, n = 12/10/9; total dairy, n = 12/10/10.

4. Discussion

The aim of this study was to analyze the body composition and its relation to dairy intake in sedentary university employees who participated in a healthy program based on nutrition education and Zumba Fitness® (ZF and ZF + BW). The main findings were an improvement of body composition, independently of the Zumba exercise intervention group (ZF or ZF + BW) and the nutritional status of the participants (NW or EW). Those employees who had a lower cheese intake before the beginning of the program showed a significant improvement in BMI after 16-weeks of interventions.

Concerning body composition, as expected, excess weight participants had higher central and general adiposity than normal weight group. Interestingly, although there were no changes in body weight, BMI and central adiposity, both ZF and ZF + BW, and EW and NW groups presented a general body fat reduction and a muscle mass increase, after 16-weeks of interventions, which are in agreement with other authors, where it has been described that a duration of 12 [22], 16 [23] and 40-weeks [24] of a Zumba Fitness® program has reported statistically significant changes in body composition, including reduction in total fat mass. This was not proportional to the time (6.3% in 12-weeks and 5.5% in 40-weeks). In our case, the participants presented higher body fat loss, corresponding to 15.5%, probably due to the combination of exercise and nutrition education, because the other interventions lacked dietary recommendations. Similarly, in a previous study [25], carried out in overweight and obese adolescents subjected to an anti-obesity program (physical activity increase, dietary treatment, nutrition education and psychological therapy), it was found a reduction in body fatness of 13.0%. Precisely, in a recent review, concerning weight loss interventions aimed to overweight and obesity [9], the authors concluded that the combination of diet and physical activity achieves better results than the application of these separately.

Due to the potential beneficial effects of dairy on obesity and health, in the present project it was explored the relationship between these and changes in body composition after this healthy program. Thereby, we observed that, although the excess weight group decreased the milk intake after the intervention, there was no relationship with body composition variables. However, the participants who consumed lower cheese amount before the intervention had a higher reduction of general adiposity at the end of the interventions. In agreement with our results, a study developed in adolescents identified positive association between total dairy intake and weight-for-age z-score, as well as with fat mass, independently of age, site, ethnicity, education of mother, energy intake, soda intake, physical activity and milk substitutes intake [15]. On the topic of dairy intake and body composition, it has been proposed that dairy intake reduce the risk of obesity, but it has also been reported contradicting and inconclusive results [26]. In a systematic review, the authors indicated that the evidence is suggestive but not consistent, and they considered that it is difficult to make solid conclusions [27]. On the other hand, Wang et al. [10] have realized a meta-analysis of mainly cross-sectional studies, where they indicated that dairy products consumption may be associated with a decreased risk of obesity; but in randomized controlled trial (long-term or studies without energy restriction), the beneficial effect of dairy products on weight and body fat loss was not demonstrated [14]. Even in other aspects of health there are controversies, such as the metabolic syndrome, where there are studies that did not support the hypothesis that dairy products consumption protects against this and its components [28].

Moreover, we observed that participants who presented higher weight loss consumed lower cheese quantity at baseline than the weight gain group. Some authors have reported favorable effects of dairy intake on body composition, but others found that the increase of them was related to higher weight gain or no relationship has been established [27]. Also, in a systematic review and meta-analysis of cohort studies, Schwingshackl et al. [26] described that each serving's increase of cheese was positively associated with body weight. In general, the studies that reported positive actions on body weight and/or overweight refer to total dairy products and not to some in particular [13], or have found statistically significant results in yogurt [26], thus the evidences on cheese intake in relation to adiposity is scarce. For example, Abreu et al. [12] have exposed that the intake of milk, but not total dairy, yogurt, or cheese, is negatively associated with cardiometabolic risk score in adolescents.

Furthermore, it should be considered that, dairy products are rich in several nutrients as calcium and fat. Regarding calcium intake, in adult males was observed that the prevalence of metabolic syndrome, the blood pressure and high-density lipoprotein-cholesterol were lower when the individuals consumed more dietary calcium, in the normal weight group [11]. Conversely, the prevalence of this syndrome was higher in obese population, however, considering the calcium intake from dairy products the authors described a reduction of prevalence than those who did not consume such products. Moreover, Xu et al. [16] showed that higher serum calcium may increase the risk of coronary artery disease. Their findings for the risk factors, low-density lipoprotein- and total cholesterol were also positive, but there was no relationship with BMI. In our population, the main source of calcium was cheese, especially mature type, since 45 g provide 329 mg of this micronutrient, whilst 224 g of milk contain 253 mg. However, those participants who consumed more cheese had lower reduction of 6-skinfold sum and increase of BMI. In the literature, it was reported differential effects depending on whether or not caloric restriction was included [14], which could explained the divergent results.

In addition, dairy, especially cheese, are rich in saturated fatty acids (SFA), which may contribute to 25–41% of saturated fat of diet [26]. Due to the detrimental effects on health, the reduction of their consumption is recommended by international organizations [29]. The recent Circulation Presidential Advisory Expert Statement on dietary fats strongly concluded that lowering intake of saturated fat and replacing it with unsaturated fats will lower the incidence of CVD [30]. According to Hariri et al. [31] SFAs promote obesity problems and preserve fat mass even after weight loss. An elevated intake of them has been related to adipose tissue expansion, rise oxidative stress and inflammation, and insulin resistance in several tissues [32]. These evidences are consistent with our findings, since the participants who intake more cheese, per day, were those who experienced a lower body mass loss or weight gain. Based on the literature, this could be due to the lipid composition of the cheese, specifically, the high saturated fatty acid content.

The main limitation of this study was the lack of control group, but since our purpose was to analyze the changes in variables at the end of the program, we think that the use of baseline values as control is adequate. There have been difficulties in collecting the dietary records, which has led to data loss and, consequently, to the decrease in sample size and absence of control group. However, we think that this study may be an important contribution to increase the knowledge about the effect of Zumba Fitness® programs plus nutrition education on body composition, and to clarify the controversial finding regarding dairy intake and health. Also, in our knowledge, this is the first study regarding to dairy intake and healthy programs which includes Zumba Fitness® exercise combined with nutritional monitoring, so may be the starting point for future researches about this type of exercise intervention including dietary patterns.

Our study shows that the healthy programs that integrate nutrition education and Zumba Fitness® or Zumba Fitness® plus bodyweight training reduce the general adiposity and increase the muscle mass, in excess weight and normal weight sedentary employees. Thus, we think that the implementation of this type of program, either by applying ZF or ZF + BW, could give a useful approach in the prevention and treatment of overweight, obesity, and associated comorbidities in sedentary people. Moreover, our findings suggest that the previous dairy dietary intake could be related to the outcomes of exercise programs aimed to improve body composition. In this study, a low cheese intake ($\leq$20 g/day), at baseline, was linked to a BMI reduction of more than 0.50 Kg/m^2. Thus, considering that the measure of BMI may be as clinically important as, or even more than, total adiposity [33], we think important and necessary to develop more studies to determine if the control of dairy intake previous an exercise program that includes nutrition education could help in achieving better results related to body composition in this population.

Furthermore, the combined analysis of the variations in body composition, blood pressure and dairy intake at different stages helped shed light on the links between those variables and the effectiveness of programs which combining Zumba Fitness® classes and nutrition education. The analysis explored may be used as a tool in the study of adiposity, body composition and dietary patterns in sedentary employees.

In conclusion, the healthy programs based on nutrition education and Zumba Fitness® are useful to improve body composition in sedentary employees. The application of Zumba Fitness® seems as effective as Zumba Fitness® plus bodyweight training to reduce general adiposity and increase mass muscle in this population. Also, this type of program is beneficial for both, sedentary participants with excess weight and normal weight. Moreover, dairy intake, particularly cheese at baseline, could be linked to a lower weight loss and even weight gain, in exercise intervention programs that combine Zumba Fitness® and nutrition education, aimed at sedentary employees. Nevertheless, these findings must be confirmed in further randomized control trial since we have not found any similar studies on this topic to compare our results.

Statement of authorship

YBR is the PI of the research project. YBR, EVG and MG designed this article and conducted the research; MG and YBR analyzed data; MG and YBR wrote paper.

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Conflict of interest

No conflicts of interest.

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