Nutritional intervention programme among a Japanese-Brazilian community: procedures and results according to gender

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Abstract

Objective: To describe the results of a nutritional intervention programme among Japanese-Brazilians according to gender.
Design: A non-controlled experimental study.
Setting: The research included three points of clinical, nutritional and physical activity evaluation: at baseline (in 2005), after the first year and at the end of the second year (in 2007). The paired Student *t* test and multiple linear regression analysis were used to evaluate changes in the subjects' profile (clinical, nutritional and physical activity variables).
Subjects: Japanese-Brazilians (*n* 575) of both genders, aged over 30 years.
Results: We verified statistically significant reductions in body weight (0·9 kg), waist circumference (2·9 cm), blood pressure, fasting blood glucose (>3 mg/dl) and total cholesterol (>20 mg/dl) and its fractions, in both genders. We also found reductions in intake of energy (among men), protein (among women) and fat (both genders) and increases in intake of total fibre (among women) and carbohydrate (among men).
Conclusions: The intervention programme indicated meaningful benefits for the intervention subjects, with changes in their habits that led to a 'healthier' lifestyle positively impacting their nutritional and metabolic profile.

Globally, CVD are the main cause of morbidity and mortality. They present multiple factors and several common mechanisms, and are highly influenced by inflammatory activity. Among the common and modifiable risk factors associated with CVD are diabetes mellitus (DM), hypertension, dyslipdaemia, hypertriacylglycerolaemia and obesity. Addressing the risk factors decreases the incidence and development of these diseases[1,2].

It is known that Japanese people who live in Japan present lower CVD morbidity and mortality rates than Japanese immigrants and their descendents who live in the Americas[3]. Brazil is home to the largest Japanese population outside Japan (around 1 280 000 people) and more than 70 % of this total lives in the south-east region, mainly in the State of São Paulo[4]. The size of this community, along with the results of American studies about the prevalence of type 2 DM among Japanese descendents in the USA[5], led to the creation of the Japanese-Brazilian Diabetes Study Group (JBDSG). The results of studies of this group of researchers, carried out according to WHO guidelines[6], have shown that the prevalence of type 2 DM was 25·5 % for men and 19·9 % for women in 1993, increasing to 40·6 % and 32·4 %, respectively, in 2000[7]. Significant increases in BMI and in all other risk factors of the metabolic syndrome have also been noticed[8]. These findings indicate the existence of a strong genetic predisposition associated with unfavourable

† See Appendix for list of members of the Japanese-Brazilian Diabetes Study Group.

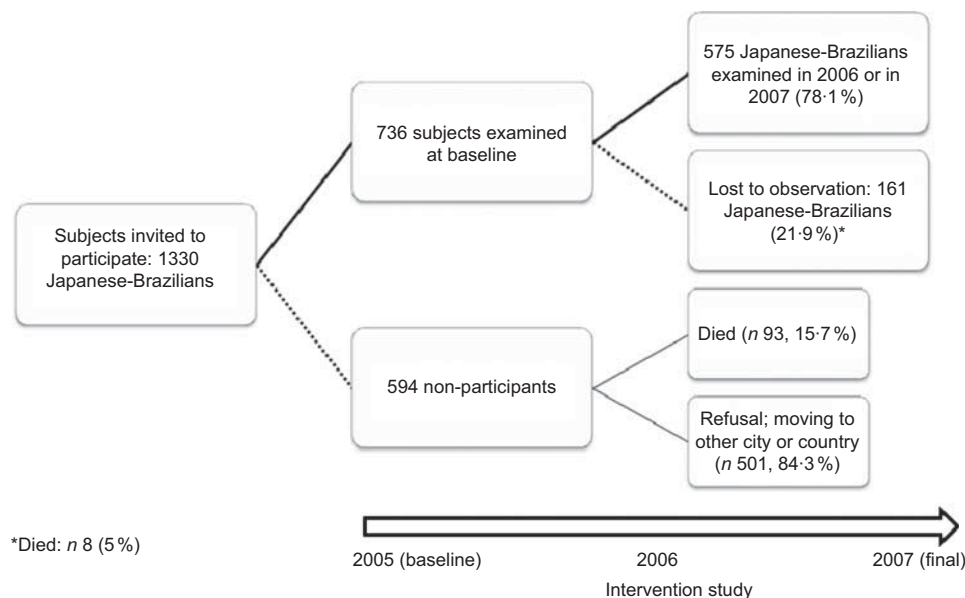*Corresponding author:* Email sgag@uol.com.br; suely.gimeno@unifesp.br

Fig. 1 Participants in the nutritional intervention study, Baura, São Paulo, Brazil, 2007

environmental conditions related to the occidental lifestyle, and the need to implement measures to prevent and control the problem among these immigrants.

Epidemiological studies reporting the efficiency of lifestyle changes in decreasing the incidence of type 2 DM can be found in the literature[9,10]. The results of surveys conducted with individuals presenting impaired glucose tolerance and excess weight have shown that changes in lifestyle are more effective than drug-based interventions[11]. However, as pointed by Sarrafzadegan *et al.*[12], these evidences are less clear for developing countries and intervention studies in such countries have been scarce.

In this context, the main objective of the present study was to describe the results of a nutritional intervention programme carried out with Japanese-Brazilians according to gender.

Experimental methods

This was a non-controlled experimental study that was developed according to principles embodied in the Declaration of Helsinki. It was approved by the Research Ethics Committee of São Paulo Federal University – UNIFESP (protocol number 0862/05).

Considering the unfavourable cardiovascular profile found among Japanese-Brazilians as previously described by JBDSG researchers[7,8], characterized by a high percentage of glucose intolerance (70 %), hypertension (58 %), dyslipidaemia (65 %) and central obesity (57 %), all participants of the JBDSG study conducted in 2000 (*n* 1330) were invited to participate in the current nutritional intervention programme regardless of their chronic diseases or nutritional status. They represented the total

Japanese-Brazilian first (Japan born) and second (born in Brazil) generation living in Bauru (State of São Paulo, south-east region of Brazil) of both genders and ≥30 years of age. In total 736 Japanese-Brazilians joined the intervention programme. Reasons for non-attendance (44·7 %) were death (15·7 %), moving to other city or country and refusal (84·3 %). Unimportant differences were observed concerning gender, age, generation and glucose tolerance status between non-participants and participants of the intervention study. The data of 575 subjects (78·1 %) who had been evaluated at least twice, at baseline (2005) and final (2006 or 2007), were used in the present analysis (Fig. 1).

The nutritional intervention programme was communicated through letters and community events. All subjects were informed about the research objectives, of the minimum risks associated with blood collection with disposable materials and of the advantages of participating in the nutritional programme; information reliability and confidentiality were secured. Those who agreed to participate signed an informed consent agreement.

The survey included three clinical examinations: at baseline (2005), after the first intervention year (2006) and at the end of the second year (2007). On these occasions, subjects were physically examined, fasting blood samples were collected for several biochemical analyses and three 24 h dietary recalls were completed.

Nutritional intervention strategy
The nutritional intervention was based on a programme previously conducted at a health-care service of the State of São Paulo[13,14]. Improvements in the anthropometric (primary outcome), clinical and biochemical profiles of the Japanese-Brazilian subjects were the goals of the

intervention programme. Individual energy requirements and nutritional status of each subject were taken into consideration for diet prescription. For those presenting overweight or central obesity, a diet with reduced energy (2092 to 4184 kJ/d) was prescribed, aiming at a 5 % weight loss. Diet consisted of five meals per day with the following distribution of total energy: 50–60 % from carbohydrates (mainly complex carbohydrates); less than 10 % from SFA (red meat intake reduced to two medium servings daily, two or three daily servings of low-fat dairy products, and reduced intake of fried food, fat, mayonnaise, industrialized food dressing, fatty meat, poultry skin and too many eggs); minimum of 20 % from MUFA and PUFA (olive oil, nuts and fish); and 400 g of fruits and vegetables daily (equivalent to five servings).

The intervention plan was divided into two phases: (i) an individual nutritional assessment and (ii) two group orientation meetings (at the first and second year of the intervention programme) coordinated by nutritionists. In the first phase subjects received an individual assessment: their food records were checked, a detailed nutritional evaluation was made (food intake, energy needs, nutritional status, clinical and biochemical examinations), a diet was prescribed with a list of food replacements, and orientation was given on the importance of a healthy diet and physical activity. The two group meetings focused on food intake goals, physical activity, healthy lifestyle and discussion about difficulties faced by the subjects. Physical therapists and nutritionists supported these sessions.

Evaluation measures

In the three clinical examinations, all subjects were invited to come fasting (10 h minimum) to the clinical laboratory of Sagrado Coração University (Bauru), where a physical examination and a biochemical evaluation were done by the medical staff of UNIFESP. The physical examination included anthropometric measurements and evaluation of blood pressure and physical activity. For those who were not fluent in the Portuguese language, family members or bilingual staff members helped perform the examinations.

After collection of baseline data, results were informed to the participants and those who had health problems were sent for medical care; at that time, appointments with nutritionists were scheduled (subjects and their family members) for orientation on healthy lifestyle.

At the three clinical examinations (baseline in 2005; intermediate in 2006; final in 2007) three 24 h recalls were obtained by nutritionists during the group meetings, laboratory examinations or clinical examinations. Detailed information on food and beverages consumed in the last 24 h was requested. All questionnaires were revised in order to check data quality. Data of food intake in household measures were transformed into grams. To avoid discrepancies when typing data, all recipes and preparations were standardized according to a previously

elaborated codification manual. NutWin software (Programa de Apoio à Nutrição, Versão 1.5; Escola Paulista de Medicina, São Paulo, Brazil) was used to quantity nutrient intake. National and international food composition tables were used for those foods not included in the above software[15–17]. In all clinical examinations, the average values of the nutrients gathered in the three 24 h dietary recalls were analysed to evaluate possible changes in dietary habits.

During the clinical assessment, weight (kg) and height (m) were measured using a digital scale (150 kg capacity, 100 g precision) and a portable stadiometer, respectively. Waist circumference (cm) was measured with a measuring tape at navel level, with subjects standing upright, with relaxed abdomen, arms along the body and feet together. Blood pressure measurements were taken three times with an automatic monitor (model HEM-712C; Omron Healthcare, Inc., Bannockburn, IL, USA) approved by the American Heart Association for epidemiological studies. After a rest for 5 min, the cuff was applied to the right upper arm of the subject who was seated, and automatically inflated. Deflation occurred at a speed predetermined by the equipment. Final values of systolic and diastolic blood pressure were the arithmetic average of the last two measurements (mmHg). Also, the physical activity of the Japanese-Brazilians was evaluated using the short version of the International Physical Activity Questionnaire (IPAQ), which has been validated in twelve countries including Brazil[18,19]. A fasting blood sample was collected to determine glucose level and lipid profile (total cholesterol and its fractions, TAG), among others. The glucose oxidation method was used to determine glycaemia and enzymatic kits were used to measure lipoproteins.

Statistical analyses

Data from the laboratory and anthropometric examinations were analysed with the STATA statistical software package version 10·0 (Stata Corp., College Station, TX, USA). Relative and absolute frequencies, measures of central tendency and dispersion of clinical, biochemical, dietary and anthropometric variables, collected at different time points, were calculated. In crude analyses the paired Student t test was used to verify the presence of statistically significant alterations in nutritional, clinical and biochemical indices at the end of the intervention programme. Absolute changes in all variables of interest (final minus baseline value) observed during the intervention programme were compared between men and women who achieved the study goal (improvement in anthropometric profile) or not, using the Student t test. Multiple linear regression analysis was employed to adjust the absolute change in all variables according to their baseline values and number of examinations (two or three). For analysis purposes, all nutrients were adjusted by energy according to Willett and Stampfer[20].

Results

The 161 (21·9 %) Japanese-Brazilians excluded from the present analysis (those who had been examined just once) presented similar frequency distributions to those who were evaluated two or three times for gender, age, BMI and waist circumference ($P > 0·05$).

Of the 575 subjects who participated in the nutritional intervention programme, 197 were evaluated twice (baseline and final: at 12 or 24 months), while 378 were examined three times (baseline, intermediate and final). Analysis of frequency distributions according to sociodemographic characteristics, anthropometric measures, health status and examinations performed showed a statistically higher rate of individuals with central obesity or normal glucose tolerance among those with two evaluations, compared with those who were evaluated three times.

Female and second-generation subjects represented 56·9 % and 84·7 % of the participants in the intervention programme, respectively. Table 1 shows mean values of anthropometric, clinical, biochemical, dietary and physical activity variables for Japanese-Brazilian men. Comparison of baseline and final values (crude and adjusted changes) showed significant reductions of body weight, waist circumference, blood pressure, fasting glucose, TAG, total cholesterol and its fractions, and energy, SFA and fibre intakes. During this period a statistically significant increase of carbohydrate intake was also observed.

The comparison of values of baseline and final variables among women showed statistically significant decreases in weight, waist circumference, blood pressure, fasting glucose, total cholesterol and its fractions, and protein, total fat (including PUFA, MUFA and SFA) and fibre intakes (Table 2). The mean daily intake of carbohydrate and alcohol increased during the study period.

Both genders showed a significant mean weight loss (0·9 kg) and a reduction in waist circumference (2·9 cm). Among all subjects, 32·5 % (*n* 172) achieved the primary goal of the study. Table 3 shows the main features of these Japanese-Brazilians according to gender. Statistically significant improvements in nutritional and metabolic profile were observed among those who achieved the study goals, especially in men (weight, BMI and TAG levels). Even among those who did not achieve the study goal, some benefits to cardiovascular health were apparently reported, particularly in men.

Discussion

The present intervention was based on a programme previously applied among overweight Brazilian subjects at a primary health-care centre that was effective in a short follow-up time[13,14]. In the present study, we verified that this programme is also suitable for free-living Japanese-Brazilian subjects after 24 months of follow-up.

Nutritional intervention studies among Japanese migrants are sparse in the literature.

In both genders, a substantial improvement in nutritional and metabolic profile was detected during the study. Comparison of the results of both genders suggests that men have achieved better results, with important changes in their anthropometric and metabolic profiles (except HDL cholesterol levels), even with no significant changes in physical activity and food intake. It is important to note that a decrease in energy intake due to reduced SFA intake can contribute to decrease LDL cholesterol levels, as observed in the present study. Although diet compliance has not been evaluated, the results presented suggest (indirectly) that it was, at least, moderate.

Several studies have shown the efficacy of lifestyle intervention programmes in reducing the incidence of type 2 DM, reporting body weight reduction, better glucose tolerance, decreased blood pressure and improved plasma lipid profile of the subjects. In their study with 1232 normotense and hypercholesterolaemic subjects aged between 40 and 49 years, Forti and Diament observed that after a 5-year oriented diet the intervention group presented a 45 % reduction of myocardial infarction risk because of decreased hypercholesterolaemia (13 %) and TAG levels (20 %) and increased HDL cholesterol levels (20 %)[21]. Researchers of the Multiple Risk Factor Intervention Trial (MRFIT) followed up 12866 high-risk subjects from twenty-two US clinical centres. The subjects were divided into two groups: (i) the intervention group (participants received group and individual counselling on smoking cessation, drug treatment programme and hypocholesterolaemic diet) and (ii) the usual care group (subjects were informed about risk factor reduction and drug treatment programme). After 6 years of follow-up, subjects from the intervention group presented a decline in hypercholesterolaemia (5 %) and smoking habit (50 %). Over a longer period of time (10·5 years) subjects in the intervention group showed a 36 % reduction of CHD mortality risk compared with those in the usual care group[22].

In weight-loss studies a lack of accuracy in self-reporting of food consumption and physical activities is frequently reported[23]. In this regard, in our study dietary intake was assessed every meeting using standardized procedures by highly trained nutritionists; however, the limitations of the 24 h dietary recall, such as underreporting mainly by women and by those with higher body weight, are well described[24].

In our study 21·9 % of the subjects evaluated at baseline were lost to observation; this is a problem frequently found in epidemiological studies with moderate- to long-term follow-up[25–28]. Considering that the subjects lost presented similar frequency distribution to those who were evaluated two or three times according to some characteristics of interest (gender, age, BMI, waist circumference), we can conclude that the study population

Table 1 Baseline and final mean values with standard deviations, and absolute change and adjusted change with 95 % confidence intervals, of anthropometric, clinical, biochemical, dietary and physical activity variables of Japanese-Brazilian men during the intervention programme, Bauru, São Paulo, Brazil, 2007

Variable	n	Baseline		Final		P value*	Absolute change†	95 % CI	Adjusted change‡	95 % CI
		Mean	SD	Mean	SD					
Weight (kg)	232	68·2	12·1	67·3	12·4	<0·001	−0·93	−1·28, −0·58	−0·93	−1·27, −0·58
BMI (kg/m²)	213	25·2	4·0	25·2	4·2	0·350	0·03	−0·12, 0·18	0·03	−0·13, 0·18
WC (cm)	232	91·6	9·6	89·6	10·9	0·001	−1·99	−2·99, −0·98	−2·03	−3·01, −1·05
DBP (mmHg)	233	83·1	11·2	78·7	11·8	<0·001	−4·42	−5·71, −3·13	−4·46	−5·65, −3·27
SBP (mmHg)	233	140·6	19·6	133·5	19·3	<0·001	−7·14	−9·32, −4·96	−7·28	−9·23, −5·32
Fasting glucose (mg/dl)	248	116·3	31·4	109·1	26·9	<0·001	−7·21	−10·20, −4·22	−7·21	−9·71, −4·72
TC (mg/dl)	248	207·8	45·2	186·8	38·3	<0·001	−20·93	−25·71, −16·14	−20·93	−24·80, −17·06
HDL-C (mg/dl)	247	49·0	12·2	46·1	10·9	<0·001	−2·87	−4·22, −1·53	−2·87	−3·99, −1·76
LDL-C (mg/dl)	223	123·2	37·4	107·3	33·6	<0·001	−14·88	−19·44, −10·32	−14·89	−18·60, −11·17
TAG (mg/dl)§	246	193·6	207·9	169·5	114·6	0·030	−24·13	−49·19, 0·92	−24·14	−37·66, −10·61
Energy (kJ/d)	235	9737·8	3414·1	9146·6	3173·6	0·003	−591·40	−1004·04, −178·36	−592·71	−939·98, −244·76
Carbohydrate (g/d)‖	235	300·0	105·3	288·1	100·4	<0·001	0·11	0·07, 0·15	0·11	0·07, 0·14
Protein (g/d)‖	235	102·6	47·2	93·2	37·3	0·448	0·32	−4·47, 5·10	0·41	−3·91, 4·72
Total fat (g/d)‖	235	77·2	38·9	71·0	37·4	0·426	−0·43	−5·04, 4·17	−0·24	−4·45, 3·96
PUFA (g/d)‖	235	19·7	9·8	19·0	10·1	0·403	0·17	−1·16, 1·50	0·22	−0·92, 1·36
MUFA (g/d)‖	235	27·1	15·2	24·2	14·4	0·074	−1·39	−3·26, 0·49	−1·30	−2·95, 0·36
SFA (g/d)‖	235	22·4	13·4	20·2	12·1	<0·001	−5·34	−5·41, −5·28	−5·34	−5·40, −5·28
Fibre (g/d)‖	235	27·3	14·2	27·3	12·9	<0·001	−1·67	−1·73, −1·61	−1·67	−1·73, −1·62
Alcohol (g/d)‖	235	5·6	13·2	4·7	10·8	0·390	−0·07	−0·58, 0·44	−0·07	−0·51, 0·36
Physical activity (min/week)§	240	49·3	51·3	49·1	50·9	0·330	0·09	−0·32, 0·50	0·09	−0·30, 0·48
Weekly frequency of physical activity	240	4·0	3·6	4·1	3·5	0·045	0·18	−0·03, 0·39	0·18	−0·02, 0·40

WC, waist circumference; DBP, diastolic blood pressure; SBP, systolic blood pressure; TC, total cholesterol; HDL-C, HDL cholesterol; LDL-C, LDL cholesterol.
*Paired Student t test.
†Absolute change = (final minus baseline value).
‡Adjusted to baseline value and number of examinations.
§Log-transformed value for statistical test.
‖Energy-adjusted value by the residual method for statistical test and confidence interval estimation.

Table 2 Baseline and final mean values with standard deviations, and absolute change and adjusted change with 95 % confidence intervals, of anthropometric, clinical, biochemical, dietary and physical activity variables of Japanese-Brazilian women during the intervention programme, Bauru, São Paulo, Brazil, 2007

Variable	N	Baseline		Final		P value*	Absolute change†	95 % CI	Adjusted change‡	95 % CI
		Mean	SD	Mean	SD					
Weight (kg)	297	56·0	9·3	55·6	9·5	0·006	−0·40	−0·71, −0·09	−0·40	0·71, −0·09
BMI (kg/m²)	265	24·5	4·1	24·6	4·2	0·143	0·08	−0·07, 0·24	0·09	−0·07, 0·24
WC (cm)	296	86·8	9·7	83·7	10·2	<0·001	−3·16	−3·78, −2·53	−3·15	−3·76, −2·54
DBP (mmHg)	302	79·6	11·9	75·6	10·5	<0·001	−3·98	−5·02, −2·94	−3·89	−4·78, −3·00
SBP (mmHg)	302	136·1	23·2	130·1	19·6	<0·001	−6·02	−7·98, −4·06	−5·99	−7·61, −4·38
Fasting glucose (mg/dl)	321	105·6	30·8	101·9	23·2	0·004	−3·73	−6·45, −1·01	−3·73	−5·75, −1·71
TC (mg/dl)	321	218·1	49·5	191·8	36·3	<0·001	−26·29	−31·29, −21·28	−26·29	−29·81, −22·76
HDL-C (mg/dl)	315	56·4	12·3	52·0	12·3	<0·001	−4·45	−5·55, −3·34	−4·45	−5·46, −3·44
LDL-C (mg/dl)	298	129·2	37·8	110·0	31·1	<0·001	−19·17	−23·21, −15·13	−19·35	−22·46, −16·25
TAG (mg/dl)§	320	150·4	103·4	155·4	132·8	0·415	5·00	−7·89, 17·89	5·00	−7·57, 17·57
Energy (kJ/d)	303	7006·1	2215·4	6969·7	2676·9	0·408	−36·48	−343·09, 270·12	−19·16	−297·32, 259·03
Carbohydrate (g/d)‖	303	226·2	73·3	230·3	100·2	0·005	0·05	0·01, 0·09	0·05	0·02, 0·09
Protein (g/d)‖	303	70·0	26·0	68·8	26·1	<0·001	−7·49	−10·28, −4·70	−7·59	−10·10, −5·08
Total fat (g/d)‖	303	56·8	23·9	52·9	24·4	<0·001	−8·48	−11·00, −5·96	−8·48	−10·78, −6·20
PUFA (g/d)‖	303	15·1	7·1	14·2	7·0	<0·001	−2·20	−3·01, −1·39	−2·06	−2·72, −1·40
MUFA (g/d)‖	303	19·4	8·8	17·8	9·2	<0·001	−3·96	−4·97, −2·96	−4·00	−4·88, −3·11
SFA (g/d)‖	303	16·6	8·4	15·6	8·5	<0·001	−5·46	−5·51, −5·40	−5·46	−5·50, −5·41
Fibre (g/d)‖	303	19·7	8·7	20·9	11·6	<0·001	−1·73	−1·79, −1·67	−1·72	−1·77, −1·67
Alcohol (g/d)‖	303	0·35	2·19	0·41	2·12	0·059	0·24	−0·06, 0·53	0·25	0·01, 0·49
Physical activity (min/week)§	318	56·3	71·2	57·5	71·5	0·269	0·09	−0·21, 0·39	0·10	−0·19, 0·39
Weekly frequency of physical activity	318	3·7	3·2	3·7	3·2	0·262	0·05	−0·10, 0·21	0·05	−0·10, 0·20

WC, waist circumference; DBP, diastolic blood pressure; SBP, systolic blood pressure; TC, total cholesterol; HDL-C, HDL cholesterol; LDL-C, LDL cholesterol.
*Paired Student t test.
†Absolute change = (final minus baseline value).
‡Adjusted to baseline value and number of examinations.
§Log-transformed value for statistical test.
‖Energy-adjusted value by the residual method for statistical test and confidence interval estimation.

Table 3 Mean absolute change with standard deviations*,† for anthropometric, clinical, biochemical, dietary and physical activity variables of Japanese-Brazilians during the intervention programme according to gender and achievement of the study goal, Bauru, São Paulo, Brazil, 2007

| | Study goal achieved: yes | | | | | Study goal achieved: no | | | | |
| | Men (n 51) | | Women (n 121) | | | Men (n 181) | | Women (n 176) | | |
Variable	Mean change	SD	Mean change	SD	P value‡	Mean change	SD	Mean change	SD	P value‡
Weight (kg)	−3·36	3·17	−1·67	2·23	<0·001	−0·24	2·10	0·47	2·71	0·003
BMI (kg/m²)	−0·93	1·24	−0·57	1·00	0·025	0·31	0·91	0·58	1·25	0·015
WC (cm)	−9·78	13·07	−7·97	4·31	0·088	0·17	3·19	0·21	2·83	0·456
DBP (mmHg)	−5·65	10·03	−4·89	9·53	0·320	−4·06	10·02	−3·28	8·88	0·217
SBP (mmHg)	−12·07	19·85	−8·38	17·52	0·113	−5·82	15·79	−4·60	16·98	0·241
Fasting glucose (mg/dl)	−9·66	29·02	−4·31	19·13	0·078	−6·33	22·13	−1·87	28·09	0·048
TC (mg/dl)	−32·81	35·34	−28·67	37·20	0·250	−17·51	39·50	−23·75	52·54	0·103
HDL-C (mg/dl)	−0·43	11·52	−4·70	9·04	0·005	−3·53	10·63	−4·16	10·70	0·289
LDL-C (mg/dl)	−19·64	31·33	−20·19	34·94	0·465	−13·17	35·43	−17·50	36·12	0·137
TAG (mg/dl)§	−96·55	212·73	−12·04	96·50	<0·001	−3·92	199·83	17·64	134·05	0·119
Energy (kJ/d)	−269·24	2656·71	−199·37	2033·89	0·428	−703·08	3325·82	53·60	2984·57	0·013
Carbohydrate (g/d)‖	0·10	0·30	0·01	0·30	0·051	0·11	0·29	0·06	0·34	0·085
Protein (g/d)‖	−1·63	32·79	−7·17	23·40	0·113	0·83	38·11	−7·75	23·12	0·006
Total fat (g/d)‖	−3·73	29·59	−10·52	21·64	0·053	−0·36	37·63	−7·23	22·43	0·021
PUFA (g/d)‖	−2·22	6·40	−2·84	6·97	0·300	0·61	11·19	−1·58	6·96	0·016
MUFA (g/d)‖	−2·69	11·93	−4·91	8·39	0·089	−1·23	15·48	−3·39	9·29	0·059
SFA (g/d)‖	−5·36	0·50	−5·50	0·50	0·059	−5·35	0·54	−5·44	0·46	0·051
Fibre (g/d)‖	−1·73	0·41	−1·81	0·52	0·188	−1·67	0·48	−1·67	0·52	0·495
Alcohol (g/d)‖	0·27	3·53	0·41	2·65	0·389	−0·12	3·83	0·04	2·57	0·331
Physical activity (min/week)§	0·02	2·55	−0·10	1·99	0·369	0·12	3·49	0·24	3·26	0·365
Weekly frequency of physical activity	0·04	0·60	−0·01	0·93	0·367	0·23	1·87	0·10	1·73	0·246

WC, waist circumference; DBP, diastolic blood pressure; SBP, systolic blood pressure; TC, total cholesterol; HDL-C, HDL cholesterol; LDL-C, LDL cholesterol.
*Absolute change = (final minus baseline value).
†Adjusted to baseline value and number of examinations.
‡Student's t test.
§Log-transformed value for statistical test.
‖Energy-adjusted value by the residual method for statistical test.

was representative of all Japanese-Brazilians who agreed to participate in this nutritional intervention programme.

The absence of a control group did not allow us to show that the results of the study were actually due to the intervention programme. Randomized controlled intervention studies are more efficient to evaluate causal relationships. However, there are ethical or logistical situations in which this type of study is not advisable. One of the most frequent, which applies to the current study, is the ethical consideration. When the effectiveness of an intervention is well known and established, proven by previous studies, then the ethical question arises and does not allow the denial of treatment to a group of individuals[29]. As previously described[7,8], this Japanese-Brazilian community demonstrated a high prevalence of metabolic syndrome components and initiatives to minimize this problem were needed urgently. In this context, the JBDSG researchers conducted the present nutritional intervention study. It is important to note that the results found in the present study are in agreement with those previously published[9–14,21–23]. Also, the absolute change adjustment to baseline values and number of examinations may have contributed to reduce the possibility of bias in the present results.

Some limitations of the study must be taken into consideration. First, although it is known that the motivation to change dietary and health habits of the subjects who entered the intervention study may be different from that of non-participants (people who were invited but, for different reasons, did not want or could not join the programme), this fact does not jeopardize the results. Second, the supposition that all intervention programme subjects adhered to the treatment has not been evaluated; but it is presumed that if 100 % of the subjects had adhered, the positive results would have been higher. Third, it is known that measurement mistakes in food intake and physical activity cannot be eliminated entirely, but the choice of a standardized methodology to collect information has probably minimized the risks. Fourth, the combined analysis of the data of subjects who were evaluated two or three times may have reduced the observed effects, as intervention benefits may be higher in shorter periods of time. Finally, the results refer to a 2-year follow-up of Japanese-Brazilian subjects but the long-term impact is unknown.

It can be concluded that the intervention programme was of benefit to those Japanese-Brazilian subjects who incorporated healthier lifestyle habits, as reflected in their nutritional and metabolic profile. Other studies are necessary to evaluate the effects of the benefits over longer periods of time.

Acknowledgements

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Appendix

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