LIFESTYLE DECREASES RISK FACTORS FOR CARDIOVASCULAR DISEASES

Jaroslav Slavíček[1], Otomar Kittnar[1], Gary E. Fraser[2], Eva Medová[1], Jana Konečná[3], Robert Žižka[3], Alena Dohnalová[1], Vladimír Novák[1]

[1]Institute of Physiology, First Medical Faculty, Charles University in Prague, Prague, Czech Republic
[2]Center for Health Research, School of Public Health, Loma Linda University, Loma Linda, CA, U.S.A.
[3]Country Life International, Nenačovice, Czech Republic

SUMMARY

The morbidity and mortality of the cardiovascular diseases is high in the developed countries. The lifestyle changes are capable to decrease it by 50%. The aim of the present study was to measure the parameters of some risk factors before and after a one-week NEW START rehabilitative retreat. 1,349 volunteers, 320 men, 1,029 woman, mean age 51±14.5 (SD) years participated in 30 rehabilitative retreats from 1999–2006 in the Czech Republic, using a low-fat, low-energy, lacto-ovo-vegetarian diet and exercise, in a stress-free environment. Body weight, height, BMI, blood pressure, heart rate, serum cholesterol and blood glucose were measured. Body weight decreased in 1,223 measured persons from 71.2±14.38 (SD) to 70.6±14.02 kg ($p<0.0001$), BMI (1,046 measured persons) from 25.1±4.60 (SD) to 24.8±4.49 (SD) kg/m^2 ($p<0.0001$), systolic blood pressure (1,218 persons) from 129.8±23.02 (SD) to 123.8±21.52 (SD) mmHg ($p<0.0001$), diastolic blood pressure (1,210 persons) from 79.8±12.7 (SD) to 77.5±11.6 (SD) mmHg ($p<0.0001$), serum cholesterol (998 persons) from 4.86±0.95 (SD) to 4.32±0.77 (SD) mmol ($p<0.0001$), blood glucose (544 persons) from 4.31±1.59 (SD) to 3.88±1.33 (SD) mmol ($p<0.0001$). Heart rate was not significantly decreased. The parameters were lower in lacto-ovo vegetarians and Seventh-day Adventists than in controls who never observed the diet and avail the lifestyle programs. The parameters were nonsignificantly changed one year after finishing the retreat in the sample of 68 persons showing the positive effect of retreats. Our results showed, that the intake of a low-fat, low-energy diet, over the course of one week in a stress-free environment, had positive impact on the risk factors of cardiovascular diseases.

Key words: cardiovascular diseases, decrease in risk factors, rehabilitative retreats, lifestyle, lacto-ovo vegetarians, Seventh-day Adventists

Address for correspondence: J. Slavíček, Institute of Physiology, First Medical Faculty, Charles University in Prague, Albertov 5, 128 00, Prague 2, Czech Republic. E-mail: jaroslav.slavicek@lf1.cuni.cz

INTRODUCTION

Some studies have shown that the application of lifestyle changes without pharmacotherapy may decrease the risk factors for cardiovascular diseases (1–8). Our previous studies have proven that the 10 day rehabilitative retreats, combined with the consumption of low-energy, low-fat diet, a stress-free environment and a small amount of physical training (the Loma Linda University lifestyle NEW START), may significantly decrease serum cholesterol, blood glucose, and blood pressure in 50-year-old volunteers of the Czech population (9, 10).

It is generally known, that these parameters are low in Seventh-day Adventists (SDAs, 11–13) and vegetarians (14). The aim of the present study was to:

1. determine if one-week-lasting NEW START retreats are capable of decreasing body weight, BMI, subcutaneous fat, blood pressure, blood glucose, and serum cholesterol in adult volunteers of the Czech population;
2. compare the parameters in vegetarians and controls before the retreat;
3. compare the parameters in SDAs and controls before the retreat.

MATERIAL AND METHODS

The study group consisted of 1,349 volunteers, mean age 51.5±14.7 (SD) years comprising 320 men, 51.4±15.1 (SD) years, and 1,029 women, 51.5±14.5 (SD) years, who participated in one of 30 one-week SDA-NEW START retreats in the Czech Republic from 1999–2006. The volunteers were informed about the retreats during the ”Days of Health“, organized by Country Life International, when tents are erected in public areas in several towns throughout the Czech Republic to promote healthy lifestyles and offer the preventive examinations for the risk factors of civilization diseases. In this way a large number of the population was addressed. In addition, the programme was advertised to visitors of vegetarian restaurants and in the shops of Country Life International. The participants of the retreats were either vegetarians and Adventists, or controls (Table 1). The Czech Republic Seventh-day Adventists are the members of the Seventh-day Advent Church of more than 5 years using the Loma Linda University (California), NEW START lifestyle. The vegetarians are the Czech lacto-ovo-vegetarians practicing it for more than 5 years and participating on the retreats. The control group comprised persons who never practised the diet or the lifestyle programmes. The cardiovascular disease risk factor parameters during 30 one-week lasting NEW START retreats in 1999–2006 were compared in all participants including controls, vegetarians and Adventists, men and women.

Table 1. *Number of persons participating in the retreats NEW START from 1999–2006 in the Czech Republic; age in years ±SD*

	Number	Men	Women	Age (SD)
Vegetarians	412	101	311	49.7±12.9
Adventists	456	87	369	50.1±14.5
Controls	481	132	349	51.2±15.1

The retreats took place at higher quality hotels in the Czech and Moravian mountains, 600–800 meters above sea level, in the spring, summer and autumn (60 volunteers per retreat). A typical day´s schedule: 07:00 wake; 07:20–07:45 morning exercise near hotel; 07:45–08:30 breakfast; 08:30–09:15 lifestyle study; 09:15–11:00 group activities: physiotherapy, balneotherapy, medical consultation, nature walk; 11:00–13:00 practical education in nutrition, exercise program; 13:00–13:30 lunch; 13:30–14:15 rest; 14:15–16:30 walk; 16:30–18:00 group activities (similar to morning).18:00–18:30 dinner; 19:00–21:00 lectures about lifestyle, cultural programmes, discussions etc.; 21:00 rest. The participants paid 4,000,- Kč for the programme (200–250 USD, 130 €).

There are about ten thousand members of the Seventh-day Adventist Church in the Czech Republic. Their NEW START lifestyle has been practiced in the population since the end of the 19th century.

The „NEW START“ Lifestyle is an acronym for:

a) N – Nutrition: low-fat, low-energy lacto-ovo-vegetarian diet,
b) E – Exercise: light physical training
c) W – Water: consumption of spring water and hydrotherapy
d) S – Sunshine
e) T – Temperance: abstinence of alcohol, smoking, coffee, tea, and spicy meals
f) A – Air: fresh air outside of large cities
g) R – Rest: sleep eight hours daily
h) T – Trust: faith in God, increased confidence in the church community

Daily energy intake of SDA – NEW START lifestyle – vegetarian diet (15): 2073±600 kcal (8500kJ), fat (g) 70.1±35, carbohydrates (g) 300±102, proteins (g) 80±30, fiber (g) 26.9±3.3, saturated fatty acids (g) 23.5±11.5, unsaturated fatty acids (g) 24.4±13.4, ratio unsatur./satur. FA 1.09±0.4, cholesterol (mg) 0–80, calcium (mg) 993±408, iron (mg) 16±5, vitamin A (μg) 1794±370, vitamin C (mg) 182±10, thiamin (mg) 2±1.2, riboflavin (mg) 2±0.7, niacin (mg) 17.6±6.2, vitamin B_6 (mg) 2±0.8. The diet was determined from recipes. The meals were supplied to participants.

The volunteers were informed about conditions on the retreat and their consent was acquired. Screening examinations were made at the beginning and near the end of the stay. The questionnaire was completed, then body weight, BMI, blood pressure, heart rate, serum cholesterol and blood glucose were measured. The data protocol was maintained for every person in the retreat. In some persons subcutaneous fat was measured by the bioimpedance method (Omron), and the percentage of body weight and the weight of fat in kilograms was recorded. Blood sugar and serum cholesterol were measured by Accutrend GC (Roche, Boehringer Mannheim) test strips. In some persons with high serum cholesterol levels, routine biochemical laboratory methods vere used to evaluate the lipid spectrum.

The measurement of risk factors was not obligatory, but voluntary. This is the reason why many variables were not recorded in all subjects.

The statistics: two-sampled t-tests were used for Tables 2 and 3, paired t-tests for Tables 4, and 5.

Table 2. *A comparison of cardiovascular diseases risk factors between SDA (143 participants – 47 men, 96 women) and control group (140 participants – 51 men, 89 women) before the NEW START retreats in 2001–2003. Age (46–47 years) and the heart rate (74–75.min^{-1}) were the same in both groups. Mean (±SD)*

Parameters (men and women)	Adventists	Controls	p
Body weight (kg)	70.2±13.1	72.1±15.6	**
BMI (kg/m^2)	24.1±5.0	25.4±5.2	**
Fat (per cent of body weight)	25.3±8.5	28.9±9.6	***
Fat (kg)	18.2±8.5	21.1±8.9	**
Blood pressure systolic (mmHg)	127.1±22.5	134.9±26.1	**
Diastolic (mmHg)	75.8±9.2	81.5±10.0	***
Blood glucose (mmol/l)	3.41±0.9	4.48±1.1	****
Serum cholesterol (mmol/l)	4.03±0.5	4.94±0.9	****

** p< 0.05; **p<0.01; ***p<0.001; ****p<0.0001*

Table 3. *Comparison of prevalence of cardiovascular diseases risk factors between lacto-ovo-vegetarians (195 persons – 65 men, 130 women) and controls (201 persons – 70 men, 131 women) before the NEW START retreats in 2002–2003. Mean (±SD)*

	Vegetarians	Parameter	p
Age (years)	controls	47.2±12.9	n.s.
	vegetarians	47.7±13.1	
Body weight (kg)	controls	69.3±15.2	**
	vegetarians	61.9±14.4	
BMI (kg/m2)	controls	25.1±5.2	**
	vegetarians	22.1±4.81	
Blood pressure systolic (mmHg)	controls	132.6±25.1	***
	vegetarians	118.1±23.5	
Blood pressure diastolic (mmHg)	controls	80.7±12.1	***
	vegetarians	70.8±11.8	
Heart rate/min	controls	76±12.5	*
	vegetarians	72±11.8	
Serum choelsterol (mmol/l)	controls	5.19±0.8	***
	vegetarians	4.01±0.9	
Blood glucose (mmol/l)	controls	4.27±0.9	***
	vegetarians	3.99±1.0	

**p<0.05; **p<0.01; ***p<0.001; n.s.–nonsignificant differences*

Table 4. *Decrease of cardiovascular disease risk factor parameters during 30 one-week NEW START retreats in 1999–2006, 1,349 persons, 1,029 women, 320 men, mean age 51.5±14.5 years, controls, vegetarians, Adventists, men and women, evaluated together. Mean (±SD)*

	Number		Parameter	p
Weight (kg)	1,046	before	71.0±14.26	****
		after	70.3±13.90	
BMI (kg/m^2)	878	before	25.1±4.60	****
		after	24.8±4.49	
Blood pressure systolic (mmHg)	1,037	before	130.0±23.33	****
		after	123.9±21.62	
Blood pressure diasolic (mmHg)	1,029	before	80.0±12.85	****
		after	77.6±11.24	
Heart rate/min	983	before	72.2±11.8	n.s.
		after	72.5±11.54	
Serum cholesterol (mM/l)	834	before	4.82±0.97	****
		after	4.31±0.78	
Blood glucose (mM/l)	409	before	4.23±1.62	****
		after	3.82±1.37	

**p<0.05; **p<0.01; ***p<0.001; ****p<0.0001; n.s. nonsignificant differences*

Table 5. *Changes of cardiovascular disease risk factor parameters in 68 persons one year after finishing one-week NEW START retreats in 1999–2006. Men, women, mean, number, SD, SE, p. Mean age 56.1±12.9 (SD) years, 14 men, 56 women.*

Parameter		Mean	N	SD	SEM	p
1	weight1	68.13	68	13.66	1.66	0.542
	weight2	68.31	68	13.93	1.69	
2	height1	167.26	66	7.96	0.98	0.505
	height2	167.12	66	7.83	0.96	
3	BMI1	24.22	67	4.20	0.51	0.943
	BMI2	24.21	67	4.33	0.53	
4	fatp1	31.10	42	8.23	1.27	0.794
	fatp2	31.21	42	8.97	1.38	
5	fat kg1	22.36	40	8.42	1.33	0.112
	fat kg2	22.83	40	8.53	1.35	
6	Bpsyst1	121.87	69	20.83	2.51	0.001
	Bpsyst2	130.94	69	22.04	2.65	
7	Bpdia1	75.64	69	12.23	1.47	0.081
	Bpdia2	78.87	69	14.36	1.73	
8	HR1	69.27	66	12.63	1.55	0.659
	HR2	69.97	66	13.09	1.61	
9	chol1	4.39	63	0.71	0.09	0.096
	chol2	4.59	63	0.89	0.11	
10	gluc1	3.59	27	0.90	0.17	0.891
	gluc2	3.63	27	1.39	0.27	

The first values – the values at the end of the previous retreat. The second values – the values at the beginning of the following retreat one year after; fatp-subcutaneous fat (% of the body weight), fatkg-subcutaneous fat in kg, Bpsyst – blood pressure systolic (mmHg), Bpdia – blood pressure diastolic (mmHg), HR – heart rate per min, chol–serum cholesterol (mmol/l), gluc–blood glucose (mmol/l), mean, SD – standard deviation, SEM – standard error of mean

RESULTS

In Table 2 there is a comparison of some risk factors in Seventh-day Adventists (SDA) and in controls who took part in the retreats for the first time and who never used the diet and the lifestyle programmes. In Table 3, the same risk factors are compared in vegetarians and in controls who participated in the NEW START retreats in 2001–2003.

Similar results have been obtained in comparison of lacto-ovo-vegetarians and controls, i.e. the decrease in 7 cardiovascular risk factors parameters in lacto-ovo-vegetarians when compared with controls ($p<0.01$).

Table 4 shows a decrease in some cardiovascular disease risk factor parameters in both men and women of the Czech population, measured at the beginning and at the end of 30 one-week NEW START retreats in 1999–2006. The results showed that 6 measured cardiovascular disease risk factor parameters decreased during 30 one-week NEW START retreats in all participating persons ($p<0.0001$).

The efficiency of retreats was determined in 68 persons repeatedly visiting the retreats (Table 5) by measuring the investigated parameters after one year. The parameters were nonsignificantly increased after one year except of the systolic blood pressure (increased significantly, $p<0.001$) thus documenting positive effect of the retreat.

DISCUSSION AND CONCLUSIONS

The presented results confirmed more favourable values for risk factors of cardiovascular diseases in lacto-ovo-vegetarians (1, 4) and in SDAs (12, 13) of the Czech population. The SDAs and lacto-ovo-vegetarians were selected from the retreats group in 2001–2003. The ability of a one-week retreat [a relatively short stay in comparison with the literature (16)] to decrease the parameters is due to the vegetarian diet and other conditions of the NEW START lifestyle, i.e., no stress, light physical training, abstinence from smoking, alcohol, coffee and spicy meals. Some parameters such as BMI and serum cholesterol were lower in our participants (Table 4) than in Czech participants of the MONICA study (17), 2000–2001 (1,012 men, BMI 28.1±4.4 kg/m^2, serum cholesterol 5.88±1.08 mmol/l, 1,066 women, BMI 27.3±5.7 kg/m^2, serum cholesterol 5.82±1.13 mmol/l) (17) due to the consumption of a low-energy diet and the presence of SDAs and lacto-ovo-vegetarians in our group. However the systolic and diastolic blood pressure in the MONICA study did not differ from our present results. In SDAs and vegetarians, the risk factor parameters for cardiovascular diseases were low before the retreat.

Some persons visited the retreats repeatedly. In 68 persons the cardiovascular diseases risk factors were measured one year after the end of the previous retreat and compared with the previous ones to determine the effectivness of the retreat (Table 5). The mean number of visits in these 68 persons was 2. Comparing Table 5 and Table 4, the returnees were in general in better health than the average at the end of the programme. We did not measure the parameters in all participants one year after finishing the retreat, however, the parameters in 68 persons (Table 5) increased insignificantly after one year except for significant increase of the systolic blood pressure ($p<0.001$). We have no explanation why

this parameter should have been particularly affected by repeated participation in the retreat, but the number of persons repeatedly present there is small when compared with all participants. The results in Table 5 showed that the study was prospective.

A one week rehabilitative retreat, combined with a low-fat, low-energy, lacto-ovo-vegetarian diet and exercise, in a stress-free environment, decreased the cardiovascular disease risk factor parameters in a 50-year-old sample of the Czech population.

The parameters are lower in lacto-ovo-vegetarians and Seventh-day Adventists due to their observation of the healthier lifestyle.

These parameters did not significantly change one year after finishing the retreat proving the positive effect of it.

The present study showed that lifestyle changes without pharmacotherapy can cause at least a decrease in the risk factors for cardiovascular diseases (Table 4).

The precize methods confirmed the positive effect of low-fat vegetarian diet on the risk factors of cardiovascular diseases (18, 19).

Acknowledgements

Authors wish to thank to Mrs. Tereza Vavříková for the preparation and corrections of manuscript and Tables.

REFERENCES

1. Ornish D, Brown SE, Scherwitz LW, Billings JH, Armstrong WT, Ports TA, et al. Can lifestyle changes reverse coronary heart disease? The Lifestyle heart trial. Lancet. 1990 Jul 21;336(8708):129-33.
2. Filipovský J, Simon J, Chrástek J, Rosolová H, Haman P, Petríková V. Changes of blood pressure and lipid pattern during a physical training course in hypertensive subjects. Cardiology. 1991;78(1):31-7.
3. Šobra J, Češka R. Diseases of civilization from the aspect of evolution of the human diet. Čas Lék Česk. 1992 Apr 10;131(7):193-7. (In Czech.)
4. Krajčovičová-Kudláčková M, Šimončič R, Béderová A. Plasma fatty acid profile in vegans, vegetarians and omnivores. Cor Vasa. 1996;38:196-200.
5. Diehl HA. Coronary risk reduction through intensive community-based lifestyle intervention: the Coronary Health Improvement Project (CHIP) experience. Am J Cardiol. 1998 Nov 26;82(10B):83T-87T.
6. Hooper L, Summerbell CD, Higgins JP, Thompson RL, Capps NE, Smith GD, et al. Dietary fat intake and prevention of cardiovascular disease: systematic review. BMJ. 2001 Mar 31;322(7289):757-63.
7. Kromhout D, Menotti A, Kesteloot H, Sans S. Prevention of coronary heart disease by diet and lifestyle: evidence from prospective cross–cultural, cohort, and intervention studies. Circulation. 2002 Feb 19;105(7):893-8.
8. Rosolová H. Non-pharmacological therapy of arterial hypertension. Kardiol Rev. 2006;8(1):44-6. (In Czech.)
9. Slavíček J, Kittnar O, Dohnalová A, Trojan S, Novák V, Tichý JA, et al. Influence of 10-days-lasting diet without animal fat on serum cholesterol, blood glucose, blood pressure and body weight in 50 years old volunteers in Czech population. Sb Lék. 2001;102:519-25. (In Czech.)
10. Slavíček J, Kittnar O, Trojan S, Tichý JA, Trefný ZM. Lifestyle in prevention of cardiovascular diseases: a review. Prakt Lék. 2001;81(10):588-93. (In Czech.)
11. Fraser GE. Determinants of ischemic heart disease in Seventh-day Adventists: a review. Am J Clin Nutr. 1988 Sep;48(3 Suppl):833-6.
12. Fraser GE, Shavlik DJ. Ten years of life: is it a matter of choice? Arch Intern Med. 2001 Jul 9;161(13):1645-52.
13. Fraser GE. A comparison of first event coronary heart disease rates in two contrasting California populations. J Nutr Health Aging. 2005;9(1):53-8.
14. Snowdon DA, Phillips RL. Does a vegetarian diet reduce the occurence of diabetes? Am J Public Health. 1985 May;75(5),507-12.
15. Schultz TD, Leklem JE. Dietary status of Seventh-day Adventists and nonvegetarians. J Am Diet Assoc. 1983 Jul;83(1):27-33.
16. Bartůňková V, Bartůněk L. Influence of new low-cholesterol rational diet and controlled physical training on the lipid spectrum in hypercholesterolemic patients treated in 1996 in Konstantinovy Lázně. Cor Vasa. 1999;41(7):332-6. (In Czech.)
17. Cífková R, Škodová Z, Lánská V. Long lasting evolution in risk factors of cardiovascular diseases in the representative sample of Czech population. Diabetol Metab Endokrinol Výživ. 2001;4 Suppl 1:17-8. (In Czech.)
18. Gould KL, Ornish D, Scherwitz L, Brown S, Edens RP, Hess MJ, et al. Changes in myocardial perfusion abnormalities by positron emission tomography after long-term, intense risk factor modification. JAMA. 1995 Sep 20;274(11):894-901.
19. Nicholson AS, Sklar M, Barnard ND, Gore S, Sullivan R, Browning S. Toward improved management of NIDDM: a randomized, controlled, pilot intervention using a lowfat, vegetarian diet. Prev Med. 1999 Aug;29(2):87-91.

Received January 25, 2008
Accepted in revised form April 28, 2008