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Effects of Obesity Reduction on Cardiovascular Risk Factors: Comparison of Individual and Group Treatment – Substudy of the Croatian Healthy Weight Loss Programme

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A B S T R A C T

Prevention of obesity may help reduce the morbidity and mortality from cardiovascular diseases. In Croatia, over half of adult population is overweight. Aldo the basic medical principles of healthy weight-loss programmes are well known, it is believed that mainly because of the leak of successful therapeutic approach obesity remains the most challenging changeable cardiovascular risk factor in nowadays clinical practice. Objective of this Croatian Healthy Weight Loss Programme substudy was to determine effects and differences between the intensive group and intensive individual weight-loss program on weight loss and cardiovascular risk factor. A clinical trial included 476 adults whose body mass index (BMI) was >30 or >28 accompanied by increased blood pressure, glucose, and cholesterol. The study participants completed either a group (n=243) or individually-based (n=233) 6-month weight-loss program consisting of education, low-fat diet, pharmacological treatment with orlistat, psychological counselling, and exercise. Body weight, body mass index, blood pressure, blood sugar, and blood cholesterol were measured in all participants after 3 and 6 months. The average weight loss was 12.2 (13%) kg and 7.6 (9%) kg in the group and individual program, respectively. Beside the weight reduction, the levels of blood cholesterol, glucose, and blood pressure were also significantly reduced in comparison with baseline, decreasing to normal values in all participants (P<0.001 for all). Decrease in the monitored parameters was greater in participants in the group program. The weight loss program provided a healthy loss of extra weight in the period of 6 months. The group program produced greater decrease in body weight, body mass index, blood pressure, glucose, and cholesterol than the individual program.

Key words: *cardiovascular diseases, obesity, orlistat, program evaluation, weight loss*

Introduction

Obesity ranks alongside smoking as one of the most important risk factors for cardiovascular diseases, which are still a very frequent cause of death in industrially developed countries[1–4]. According to the available data for transitional countries, approximately 60–70% of the population suffers from overweight[5,6]. In Croatia, 79% of men and 50% of women are overweight[6]. Moreover, in the past few years, the morbidity and mortality from cardiovascular diseases in Croatia has increased, while Europe and the USA are marking the declining trend[3–7]. It is estimated that treating obesity and obesity-related complications accounts for 2–7% of the total costs of healthcare[8–10].

The Croatian national strategy for the prevention of cardiovascular diseases strongly supports programs dealing with the adoption of healthy habits as the least ex-

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pensive mechanism for reducing cardiovascular morbidity and mortality. The programs based on the proper nutrition, reduction in the intake of fats, and change in behaviour make an integral part of this process[11]. Although the scope of the problem of obesity treatment increasingly requires an out-patient approach under the supervision of the family doctor, the majority of obesity treatment studies so far have been conducted in hospital conditions under the supervision of specialized hospital services. As previously demonstrated in the Croatian Healthy Weight Loss Program Study[12], the six-month outpatient intensive weight loss treatment based on the healthy diet, fat reduction, psychological counselling, regular exercise training and orlistat administration is efficient in weight loss and reduction of blood pressure, fasting blood glucose and total cholesterol. The aim of this substudy was to determine the possible differences between group and individual treatment of obesity, as well as to compare the results of the cardiovascular risk factor reduction provided through individual work with the results of the programme provided through group work.

Subjects and Methods

The study included 627 persons who successfully completed the Healthy Weight Loss Program between September 1, 2000 and December 31, 2004. By their own choice, participants were divided in a group (n=243) or individual (n=233) programme. The study participants were aged between 18 and 65 and had a body mass index (BMI) over 30 or BMI over 28 accompanied by increased blood pressure, sugar and/or cholesterol.

At the beginning of the Program, all participants attended a one-day interactive workshop given by the authors of the study, general practitioners, specialists in internal medicine, pharmacists, nutritionists, psychiatrists, and sports medicine specialists. The workshop consisted of lectures followed by the discussion on the reasons for overweight, its complications, and treatment options ranging from proper diet to regular exercise to pharmacotherapy. Information on healthy weight loss strategies was also provided in a form of written educational material and a weight loss guide, *Take Control of Your Body Weight*[13]. Height, weight, waist circumference, and BMI were measured in all participants, whereas data on hypertension, increased blood sugar and cholesterol were collected from the medical records. After the workshop, the participants were free to chose whether to continue the program through individual or group work.

The program lasted 6 months and consisted of healthy diet education, psychotherapeutic counselling, physical exercise, reduction diet, and pharmacological treatment with orlistat. All patients received detailed written instructions on nutrition and physical activity as well as information on the body weight control program.

Participants in the group program (n=320) were divided in groups of 10, which gathered every 4 weeks for 2-hour thematic meetings to discuss the reasons for obesity, health complications of obesity, nutrition, treatment with orlistat, physical activity, and the psychology of overweight people and methods to keep the achieved body weight. Group meetings were moderated by the authors of the study and attended by psychologists, psychiatrists, nutritionists, and family doctors, and specialists in internal and sports medicine. After the meeting, one academic hour was dedicated to an interactive conversation on the topic of the meeting. Particular attention was given to the analysis of previous unsuccessful attempts to decrease body weight. If desired, participants could bring a friend or family member to group meetings. Participants in the individual program (n=307) saw their physician once a month for a medical check up and discussion about the various aspects of treating obesity instead of participating in group meetings.

During the program, all participants were on a mild hypocaloric diet (1600 kcal/day) containing not more than 30% of fat. After a 4-week adjustment to the diet, psychotherapy support, and nutritional education, they started taking orlistat (3×120 mg/day), a lipase inhibitor reducing fat absorption from the digestive system, three times a day with a meal. No appetite suppressors were allowed during the Program. All participants were required to keep a journal on their daily nutrition, physical activities, and problems that appeared during the course of the program.

Height, body weight, BMI, waist size, complete laboratory blood analysis, and blood pressure were monitored in all patients on monthly basis. Laboratory tests were conducted twice during the study, in weeks 12 and 24.

During the 6-month program, 77 participants dropped out from the group and 74 from the individual program. The final analysis included 476 participants who completed the program, i.e., 233 in the individual and 243 in the group program (Table 1).

Statistical analyses were performed with baseline data and data obtained at weeks 12 and 24. Data were presented as mean values with standard deviations (±SD). For the comparison of two groups, the *t*-test was used, whereas for the comparison of mean values for several groups, the analysis of variance (ANOVA) and the Duncan test for multiple comparison were applied. Differences in the distribution of categorical variables were analyzed with χ^2-test. The characteristics that significantly differed between the groups at the beginning of the program were compared by using analysis of covariance (ANCOVA). All statistical tests were performed with SAS© System, ver. 8.2 (SAS Institute Inc., Cary, NC, USA), with the level of significance set at 0.05.

Results

At baseline, participants in the group program did not differ from participants in the individual program in their age and values of blood pressure, glucose, and cholesterol (Table 1). However, the participants in the group program had a significantly greater BMI, body height, body weight, and waist circumference than the partici-

TABLE 1
CHANGES IN ANTHROPOMETRIC PARAMETERS AND CARDIOVASCULAR RISK FACTORS FROM BASELINE TO WEEKS 12 AND 24 IN 476 PARTICIPANTS IN THE INDIVIDUAL AND GROUP WEIGHT LOSS PROGRAM*

Parameters	Healthy weight-loss program (mean±SD)		p*
	individual (n=233)	group (n=243)	
Baseline			
age (years)	51.1 (14.0)	52.0 (13.8)	0.467
sex (men, %)	69 (28.4)	97 (40.2)	0.007†
waist (cm)	100.2 (13.2)	104.8 (14.7)	0.001
body height (cm)	166.8 (8.5)	170.1 (9.0)	<0.001
body weight (kg)	85.9 (14.4)	94.7 (17.3)	<0.001
body mass index (kg/m^2)	30.9 (4.6)	32.7 (5.2)	<0.001
systolic blood pressure (mmHg)	142.1 (21.9)	145.9 (21.3)	0.056
diastolic blood pressure (mmHg)	87.1 (11.4)	88.7 (10.7)	0.125
plasma glucose (mmol/L)	5.8 (1.8)	6.0 (1.8)	0.191
cholesterol (mmol/L)	6.0 (1.1)	6.1 (1.1)	0.294
Week 12			
body weight (kg)	81.1 (13.6)	88.2 (15.6)	<0.001
body mass index (kg/m^2)	29.1 (4.4)	30.5 (4.7)	0.002
Week 24			
body weight (kg)	78.4 (13.3)	82.5 (14.5)	0.001
body mass index (kg/m^2)	28.1 (4.3)v	28.5 (4.4)	0.360
systolic blood pressure (mmHg)	133.2 (11.6)	135.4 (12.6)	0.045
diastolic blood pressure (mmHg)	83.5 (7.2)	84.9 (7.0)	0.023
plasma glucose (mmol/L)	5.1 (1.0)	5.4 (1.3)	0.033
cholesterol (mmol/L)	5.4 (0.7)	5.4 (0.8)	0.268

* *t*-test
† χ^2-test

pants in the individual program. There were also significantly more men among the participants in the group program.

At week 12, the body weight and BMI were still significantly greater in participants in the group program than participants in the individual program (Table 1). At week 24, there was no difference in BMI between the two groups, but the difference in body weight remained. Although blood pressure and glucose were statistically higher at week 24 in the participants in the group program than in the participants in the individual program, the values of these parameters in both groups decreased and were within normal range.

Overall, almost half of all participants lost 5–10% of their baseline weight by week 12 and over 10% of baseline weight by week 24 (Table 2). Participants in the group program had significantly greater weight loss than participants in the individual program both at week 12 and at week 24 ($p<0.001$, χ^2-test).

As there were differences between the groups at the beginning of the program, the corresponding changes in monitored parameters were compared instead of their values at weeks 12 and 24. There was a significant decrease in all parameters from baseline to weeks 12 and 24 in participants in both the individual and group program ($p<0.001$ for all; t-test; Table 3). The decrease in body weight and BMI from baseline to weeks 12 and 24 was

TABLE 2
NUMBER OF PARTICIPANTS IN THE INDIVIDUAL AND GROUP WEIGHT LOSS PROGRAM ACCORDING TO THE PERCENTAGE OF WEIGHT LOSS IN WEEKS 12 AND 24

Weight loss	No. (%) of participants in Healthy Weight Loss Program		
	all (n=476)	individual (n=233)	group (n=243)
Week 12			
0	4 (0.8)	3 (1.3)	1 (0.4)
0–5%	189 (39.7)	115 (49.4)	74 (30.5)
5–10%	236 (49.6)	100 (42.9)	136 (56.0)
>10%	47 (9.9)	15 (6.4)	32 (13.2)
Week 24			
0	0 (0.0)	0 (0.0)	0 (0.0)
0–5%	56 (11.8)	47 (20.3)	9 (3.7)
5–10%	197 (41.5)	109 (47.0)	88 (36.2)
>10%	222 (46.7)	76 (32.8)	146 (60.1)

TABLE 3
COMPARISON OF THE MEAN CHANGES IN PARAMETERS FROM BASELINE TO WEEKS 12 AND 24 IN 476 PARTICIPANTS IN THE INDIVIDUAL AND GROUP WEIGHT LOSS PROGRAM*

Parameter	Change from baseline (mean±SD)		p†
	individual program (n=233)	group program (n=243)	
Week 12			
body weight (kg)	–4.8 (3.3)	–6.5 (3.4)	<0.001
body mass index (kg/m^2)	–1.7 (1.2)	–2.2 (1.2)	<0.001
Week 24			
body weight (kg)	–7.6 (4.5)	–12.2 (6.6)	<0.001
body mass index (kg/m^2)	–2.7 (1.6)	–4.2 (2.2)	<0.001
systolic blood pressure (mmHg)	–8.9 (15.5)	–10.5 (13.6)	0.243
diastolic blood pressure (mmHg)	–3.6 (8.0)	–3.7 (7.6)	0.879
plasma glucose (mmol/L)	–0.6 (1.0)	–0.6 (0.9)	0.896
cholesterol (mmol/L)	–0.6 (1.0)	–0.7 (0.7)	0.706

* $p<0.001$ (*t*-test) for all changes from baseline to weeks 12 and 24 in both groups.
† t-test, between-group comparison.

significantly greater in participants in the group program than in participants in the individual program, whereas the decrease in blood pressure, glucose, and cholesterol was similar in both groups (Table 3). Participants in the group program lost 13% of their baseline body weight and 12.8% of their BMI after 24 weeks, whereas participants in the individual program lost 9% of their baseline body weight and 9.1% of their BMI (Table 3). To determine which groups mutually differed in the mean values of monitored parameters, the Duncan test for multiple comparisons was applied. At the beginning of the program, men and women in individual and group program significantly differed in their body weight (Table 4). Men in the individual program did not differ in systolic blood pressure from women in individual or participants in the group program. Also, there were no differences in glucose levels among men and women in individual and group program. At week 12, women in the individual program had the lowest BMI, whereas men in the individual and group program and women in the group program did not mutually differ in their BMI. After 24 weeks, there was no difference in body weight and blood glucose among men and women in two programs. However, men in the group program had the greatest systolic and diastolic blood pressure, whereas men in the individual program and women in the individual and group program did not mutually differ in their blood pressure (Table 4). A comparison of the changes in body weight and BMI in week 12 showed no significant difference between men in the individual program and women in the group program (Table 5). There were no differences in BMI between men and women in the individual program either. At week 24, changes in body weight differed among men and women in two programs. To confirm that these differences results from the program and not from the baseline differences, analysis of covariance (ANCOVA) was carried out.

Participants in the individual program were significantly different at baseline from participants in the group program with respect to the waist circumference, body height, body weight, and BMI, with participants in the group program having greater values of these parameters. To exclude the possibility that the differences in the changes in monitored parameters were the result of the baseline differences rather than the program, analysis of covariance (AMCOVA) was applied with BMI and body weight chosen as covariates (Figure 1). The dependency of the changes on BMI was significant for all monitored parameters, except for cholesterol, and the dependency of changes in body weight on BMI was also significant ($p<0.001$).

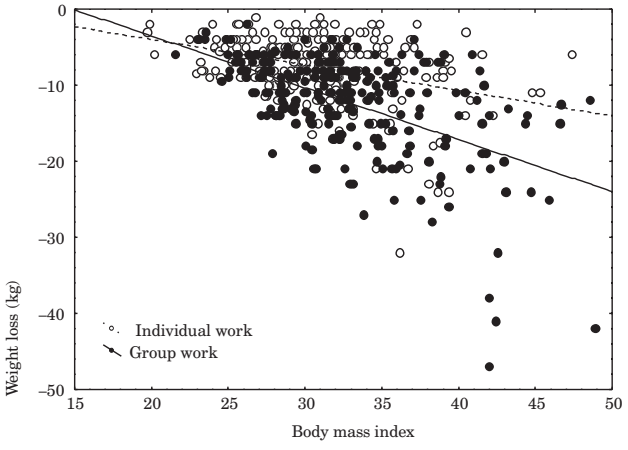

Fig. 1. Healthy Weight Loss Program Outcomes. Changes in body weight with BMI as a covariate in 476 participants in Healthy Weight Loss Program. White dots/line – participants working individually; black dots/line – participants working in groups; analysis of covariance (ANCOVA).

TABLE 4
COMPARISON OF THE PARAMETERS IN MEN AND WOMEN IN THE INDIVIDUAL AND GROUP WEIGHT LOSS PROGRAM AT BASELINE AND WEEKS 12 AND 24 *

Parameters	Men		Women		
	individual (n=69)	group (n=97)	individual (n=164)	group (n=146)	*p**
Baseline					
age (years)	53.1	54.4	50.4	50.5	0.098
waist (cm)	108.9[1]	111.2[1]	96.8[2]	100.4[2]	<0.001
body height (cm)	175.3[1]	176.2[1]	163.4	165.9	<0.001
body weight (kg)	97.2	104.3	81.5	88.1	<0.001
body mas index (kg/m^2)	31.6[1,2]	33.7	30.6[2]	32.0[1]	<0.001
systolic blood pressure (mmHg)	144.6[1,2]	149.8[1]	141.2[2]	143.4[2]	0.019
diastolic blood pressure (mmHg)	87.9	90.3	86.8	87.6	0.098
glucose (mmol/L)	6.6[1]	6.5[1]	5.4[2]	5.6[2]	<0.001
cholesterol (mmol/L)	6.0	6.1	6.0	6.1	0.731
Week 12					
body weight (kg)	91.2	96.7	77.1	82.4	<0.001
body mas index (kg/m^2)	29.7[1]	31.2[1]	28.9	29.9[1]	0.001
Week 24					
body weight (kg)	88.1[1]	90.1[1]	74.5[2]	77.4[2]	<0.001
body mass index (kg/m^2)	28.7	29.1	27.9	28.1	0.152
systolic blood pressure (mm Hg)	133.6[1]	138.4	133.0[1]	133.4[1]	0.003
diastolic blood pressure (mm Hg)	84.0[1]	86.3	83.2[1]	84.1[1]	0.010
glucose (mmol/L)	5.5[1]	5.6[1]	5.0[2]	5.2[2]	<0.001
cholesterol (mmol/L)	5.4	5.5	5.4	5.4	0.624

[1,2] – same numbers denote groups with no significant differences between means (Duncan test for multiple comparison)
*ANOVA test.

The analysis also showed that the lines were not parallel (p=0.019). The two program groups were compared at BMI of 27, 32, and 37. At BMI of 27, there was no significant difference in weight loss between participants in the individual program and those in the group program, whereas at BMI values of 32 and 37, the differences were significant (p<0.001). A similar result was obtained for the changes in BMI after 12 weeks. Changes in body weight and BMI after 24 weeks also depended on BMI (p<0.001 for changes in both body weight and BMI). A comparison of individual and group program based on different BMI values in weeks 12 and 24 showed a significant difference for the lowest, middle, and highest BMI values. The participants with greater body weight and BMI lost more weight working in groups, thereby being more successful in reducing cardiovascular risk factors.

Discussion

We found that persons completing the Healthy Weight Loss Program, which lasted 6 months and consisted of education, psychological support, physical exercise, low fat diet, and pharmacological treatment with orlistat, significantly reduced their body weight, BMI, blood pressure, glucose, and cholesterol. Furthermore, the decrease in these parameters was greater in persons in the group program than in persons opting for the individual program of weight loss.

Many studies dealing with the problem of obesity point to the importance of treating obesity in order to reduce health complications, first and foremost cardiovascular diseases and diabetes mellitus[14–18]. Pharmacological treatment combined with a proper diet and regular exercise provides a significant contribution in the treatment of obesity as well as associated risk factors[14]. Our results are in accordance with those obtained in previous research[14–18]. In our study, all monitored values decreased considerably in all participants of weight loss program.

Over 10% reduction in body weight after 6 months was recorded in two-thirds of participants in the group program and one-third of participants working individually. The participants who were attending the group weight-loss program lowered their body weight, BMI, blood pressure, glucose, and cholesterol more than those who worked individually. Working in the group creates a positive atmosphere of mutual support, which makes the adoption of healthy habits and long-term control over body weight easier, and the fact that participants who chose to work in groups had greater body weight at base-

line implies the need of obese individuals in the process of losing weight to have the support of their environment.

Blood pressure decreased significantly in all participants without any differences between men and women or between participants in the individual and those in the group program; the differences depended on the baseline blood pressure. A systematic review of the studies that followed the relation between the loss of extra weight and high blood pressure, from 1966 to 2001, showed that the loss of 10 kilograms decreases both systolic and diastolic blood by 4–6 mmHg[15].

Decrease in blood glucose was greater in men than in women, without any difference between the individual and group program. However, the difference in the decrease of blood glucose level was greater where the baseline values were higher; the decrease was greater in participants in the individual program. The difference in the reduction of cholesterol was noticed only in the dependence on cholesterol values at the beginning of the program. Given the fact that participants in the group program had greater initial cholesterol values, they achieved significantly greater decrease.

Orlistat was shown effective not only in the reduction of body weight by reducing the absorption of fat from food, but also in reduction of risk factors, such as increased blood pressure, lipids, and sugar[19–21]. Furthermore, there are economic in addition to pharmacological advantages in treating obesity with orlistat[22]. The effectiveness of orlistat in combination with healthy nutrition and regular physical activity, as fundamental guidelines of our weight-loss program, allows the creation of therapy models for a professional and organized approach in the long-term treatment of obesity.

Extreme importance in treating obesity should be directed towards family doctors and pharmacists[23–26]. They are ideal for creating and realizing similar programs of healthy weight loss because individuals who are overweight most often come to them in search for expert help in loosing the extra weight. So far, their engagement has not been sufficient in the implementation of a unique algorithm for treating obesity. Several studies have confirmed that it is these types of programs, as well as pharmacotherapy with orlistat in the area of primary healthcare, that are invaluable for the successful treatment of obesity and the prevention of the development of serious clinical complications, including cardiovascular diseases[20–31].

The present study based on an applied program for treating obesity aimed to provide a paradigm for the organization of future obesity treatment programs, including prevention of obesity and obesity-related health complications, especially cardiovascular diseases.

The results of and experience in our program of healthy weight loss confirm the need for obesity treatment to be approached gradually, with objectives that are realistic and weight loss that increases every three months. Thus, disappointment by unrealistic expectations is avoided, as well as the emergence of the yoyo effect due to an overly rapid loss of weight. The general health condition of our participants who lost 5–10% or more of the initial body weight was improved, as confirmed by the values of blood pressure, glucose, and cholesterol, which returned to normal by the end of the program.

Study limitation

There are some limitation in the study that need to be acknowledged and addressed regarding the lack of randomization into individual or group treatment program.

Conclusion

Our study showed that attending the 6-month program for treating obesity had effect on body weight and cardiovascular risk factors in individuals on orlistat therapy, regardless of whether or not the program was carried out in a group or individually, even though all monitored parameters decreased more in participants in the group program, which in itself contained elements of the behavioural approach to treatment. Body weight, BMI, systolic and diastolic blood pressure, blood glucose, and cholesterol were significantly lower at the end of program in comparison with baseline values in all participants. The presented program of healthy weight loss could be a long-term solution in treating obesity and preventing diabetes mellitus and cardiovascular diseases, frequently related to excessive body weight. For the final evaluation of the Healthy Weight Loss Program, the present research should be continued and new similar projects initiated on a larger sample for a longer time. Treatment of obesity should include family physicians, pharmacists, and other interested parties, from civil society to health and pension funds to state institutions, to increase the effectiveness of the treatment of obesity and prevention of obesity-related morbidity and mortality. Our study showed that attending the 6-month program for treating obesity had effect on body weight and cardiovascular risk factors in individuals regardless of whether or not the program was carried out in a group or individually, even though all monitored parameters decreased more in participants in the group program, which in itself contained elements of the behavioural approach to treatment and because of its effectiveness should be considered one of the most promising models for future development of weight loss programs.

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UČINCI LIJEČENJA PRETILOSTI NA KARDIOVASKULARNE RIZIČNE ČIMBENIKE: USPOREDBA INDIVIDUALNOG I GRUPNOG PROGRAMA GUBITKA TJELESNE TEŽINE – SUBANALIZA HRVATSKOG PROGRAMA ZDRAVOG MRŠAVLJENJA

S A Ž E T A K

Prevencija debljine pomaže u redukciji morbiditeta i mortaliteta kardiovaskularnih oboljenja. U Hrvatskoj, preko polovine odrasle populacije ima prekomjernu tjelesnu težinu koja je dokazano terapijski najtvrdokorniji promjenjivi kardiovaskularni rizik. Obzirom na neupitne temeljne postulate liječenja debljine i prethodno dokazanu učinkovitost terapijskog pristupa korištenog u studiji, ova je subanaliza usmjerena utvrđivanju razlika u učinkovitosti grupnog i individualnog programa mršavljenja na redukciju čimbenika kardiovaskularnog pobola. U komparativnu studiju uključeno je 476 odraslih osoba s indeksom tjelesne mase (ITM) >30 ili >28 uz dodatne rizike: povišene vrijednosti krvnog tlaka, glukoze u plazmi i kolesterola. Učesnici studije uključeni su u dva različita programa liječenja sniženja tjelesne težine koji su trajali šest mjeseci: grupni (n=243) ili individualni (n=233) program koji su se sastojali od edukacije, dijete s niskim sadržajem masnoće, farmakološkog liječenja orlistatom, psihološke potpore i tjelovježbe. Tjelesna težina, indeks tjelesne mase, krvni tlak, glukoza i kolesterol u krvi mjereni su u svih sudionika na početku studije, nakon 3, te nakon 6 mjeseci liječenja. Prosječan gubitak težine u grupnom programu iznosio je 12,2 kg (13%), a u individualnom programu 7,6 kg (9%) kg. Uz smanjenje indeksa tjelesne mase postignuto je također i značajno sniženje vrijednosti razine kolesterola u krvi, glukoze u plazmi i krvnog tlaka u odnosu na bazalne vrijednosti na početku studije. Nakon 6 mjeseci liječenja u svih sudionika studije postignute su normalne vrijednosti razine kolesterola u krvi, glukoze u plazmi i krvnog tlaka ($p<0.001$ u svih). Primijenjen program mršavljenja omogućio je učinkovit i zdrav gubitak tjelesne težine tijekom razdoblja od 6 mjeseci u obje analizirane skupine, ali je grupnim programom postignuto veće smanjenje tjelesne težine, indeksa tjelesne mase, krvnog tlaka, glukoze u plazmi i kolesterola. Uz potrebu za dodatnom potvrdom ovih rezultata, čini se da bi upravo provedba grupnih programa mršavljenja mogla predstavljati osnov buduće globalne strategije u liječenju debljine.