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Team-based "Get-a-Grip" lifestyle management programme in the treatment of obesity

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ABSTRACT

This study examined weight loss during an extensive 1-year lifestyle programme in primary care in Finland in overweight subjects (n = 134, age 18–69 years; BMI > 30, or BMI > 25 with a comorbidity that would benefit from weight loss) between 2009 and 2013 in a single arm design. The programme included four medical doctor visits, five sessions by a dietitian (advice on diet and on-location shopping behaviour), cooking classes, exercise supervised by personal trainer, and group discussions. A motivational interview method was applied.

Of the 134 participants, 92 (69%) completed the 1-year programme. Among the participants 44% lost ≥ 5%, while 21% lost ≥ 10% of their initial body weight. In intention-to-treat-analyses, the mean weight loss during one year was 4.8 kg ($p < 0.001$). Mean BMI decreased by 1.7 kg/m^2 ($p < 0.001$) and waist circumference by 5.6 cm ($p < 0.001$). Mean muscle mass increased by 3.3% ($p < 0.001$), and body fat decreased by 5.0% ($p < 0.001$). After the programme mean visceral fat content was reduced by 6.4%, systolic blood pressure by 8 mmHg ($p < 0.001$), and diastolic blood pressure by 6 mmHg ($p < 0.001$).

In conclusion, retention to the team-based lifestyle management programme resulted in moderate but significant weight loss with beneficial changes in body composition, and the trend to lose weight was maintained throughout the year.

Trial registration: Clinicaltrials.gov identifier NCT04003259.

1. Introduction

Obesity is associated with several health hazards like elevated blood pressure (BP), unfavourable lipid profile, and insulin resistance (Bray et al., 2016). Obesity especially increases the risk of death from cardiovascular causes (Flegal et al., 2005; Whitlock et al., 2009). The methods to decrease weight include dietary programmes like meal-replacement diets (Kreider et al., 2011), commercial weight-losing programmes (Heshka et al., 2003), lifestyle modification (The Look AHEAD Research Group, 2014), and pharmacotherapy (Davidson et al., 1999; Xia et al., 2015). Bariatric surgery is an established treatment option of morbid obesity (Sjöström et al., 2012), and long-term weight management with bariatric surgery prevents cardiovascular disease and the development of diabetes (Adams et al., 2017; Sjöström et al., 2012). Yet, only selected patients can be operated.

The consequences of obesity burden the whole health care system, but obesity-related problems are most frequently encountered in primary care (Tsigos et al., 2008). The prevention of obesity is difficult as high-energy nutrients are easily attainable (Ho et al., 2016; Tuomilehto et al., 2001; Williamson, 2017). Practical and individually tailored programmes for weight management are increasingly needed (Hainer et al., 2008; Ho et al., 2016; Williamson, 2017). The conservative strategies for weight management should be encouraging, easily applicable and cost-effective, but such strategies often fail due to low patient compliance (Kushner, 2010; The Look AHEAD Research Group, 2014).

Comprehensive lifestyle interventions that include the three components 1) reduced-calorie diet, 2) increased physical activity, and 3) behaviour therapy to facilitate adherence to diet and activity goals, comprise the first-line treatment of obesity and its complications

Abbreviations: BP, Blood pressure; GAG, "Get-a-Grip"; BMI, Body mass index

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(Jensen et al., 2014). A duration of ≥ 6 months containing 14 contacts with professionals, and ≥ 1 year with monthly contacts, has been recommended for behavioural lifestyle interventions for weight loss and weight maintenance, respectively (Jensen et al., 2014; Williamson, 2017). A recent review that included randomised controlled trials with overweight and obese patients from primary care reported that after 6 months of intervention the mean weight loss ranged from 0.3 to 6.6 kg (Wadden et al., 2014). Larger weight losses were detected in interventions that included all of the above 3 components (diet, exercise, behaviour therapy) (Wadden et al., 2014). Further, a greater frequency of visits to trained interventionists was associated with larger weight loss.

Here we describe the results of team-based "Get-a-Grip" (GAG) study, a pilot project using a single arm design in primary care, which during 1-year follow-up aimed at 5–10% weight loss, which reduces the risk of obesity-associated adverse events (Diabetes Prevention Program Research Group, 2002; Look AHEAD Research Group et al., 2016; Tuomilehto et al., 2001). The participants attended a personalised exercise programme, cooking and shopping lessons, received health and dietary education, participated in group discussions, and were examined and followed-up by a physician. A motivational interview approach was utilised (Armstrong et al., 2011; VanBuskirk and Wetherell, 2014; Finnish Guidelines for the Current Care of Obesity, 2013). The programme resulted in gradual weight loss of about 5 kg during one-year follow-up.

2. Subjects and methods

2.1. Team-based GAG lifestyle programme

An open-label single arm design was used. The TREND statement checklist is presented as Appendix A. The programme consisted of guidance on 25 separate occasions (Table 1). If the subjects missed a scheduled meeting, a new appointment was set. In the *initiation* phase (1–3 months) the aim was on motivation, in the *establishment* phase (3–6 months) on adherence, and during the *maintenance* phase (7–12 months) on sustaining healthier lifestyle.

Ethical approval

This project was intended to be a clinical programme. Before recruitment, the study plan was submitted to the Ethics Committee. According to the decision of the Committee, no permit was required for subject recruitment to the clinical programme. Subsequently, the subjects were enrolled and data was collected. After preliminary analyses, the study protocol was for the second time submitted to the Ethics Committee. The study was approved on the 25th of March 2014 (study code R12099) providing that all subjects give written informed consent. This was obtained from all but 4 subjects, who were excluded from the analyses. The study was registered to a database of clinical trials after its completion (clinicaltrials.gov identifier: NCT04003259). The study conforms to the Declaration of Helsinki.

2.3. Participant selection

Participants were recruited from the local diabetes centre and health care providers. One announcement was published in a newspaper. An effort was made to recruit participants also from lower social classes (Newton et al., 2017). The *inclusion criteria* were: age 18–69 years, BMI > 30 or BMI > 25 with a co-morbidity that would benefit from weight loss (diabetes, hypertension, arthrosis, asthma, chronic obstructive lung disease, sleep apnoea). The *exclusion criteria* were: physical condition preventing exercise, abuse of alcohol or drugs, medical history suggesting poor adherence, severe concurrent disease, and moderate to severe dementia. The total number of subjects with written informed consent was 134 (Fig. 1). The study data were

Table 1
Flow-chart: team-based Get-a-Grip lifestyle management programme, 25 visits with professionals (Tampere, Finland, 2009–2013).

Phase	Timetable (months)	Medical doctor	Personal trainer	Evaluation of physical status	Voluntary exercise	Dietitian	Professional chef	Group discussions and feedback
Initiation	0	Interview and examination (1 h)†		UKK institute walk test*	Exercise at the gym with the training equipment. Exercise out-of-doors: walking, Nordic walking.	Advice based on dietary 3-day recall (1 h)#		
	0–1	Educational lecture (1 h)					Two cooking classes (3 h each)	
	1–2		Personalized exercise advice (1 h)#, four guided group exercise sessions at the gym (1 h each), two guided group Nordic walking sessions (1 h each)			Dietary advice (45 min)#		
	2–3	Examination (1 h)†						
Establishment	4–5					Shopping advice on location in shops (1 h)		
	5–6	Examination (1 h)†	Personalized exercise advice (30 min)#			Dietary advice (45 min)#		Discussions and feedback (1 h)
Maintenance	7–8							
	9–10		Personalized exercise advice (30 min)#			Dietary advice (1 h)#		
	11–12	Examination (1 h)†		UKK institute walk test*				Discussions and feedback (1 h)

* http://www.ukkinstituutti.fi/en/products-services/ukk-walk-test.
† Measurement of weight, body mass index, body composition, and systolic and diastolic blood pressure, and these values were used in the statistical analyses. #Measurement of weight.

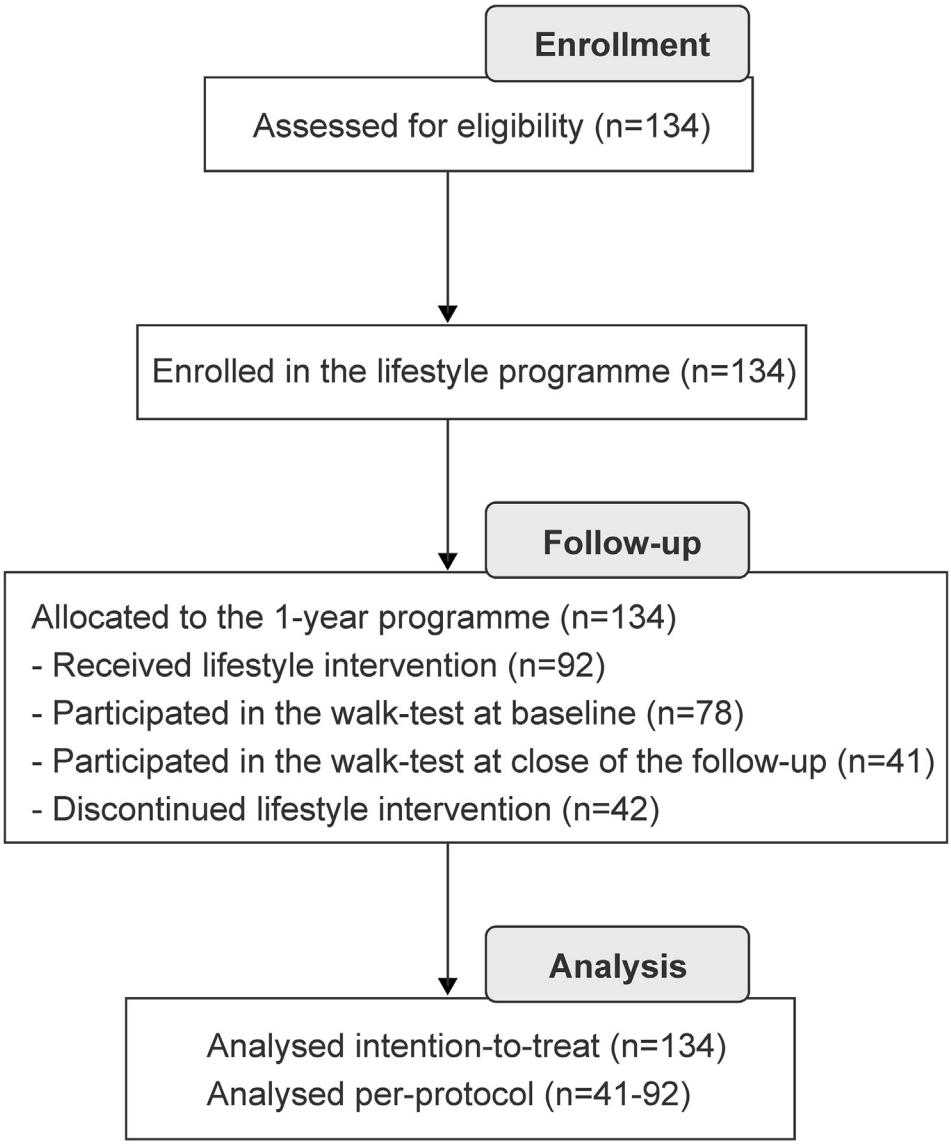

Fig. 1. The flow diagram of study subjects in the Get-a-Grip study in Tampere, Finland, 2009–2013.

collected from January 2009 to December 2013 at Tampereen Terveystaito Ltd, a healthcare provider in Tampere, Finland.

2.4. Medical examination, body composition, and educational lecture

A physician examined all participants (Table 1), recorded health problems, cardiovascular risk factors, and introduced the goal of 5–10% weight loss. Weight, height, body mass index (BMI), waist circumference, and BP were measured (Mancia et al., 2013), and body fat estimated using bioelectrical impedance (Omron BF 500, Omron Healthcare Co, Kyoto, Japan) by the physician at months 0, 2–3, 5–6, and 11–12. Based on medical history and physical findings, laboratory analyses were performed, as appropriate.

An *educational lecture* about obesity, weight loss benefits, and role of exercise in weight control was given by physician and personal trainer (Table 1). The exercise programme was introduced with the Physical Activity Pie concept consisting of two principal parts (UKK Institute Physical Activity Pie): 1) ≥ biweekly muscle strengthening and balance training (including resistance training, ball games, aerobics), and 2) ≥ 150 min of moderate aerobic physical activity per week, or ≥ 75 min of vigorous aerobic physical activity per week.

2.5. Exercise supervised by personal trainer

All participants were invited to a two-kilometre walk-test with heart rate monitoring to construct a fitness index taking into consideration age, gender, height, weight, walking time, and heart rate (UKK Walk Test). The index value 100 in this test corresponds to maximal aerobic power of 40.0 and 30.9 $ml*min^{-1}*kg^{-1}$ in men and women, respectively (UKK Walk Test). The participants were divided into groups of corresponding performance capacity for the exercise sessions.

The trainer tailored a personalized exercise programme for outdoor and indoor activities (Table 1, Supplemental Table B.1) with one-year gym access (Liikuntamaailma Gym Tampere Finland). Four guided gym sessions were given in groups of 6–8 participants during months 1–3 to initiate muscular training (Supplemental Table B.1). Further, outdoor Nordic walking was tutored in groups of 6–8 participants with heart rate monitoring to ensure sufficient chronotropic responses (Polar heart rate monitors). Voluntary exercise was encouraged. The gym visits were monitored, and if no activity was observed within two weeks, the participant was sent a reminder. The participants recorded their indoor and outdoor activities to a diary that was reviewed by the personal trainer during the follow-up visits (Supplemental Table B.1).

2.6. Dietary advice, shopping behaviour, and cooking classes

The participants were tutored to 1) evaluate the nutritional value of food, 2) choose low-calorie alternatives, 3) prepare tasty low-calorie food, and 4) avoid unhealthy food preparing methods.

Dietary advice. The dietitian gave tailored advice based on the 3-day food diary and personal preferences using a motivational interview approach (Table 1, Supplemental Table B.2) (Armstrong et al., 2011; VanBuskirk and Wetherell, 2014; Finnish Guidelines for the Current Care of Obesity, 2013). Instead of a formal calorie goal, the following dietary approaches were instructed to achieve a balanced diet with lower energy intake: eating at regular intervals (breakfast, lunch, dinner, 1–2 snacks if needed), creating meals according to the plate model (The National Nutrition Council of Finland, 2014), reducing the intake of high-energy foods rich in saturated fat and/or added sugars, increasing the intake of vegetables, fruits and berries, and substituting refined cereal products with whole grains (Finnish Guidelines for the Current Care of Obesity, 2013). Leaner protein sources and the use of vegetable oils (like rapeseed oil) and soft vegetable-oil based spreads were instructed. Altogether, concrete stepwise dietary goals were set. The meetings included guidance on behaviour chains as a problem-solving tool (Foster et al., 2005), and anticipation and management of possible setbacks (Supplemental Table B.2). The subjects were encouraged to fill in a 3-day food diary preceding the follow-up visits after 1–2, 5–6 and 9–10 months in order to evaluate the success in dietary changes.

Shopping behaviour. After 4–5 months, rational *on-location* shopping advice was given by the dietitian in groups of 6–8 participants. The foods were examined according to their fat, added sugars, fibre, and salt content (Table 1, Supplemental Table B.2).

Cooking classes. The preparation of healthy food was instructed during two *hands-on* cooking classes by a professional chef, specialised in weight maintenance and healthy food.

2.7. Group discussions and costs

Discussions were arranged for empowerment and feedback in groups of ≤ 32 participants (Table 1). The total costs of the programme were ~ 1500 € per participant. Funding was provided by the city of Tampere and the Finnish Innovation Fund SITRA (Finnish Innovation Fund SITRA). The subjects paid a maximum sum of 500 € for participation, while altogether 37 subjects with low income or unemployment received support that covered 80–90% of their costs.

2.8. Statistical analyses

The primary endpoint was the change in weight during the intervention, examined as the difference between the first and the last measurement of weight. The Wilcoxon paired test was applied for the unadjusted analyses, and an l1-regression for the adjusted analyses.

Power calculations: In a related study, a minimum of 71 subjects was required to detect a mean weight loss of 6.5% from baseline (Wadden et al., 2011) (alpha level 0.05, 80% power, population mean ± standard deviation 4.7 ± 5.4% (Tuomilehto et al., 2001), power analysis method for one-sample *t*-test). This indicates that our samples sizes were large enough even when using nonparametric methods, which were applied because our data has heavy tails. Since all subjects did not finish the 1-year programme, we applied a logistic regression model to address whether adherence depended on age, initial weight or economic status. Dropping out was examined using Fisher's exact test. To model the change in each variable, the linear l1–regression model was fitted with sex, age, economic status and the initial value of each variable as explaining variables. A stepwise backwards model, based on p–values (cut-off 0.05), was used to remove insignificant variables. Wilcoxon test was applied for the statistics of the UKK-walk-test. Intention-to-treat analysis was applied using the method of "last observation carried forward" (McCoy, 2017) to impute observations where the initial value of repeated measurements was not missing. The analysis was performed using R statistical programme (R Development Core Team, 2020).

3. Results

3.1. Subjects and retention in the GAG programme

Altogether 92 subjects of the 134 recruited stayed with the programme for the 1-year follow-up. Initial weight status did not influence whether the subjects completed the programme ($p = 0.133$).

The income class was evaluated as average in 100 subjects, low in 15 subjects, while 19 subjects were unemployed. The drop-out rates in these subgroups were 26%, 27%, and 63%, respectively ($p = 0.0015$). Although final drop-out rates were similar in subjects with average and low income, the subjects in the latter group dropped out earlier during the programme (not shown). Dropping out correlated with lower participant age at 3 and 6 months, and younger age was associated with lower retention with borderline significance ($p = 0.061$). The 1–year retention of employed and unemployed subjects was 75% and 43% ($p = 0.049$), respectively, and the proportion of unemployed subjects was highest in the non-retention group (63% versus 26% in the two other groups, $p = 0.025$). The characteristics of those who discontinued the programme are presented in Table 2A.

3.2. Outcomes of the GAG programme in per-protocol analysis

The characteristics of those 92 subjects who stayed with the programme were (Table 2B): median age 51.5 years, BMI 35 kg/m^2, systolic/diastolic BP 138/91 mmHg, muscle percentage 25%, and fat percentage 44%. Among these participants, 57% lost ≥ 5%, while 27% lost ≥ 10% of their initial body weight. The decrease of weight was fastest in the first quartile.

Medication changes: 1) 20 subjects were on antidiabetic medications, and the dosage or number of drugs was reduced in 5 and increased in 2 subjects; 2) 26 subjects were on lipid-lowering medications, and the dosage or number of drugs was reduced in 1 and increased in 1 subject; 3) 44 subjects were on BP-lowering medications, and the dosage or number of drugs was reduced in 5 and increased in 6 subjects.

Fig. 2 shows the changes in weight, BMI, waist circumference and fat percentage, and Fig. 3 in visceral fat, muscle percentage, systolic and diastolic BP. During one year the median weight loss was 6.2 kg (i.e. 6.7%), BMI decrease 2.2 kg/m^2, waist circumference reduction 6 cm, and fat percentage lowering 2.1 points (Fig. 2).Visceral fat area was reduced by 10 cm^2, muscle mass was increased by 1 percentage point, while BP was reduced by 8/5 mmHg (systolic/diastolic) (Fig. 3).

Altogether 78 subjects participated in initial evaluation of cardiovascular performance by the walk-test (UKK Walk Test). The mean (95% confidence interval) fitness index in these 78 subjects was 69.3 (63.6 to 75.0), corresponding to a performance of considerably below average. At close of the follow-up 41 subjects participated in the walk-test. The initial and final mean fitness indexes in these subjects were 70.3 and 84.1 (Fig. 4), respectively, the latter corresponding to a performance of somewhat below average (UKK Walk Test). In these 41 subjects the average increase in fitness index was 13.8 units (10.2 to 17.4, $p < 0.001$) or 27% (16.3 to 38.5).

We compared those subjects who only participated in the first walk-test with those who participated in both tests: in the first test the fitness-indexes in these subgroups were 68.2 (59.5 to 77.0) and 70.3 (62.4 to 78.2) ($p = 0.783$), respectively, while the mean reductions in weight were –6.5 kg (–4.75 to –8.30) and –7.69 kg (–9.46 to –5.91), respectively ($p = 0.409$).

Table 2
Initial clinical variables and fat percentages in subjects who discontinued the programme (A) and who stayed with the programme (B) in Tampere, Finland, 2009–2013.

A. Subjects who discontinued the lifestyle programme (n = 42, 9 males, 33 females).

Variable	Median	25th – 75th percentile	Range	Number of missing values
Age (years)	43.5	32–58	22–65	0
Weight (kg)	98.9	89.9–127.9	75.0–159.5	0
Body mass index (kg/m^2)	36.2	33.0–42.3	28.4–42.3	0
Waist circumference (cm)	115.5	109.0–128.2	96.0–143.0	0
Systolic blood pressure (mmHg)	139	124–147	109–185	6
Diastolic blood pressure (mmHg)	90	83–99	72–110	6
Muscle percentage	22.8	21.5–24.6	19.7–30.6	10
Fat percentage	48.7	43.5–51.3	32.3–57.1	7
Visceral fat (cm^2)	110	90–130	60–230	11

B. Subjects who stayed with the lifestyle programme for 1 year (n = 92, 33 males, 59 females).

Variable	Median	25th – 75th percentile	Range	Number of missing values
Age (years)	51.5	42–60	21–69	0
Weight (kg)	97.7	89.3–111.3	67.5–171.6	0
Body mass index (kg/m^2)	35.1	32.1–38.2	25.7–53.9	0
Waist circumference (cm)	114.2	106.0–123.8	80.0–162.0	0
Systolic blood pressure (mmHg)	138	126–147	103–185	1
Diastolic blood pressure (mmHg)	91	85–97	60–135	1
Muscle percentage	24.6	21.8–27.0	17.3–34.2	9
Fat percentage	44.2	37.8–50.5	26.0–58.1	4
Visceral fat (cm^2)	130	100–160	70–260	9

3.3. Outcomes of the GAG programme in intention-to-treat analysis

The mean changes in weight, BMI, waist circumference, body composition, and systolic and diastolic BP using intention-to-treat analysis are presented in Table 3. The mean changes in these clinical variables were somewhat smaller when compared with the results of the per-protocol analysis after 5–6 months and 11–12 months. However, the observed changes were statistically significant ($p < 0.001$ for all) (Table 3).

4. Discussion

Weight-losing programmes should rather apply comprehensive approaches than only a single method like low-fat-low-calorie diet or exercise programme (Jensen et al., 2014; Williamson, 2017). Here we employed a team-based approach to attain weight-management and improve fitness. A special emphasis was on education and motivation. The study consisted of medical examinations, dietary advice, and guidance on exercise, shopping behaviour and food preparation, and group discussions. After 5–6 months, the mean weight loss was 4.0 kg, which can be considered as quite a good result when compared to the weight loss range (0.3 to 6.6 kg) presented in a previous review (Wadden et al., 2014). At close of the study, mean reduction in weight was 4.8 kg (4.8%). Of note, 44% and 21% of the participants lost at least 5% and 10% of their initial body weight, respectively. According to the U.S Preventive Services Task Force's review of studies relevant for primary care, behavioural interventions containing 12–26 sessions in the first year resulted in 4–7 kg (6%) weight loss (Leblanc et al., 2011), which is in line with the present findings.

Recently, an intervention weight management programme was compared with standard care in 306 overweight or obese type 2 diabetics (Lean et al., 2018). The intervention comprised initial diet replacement with ~ 850 kcal/day, followed by stepped food reintroduction. At 12 months, average weight loss was –10 kg in the intervention versus –1.0 kg in the control group. Diabetes remission was achieved in 46% of participants of the intervention group and in 4% of controls (Lean et al., 2018). One-year treatment with 120 mg orlistat daily plus diet reduced weight by –8.8 kg versus –5.8 kg in those on placebo plus diet (Davidson et al., 1999). However, the challenge after low-calorie diets or pharmacotherapy is the maintenance of weight (Bray et al., 2016; Davies et al., 2017; The Look AHEAD Research Group, 2014; Williamson, 2017).

In the present study, weight-loss intervention was supported by behavioural components aiming at increased physical activity, reduced energy intake, rational shopping behaviour, and low-calorie food preparation (Ahern et al., 2017; Appel et al., 2011; Heshka et al., 2003; The Look AHEAD Research Group, 2014). A programme with plans for food and exercise and modification of behaviour was more effective than counselling sessions with a nutritionist and provision of self-help resources at one year after the start (–4.3 vs. −1.3 kg) (Heshka et al., 2003). Referral of overweight adults to an open-group behavioural programme for ≥ 12 weeks was more effective than brief advice and self-help materials (Ahern et al., 2017). Two behavioural interventions in obese patients, one delivered in-person and the other remotely via telephone, study website, and e–mail, achieved corresponding weight losses over two years (–5.1 and –4.6 kg, respectively), while in the self-directed control group weight loss was only –0.8 kg (Appel et al., 2011).

Traditional behavioural counselling includes goal setting (targets for diet and physical activity), self-monitoring (food intake and physical activity recording, weight monitoring), and components like problem solving, stimulus control, relapse prevention, and feedback and support from interventionists (Tronieri et al., 2019; Wadden et al., 2012, 2014). According to recent reviews on primary care interventions for weight loss, counselling methods like motivational interview that do not contain specific behavioural goals for energy intake or exercise, resulted in weight reduction of 0.5 to 2 kg (Barnes and Ivezaj, 2015; Tronieri et al., 2019; Wadden et al., 2014). The maximum visit frequency in the majority of these studies was one per month, which may have attenuated the outcome (Tronieri et al., 2019). In GAG, motivational interview (VanBuskirk and Wetherell, 2014) was applied with other behavioural components, and the intervention included > 14 contacts during the first 6 months (Jensen et al., 2014) and altogether 25 contacts during one year. The effectiveness of motivational interviewing is enhanced when applied together with other weight management measures (Armstrong et al., 2011; VanBuskirk and Wetherell, 2014), and the importance of lifestyle interventions that combine different strategies is well recognised (Williamson, 2017).

In the present study, the mean –4.8 kg reduction of weight is

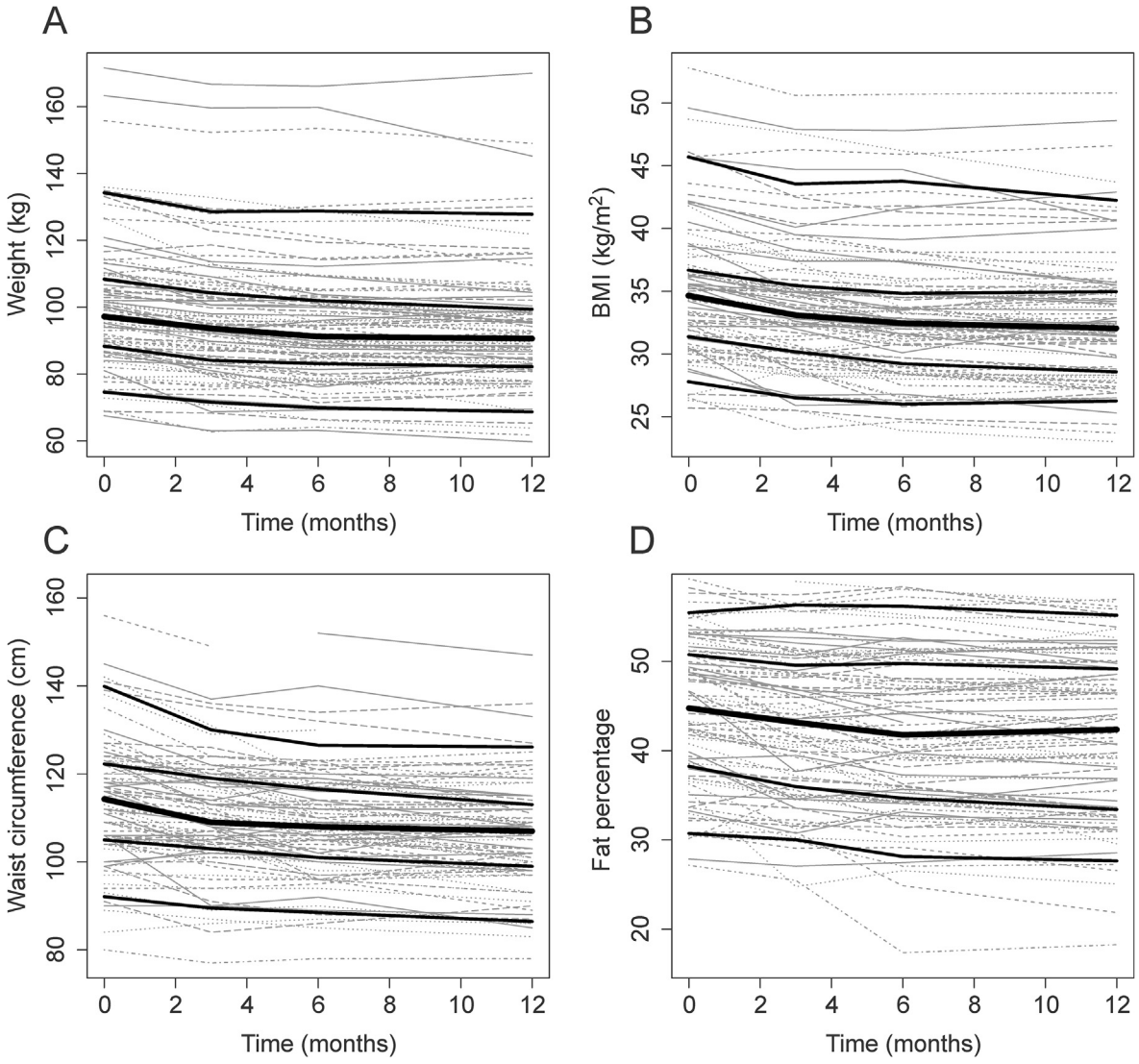

Fig. 2. Changes in weight, body mass index, waist circumference, and fat percentage during the 12-month Get-a-Grip study in Tampere, Finland, 2009–2013. Per-protocol analysis; grey lines depict individual values, thick black lines median values, and thin black lines 10th, 25th, 75th, and 90th percentiles in participant weight (A), body mass index (B), waist circumference (C), and fat percentage (D).

clinically significant (Diabetes Prevention Program Research Group, 2002; The Look AHEAD Research Group, 2014; Tuomilehto et al., 2001). During a mean follow-up of 3.2 years in 522 overweight subjects with impaired glucose tolerance, the diabetes prevention study compared individualised counselling aimed at reducing fat intake, and increasing fibre intake and physical activity with oral and written information (Tuomilehto et al., 2001). The mean one-year reductions in weight were –4.2 kg and –0.8 kg, respectively, while the risk of developing type 2 diabetes was reduced by 58% in the counselling group (Tuomilehto et al., 2001). Similar results were achieved in the diabetes prevention programme (DPP), in which lifestyle modification consisted of low-calorie, low-fat diet, moderate-intensity physical activity, and lessons about diet and exercise (Diabetes Prevention Program Research Group, 2002). Weight was reduced by ~ 6.5 kg at one year and by ~ 3.5 kg at 4 years, while the incidence of diabetes was reduced by 58% (Diabetes Prevention Program Research Group, 2002). The Look AHEAD study compared intensive lifestyle intervention and usual care in 5,145 overweight or obese subjects with type 2 diabetes over eight years (The Look AHEAD Research Group, 2014). The intervention consisted of group sessions, individual discussions, reduced-calorie diet, and moderate intensity exercise; the usual care consisted of diabetes support and education. Individuals who lost ≥ 10% of their weight in the first year had a 21% lower risk of incident cardiovascular disease than individuals with stable weight or weight gain (Look AHEAD Research Group et al., 2016). Fat mass reduction in the intervention group was more pronounced than in the usual care group during the 8-year follow-up (Pownall et al., 2015).

The fitness index in the walk-test was improved by 13.8 units (27%) in those 41 subjects who participated in both walk-tests. Dropping out from the second UKK–walk-test was not related to the weight loss or fitness of the subjects, as the outcome of the first walk–test and the reduction in weight was corresponding in those subjects who only participated in the first walk-test when compared with those who participated in both walk-tests. The present results showed a mean reduction in fat percentage of 2.0 points, and in visceral fat area of 9.3 cm^2, while muscle mass was increased by 0.8 percentage point. The beneficial changes in body composition did not depend on age, sex, socioeconomic status, or initial value of weight, or BMI. Increased physical activity is a proven strategy for the prevention of cardiovascular diseases in all weight groups (Oktay et al., 2017). Improved cardiorespiratory fitness is also a treatment target in overweight and obese subjects (Kreider et al., 2011; Lavie et al., 2016; Ortega et al., 2016). Achieving an increase of at least 2 metabolic equivalents in fitness was associated with a significant reduction (adjusted HR 0.77) in the

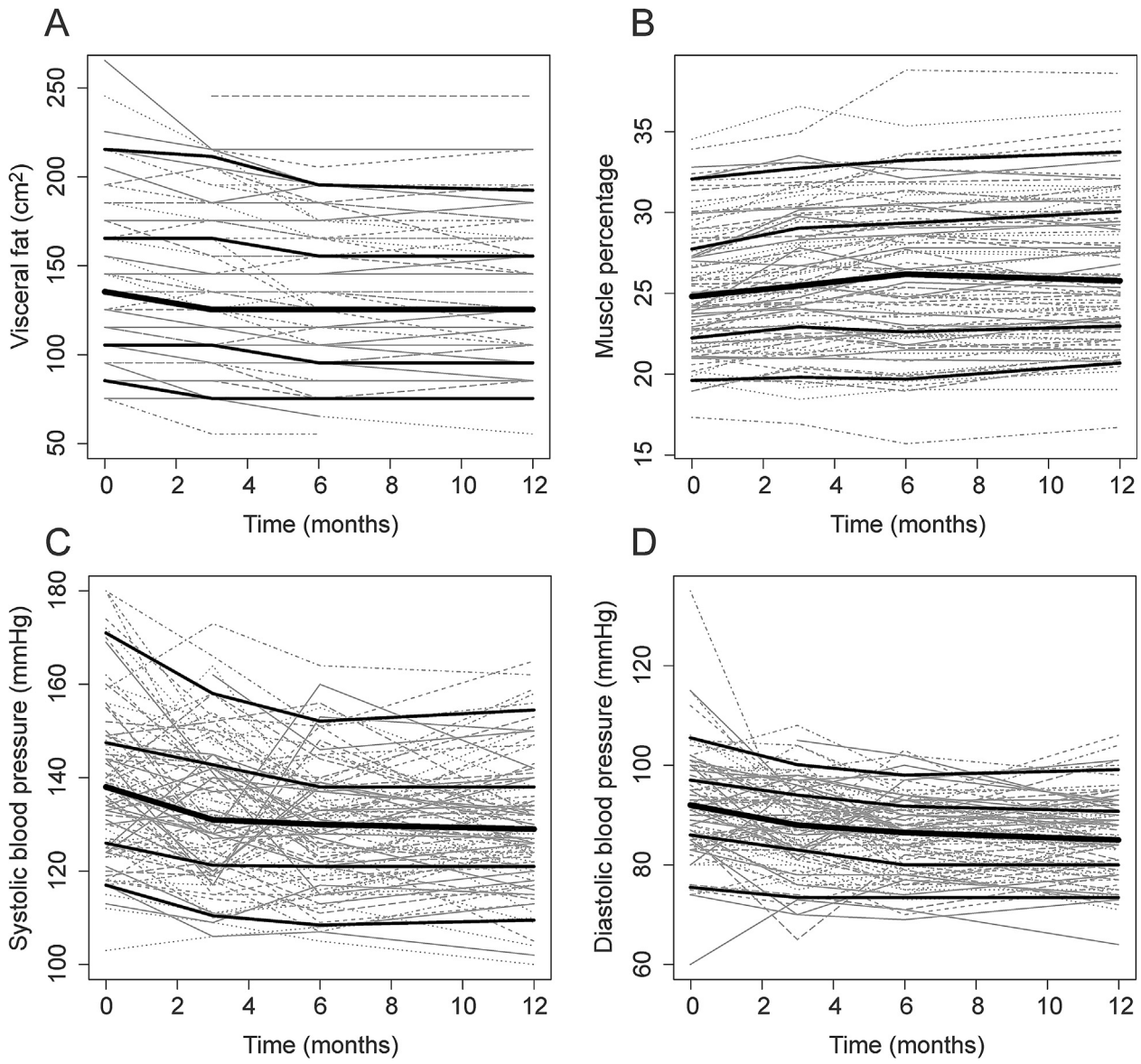

Fig. 3. Changes in visceral fat area, muscle percentage, and blood pressure during the 12-month Get-a-Grip study in Tampere, Finland, 2009–2013. Per-protocol analysis; grey lines depict individual values, thick black lines median values, and thin black lines 10th, 25th, 75th, and 90th percentiles in participant visceral fat area (A), muscle percentage (B), systolic blood pressure (C), and diastolic blood pressure (D).

composite end-points in the Look AHEAD study (Look AHEAD Research Group et al., 2016).

The retention in GAG was 69%, which is lower compared to other lifestyle interventions in primary care settings (Bennett et al., 2012; Christian et al., 2008; Logue et al., 2005; ter Bogt et al., 2009; Wadden et al., 2011). However, lower participation rates to the study visits than in the present study have also been reported (de Vos et al., 2016, 2014). The non-retention in GAG was probably attributed to the intensity of the programme that required high level of motivation. Overweight and obesity are especially a problem in lower social classes (Newton et al., 2017). The present retention was corresponding in subjects with average versus low income, while retention was lowest in unemployed subjects. Weight control in unemployed people remains a special challenge.

This study has limitations, as there was no control group in the study. Nevertheless, the present reduction in weight is corresponding to that in previous studies (Leblanc et al., 2011; Tronieri et al., 2019). Beneficial changes in body composition were observed, but the metabolic status was not monitored with laboratory testing, and we have no data about possible changes in the lipid status or insulin resistance in these subjects. The maintenance of weight after an initial weight-losing period is very important (Knowler et al., 2009; The Look AHEAD Research Group, 2014; Tuomilehto et al., 2001). We do not have information about the persistence of the weight loss beyond one year. Typically, most overweight people will again gain weight in the course of time (Bray et al., 2016; Heshka et al., 2003; Wing et al., 2016). In the Look AHEAD study at one year, weight loss in the intensive intervention group was 8.5% and in the usual care group 0.6%, while at 8 years the weight losses were 4.7% and 2.1%, respectively (The Look AHEAD Research Group, 2014). In the present study, the subjects were instructed to fill in a 3-day food diary at baseline and preceding the follow-up visits at months 1–2, 5–6, and 9–10, but daily monitoring of calorie intake was not required. Further, the participants were instructed to record their indoor and outdoor activities to an exercise diary during the one-year intervention. The records were reviewed at the visits by the physician, personal trainer, and dietitian for feedback and support. The present work did not include the dietary and physical activity data, which is a limitation of this study.

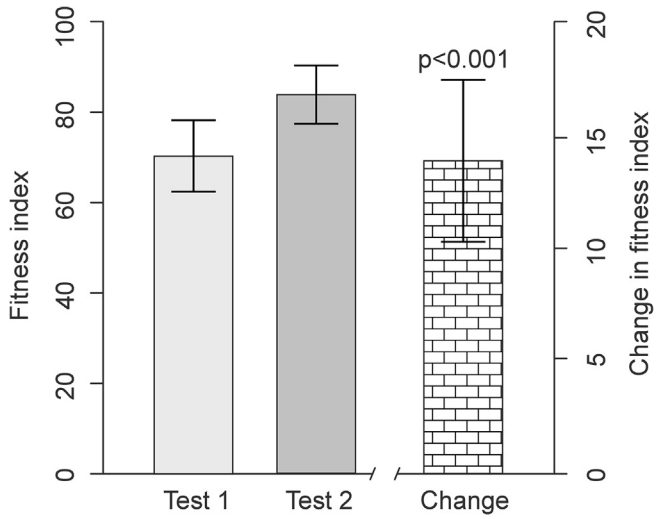

Fig. 4. Fitness index during the 12-month Get-a-Grip study in Tampere, Finland, 2009–2013. Per-protocol analysis; fitness index was derived from walk-test in the beginning and at close of the study, and the change in fitness index was calculated in those 41 subjects who participated in both of these tests (mean, 95% confidence interval of the mean).

Table 3
Changes in clinical variables and body composition in the subjects who stayed with the lifestyle programme for 1 year (n = 92, 33 males, 59 females) and in all subjects who were enrolled in the programme (n = 134, 42 males, 92 females) in Tampere, Finland, 2009–2013.

	Per-protocol (n = 92)			Intention-to-treat (n = 134)		
	Mean	SD	p-value*	Mean	SD	p-value*
Weight (kg)						
At month 5–6	−5.6	4.3	< 0.001	−4.0	4.5	< 0.001
At month 11–12	−6.7	5.4	< 0.001	−4.8	5.5	< 0.001
BMI (kg/m2)						
At month 5–6	−2.0	1.5	< 0.001	−1.4	1.6	< 0.001
At month 11–12	−2.4	1.8	< 0.001	−1.7	1.9	< 0.001
Waist circumference (cm)						
At month 5–6	−5.3	5.4	< 0.001	−4.4	5.1	< 0.001
At month 11–12	−7.1	6.0	< 0.001	−5.6	5.8	< 0.001
Fat (percentage points)						
At month 5–6	−2.4	2.8	< 0.001	−1.8	2.7	< 0.001
At month 11–12	−2.7	2.9	< 0.001	−2.1	2.9	< 0.001
Visceral fat (cm^2)						
At month 5–6	−11.0	12.8	< 0.001	−8.2	12.1	< 0.001
At month 11–12	−12.5	15.6	0.002	−9.4	14.3	< 0.001
Muscle (percentage points)						
At month 5–6	1.0	1.3	< 0.001	0.7	1.3	< 0.001
At month 11–12	1.2	1.4	< 0.001	0.9	1.4	< 0.001
Systolic BP (mmHg)						
At month 5–6	−9.1	14.5	< 0.001	−8.3	13.6	< 0.001
At month 11–12	−8.5	13.5	< 0.001	−8.2	12.8	< 0.001
Diastolic BP (mmHg)						
At month 5–6	−6.1	9.8	< 0.001	−5.3	9.1	< 0.001
At month 11–12	−6.1	9.2	< 0.001	−5.5	8.6	< 0.001

BMI, Body mass index; BP, Blood pressure.
* Wilcoxon signed rank test.

In conclusion, in line with the view that comprehensive lifestyle interventions are required for effective obesity management (Bray et al., 2016), the present study showed that an intensive team-based lifestyle intervention could moderately but significantly reduce body weight and beneficially influence body composition and fitness during one-year follow-up in overweight and obese subjects.

CRediT authorship contribution statement

Jyrki Taurio: Visualization, Writing - original draft, Writing - review & editing. **Jorma Järvinen:** Conceptualization, Funding acquisition, Methodology, Investigation, Writing - review & editing. **Elina J. Hautaniemi:** Visualization, Writing - review & editing. **Arttu Eräranta:** Data curation, Writing - original draft, Writing - review & editing. **Jani Viitala:** Data curation, Writing - review & editing. **Klaus Nordhausen:** Formal analysis, Writing - review & editing. **Katri Kaukinen:** Formal analysis, Supervision, Writing - review & editing. **Jukka Mustonen:** Formal analysis, Supervision, Writing - review & editing. **Ilkka H. Pörsti:** Formal analysis, Funding acquisition, Supervision, Visualization, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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