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Short- and long-term effect of a worksite group versus individual counseling on physical activity and dietary habits in moderately overweight hospital employees – a randomized controlled trial

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Abstract

Background Individual counseling demands considerable resources whereas a group intervention will lower the costs in relation to lifestyle changes on physical activity and dietary habits. The aim of this study was to examine the short- and long-term effect of group counseling compared to individual counseling on physical activity and dietary habits in moderately overweight hospital employees with a Body Mass Index between 25.0 and 30.0.

Methods A randomized controlled trial, allocating participants to individual or group-based counseling based on a behavioural change approach, which consisted of five meetings during the first three months and one follow-up meeting respectively after 6 and 12 months. Assessment of physical activity was obtained using the International Physical Activity Questionnaire. Data on diets were obtained by a three-day self-administered dietary record. Additional measurements were Body Mass Index, fat percentage, waist circumference and fitness rating. Assessments were at 3, 6 and 12 months.

Results 120 employees, consisting of 105 women and 15 men aged between 25 and 66 years were consecutively included. No statistically significant differences were seen between the groups in relation to physical activity level, total fruit and vegetable intake or fat energy percentage at any time. Statistically significant differences were seen within the groups, especially at the 3-month follow-up. No significant differences between the groups were seen in relation to BMI, fat percentage, waist circumference and fitness rating.

Conclusion Based on resource calculations more people can be offered counseling by group intervention provided that the general problems concerning long-term compliance are solved. From a public health point of view maintenance of physical activity and weight stabilization are important effect outcomes.

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Introduction

Physical inactivity and obesity are increasing public health problems in Denmark and worldwide due to a high prevalence and a strong association with risk of serious medical illnesses (1;2). There is substantial evidence from several longitudinal studies that improving dietary habits and/or increasing physical activity can reduce the risk for developing cardiovascular diseases and type 2 diabetes (3-5). Regular physical activity alone prevents illnesses such as cardiovascular disease, diabetes, certain cancers and osteoporosis (2). The Oslo Diet and Exercise Study showed that a combined intervention was superior to a single intervention in affecting lipid concentrations and blood pressure (6).

In 2000, 50% of men and 34% of women in the Danish population were overweight. In 2013, the incidence of overweight and obesity had raised to 69% in men and 55% in women (7;8). The increase in overweight and obesity might be due to several independent factors including increased calorie consumption and decreased physical activity, but evidence from initiatives which can ensure primary prevention of obesity is inconclusive (9). Positive changes in lifestyle may improve health status regardless of any weight loss (10). From an economic and a public health perspective, preventing weight gain for moderately overweight people may be an important focus rather than treating established overweight and obesity as an important response to the obesity epidemic (1).

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There is no consensus on (cost) effective ways to implement lifestyle interventions, but attention to both dietary habits and physical activity combined with components from behavioral therapy, continuity and intensity seem to be important aspects (11). Earlier studies show that an intervention targeting both physical activity and diet can be beneficial although results are varying (11;12). The Danish National Board of Health has published National Action Programs for both physical activity and obesity to improve public health (13;14).

A worksite offers a unique setting to implement health promotion programs and provides an ideal opportunity to engage large numbers of individuals in an efficient manner (15). The worksite offers a feasible and social empowering environment, which may support adherence to life style changes. A systematic review conducted by Proper et al. (16) found evidence that worksite physical activity programs were effective regarding levels of physical activity, although an effect on physical fitness was inconclusive (16). The authors stress that only a few of the identified studies were of high quality and recommend more rigorously conducted randomized controlled trials (16). Individual counseling demands considerable resources whereas a group counseling will lower the costs and may be a motivational factor for participation.

The aim of this study was to examine short- and long-term effect of group counseling compared to individual counseling on physical activity and dietary habits in moderately overweight hospital employees with a Body Mass Index (BMI) between 25.0 and 30.0.

Methods

Participants, setting and ethics

The study was a randomized controlled trial and health care workers were allocated to individual or group-based counseling on physical activity and diet. The intervention took place at the worksite. The participants were employed at a University Hospital in Denmark and were recruited through information sent to all personnel. The inclusion criteria were a BMI between 25.0 and 30.0 and a motivation for lifestyle changes. Employees with conditions requiring special attention were excluded.

Participants were randomized to individual counseling (IC) or group counseling (GC) through block randomization with permuted blocks of 12. The block randomization was carried out in ten stages by placing 12 envelopes (six for individual and six for group intervention) in a bag, after which the participants were asked to take an envelope each. The group size was six participants. The project leader was only responsible for the concealed randomization procedure. The study was approved by The Danish Data Protection Agency. Informed written consent was obtained from all participants.

Intervention

The interventions concerning physical activity and dietary habits were similar in both groups and were provided by a physiotherapist and a clinical dietician. The counseling was based on a pre-determined program consisting of five meetings during the first three months and respectively one follow-up meeting after six months and one after 12 months. Interventions for individuals lasted between 1 and 1½ hour each and for group interventions between 2 and 2½ hours. The first five meetings consisted of setting and evaluating goals for the participants, providing exercise options, intensity, strain, duration and frequency, together with dietary information and advice. In both groups, the counseling was based on a behavioural change approach and emphasis was on self-awareness, goal setting, facilitators and barriers to overcome during the process as this approach preveiously has proven useful in a worksite based intervention in relation to physical activity (17). Furthermore, group counseling aimed to support experience based dialogues between the participants as a means towards the achievement of the participants' individual goals. Discussions and negotiations about suitability, challenges and modifications of goals and plans were continuosly initiated by the counselors to ensure adherence to the program and integration of changes into everyday lives.

The counseling given on exercise was based on the recommendations of the Danish National Board of Health, which suggest a minimum of 30 minutes daily exercise of light to moderate intensity and 30 minutes twice a week exercise of moderate to high intensity (2;13). The aim of the diet counseling was to improve the eating habits of the participants. As a secondary aim, the participants were encouraged to follow the recommendations concerning a low fat content (max 30 E%) and a high carbohydrate content (55-60 E%), primarily unprocessed carbohydrates. The diet counseling was based on the National Dietary Recommendations (14). The two physiotherapists and the two clinical dieticians involved were trained in standard procedures to minimize variation.

Measurements

Primary outcomes

Assessment of physical activity was obtained using the International Physical Activity Questionnaire (IPAQ-long form) (18) asking about physical activity during seven days immediately prior to counseling. IPAQ has shown acceptable measurement properties in a large in-

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ternational study across 12 countries (19). The participants were required to fill in the questionnaire at baseline and at 3, 6 and 12 months. The questionnaires were sent out before the 6- and 12-month follow-up meetings and filled in by the participants before the meetings. The participants who were absent were asked to send the questionnaire to the project leader. Written reminders were sent if necessary.

Data on diets were obtained by a 3-day self-administered dietary record using household measurements for three consecutive days (two weekdays and one weekend day). The diet records were to be completed four times, at the introduction to the project (week 0) and at 3, 6 and 12 months.

Secondary outcomes

Additional measurements were obtained six times during the project - in intervention weeks 0, 4, 8, 12 and follow-up at 6 and 12 months. These measurements included: weight, BMI, fat percentage, waist circumference and fitness rating. Measurements were intended to be a motivating factor for lifestyle chances.

A Tanita impedance scale model BC-418MA was used to calculate BMI and fat percentage. For standardization of measurement the procedure was carried out at the same time of the day. The participants were informed of no alcohol and no physical activity of high intensity 24 hours prior to the measurements.

The fitness rating was measured with a Watt-max Test carried out on an exercise bicycle. The fitness rating was assessed as good/average/poor (2).

Statistical analysis

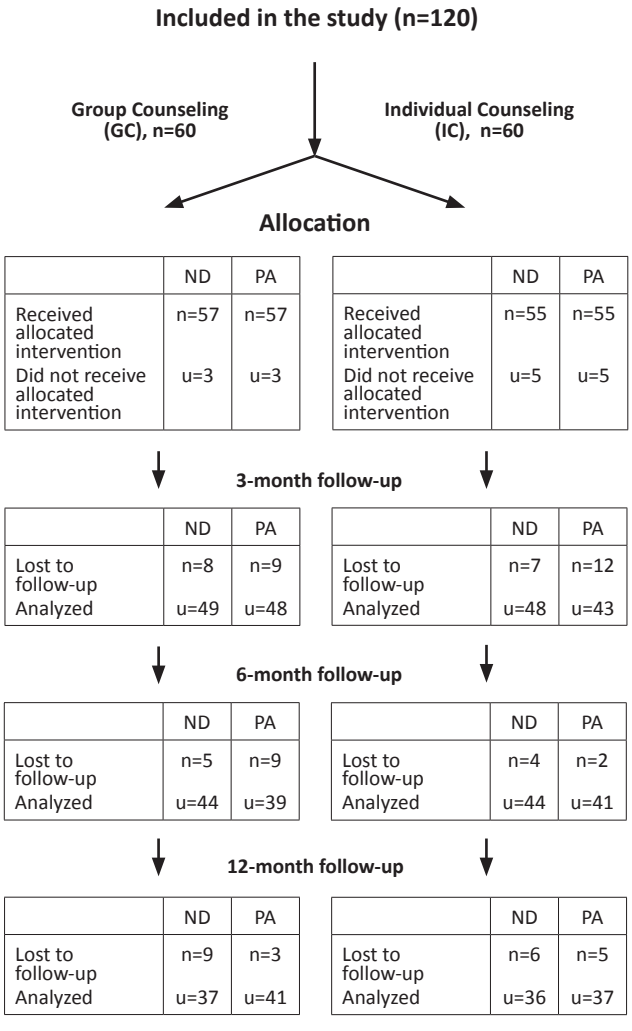
Baseline characteristics were reported for each group giving the actual numbers for categorical variables and giving the mean +/- standard deviation for continuous variables. The physical activity was summarized using medians with bootstrapped 95% confidence interval, as data was not normally distributed. For continuous variables judged to be normally distributed, a paired t-test was used for analysis of within-group change from baseline, and a unpaired t-test for comparing the change-from-baseline between the groups. The comparisons of physical activity were carried out using Wilcoxons signed-rank test within groups and Wilcoxons rank-sum test between groups. The diet registrations were processed using the program Master Diætist version 1.223, 2005, Master Data I/S, Copenhagen, Denmark. Energy distribution and intake of fruit and vegetables were calculated. Due to a high drop-out, a per protocol analysis was performed. A drop-out analysis was performed to define possible predictors of the drop-outs using Fisher's exact test.

Analyses were done using Stata 9.2SE. A two-sided p-value<0.05 was considered statistically significant.

Results

120 employees, consisting of 105 women and 15 men with BMI between 25.0 and 30.0, were consecutively included. The participants were between the ages of 25 and 66 years. The two groups were almost identical at baseline although a difference in dispersion of job categories was seen (Table 1). Drop-outs at the 3-month follow-up was 9 and 12 out of 60 participants following GC and IC respectively. At the 12-month follow-up, 41 and 37 participants returned the questionnaires (Figure 1). Reasons for drop-out were change of employments, poor health and lack of time and motivation.

Figure 1 Flowchart



ND = Nutrition data, PA = Physical activity data

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Table 1 Baseline characteristics

		Group Counseling (GC)	**Individual** Counseling (IC)
Participants		57	55
Gender	*Male, n (%)*	6 (11)	8 (15)
	Female, n (%)	51 (89)	47 (85)
Age	*≤ 45, n (%)*	27 (47)	26 (47)
	> 45, n (%)	30 (53)	29 (53)
Marital status	*Married, n (%)*	45 (79)	47 (85)
	Single, n (%)	12 (21)	8 (15)
Children	*None, n (%)*	27 (47)	28 (51)
	At least one, n (%)	30 (53)	27 (49)
Education*	*≤ 10 years, n (%)*	12 (21)	7 (13)
	> 10 year, n (%)	45 (79)	47 (87)
Job	*Medical staff, n (%)*	24 (42)	33 (60)
	Administration staff, n (%)	12 (21)	11 (20)
	Service staff, n (%)	21 (37)	11 (20)
Smoker**	*Yes, n (%)*	4 (11)	2 (5)
	No, n (%)	34 (89)	36 (95)
Body measures	*Height, cm* +/- SD	167.0 +/- 6.3	167.2 +/- 8.4
	Fitness rating, oxygen l/min +/- SD	27.7 +/- 4.5	27.7 +/- 6.0
	Weight, kg +/- SD	76.2 +/- 8.2	76.7 +/- 8.4
	Body fat, % +/- SD	30.2 +/- 6.2	30.3 +/- 6.5
	Body mass index, kg/m2 +/- SD	27.2 +/- 1.6	27.4 +/- 1.7
	Waist, cm +/- SD	88.5 +/- 6.9	89.0 +/- 6.9

Data are presented as number of participants (%) or mean +/- standard deviation
* Information about education is missing for 1 participant (Individual).
** Information about smoking status is missing for 19 (Group) and 17 (Individual) participants.

Table 2 Daily exercise and food intake. Changes from baseline

	Baseline	**3 months**	**6 months**	**12 months**
Group Counseling (GC):				
Number:	*57*	*48*	*39*	*41*
	median (95%CI)	median (95%CI)	median (95%CI)	median (95%CI)
Total physical activity (minutes) *	69 (51,86)	**+21 (-2,44)**	+19(-7,45)	-11 (-31,8)
Physical activity - leisure time (minutes)	59 (43,75)	**+18 (5,31)**	+13 (-2,27)	-4 (-24,16)
Number:	*57*	*49*	*44*	*37*
	mean (95%CI)	mean (95%CI)	mean (95%CI)	mean (95%CI)
Fruits, g	231.2 (193.3; 269.1)	-9.3(-65.0; 46.5)	-30.7 (-87.8; 26.0)	-41.2 (-100.0; 17.7)
Vegetables, g	244.8 (206.8; 282.7)	7.6 (-49.7; 64.8)	48.4 (-10.2; 106.9)	-0.6 (-61.5; 60.3)
Total, g	475.9 (415.6; 536.3)	0.3 (-88.1; 88.8)	19.6 (-70.6; 109.7)	-39.3 (-132.2; 53.7)
Fat energy %	30.9 (29.2; 32.7)	**-3.2 (-5.8; -0.6)**	**-3.1 (-5.7; -0.4)**	**-1.2 (-4.0; 1.5)**
Individual Counseling (IC):				
Number:	*55*	*43*	*41*	*37*
	mean (95%CI)	mean (95%CI)	mean (95%CI)	mean (95%CI)
Total physical activity (minutes)	51 (38,64)	**+9 (-10,29)**	+16 (-1,34)	+14 (-4,32)
Physical activity - leisure time (minutes)	41 (33,48)	**+14 (-8,35)**	**+14 (-2,30)**	**+17 (-2,36)**
Number:	*55*	*48*	*41*	*36*
	mean (95%CI)	mean (95%CI)	mean (95%CI)	mean (95%CI)
Fruits, g	264.2 (217.0; 311.4)	-29.6 (-71.2; 11.8)	-42.7 (-85.4; 0.1)	-28.2 (-74.0; 17.7)
Vegetables, g	245.5 (202.3; 288.6)	39.6 (-6.2; 85.5)	23.4 (-40.5; 87.3)	-23.3 (-91.8; 45.1)
Total, g	509.7 (448.3; 571.1)	10.3 (-51.7; 72.2)	23.4 (-40.5; 87.3)	-23.3 (-91.8; 45.1)
Fat energy %	31.1 (29.3; 32.9)	**-3.3 (-5.4; -1.2)**	**-3.1 (-5.2; -1.0)**	**-2.3 (-4.6; -0.1)**

*) Note that the sum of medians is not the same as the median of the total sums.
[+]Highlighted in bold: Significant change from baseline within group (Wilcoxons signed-rank test), p<0.05.
There are no significant differences between the groups.

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There was a non-significant difference of 18 min/day in total physical activity between the groups at baseline. Both groups increased their total physical activity levels significantly after three months by 30% (21 min/day (-2;44)) after GC and 18% (9 min/day (-10;29)) after IC. After six months the increase was maintained, but non-significant in total physical activity of 26% (19 min/day (-7;45)) and 31% (16 (-1;34)), respectively. At the 12-month follow-up the total physical activity level after GC had dropped by 16% (-11 min/day (-31;8)) from baseline, while after IC the total physical activity level was still increased by 27% (14 min/day (-4;32)), still non-significant. There were no significant differences in changes in physical activity levels between the groups. Most physical activity was carried out during leisure time (Table 2).

At baseline, there was a significant difference in the total intake of fruit and vegetables of 33.8g between the groups as a larger intake of fruit was reported in the IC. After three months, the IC had increased their total intake of fruit and vegetables in relation to the starting-off point by 10.3g (-51.7;72.2) whereas the GC had maintained their intake of 0.3g (-88.1;88.8). After six months a higher level of intake of 23.4g (-40.5;87.3) for the IC and 19.6g (-70.6-109.7) for the CG was presented. At the 12-month measurement point, the IC´s intake of fruit and vegetables was 23.3g (-01.8;45,1) lower than at baseline, and for the CG the amount was 39.3g (-132.2;53.7) lower.

At baseline, the fat energy percentage was 30.9 (29.2;32.7) and 31.1 (29.3;32.9) respectively, for the CG and the IC. At three months, the fat energy percentage had dropped by 3.2 (-5.8;-0.6) percentage points after GC and 3.3 (-5.4;-1.2) percentage points after IC. At the six-month follow-up, the decrease was 3.1 points for both groups. After 12 months, the decrease in relation to baseline was 1.2 and 2.3 percentage points for GC and IC, respectively.

There was no statistically significant difference between the two groups. (Table 2).

Table 3 shows anthropometry and physical fitness measurements at baseline, 3, 6 and 12 months for BMI, weight, waist, fat percentage and fitness rating. The number of fitness rating tests varied, as several participants preferred not to carry out this test, due to the workload intensity in the test. The results show no significant difference in changes between the groups in relation to weight, BMI, fat percentage, waist circumference and fitness rating. Within the groups there were significant improvements in relation to all measurements at the 3- and 6-month follow-up compared to baseline. Furthermore, improvements after GC were significant at the 12-month follow-up, whereas after IC, changes were only significant for waist circumference and fitness rating.

The average BMI among participants in GC was 27.2 (26.8;27.7) at baseline, and fell to 26.5 (25.8;27.4) at the 3-, 6-, and 12-month follow-up. BMI among participants in IC dropped from 27.4 (26.9;27.8) to 27 (26.0;27.7) at the 3-month follow-up, and 26.8 (26.0;27.6) at the 6 -month follow-up and to 27 (26.0;27.7) at the 12-month follow-up. No statistical significant differences were seen between the groups. The weight loss after GC was 2,1 kilograms, while after IC, the loss was 1,1 kilogram at 3 months and 1.2 kilogram at the 12-month follow-up.

Table 3 Anthropometry and physical fitness level. Changes from baseline

	Baseline	**3 months**	**6 months**	**12 months**
Group counseling (GC)	mean (95%CI)	mean (95%CI)	mean (95%CI)	mean (95%CI)
Number:	*57*	*33*	*39*	*32*
Body mass index, kg/m2	27.2(26.8,27.7)	-0.7(-1.0,-0.4)	-0.7(-1.0,-0.3)	-0.7(-1.1,-0.3)
Weight, kg	76.2(74.0,78.4)	-1.9(-2.7,-1.0)	-1.9(-2.9,-0.9)	2.1(-3.2,-1.0)
Waist circumference, cm	88.5(86.7,90.4)	-2.0(-3.1,-0.8)	-2.5(-3.6,-1.3)	-2.6(-4.2,-1.0)
Body fat, %	36.0 (34.8,37.2	-1.3(-2.0,-0.6)	-2.2(-2.9,-1.5)	-1.8 (-2.5,-1.1)
Fitness rating, oxygen l/min*	27.7(26.4,28.9)	2.6 (1.5,3.8)	2.6 (1.3,3.8)	2.3 (1.4,3.1)
	Baseline	**3 months**	**6 months**	**12 months**
Individual counseling (IC)	mean (95%CI)	mean (95%CI)	mean (95%CI)	mean (95%CI)
Number:	*55*	*37*	*36*	*32*
Body mass index, kg/m2	27.4 (26.9,27.8)	-0.4 (-0.6,-0.1)	-0.6 (-0.9,-0.2)	-0.4 (-0.9,0.1)
Weight, kg	76.7 (74.2,79.2)	-1.1 (-1.8,-0.4)	1.2 (-2.7,-0.6)	-1.2 (-2.6,0.1)
Waist circumference, cm	89.0 (87.1,90.9)	-2.2 (-3.2,-1.3)	-2.2 (-3.3,-1.1)	-1.8 (-3.2,-0.4)
Body fat, %	34.4 (32.5,36.3)	-0.8 (-1.4,-0.1)	3.1 [9] (1.5,4.7)	2.1 [8] (0.4,3.8)
Fitness rating, oxygen l/min *	27.7 (26.1,29.3)	2.2 [7] (1.3,3.1)	3.1 [9] (1.5,4.7)	2.1 [8] (0.4,3.8)

Data are presented as mean and 95% confidence interval at baseline, and at each follow-up time as mean change from baseline with 95% confidence interval. There are no significant differences between the groups. - Number of missing values in square brackets.

The fitness rating was 27.7 (26.4;28.9) for both groups at the baseline and was increased by 2,2 points (IC) and 2,6 (GC) at the 3-month follow-up. This increase was maintained by both groups throughout the study. Overall the statistical significant changes in the anthropometric measurements and the fitness rating within both groups were relatively small, but maintained over time.

The total drop-out at the 12-month follow-up were 25 (42%) in the GC and 24 (40%) in the IC. Analyses using Fisher's exact test showed no difference between the drop-out group and the baseline group.

Discussion

Physical activity levels and dietary habits improved after a three-month intervention in both groups. There were no statistically significant differences between the groups. After one year, physical activity and dietary habits were close to baseline levels. Most measurements (BMI, weight, waist, fat percentage and fitness rating) showed significant changes after one year in both groups and thereby the interventions seem to be preventive against a weight gain. However, multiple testing may have increased the risk of type I errors in the secondary outcomes. The analyses were hypothesis driven but individual, non-systematic differences between groups should be interpreted critically.

A limitation of this study may be that both groups improved just because they participated in an intervention study. If we had included a control group, a difference between this group and the two intervention groups might have been seen. We did however, not include a control group as the primary aim was to explore differences in effects of group and individual intervention. The costs of individual intervention would limit the potential of this intervention. Furthermore selection bias may have influenced the results and thereby also the generalizability of the results as the participants were recruited by self-selection and it might therefore be the more active/motivated volunteers that signed up for the study than the general population.

Drop-out is often high in lifestyle programs. Toft et al. (20) found that awareness of unhealthy lifestyle, perceived susceptibility of disease and motivation towards a lifestyle change were important mediators of participation. Susceptibility of disease was not an inclusion criteria and this might have influenced the drop-out rate. The motivational factor may as well be affected (4). The large drop-out may weaken the validity of the results, although drop-outs were equally divided between the two groups. Even though an intention-to-treat analysis is the recommended method in randomized controlled trials, it was decided to perform a per-protocol analysis due to the large drop-out and this may be a potential bias in the study. As a supplement, a drop-out analysis was performed to identify potential predictors for drop-out.

Physical activity is a behavior which is difficult to estimate (21). The IPAQ is a validated tool widely used in the literature (18;22-24), but may lead to higher estimates of total physical activity than other questionnaires (25). Furthermore, social desirability and recall bias might have influenced the data. Using an activity log combined with the IPAQ questionnaire could have improved the validity of the data (21). However, IPAQ has successfully been used in health promotion studies previously. Further, VO2 max tests were used to substantiate the physical fitness assessment.

Dietary habits reported on fruit and vegetable intake after 12 months were lower than reported at baseline after an increase in both groups at six months. Studies have shown overweight people generally underreport their food intake, which may also be the case in our study (26).

Other studies also found an increase in physical activity and weight loss after the three-month follow-up, whereas the long-term compliance, especially in relation to physical activity, was reported to be low (24;27;28). Even though there were no significant changes in the daily physical activity after 12 months the participants did not gain weight. Both groups had a small weight loss which was maintained throughout the study. It is recommended that prevention through weight stabilization is preferable when excess weight is already a reality (1;29) and it is questioned whether a weight loss even may be hazardous in the long term.

In a worksite setting, it is time consuming to implement both physical activity and dietary counseling. Recent evidence on the effects of physical activity (29) shows a trend towards physical activity alone as having a positive effect on preventing obesity, cardiovascular disease and cancer disease, thereby indicating that especially physical activity is important to implement in a health promotion in a worksite setting. Focus on physical activity may increase both motivation and implementation of a lifestyle change. Furthermore, it seems clear that making lifestyle changes is difficult over time and there may be very complex dynamics and patterns involved. A qualitative exploring approach could help to describe and address these dynamics thereby providing knowledge on how to improve the interventions and minimize drop-outs.

The limitations of our study were also reported in a Cochrane review and only limited conclusions could be drawn regarding whether individual or group based interventions were preferable (30).

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Conclusion

It was possible to change physical activity levels with both individual and group counseling, and the level was changed markedly and significantly at the 3-month point. After one year, the changes were, however, non-significant in both groups and not significantly different. Dietary habits reported on fruit and vegetable intake after 12 months were lower than reported at baseline.

Most measurements (BMI, weight, waist, fat percentage and fitness rating) showed significant changes within both groups, indicating that the interventions may have prevented a weight gain and improved the aerob capacity of the participants.

No significant differences in improvement between the groups were found, and one type of counseling does not seem superior. Based on resource calculations, more people can be offered advice by group counseling than by individual counseling, provided that the general problems concerning long-term compliance are solved.
From a public health point of view the maintenance of physical activity of the participants and weight stabilization are important effect outcomes.

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Contribution Details

All authors have read and approved the manuscript and met the ICMJ criteria for authorship. LS, KO and JA designed the study and all authors analyzed and interpreted the results. LS and JA drafted the article and LS, KO and JA revised the article critically on content.

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Competing Interests

None declared.

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