BeweegKuur

An effective lifestyle intervention in practice?

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The BeweegKuur: An effective lifestyle intervention in practice?

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Preface

During the last 6 months I analyzed the effectiveness of the BeweegKuur at NISB. The first time I came in contact with the BeweegKuur was in spring 2010 during my bachelor thesis; I did a literature study about the implementation of the SLIMMER intervention. When Annemien told me it was possible to do my second master thesis about the BeweegKuur I was almost directly enthusiastic; I'm attracted by ways to prevent diseases or to improve quality of life by changes in lifestyle and with this thesis it was also possible to get some more experience in analyzing data. Furthermore I get the possibility to experience the nice atmosphere at NISB; I liked the informal and friendly ways of communicating in this organization. Because of the good location of NISB, it was also possible to have a lunch walk with some colleagues in the forest almost every day, which I really liked.

Beforehand I was already warned that it would take some time to collect the registration files of the lifestyle advisors and to clean the data. Luckily I get some help from Jolien in December; therefore I could already start with analyzing some data. It was nice to work together for some weeks.

Finally, I would like to thank my supervisors Liesbeth Preller and Annemien Haveman for their advice and help during the research project. I appreciate it very much that you always started with some positive feedback before you told me what I should improve or change.

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Samenvatting

De prevalentie van obesitas in Nederland is gestegen van 5 % in 1981 tot 12 % in 2009. Obesitas verhoogt de kans op verschillende chronische ziekten, voornamelijk hart- en vaatziekten en diabetes. Overgewicht en obesitas worden veroorzaakt door een verstoorde energiebalans. Gecombineerde leefstijlinterventies kunnen deelnemers ondersteunen bij het veranderen van hun eetpatroon en het verhogen van de hoeveelheid lichamelijke activiteit. Een voorbeeld van een gecombineerde leefstijlinterventie is de BeweegKuur, deze interventie is bedoeld voor mensen met overgewicht of obesitas. In tegenstelling tot de meeste andere gecombineerde leefstijlinterventies vindt de BeweegKuur niet plaats in de klinische setting, maar in de praktijk. Het doel van de interventie is het realiseren van gezondheidswinst door middel van meer bewegen, een gezonde voeding en het laten beklijven van de aangepaste leefstijl door gedragsverandering.

Het doel van deze studie was het evalueren van het effect van de BeweegKuur op lichaamssamenstelling, bloeddruk, bloed glucose en lichamelijke activiteit van de deelnemers. Daarnaast is de relatie tussen de effectiviteit van de studie, persoonsgebonden factoren en het aantal consulten met de diëtist en leefstijladviseur (LSA) onderzocht.

Deelnemers aan de BeweegKuur worden geïncludeerd op basis van BMI, middelomtrek en comorbiditeit. Andere inclusiecriteria zijn een inactieve leefstijl en motivatie voor gedragsverandering. Op basis van BMI, middelomtrek en gezondheidsprofiel worden deelnemers ingedeeld in een van de drie beweegprogramma's: het zelfstandig beweegprogramma, het opstartprogramma en het begeleid beweegprogramma. De programma's verschillen vooral van elkaar wat betreft de hoeveelheid begeleiding door de fysiotherapeut. Daarnaast worden alle deelnemers een jaar lang begeleid door een leefstijladviseur en een diëtist. Verschillende persoonlijke factoren zoals leeftijd en opleidingsniveau worden bij aanvang van de interventie geregistreerd door de LSA. Voor, tijdens en aan het eind van de interventie worden gewicht, middelomtrek, bloedglucose en bloeddruk gemeten. Daarnaast wordt de hoeveelheid lichamelijke activiteit aan het begin en eind van de interventie gemeten met behulp van de SQUASH vragenlijst. Het aantal consulten met de leefstijladviseur en diëtist wordt aan het eind van de interventie geregistreerd. In deze studie is door middel van gepaarde t-testen getoetst of lichaamssamenstelling, bloeddruk, bloedglucose en de hoeveelheid lichamelijke activiteit van de deelnemers bij aanvang en aan het eind van de interventie significant verschilde. Daarnaast is door middel van ANOVA getest wat de relatie was tussen persoonlijke factoren, het aantal consulten met de LSA en diëtist en de effectiviteit van de interventie.

De studiepopulatie was ouder in vergelijking met de algemene bevolking in Nederland. Daarnaast hadden deelnemers gemiddeld een hoger BMI bij aanvang van de interventie in vergelijking met de gemiddelde bevolking in dezelfde leeftijdsgroep in Nederland. Gewicht, BMI, middelomtrek, bloed glucose en bloeddruk namen significant af tijdens de interventie. De deelnemers vielen gemiddeld 2,9 kg af; middelomtrek nam af met 2,6 cm. Deelnemers spendeerden gemiddeld 2,1 uur per week meer aan lichte tot matig intensieve lichamelijke activiteit, voor intensieve lichamelijke activiteit was dit 1,7 uur. Deelnemers jonger dan 55 jaar en deelnemers met een BMI hoger dan 35 kg/m^2 bij aanvang van de interventie vielen significant meer af dan oudere deelnemers en deelnemers met een lager BMI. De afname van middelomtrek was voor deelnemers met een hoger BMI bij aanvang van de interventie ook hoger. Afname in gewicht en middelomtrek was hoger voor deelnemers met 6

of meer consulten bij de LSA. Deelnemers die naar de groepslessen gingen en 4 of meer consulten hadden bij de diëtist vielen ook meer af.

In deze studie ontbrak een controlegroep waardoor het niet mogelijk was de veranderingen in lichaamssamenstelling, bloeddruk, bloedglucose en lichamelijke activiteit te vergelijken met mensen die niet deel hadden genomen aan de interventie. Daarnaast was veel data van deelnemers incompleet. Voor een deel werd dit veroorzaakt door het feit dat veel deelnemers de interventie nog niet hadden afgerond. Daarnaast werden de registratiebestanden door veel leefstijladviseurs niet volledig ingevuld. Desondanks bleek de BeweegKuur effectiever dan de meeste andere gecombineerde leefstijlinterventies in de praktijk.

Uit deze studie kan geconcludeerd worden dat de BeweegKuur een positieve invloed heeft op lichaamssamenstelling, bloedglucose, bloeddruk en lichamelijke activiteit van de deelnemers. Daarnaast bleek de effectiviteit van de interventie samen te hangen met enkele persoonlijke factoren en het aantal consulten met de leefstijladviseur en diëtist.

Abstract

Background The prevalence of overweight and obesity in adults in the Netherlands increased during the past 20 years. Obesity is a significant risk factor of and contributor to increased morbidity and mortality. The BeweegKuur is a combined lifestyle intervention embedded in primary care meant for overweight people. The aim of the intervention is to realize health benefits through increased physical activity and healthy nutrition. Participants are supervised for one year.

Objectives The first objective of this study was to evaluate the effect of the BeweegKuur on body composition, cardiovascular disease risk factors and physical activity of the participants. Secondly, the relation between the effectiveness of the BeweegKuur, compliance to the program and different person-related characteristics were examined.

Methods Different person related characteristics were recorded at the start of the intervention. To evaluate the effectiveness of the BeweegKuur weight, waist circumference, blood glucose, blood pressure and physical activity before, during and at the end of the intervention were recorded. In this study data of 2397 participants were analyzed.

Results Weight, BMI, waist circumference, blood glucose and blood pressure were significantly decreased at the end of the intervention ($p<0.001$); physical activity was significantly increased ($p<0.001$). Weight loss was higher in younger participants and participants with a BMI > 35 at baseline ($p<0.01$ and $p<0.001$, respectively). Change in weight and waist was higher for participants visiting the LSA 6 times or more (n.s., $p<0.05$, respectively). Weight loss was higher in participants attending the group lessons and visiting the dietician 4 times or more ($p<0.05$).

Conclusion The intervention had a positive influence on weight, waist circumference, blood glucose, blood pressure and physical activity of the participants. Effectiveness seemed to be related with personal characteristics and compliance to the program.

Introduction

The prevalence of overweight and obesity in adults in the Netherlands increased from 32 and 5 % in 1981 (Statistics Netherlands, 1996) to 47 and 12 % in 2009 (Bakel and Zantinge, 2010), according to self-reported data. Obesity is a significant risk factor of and contributor to increased morbidity and mortality, most importantly of cardiovascular disease (CVD) and diabetes, but also from cancer and chronic disease, including osteoarthritis, liver and kidney disease, sleep apnoea and depression (Pi-Sunyer, 2009). According to an analysis done by the WHO (2002), approximately 58 % of the diabetes mellitus globally, 21 % of ischemic heart diseases and 8-42 % of some types of cancer are attributed to high BMI. Decreasing the prevalence of obesity will have a positive effect on the prevalence of different chronic diseases. As overweight and obesity are caused by an imbalance between energy intake and expenditure, a diet low in energy dense food and increasing physical activity will help to decrease the prevalence of overweight and obesity in the population.

Combined lifestyle interventions can be one of the tools to assist people increasing physical activity and changing dietary intake. Different clinical trials found promising results (Diabetes Prevention Program Research Group, 2002; Finnish Diabetes Prevention Study Group, 2006; Roumen, 2011). However, randomised controlled trials with one-to-one counselling are expensive and the mean duration time of these interventions was 4, 2.8 and 4.1 years, respectively. Different interventions are designed to determine whether the results obtained in clinical trials could be replicated in 'real world' primary care settings with limited resources and existing personal. Most of them were designed for participants with a high risk of developing type 2 diabetes and/or cardiovascular disease. Studies analysing these interventions found modest changes in body composition, blood pressure and blood glucose (Laatikainen, et al., 2007; Vermunt, 2011; Lakerveld, et al., in press; Absetz, et al., 2007).

The BeweegKuur aims at people with a (very) high weight related health risk and an inactive lifestyle. Several studies were already conducted to evaluate the BeweegKuur, but most of them were process evaluations (Helmink et al., 2010a; Helmink et al., 2010b; Helmink, et al., 2011a) or were based on self-reported physical activity level, diet and weight (Helmink et al., 2010c; Helmink, et al., 2011b). According to the research of Helmink et al. (2010c) participants were positive about the exercise and nutrition programme. Half of the respondents in the study of Helmink et al. (2011b) increased physical activity and had a more healthy diet during and one year after the end of the intervention, based on self-reported data. Weight and BMI of the respondents decreased significantly with 2.0 kg ($p<0.01$) and 0.68 kg/m^2 ($p<0.01$), respectively. Finally, respondents with lower BMI and lower age at baseline appeared to have higher motivation to eat healthy and keep exercising one year after the end of the BeweegKuur. In 2011 a small pilot study is done to evaluate the effect of the BeweegKuur on the participants based on information recorded by the lifestyle advisors. However, this analysis was based on a limited number of subjects. At this moment the intervention is finished by much more participants and therefore the effect of the intervention on some health indicators will be analysed again. The objective of this study was to evaluate the effect of the BeweegKuur on body composition, cardiovascular disease risk factors and physical activity of the participants. Furthermore, the association between the effectiveness of the BeweegKuur, compliance to the program and different person-related characteristics is examined.

Methods

Lifestyle intervention

The BeweegKuur is a combined lifestyle intervention aimed at people with a (very) high weight related health risk and an inactive lifestyle. Appendix 1 contains the logic model of this intervention. The goal of the BeweegKuur is to realise health benefits through increased physical activity, healthy nutrition and to maintain this healthy lifestyle through behavioural change. In contrast to some lifestyle interventions in the clinical setting, the BeweegKuur is embedded in primary care. The advisors of the ROS regions (Regional Support Structures for Primary Care) play a central role in the local coordination and facilitation; they are the first contact for care professionals who want to work with the BeweegKuur. The ROS advisors are supported by NISB (The Netherlands Institute for Sport and Physical Activity). Different documents for the ROS regions are developed to support the locations and to formalize the cooperation between the different organisations in the local setting. Additionally, several documents are available for the health care professionals to implement the intervention. These documents are meant as a guideline and therefore can be adapted to the local situation. So, in contrast to the interventions in the clinical setting, the implementation of the BeweegKuur is different for every location.

In 2010 the intervention was conducted at 155 pilot locations in the Netherlands, with a maximum of 40 participants per location per year. The participants are selected by the GP, practice nurse, physiotherapists or other health care providers in primary care. After inclusion, the participants are directed to a lifestyle advisor (LSA) and physiotherapist in the BeweegKuur. The lifestyle advisor is mostly a practice nurse, but can also be another health care provider in primary care. During the first consult with the lifestyle advisor, the weight related health risk, the cardiovascular risk profile and the level of physical activity is determined. Appendix 2 gives an overview of the information gathered during the intervention. The physiotherapist determines the wishes, possibilities and existing exercise barriers of the participant and tests their exercise capacity with some tests. Based on the information collected during these consults and in collaboration with the participant, the lifestyle advisor decides which exercise program the participant will follow. Three different exercise programs exist: independent exercise program (1); start up program (2) and the supervised exercise program (3). The programs mainly differ in intensity of support that the participants receive from the physiotherapist. Within each exercise program an individual diet and physical activity plan is designed by the dietician and physiotherapist or lifestyle advisor, which is based on goals, preferences and possibilities of the participant. This plan can be adjusted during the intervention based on the progress of the participant.

The participants get supervision and advice by a dietician and a lifestyle advisor for one year. In every exercise program, the lifestyle advisor is the pivot in the BeweegKuur intervention. He or she is responsible for unequivocal and smooth communication between the GP, dietician, physiotherapist and local sport organisations. The LSA also coordinates the individual activities within the intervention and records the progress of the participants in registration files, among others on weight, BMI, blood glucose levels and physical activity level of the participant. More information about the design of the BeweegKuur is given in the report of Butselaar et al. (2010).

Study design and participants

This study had a pre test post test study design, so no control group existed. To evaluate the effectiveness of the BeweegKuur different measurements were done before, during and at the end of the intervention. This information is entered in the registration files by the lifestyle advisors.

The participants are selected by the GP, practice nurse, physiotherapists or other health care providers in primary care. The inclusion criteria stated in the protocol are:

- motivated for behavioural change
- an inactive lifestyle, defined as people who don't meet the Dutch Standard for Healthy Exercise; this means they don't exercise for at least 30 minutes a day on at least 5 days of the week.
- a BMI between 25 and 30 in combination with a large waist circumference (≥ 88 cm for women; ≥102 cm for men) and/or comorbidity
- a BMI between 30 and 35, regardless of waist circumference and comorbidity
- a BMI between 35 and 40 regardless of waist circumference but without comorbidity

Forms of comorbidity include hypertension, dyslipidemia, diabetes mellitus, cardiovascular disease, arthrosis and sleep apnoea. The GP is responsible for the screening of contra-indications and decided if a person could participate in the BeweegKuur. The decision from the GP is based on current guidelines and standards.

In this research data of 2397 participants were used, they mainly started in 2009 and 2010 with the intervention. In 2009 the target population of the BeweegKuur consisted of prediabetic patients and patients with type 2 diabetes (Helmink et al., 2010a). In 2010 the main target group were people with overweight or obesity (Helmink et al., 2010b).

Measurements

Appendix 2 gives an overview of the information that is gathered to evaluate the intervention. Clinical measurements were taken during the different consults with the LSA. In the protocol was not described how these measurements should be done; the lifestyle advisors only registered if blood glucose was measured in fasting state or not. Physical activity was self-reported using a short version of the validated SQUASH questionnaire (Wendel-Vos, et al., 2003). Participants filled in this questionnaire together with the LSA before and at the end of the intervention. Because two variables existed for physical activity, in addition one variable was designed to combine them. The hours of vigorous physical activity were multiplied by 2.5 and added to the hours of light to moderate physical activity, resulting the variable is unitless. The weight of 2.5 was chosen based on estimated average differences in energy expenditure of the activities.

To examine if personal related factors were associated with change in weight, waist circumference and total physical activity, background characteristics of the participants were recorded during the first consult with the lifestyle advisor. Cardiovascular risk profile and weight related risk profile were based on the medical history as known by the GP. At the end of the intervention, program participation was recorded by the lifestyle advisor.

Statistical analysis

Data analysis was conducted using SPSS for Windows (version 18). Data are presented as mean (SD) in the tables, unless stated otherwise. Differences in weight, BMI, waist circumference, fasting blood glucose, blood pressure and physical activity before and at the end of the intervention were normally distributed based on plotted histograms. Differences between the clinical measurements and physical activity at baseline and at the end of the intervention were tested with a Student's *t*-test for dependent samples. A p-value of < 0.05 was considered statistically significant. All tests were two-sided.

To study the association between compliance, person-related characteristics and the change in weight, waist circumference and total physical activity at the end of the intervention, ANOVA tests were conducted. For every characteristic two or more groups were made to examine the difference in change in weight, waist circumference and total physical activity between these groups. Change in weight, waist circumference and total physical activity were normally distributed for almost all the subgroups. Games-Howells post-hoc analyses ($p<0.05$) were performed to identify which groups differed significantly.

To examine if some personal characteristics were related to a higher effectiveness of the BeweegKuur after correction for other characteristics, multiple linear regression analyses were done. The associations between weight, waist circumference and total physical activity and the following characteristics were examined: sex, age, weight or waist at baseline, education, exercise program, number of consults with the LSA, dietician, attendance to the group education lessons, change in light to moderate and vigorous physical activity. Before these analyses were done, the assumptions for homoscedasticity, linearity, normality and independency of residuals were checked. Based on change in R^2, significance of F-change or (change in) B of the variables in the model was decided if a variable should be included in the model.

Results

Characteristics of the population

Background characteristics of the participants are described in table 1. The study population was older than the general Dutch population (CBS, 2011); most participants were between 50 and 70. In the population were more females than males. The percentage of higher educated people was lower in the study population, compared to the Dutch population of 55 to 65 years (26.0 % and 16.1 %, respectively) (CBS, 2010a). The percentage of smokers was lower (13.6 and 24.6, respectively) (CBS, 2010b).

Effectiveness of the BeweegKuur

Baseline measurements and changes in body composition, cardiovascular disease risk factors and physical activity between baseline and the end of the intervention are shown in table 2. Weight loss was on average 2.9 kg, this was a decrease of 2.6 %. BMI and waist circumference were reduced by 1.0 kg/m^2 (-2.6 %) and 4.3 cm (-3.2 %), respectively. In addition, blood glucose and blood pressure decreased by more than 4 and 2 %, respectively. Furthermore, the amount of light to moderate and vigorous physical activity was increased. All paired t-tests had a p-value <0.001.

Differences in effectiveness between subgroups

Most important changes in weight and waist circumference between baseline and the end of the intervention according to different subgroups are shown in table 3; the full table is shown in appendix 3. Younger participants lost on average more weight than older participants. Participants below 55 years lost on average 3.8 kg; participants above 65 years lost 2.2 kg ($p<0.01$). Absolute differences in change in waist between the three age groups were not significant. 28 % of the participants had a BMI above 35 at baseline. Reduction in weight and waist seemed higher in these participants ($p<0.001$ and $p<0.05$, respectively). Reduction in waist seemed higher for participants in

the supervised exercise program ($p<0.05$). In participants attending 6 or more consults with the LSA, change in weight and waist was on average -3.1 kg and -4.8 cm; for participants attending less consults with the LSA this was -2.4 kg and -3.3 cm. Participants increasing physical activity reduced their weight and waist more compared with participants exercising less.

To examine if a trend was seen in change in weight and waist according to the attendance of group lessons or the number of consults with the dietician or LSA, these variables were combined (table 4). Reduction in waist seemed significantly higher in participants attending the group lessons and visiting the LSA 6 times or more compared to participants not attending the group lessons and visiting the LSA less than 6 times ($p<0.05$). The trend between these groups was significant ($p<0.01$). Furthermore, reduction in waist was higher in participants attending the group lessons and visiting the dietician 4 times or more (trend $p<0.05$). Furthermore, older age and a BMI above 35 were related to a higher reduction in weight (trend $p<0.001$) and waist (n.s.) compared to younger age and a lower BMI.

When examining the association between change in total physical activity and personal characteristics and compliance to the program, no significant trends were found (appendix 4). Nevertheless, younger participants increased their physical activity more compared to older participants. Higher educated participants had a higher increase of physical activity compared to less educated participants. Participants in the independent exercise program increased their physical activity more than participants in the other exercise programs. Participants visiting the dietician and LSA respectively 4 and 6 times or more, increased their total physical activity more compared to participants with less consults.

To examine if some personal characteristics were related to a higher reduction of weight and waist after correction for other characteristics, linear regression analyses were done. Because of incomplete data, it was not possible to include a lot of the variables at once in the model. Weight or waist at baseline had a strong association with change in weight and waist respectively; age and sex were often confounders for the relationship between change in weight or waist and other variables. Therefore these three variables were always included in the model. In combination with sex, age, waist at baseline and exercise program, the number of consults with the LSA was significantly associated with change in waist ($p<0.05$) (data not shown). However, this association didn't exist when education or change in total physical activity were added to the model. No association existed between the number of consults with the LSA and change in weight or total physical activity.

Discussion

Participation in the BeweegKuur had a positive influence on body composition, cardiovascular disease risk factors and physical activity of the participants. Participants in the BeweegKuur lost on average 2.9 kg and waist circumference was decreased by 4.3 cm. The amount of light to moderate and vigorous physical activity was increased by 2.1 and 2.7 hours a week. BMI, age, exercise program, number of consults with the LSA and change in total physical activity appeared to be significantly related to change in weight and/or waist.

Limitations of this study

The analyses of this study were based on a dataset with almost 2400 participants. However, most data were not complete. First, because a lot of participants started at the end of 2010 and therefore didn't finish the intervention before data collection took place. Secondly, the quality of the registration files differed between the different locations. Some LSA's filled in the registration files very minimally. Therefore data of a lot of participants were not complete; most analyses were done based on 200 to 500 participants. Because of incomplete data it was not possible to put a lot of predictors in one regression model; the models were not stable enough. Furthermore, it might be possible that the LSA's of the more successful locations filled in and sent back the registration files. Therefore overestimation of the effectiveness of the BeweegKuur might be true.

Another limitation of this study was the absence of a control group. Therefore it was not possible to compare the changes in body composition, cardiovascular risk factors and physical activity of participants with people who didn't participate in the BeweegKuur. However, more consults with the dietician and lifestyle advisor were related to a higher reduction in weight and waist, which indicates that reduction in weight and waist circumference is related to the supervision during the BeweegKuur.

Discussion of the results

Some remarks should be made about the results of this study. First, the means of the different subgroups in table 3 and 4 were influenced by some outliers; participants in which change in weight and waist circumference was more than 20 kg or 20 cm, respectively. Especially when subgroups became smaller, these participants might have influenced the mean of the subgroup. After examining the results of these participants, it was decided not to exclude these participants, because most participants gradually lost or gained this amount of weight, which is an indication that the data is correct. Furthermore, to prevent selection bias, all participants were included in the analyses. If these participants were excluded, it would not be possible to generalise the results for the whole study population.

Secondly, variance between groups of the same variable was not always the same, which is actually an assumption of the ANOVA test. If the variances between the groups differed significantly, also Welch's F-ratio and Brown-Forsythe F-ratio were tested, but conclusions were the same. Furthermore, in post-hoc tests Games-Howell procedure was used, this procedure corrects for differences in sample size and variance between the groups.

Furthermore, decrease in waist circumference is significantly higher in participants with program 3 compared to program 1. This can be caused by more supervision in this program, but can also be explained by the fact that in this group more participants had a BMI above 35 compared to participants in program 1, 33.1 % and 17.7 %, respectively. Reduction in waist is higher in participants with a BMI above 35 (table 3).

Finally, the effectiveness of the BeweegKuur has a wide variability between the different participants. This might not only be because of personal characteristics, but might also be dependent on the location. Some locations might be more successful to others, for example because of more experience of the health care professionals. In the APHRODITE study (Vermunt et al., 2011) the mean work experience of the nurse practitioner was higher in participants who were losing weight or those

maintaining weight, compared to the group participants who gained weight during the intervention. Because the models in the regression analysis were not stable enough, it was not possible to control for differences between practices in this study.

Comparison with other lifestyle interventions

Most combined lifestyle interventions designed to test the association between physical activity, diet and health outcomes are developed in a clinical setting. These interventions are mostly intensive, specialised and highly standardised, and delivered by a small group of staff who is specially educated and works via strict protocols (Bonell, Oakley et al., 2006; Wang, Moss et al., 2006). The implementation of these interventions in practice appears to be a challenging next step (Absetz et al., 2007; Ackermann et al., 2008, Amundson et al., 2009, as cited by Linmans et al., 2011). In contrast to the interventions in the clinical setting, the BeweegKuur is embedded in local primary care. The intervention takes place in the participants' own village or district, sport activities are mostly performed in the local sport facilities or clubs. Furthermore, the documents available for the ROS advisors and health care providers are meant as a guideline for the implementation in the local situation. Therefore, the implementation of the BeweegKuur is different for every location.

Examples of other combined lifestyle interventions in practice are the Greater Green Triangle (GGT) Diabetes Prevention Project, APHRODITE study, Hoorn prevention study, the GOAL intervention study and the Finnish National Diabetes Prevention Program (FIN-D2D). Studies analysing these interventions found modest changes in body composition, blood pressure and blood glucose (Laatikainen, et al., 2007; Vermunt, et al., 2011; Lakerveld, et al., in press; Absetz, et al., 2007; Saaristo, et al., 2010). Weight loss at 12 months follow up was between 0.5 and 2.5 kg. Waist circumference was reduced by 1.2 to 4.2 cm. Unless the weak study design, the effectiveness of the Beweegkuur was higher compared to most other interventions; reduction of weight and waist circumference was on average 2.6 kg and 3.2 cm, respectively. Furthermore, changes in BMI, blood glucose and blood pressure in the BeweegKuur were higher compared to other lifestyle interventions in practice. Age and BMI of the participants in the BeweegKuur at baseline were comparable with most other interventions and therefore not explains the higher effectiveness of the BeweegKuur. One of the explanations might be the different target group; all the other lifestyle interventions were designed for people with high risk of developing type 2 diabetes and/or cardiovascular disease. The BeweegKuur was first designed for people with (pre)diabetes, but from 2010 onwards the target group consisted of overweight and obese people with an inactive lifestyle. In the first group weight loss was on average 2.4 kg, in the second group this was 3.6 kg (appendix 3). Also reduction in BMI, waist, blood glucose and blood pressure was higher in participants of the second target group. However, even in participants of the first target group, changes in body composition, blood glucose and blood pressure were higher compared to most other lifestyle interventions. Secondly, the number of consults with the LSA in the BeweegKuur was on average higher compared to the number of intervention visits in the other interventions. 55 percent of the participants in the BeweegKuur visited the LSA 6 times or more. The average number of intervention visits in the Hoorn study and the FIN-D2D study was 2 and 2.9, respectively (Lakerveld, et al., in press; Saaristo, et al., 2010). 43 and 57 percent of the participants attended the maximum of 6 counselling sessions in the GGT Diabetes Prevention Project and the GOAL intervention, respectively (Laatikainen, et al., 2007; Absetz, et al., 2007). The number of sessions in the APHRODITE study is not known.

Recommendations for further research

It would be interesting to repeat these analyses if more participants finished the BeweegKuur. If more participants have (almost) complete data it would be possible to do multiple regression analyses and to correct for some background variables. In addition, it would be interesting to do a qualitative research to examine why the BeweegKuur is more effective in some participants. Some qualitative studies are already done (Helmink et al., 2010b; Helmink et al., 2010d; Helmink, et al., 2011a), but they are mainly about the opinion of the participants, health care providers or ROS advisors about the BeweegKuur; the relationship with the effectiveness is mostly not made. This would be possible by using the log books filled in by participants who finished the BeweegKuur. These log books might give information about barriers to change participants' diet or to exercise more, but it might also give more information about the success factors. In addition, it might be interesting to examine what distinguishes successful practices from less successful ones, to see what the success factors are.

Conclusions

Unless the weak study design, the BeweegKuur appears to be more effective compared to some other lifestyle interventions in the primary health care setting. Interventions such as the BeweegKuur can help to decrease the incidence of overweight and obesity, which might decrease the incidence of cardiovascular disease and diabetes mellitus in the Netherlands. All ROS regions in the Netherlands are already involved in the BeweegKuur; moreover the activities the health professionals need to perform in the BeweegKuur are already part of their usual work. Therefore, it is relatively easy to implement the BeweegKuur in more locations in the Netherlands. It is a pity that the BeweegKuur is not taken up in the basic health care insurance, but hopefully other financial resources can be found to finance the BeweegKuur.

Tables

Table 1
Background characteristics of the participants

	N	%
Age (yrs), mean	511	58.2
Sex (%)		
male	210	40.8
female	305	59.2
Civil status (%)		
married	368	73.5
living together	29	5.8
single	55	11.0
divorced	24	4.8
widow/widower	25	5.0
Education (%)		
lower educated	123	39.5
middle educated	138	44.4
higher educated	50	16.1
Smoking behaviour (%)		
smoker	28	13.6
non-smoker	178	86.4

Table 2
Baseline measurements and change in body composition, blood glucose, blood pressure and physical activity at the end of the intervention

	n	Baseline Mean (SD)		Difference Mean (SD)		Difference % Median
Weight (kg)	517	95.5	(0.8)	-2.9	(4.9)***	-2.6
BMI (kg/m^2)	517	33.0	(5.7)	-1.0	(1.7)***	-2.6
Waist circumference (cm)	396	110.4	(13.0)	-4.3	(6.4)***	-3.2
Blood glucose (mmol/l)	258	7.5	(1.9)	-0.5	(1.9)***	-4.5
Systolic blood pressure (mmHg)	436	138.7	(15.3)	-3.3	(15.5)***	-2.3
Diastolic blood pressure (mmHg)	434	82.4	(9.1)	-2.5	(8.8)***	-2.4
Light to moderate physical activity (hours/week)	396	13.6	(13.0)	2.1	(11.3)***	12.1
Vigorous physical activity (hours/week)	251	4.3	(6.2)	1.7	(6.6)***	44.4

*** P-value for dependent t-test <0.001.

Table 3

Change in weight and waist circumference at the end of the intervention in different subgroups

	n	weight change (kg)#		n	waist change (cm)#	
Sex						
male	210	-3.1	(4.4)	172	-4.5	(5.7)
female	305	-2.8	(5.3)	223	-4.2	(6.9)
Age (years)						
<55	188	-3.8	(5.7)** [a]	137	-4.1	(6.3)
55-65	187	-2.6	(4.9)	157	-4.4	(6.5)
>65	136	-2.2	(3.4) [a]	98	-4.4	(6.3)
BMI at baseline (kg/m^2)						
<30	174	-2.1	(3.7)*** [a]	133	-3.9	(5.6)*
30-35	199	-2.6	(4.7) [b]	154	-3.7	(5.7) [a]
>35	144	-4.4	(6.0) [a,b]	108	-5.8	(7.9) [a]
Education						
lower educated	123	-3.1	(4.7)	105	-5.2	(7.6)
middle educated	138	-3.1	(5.0)	119	-4.7	(6.4)
higher educated	50	-3.2	(4.6)	39	-4.1	(5.2)
Motivation to exercise more						
Score 0-5	54	-1.6	(3.3)	45	-2.2	(4.1)
Score 6-10	236	-2.6	(4.9)	184	-3.7	(6.5)
Motivation healthy diet						
Score 0-5	56	-2.7	(3.4)	41	-3.3	(4.8)
Score 6-10	231	-2.4	(4.9)	187	-3.5	(6.4)
Exercise program						
1: independent program	158	-2.6	(5.0)	123	-3.1	(5.3)* [a]
2: start up program	164	-3.2	(4.8)	125	-4.7	(6.0)
3: supervised program	166	-2.9	(5.1)	132	-5.1	(7.5) [a]
Number of consults with dietician						
1-4	239	-2.6	(4.2)	196	-4.1	(6.1)
4 or more	159	-3.5	(5.9)	126	-5.1	(7.3)
Attendance group education lessons						
no	75	-1.7	(4.5)	47	-1.4	(4.9)
yes	150	-2.3	(4.7)	127	-3.5	(6.8)
Number of consults with LSA						
1-5	205	-2.4	(4.4)	156	-3.3	(6.2)*
6 or more	253	-3.1	(5.1)	201	-4.8	(6.2)
Change light physical activity (hours)						
<0	137	-2.3	(5.0)	102	-3.9	(5.5)
0-3.5	116	-2.8	(4.9)	89	-4.2	(7.3)
>3.5	123	-3.2	(4.8)	113	-5.1	(6.5)
Change vigorous physical activity (hours)						
<0	82	-2.4	(5.5)	58	-4.5	(7.0)
0-2	87	-2.9	(4.0)	75	-4.4	(6.4)
>2	70	-3.5	(4.9)	59	-5.2	(7.2)

Data are mean (SD)

* Statistical significant difference between the subgroups (P-value < 0.05) ** Statistical significant difference between the subgroups (P-value <0.01) *** Statistical significant difference between the subgroups (P-value <0.001)

Games - Howell post hoc tests for main effects. Superscript letters (a and b) indicate pairs of means that differ significantly from one another (p<0.05)

Table 4

Change in weight and waist at the end of the intervention in different subgroups

	n	weight change (kg)#		n	waist change (cm)#		
No attendance to group lessons, <6 consults LSA	39	-1.6	(3.8)	21	-0.3	(4.7)**	a
No attendance group lessons, 6 or more consults LSA	32	-1.7	(5.3)	24	-2.5	(5.1)	
Attendance to group lessons, <6 consults LSA	60	-1.7	(3.3)	45	-1.1	(4.5)	b
Attendance to group lessons, 6 or more consults LSA	88	-2.7	(5.5)	80	-4.4	(7.2)	a,b
No attendance to group lessons, <4 consults dietician	50	-1.8	(3.4)	32	-1.6	(4.5)*	
No attendance group lessons, 4 or more consults dietician	23	-1.5	(6.5)	15	-0.9	(5.9)	
Attendance to group lessons, <4 consults dietician	88	-1.8	(3.9)	76	-2.8	(5.3)	
Attendance to group lessons, 4 or more consults dietician	50	-3.0	(5.5)	43	-4.3	(9.0)	
<4 consults dietician, <6 consults LSA	119	-1.9	(4.3)*	95	-3.6	(6.6)	
<4 consults dietician, 6 or more consults LSA	113	-3.2	(4.1)	96	-4.6	(5.4)	
4 or more consults dietician, <6 consults LSA	41	-3.7	(5.3)	32	-3.6	(6.7)	
4 or more consults dietician, 6 or more consults LSA	110	-3.3	(6.2)	87	-5.3	(7.2)	
BMI < 30, age >55	122	-2.0	(3.5)*** a	96	-4.2	(5.5)	
BMI < 30, age <55 + BMI 30-35, age >65	107	-2.1	(3.8) b	79	-3.4	(5.7)	
BMI 30-35, age <65 + BMI >35, age >65	163	-2.8	(5.1) c	124	-4.0	(5.6)	
BMI >35, age <65	119	-4.7	(6.3) a,b,c	92	-5.8	(8.3)	

Data are mean (SD)

** Statistical significant linear trend between the subgroups (P-value <0.01) *** Statistical significant linear trend between the subgroups (P-value <0.001)

Games - Howell post hoc tests for main effects. Superscript letters (a, b and c) indicate pairs of means that differ significantly from one another (p<0.05)

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Appendices

Appendix 1: Logic model of the BeweegKuur

Appendix 2: Schematic overview of the evaluation of the BeweegKuur

Appendix 3: Change in weight and waist circumference at the end of the intervention in different subgroups

Appendix 4: Change in total physical activity (PA) at the end of the intervention in different subgroups

Appendix 1: Logic model of the BeweegKuur

Inputs	Activities	Outputs	Intermediate objectives	Long-term objectives	Overall aim
- Dieticians, lifestyle advisors and physiotherapists are trained	- Participants are included by practice nurse, physiotherapist or other health care provider in primary care. - LSA and physiotherapist determine health status, exercise barriers and wishes of the participant. - LSA determines which exercise program the participant will follow. - LSA (program 1) or physiotherapist (program 2 and 3) designs an individual physical activity program. - LSA and physiotherapist supervise and motivate the participant during follow-up consults* - LSA informs, advises and coaches the participant, coordinates the health care and evaluates the progress of the participant* - Dietician designs individual diet, advises and motivates participant during individual follow-up consults and gives group education lessons about healthy nutrition - LSA or physiotherapist search together with the participant for local exercise facilities.	- Participants visit the LSA, dietician and physiotherapist. - Participant sports in local exercise facilities.	- To decrease participants' energy intake - To increase participants' physical activity	- To achieve health benefits for participants through increased physical activity and healthy nutrition and to maintain this healthy lifestyle through behavioural change	- To decrease the prevalence of overweight related risks in the Netherlands

Other factors	
- Age - Civil status - Education level - Motivation to change behaviour - Main reason to participate in BK	- Presence of comorbidity, exercise related complaints and starting barriers - Location (quality of supervision by dietician, physiotherapist and LSA) - Health status at baseline (weight, BMI, waist circumference, blood pressure, blood glucose) - Amount of physical activity at baseline

* The number of consults with the physiotherapist and LSA is dependent on the exercise program followed.

Appendix 2: Schematic overview of the evaluation of the BeweegKuur

Personal characteristics recorded at baseline	Measurements done before, during and at the end of the intervention	Additional information recorded at the end of the intervention
Date of birth	Weight	Number of consults with dietician
Date of inclusion	BMI	Number of visited group education lessons with dietician[#]
Civil status	Waist circumference	
Education level	Blood glucose	Number of consults with LSA
	Systolic blood pressure	
Main reason of participant to participate in the BeweegKuur	Diastolic blood pressure	
Motivation score to exercise more*		
Motivation score to eat healthier*	Hours of light/moderate physical activity‡	
	Hours of vigorous physical activity‡	
Comorbidity		
Exercise related complaints		
Starting barriers		
Cardiovascular risk profile[#]		
Weight related risk profile[#]		
Smoking behaviour[#]		
Exercise programme		

* This information is only recorded for participants included in 2009.

[#] This information is only recorded for participants included in 2010.

‡ Physical activity is only measured at baseline and at the end of the intervention.

Appendix 3

Change in weight and waist circumference at the end of the intervention in different subgroups

	n	weight change (kg)#			n	waist change (cm)#		
Sex								
male	210	-3.1	(4.4)		172	-4.5	(5.7)	
female	305	-2.8	(5.3)		223	-4.2	(6.9)	
Age (years)								
<55	188	-3.8	(5.7)**	[a]	137	-4.1	(6.3)	
55-65	187	-2.6	(4.9)		157	-4.4	(6.5)	
>65	136	-2.2	(3.4)	[a]	98	-4.4	(6.3)	
BMI at baseline (kg/m^2)								
<30	174	-2.1	(3.7)***	[a]	133	-3.9	(5.6)*	
30-35	199	-2.6	(4.7)	[b]	154	-3.7	(5.7)	[a]
>35	144	-4.4	(6.0)	[a,b]	108	-5.8	(7.9)	[a]
Education								
lower educated	123	-3.1	(4.7)		105	-5.2	(7.6)	
middle educated	138	-3.1	(5.0)		119	-4.7	(6.4)	
higher educated	50	-3.2	(4.6)		39	-4.1	(5.2)	
Target group								
2009: (pre)diabetics	298	-2.4	(4.6)*		233	-3.4	(6.1)	
2010: overweight/obesity	219	-3.6	(5.3)		163	-5.6	(6.6)	
Motivation to exercise more								
Score 0-5	54	-1.6	(3.3)		45	-2.2	(4.1)	
Score 6-10	236	-2.6	(4.9)		184	-3.7	(6.5)	
Motivation healthy diet								
Score 0-5	56	-2.7	(3.4)		41	-3.3	(4.8)	
Score 6-10	231	-2.4	(4.9)		187	-3.5	(6.4)	
Main reason to participate								
lose weight	201	-3.7	(5.6)		149	-4.4	(6.4)	
improve condition	62	-2.3	(3.7)		43	-4.5	(7.6)	
improve health	172	-2.6	(4.4)		137	-4.4	(6.2)	
decrease medication	16	-2.7	(3.3)		13	-4.2	(5.4)	
Increase physical activity	39	-1.9	(3.5)		29	-4.3	(5.2)	
professional supervision	19	-1.4	(7.6)		18	-3.2	(8.4)	
Exercise program								
1: independent program	158	-2.6	(5.0)		123	-3.1	(5.3)*	[a]
2: start up program	164	-3.2	(4.8)		125	-4.7	(6.0)	
3: supervised program	166	-2.9	(5.1)		132	-5.1	(7.5)	[a]
Number of consults with dietician								
1-4	239	-2.6	(4.2)		196	-4.1	(6.1)	
4 or more	159	-3.5	(5.9)		126	-5.1	(7.3)	
Attendance group education lessons								
no	75	-1.7	(4.5)		47	-1.4	(4.9)	
yes	150	-2.3	(4.7)		127	-3.5	(6.8)	
Number of consults with LSA								
1-6	205	-2.4	(4.4)		156	-3.3	(6.2)*	
6 or more	253	-3.1	(5.1)		201	-4.8	(6.2)	

Appendix 3 (continued)

Change in weight and waist circumference at the end of the intervention in different subgroups

	n	weight change (kg)#			n	waist change (cm)#		
Change light physical activity (hours)								
<0	137	-2.3	(5.0)		102	-3.9	(5.5)	
0-3.5	116	-2.8	(4.9)		89	-4.2	(7.3)	
>3.5	123	-3.2	(4.8)		113	-5.1	(6.5)	
Change vigorous physical activity (hours)								
<0	82	-2.4	(5.5)		58	-4.5	(7.0)	
0-2	87	-2.9	(4.0)		75	-4.4	(6.4)	
>2	70	-3.5	(4.9)		59	-5.2	(7.2)	
Change physical activity total								
first quartile	55	-2.6	(5.1)		42	-5.1	(6.9)*	
second quartile	63	-2.4	(4.4)		46	-2.6	(5.1)	[a]
third quartile	52	-3.5	(4.5)		45	-7.0	(8.8)	[a]
fourth quartile	59	-3.2	(5.6)		53	-4.5	(5.6)	
Risk to die of CVD								
0-4 %	51	-3.4	(4.8)		43	-4.2	(4.5)	
5-9 %	30	-3.6	(5.9)		28	-5.8	(7.6)	
10 %	23	-2.9	(3.8)		21	-5.8	(6.6)	
Weight-related health risk								
no or increased	68	-3.9	(5.0)*		55	-4.9	(5.4)	
high	47	-2.0	(4.0)	[a]	36	-4.6	(6.3)	
very high / extremely high	43	-4.7	(5.7)	[a]	31	-6.5	(7.5)	

Data are mean (SD)

* Statistical significant difference between the subgroups (P-value < 0.05) ** Statistical significant difference between the subgroups (P-value <0.01) *** Statistical significant difference between the subgroups (P-value <0.001)

Games - Howell post hoc tests for main effects. Superscript letters (a and b) indicate pairs of means that differ significantly from one another (p<0.05)

Appendix 4

Change in total physical activity (PA) at the end of the intervention in different subgroups

	n	Change in total PA (SD)
Sex		
male	90	7.1 (16.5)
female	151	6.3 (20.2)
Age (years)		
< 55	83	8.2 (22.5)
55-65	95	6.5 (18.9)
>65	61	4.5 (13.0)
BMI at baseline (kg/m^2)		
<30	79	4.5 (13.3)
30-35	99	6.4 (17.8)
>35	61	6.2 (18.5)
Education		
lower educated	57	4.2 (15.9)
middle educated	70	7.3 (20.9)
higher educated	25	15.0 (21.7)
Target group		
2009: (pre)diabetics	133	6.4 (16.3)
2010: overweight/obesity	108	5.0 (16.9)
Motivation to exercise more		
Score 0-5	23	7.0 (19.4)
Score 6-10	106	7.7 (19.0)
Motivation healthy diet		
Score 0-5	28	6.9 (14.8)
Score 6-10	98	8.6 (19.4)
Main reason to participate		
lose weight	96	5.5 (18.9)
better condition	29	4.3 (17.0)
better health	76	9.5 (19.8)
decrease medication	13	7.2 (19.3)
more exercise	16	2.2 (16.3)
professional supervision	6	16.3 (20.4)
Exercise program		
1: independent program	83	8.3 (17.9)
2: start up program	69	8.1 (21.6)
3: supervised program	76	4.6 (16.4)
Number of consults with dietician		
1-4	114	6.4 (17.8)
4 or more	76	8.5 (20.5)
Attendance group education lessons		
no	38	9.5 (21.1)
yes	65	5.5 (17.3)
Number of consults with LSA		
1-6	107	4.7 (16.5)
6 or more	116	8.6 (21.4)

Appendix 4 (continued)

Change in total physical activity (PA) at the end of the intervention in different subgroups

	n	Change in total PA (SD)
Risk to die of CVD		
0-4 %	30	7.6 (15.2)
5-9 %	11	8.8 (26.5)
10 %	15	3.7 (13.3)
Weight-related health risk		
no or increased	42	2.4 (13.3)
high	19	11.1 (21.4)
very/extremely high	17	14.2 (28.1)

Data are mean (SD)