Intervention

Maintenance of lifestyle changes: 3-Year results of the Groningen Overweight and Lifestyle study

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ABSTRACT

Objective: This study aims to evaluate the three-year effect of lifestyle counseling by a nurse practitioner (NP) on physical activity (PA) and dietary intake compared with usual care by a general practitioner (GP).

Methods: At baseline, subjects were randomly allocated to the NP group (n = 225) or to the GP group (n = 232). The NP group received a low-intensive lifestyle intervention for three years by the NP and the GP group received one consultation by the GP and thereafter usual care. PA and dietary intake were assessed with questionnaires at baseline, 1 year follow-up and 3 year follow-up.

Results: After three years, leisure-time activity increased and favorable improvements towards a healthy diet were made for both groups. These three-year changes in PA and diet did not differ significantly between groups. Changes in PA and dietary habits after one year were practically maintained after 3 years, because only small relapses were found.

Conclusion: After three years, subjects were more physically active and had a healthier diet compared to baseline. Lifestyle counseling by NP resulted in similar lifestyle changes compared to GP consultation.

Practice implications: NPs could also advice patients at cardiovascular risk by lifestyle counseling, to possibly reduce GP barriers.

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1. Introduction

Till 2008, overweight and obesity prevalence were increasing worldwide [1,2], resulting in 1.46 billion adults with a body mass index (BMI) of 25 kg/m² or more [1]. Overweight and obesity are associated with various health problems such as cardiovascular disease, type 2 diabetes mellitus and cancer [3,4].

Higher levels of physical activity (PA) and a healthy diet are related to weight loss and long-term weight maintenance [5,6] and can prevent weight gain [7,8]. In addition, independently of BMI, increased PA and a healthy diet have positive health effects on cardiovascular disease, type 2 diabetes and several cancer types [6,9–11].

Some studies investigated the weight change after lifestyle interventions on the longer term [12–14], but there is only limited evidence on the long-term effectiveness on changes in physical activity and dietary behavior. Only few studies investigated progression in PA and dietary intake at more than 19 months [15]. Short-term studies have shown that lifestyle counseling in primary care increases PA after one year, with most effect on moderate-to-vigorous PA and leisure-time activity [16–19]. Furthermore, counseling according to healthy diet recommendations results in favorable improvements in dietary intake [18,20,21]. In contrast, other short-term studies showed that counseling in primary care does not favor brief advice and/or educational material on health behavior [22–24].

Furthermore, research showed that general practitioners (GPs) perceive barriers in lifestyle counseling, like lack of time and knowledge [25]. To overcome these barriers, nurse practitioners (NPs) can partially take over health promotion [26]. Therefore, in the Groningen Overweight And Lifestyle study (GOAL), tailored counseling for overweight or obese subjects with hypertension or hyperlipidemia is provided by NPs. The GOAL-study aims to permanently change lifestyle and to prevent weight gain in the long term. Previous research showed that the GOAL-study significantly increased leisure-time walking after one year [26] and succeeded in preventing weight gain after three years [27].

To provide more insight in the long-term effectiveness of lifestyle counseling by NPs, this paper presents the three-year
results on changes in PA and dietary intake of lifestyle counseling by NP compared to usual care by GP. Furthermore, it is investigated whether lifestyle changes after one year were maintained after three years of follow up.

2. Methods

2.1. Subjects

To participate in the study subjects should be aged between 40 and 70 years, with a BMI between 25 and 40 kg/m² and should have hypertension and/or dyslipidemia. Exclusion criteria were having diabetes mellitus, hypothyroidism, liver- or kidney disease, mental illness, addiction to alcohol and/or drugs, shortened life expectancy, current treatment for malignancy and being pregnant.

2.2. Study design and intervention procedure

1378 patients, recruited from eleven general practices in the northern part of the Netherlands, were invited to participate in the study of which 825 met the inclusion criteria. After further screening and selection procedures 457 subjects (55%) were randomized into the NP and GP group. The power analysis and the screening and assignment procedure were described elsewhere in detail [28].

Study subjects were randomly allocated to the nurse practitioner (NP) group (n = 225) or to the general practitioner (GP) group (n = 232). In the first year the intervention contained four individual counseling meetings by a NP (1, 2, 3 and 8 months after baseline) and one feedback consultation by phone (5 months after baseline). In the second and third year subjects had one meeting with NP and received two feedback phone calls each year. In their counseling NPs were guided by a standardized computerized software program. This software program contained instructions on lifestyle counseling according to (inter)national guidelines [29,30]. The aim of the intervention was to achieve persistent lifestyle changes and prevent weight gain. Only if subjects were motivated for weight loss the intervention aimed at losing 5–10% of body weight. The GP group was offered one GP consultation to discuss the results of baseline measurements and thereafter received usual care by a general practitioner according to national GP guidelines [31].

The GOAL study was approved by the Medical Ethics Review Committee of the University Medical Center Groningen and all subjects gave written informed consent.

2.3. Measurements

At baseline, all subjects received a structured medical exam including body weight and height measurements performed by a trained research team. Socio-demographic characteristics (e.g., age, gender, and educational level), PA level, and dietary intake were assessed using questionnaires. The medical exam and the assessments of PA and diet were repeated after one-year and three-year follow up.

2.3.1. Physical activity

Physical activity was measured by the Short QQuestonnaire to ASsess Health-enhancing physical activity (SQUASH), where one average week in the past month is used as reference period. This showed to be a reliable and valid questionnaire to assess PA [32]. Activity level was divided into light, moderate, and vigorous intensity, based on age, metabolic equivalent value of activity (MET) [33] and self-reported intensity level (e.g., slow/light, moderate or fast/intense). According to the SQUASH guideline, light, moderate, and vigorous activity were defined as, respectively, less than 4 METs, between 4 and 6.5 METs and 6.5 METs or more for adults under the age of 55 years, and less than 3 METs, between 3 and 5 METs and 5 METs or more for adults of 55 years and older.

In this study changes in PA in minutes per week between baseline and three-year follow up (calculated as mean change) were considered as primary outcome. Secondary outcomes were changes in compliance with two PA guidelines: (1) the Dutch guideline for PA which recommends being moderately active for at least 30 min per day for minimal five days a week [34] and (2) the guideline for cardio respiratory fitness, the ACSM fit guideline, which recommends vigorous PA for minimal 20 min per day for at least three days a week [35].

2.3.2. Dietary intake

For dietary intake a validated Food Frequency Questionnaire (FFQ) was used to assess total energy and nutrient intake by using the last month as reference period [36]. Total daily energy intake was assessed by total intake of kcal per day and nutrient intake by percentage energy intake from carbohydrate, protein, and (saturated) fat of total energy intake. Cholesterol, fruit, and vegetable intakes were measured in (milli) grams per day.

Three-year changes in dietary intake, calculated as mean change, were considered as primary outcome. Secondary outcome was compliance with the Dutch dietary guidelines. Compliance was defined as consumption of at least 200 g of fruit per day, 200 g of vegetables per day and a maximum intake of saturated fat of 10% of total daily energy intake [37].

2.4. Statistical analyses

Analyses were performed for subjects who completed the SQUASH or the FFQ at baseline and three year follow up. Subjects
with unrealistic values in PA and dietary intake (e.g., active > 7 days a week and > 960 min a day) were considered as missing values and were excluded from corresponding analysis. For subjects with missing items after three years, intention-to-treat analyses using baseline observation carried forward (BOCF) were performed.

Subjects who did not respond to both questionnaires at baseline and three year follow up were considered as dropouts and differences in baseline characteristics between completers and dropouts were determined by independent samples t-tests (for continuous variables) and chi-square (for categorical variables). Differences in baseline characteristics and baseline values and changes in primary outcomes after three years between study groups were evaluated by independent samples t-tests and chi-square. Changes within the NP and GP group were evaluated with paired samples t-tests for continuous variables and by McNemar test for categorical variables. A General Linear Model (GLM) was conducted to adjust for baseline values and baseline characteristics. Changes in complying with PA and dietary guidelines between baseline and three year measurements were analyzed by using logistic regression analysis, adjusted for baseline differences.

For analysis of maintenance of changes in PA and dietary intake subjects were only included if baseline, one year and three year data were available. To investigate maintenance repeated measures analysis of variance (ANOVA) was performed, adjusted for baseline differences. When changes

Table 1
Baseline characteristics of subjects who completed the SQUASH and/or the FFQ at 3 years follow-up.

<table>
<thead>
<tr>
<th></th>
<th>Nurse practitioner group (n = 162)</th>
<th>General practitioner group (n = 176)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Age (years)</td>
<td>55.5</td>
<td>7.8</td>
</tr>
<tr>
<td>Gender (% men)</td>
<td>49.4</td>
<td>–</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>88.1</td>
<td>–</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>29.4</td>
<td>3.0</td>
</tr>
<tr>
<td>BMI (≥30 kg/m²)</td>
<td>33.9</td>
<td>–</td>
</tr>
<tr>
<td>Smokers (%)</td>
<td>17.0</td>
<td>–</td>
</tr>
<tr>
<td>Educational level (% lower educated)</td>
<td>34.6</td>
<td>–</td>
</tr>
<tr>
<td>History of weight loss attempts (% ≥ 3 attempts in 5 years)</td>
<td>15.1</td>
<td>–</td>
</tr>
</tbody>
</table>

* Significant difference (p < 0.05) between study groups at baseline.

Table 2
Changes in physical activity and dietary intake after three years.

<table>
<thead>
<tr>
<th></th>
<th>Nurse practitioner group</th>
<th>General practitioner group</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n*</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean²</td>
<td>SD</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>148</td>
<td>88.3</td>
<td>12.1</td>
</tr>
<tr>
<td>Total physical activity (min/week)</td>
<td>111</td>
<td>2260b</td>
<td>1231</td>
</tr>
<tr>
<td>Light intensity (min/week)</td>
<td>111</td>
<td>1629</td>
<td>1080</td>
</tr>
<tr>
<td>Moderate intensity (min/week)</td>
<td>111</td>
<td>424</td>
<td>532</td>
</tr>
<tr>
<td>Vigorous intensity (min/week)</td>
<td>111</td>
<td>217</td>
<td>233</td>
</tr>
<tr>
<td>Leisure time physical activity (min/week)</td>
<td>127</td>
<td>529b</td>
<td>426b</td>
</tr>
<tr>
<td>Gardening (min/week)</td>
<td>144</td>
<td>69b</td>
<td>140</td>
</tr>
<tr>
<td>Sports (min/week)</td>
<td>141</td>
<td>86</td>
<td>195</td>
</tr>
<tr>
<td>Odd jobs (min/week)</td>
<td>141</td>
<td>93</td>
<td>142</td>
</tr>
<tr>
<td>Light intensity (min/week)</td>
<td>137</td>
<td>18</td>
<td>62</td>
</tr>
<tr>
<td>Moderate intensity (min/week)</td>
<td>137</td>
<td>21</td>
<td>68</td>
</tr>
<tr>
<td>Vigorous intensity (min/week)</td>
<td>137</td>
<td>50</td>
<td>100</td>
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<tr>
<td>Occupational activity (min/week)</td>
<td>146</td>
<td>940b</td>
<td>1058</td>
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<tr>
<td>Domestic activity (min/week)</td>
<td>128</td>
<td>560</td>
<td>584</td>
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<tr>
<td>Commuting activity (min/week)</td>
<td>141</td>
<td>41</td>
<td>107</td>
</tr>
<tr>
<td>Total energy intake (kJ/day)</td>
<td>158</td>
<td>8521</td>
<td>2600</td>
</tr>
<tr>
<td>Fat intake (g/d)</td>
<td>158</td>
<td>35.3</td>
<td>5.6</td>
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<tr>
<td>Saturated fat intake (g/d)</td>
<td>158</td>
<td>12.9</td>
<td>2.9</td>
</tr>
<tr>
<td>Carbohydrate intake (g/d)</td>
<td>158</td>
<td>44.7</td>
<td>6.4</td>
</tr>
<tr>
<td>Protein intake (g/d)</td>
<td>158</td>
<td>15.5</td>
<td>2.1</td>
</tr>
<tr>
<td>Cholesterol intake (mg/d)</td>
<td>158</td>
<td>187.0</td>
<td>73.3</td>
</tr>
<tr>
<td>Fruit intake (g/day)</td>
<td>158</td>
<td>143.5</td>
<td>129.0</td>
</tr>
<tr>
<td>Vegetable intake (g/day)</td>
<td>158</td>
<td>133.6</td>
<td>70.7</td>
</tr>
</tbody>
</table>

Ex, percentage of total daily energy intake.

* Significant difference (p < 0.05) between study groups at baseline.

† Significant difference (p < 0.05) between baseline and 3 year within study group.

‡ Significant difference (p < 0.05) between study groups after 3 years.

§ Number of subjects may differ because of missing items in the SQUASH questionnaire.

Mean difference, calculated as 3-year value minus baseline value.

* Differences in changes between baseline and 3 year, between study groups. Calculated by GLM, adjusted for baseline values and history of weight loss attempts.
differed significantly between study groups post hoc Bonferroni tests were performed. In the analysis of maintenance, time effects show changes over time within study groups and interaction effects describe differences in development of changes over time between study groups.

All analyses were performed using SPSS, version 19.0 for Windows (SPSS, Chicago, IL). In all analyses, \( p < 0.05 \) was considered statistically significant.

3. Results

3.1. Baseline characteristics and drop out

At baseline 455 of 457 subjects completed the SQUASH and/or FFQ. Of these 455 subjects 304 subjects completed the SQUASH and 330 subjects completed the FFQ after three years and were included in analyses for changes after three years (Fig. 1). Subjects who did not respond to both questionnaires at baseline and three year follow up (\( n = 119 \)) were considered as dropouts. They did not differ in baseline characteristics from the subjects who were included in our analyses, with the exception that dropouts were more often smokers (25.9% vs. 17.2%, \( p = 0.05 \)). Subjects who completed the questionnaires after one year and did not respond to the questionnaire after three years (\( n = 109 \)), did not differ in their PA or dietary changes at one year from completers at three year.

Table 1 describes the baseline characteristics of the study population who completed the SQUASH and/or the FFQ at three-year follow up (\( n = 338 \)). Within this study population, history of weight loss attempts differed significantly between study groups. Subjects in the GP group had more often three or more weight loss attempts in the last five years than the NP group (24.4% vs. 15.1%, \( p = 0.03 \)). At baseline the NP group had a higher level of light intensity PA and spent more time on occupational activity. Furthermore, they spent less time on total and moderate leisure-time activity and gardening. There were no differences in dietary intake between study groups at baseline (Table 2).

3.2. Changes in physical activity and dietary intake after three years

Changes in PA and diet after three years are described in Table 2. No significant difference was found between study groups concerning total PA. It decreased in both groups which was mostly explained by decreased occupational activity. Furthermore, light intensity PA decreased within both study groups, while moderate and vigorous PA increased, but differences between groups were not significant. Also, leisure-time PA increased within both groups, but groups differed not significantly. In sports, the NP group differed significantly from the GP group in light intensity sports (14 min/week vs. –16 min/week, \( p = 0.04 \)). However, in moderate intensity sports a reverse trend was found, whereas the GP group increased more in moderate intensity sports than the NP group (\( p = 0.07 \)).

With respect to dietary changes, no significant differences were found between study groups. Within both study groups total daily energy intake, (saturated) fat and cholesterol intake decreased, whereas carbohydrate, fruit, and vegetable intake increased (\( p < 0.01 \) for all) (Table 2).

Moreover, similar results for changes in PA and dietary intake were found using an intention-to-treat analysis (BOCF).

3.3. Changes in compliance with PA and dietary guidelines after three years

Changes in compliance with guidelines are shown in Table 3. No significant differences between study groups were observed. Within both study groups compliance with the two PA guidelines increased. Furthermore, within the NP group compliance towards the saturated fat guideline increased, but this increase was not significant (\( p = 0.07 \)). In addition, within both groups compliance with the fruit guideline increased, respectively by 16.3% (NP group) and 12.2% (GP group).

3.4. Maintenance of changes in physical activity and dietary intake

As described in Table 4 repeated measures analysis of variance (ANOVA) between baseline, one year, and three year measurements showed that the greatest improvements according to PA and dietary intake occurred during the first year of intervention. Favorable improvements regarding healthy lifestyle were well-maintained during the years, but small relapses were found during follow up in all leisure-time activities and dietary intake within both study groups.

In addition, a significant interaction effect was found for vigorous leisure-time activity (\( p = 0.05 \)), which showed that the development of changes over time differed significantly between study groups. The NP group increased vigorous leisure-time activity during the first year and showed small decreases during follow up, while the GP group showed the opposite effects. Another interaction effect was found in moderate intensity sports (\( p = 0.04 \)) in which the GP group increases relatively more during follow up.

With respect to dietary changes, analysis of maintenance showed that both study groups improved dietary intake in favor of a healthy diet during the three years, but changes between groups were not significant (Table 4).

| Table 3 | Changes in compliance with guidelines after three years. |
|-----------------|-----------------|-----------------|-----------------|
| | Nurse practitioner group (\( n = 111 \)) | General practitioner group (\( n = 137 \)) |
| | Baseline | 3 year | Baseline | 3 year | \( p \) value\(^1\) |
| Dutch PA guideline (%) | 68.6 | 73.8\(^a\) | 71.4 | 73.9 | 0.28 |
| ACSM Fit guideline (%) | 53.4 | 64.1\(^a\) | 50.4 | 61.3\(^a\) | 0.99 |
| Nurse practitioner group (\( n = 158 \)) | General practitioner group (\( n = 172 \)) |
| | Baseline | 3 year | Baseline | 3 year | \( p \) value\(^1\) |
| Saturated fat guideline (%) | 15.0 | 21.7 | 16.9 | 18.6 | 0.35 |
| Fruit guideline (%) | 30.6 | 47.8\(^a\) | 39.5 | 52.0\(^a\) | 0.77 |
| Vegetable guideline (%) | 14.9 | 20.1 | 16.9 | 21.5 | 0.95 |
|\(^a\) | Significant (\( p < 0.05 \)) difference in proportion compliers at baseline and after 3 years within study group. |
|\(^1\) | Logistic regression analysis, adjusted for baseline values and history of weight loss attempts. |

4. Discussion and conclusion

4.1. Discussion

Our study shows that both the NP group and the GP group showed favorable changes in leisure-time activity and dietary intake after three years. Although greatest improvements were found after one year, lifestyle adaptations were well-nigh maintained after three years. After three years of follow up total PA was decreased in both study groups, mostly explained by large decreases in limited intensive occupational activities, while moderate (16 min/week (NP group) vs. 73 min/week (GP group)) and vigorous PA (59 min/week (NP group) vs. 45 min/week (GP group)) increased within both study groups. These findings are in line with previous lifestyle-intervention studies aimed at promoting PA in primary care and showed that lifestyle counseling only provided little advantage over usual care [22,24]. Kinnmonth et al. found an average increase of 140 min/week in leisure-time activity in all study subjects [22] and van Sluijs et al. showed that changes in PA were not significantly different between the counseling group and usual care by GP [24]. In our study the mean age of subjects was around 56 years. This could imply that subjects retired during the years or switched to less physical intensive jobs, resulting in less (occupational) PA. In contrast, other studies aimed at improving lifestyle showed that counseling significantly improved PA and compliance with PA guidelines [17,19,38]. However, these studies provided more frequent and intensive counseling meetings than the GOAL-study and follow up was limited to only one year.

In our study leisure-time PA, compliance with PA guidelines, and dietary intake improved, even in subjects who were only offered one meeting with the GP to discuss baseline measurements and thereafter received usual care. Favorable improvements in the control group are often reported in other studies and could be explained by improved lifestyle advice provided by GP due to increased awareness on lifestyle changes because of study participation [39]. It is also plausible that subjects positively changed their health behavior themselves because of study participation, also known as the Hawthorne effect [39,40].

Comparable with other longitudinal studies [16,18] greatest improvements in moderate and vigorous PA, leisure-time activity and dietary intake occurred during the first year of intervention. But, during further follow up small relapses were seen in all leisure-time activities, total energy intake, (saturated) fat, cholesterol, and fruit and vegetable intake. However, retrogression over time is a well known phenomenon in intervention studies. An intervention of Kuller et al. succeeded in increasing leisure-time PA between 6 and 30 months, but after 48 months subjects showed small relapses [41]. The authors attributed the relapses to reduced contact intensity, which was also indicated in other studies showing that a higher amount and frequency of personal contacts and prolonged duration of interventions results in improved maintenance of dietary changes [15,42]. In the GOAL-study, according to the protocol meetings with NP were limited and during follow up intensity was reduced to only one meeting and two feedback phone calls. Furthermore, the process evaluation of the GOAL-study showed that the intervention differed from the protocol, because the majority of the participants (63%) did not
have any phone calls with the NP [43]. However, despite this limited intensity and reduced contact, subjects were still able to sustain their lifestyle improvements in leisure-time activity and dietary intake after three years. Thus, both groups were more physically active in leisure time and had a healthier diet after three years compared to the beginning of the intervention.

According to the public health perspective, changes in health behavior are quite valuable because prolonged changes in PA and diet prevent deterioration of glucose tolerance [44] and reduce the risk of diabetes, even without weight loss [9]. Therefore, lifestyle changes should be encouraged in primary care. However, research showed that GPs perceive many barriers in lifestyle counseling, such as lack of time [25] and therefore the NP, considered as professional and motivational in changing health behavior [43], could also give this counseling.

A limitation of our study is that PA and diet were subjectively assessed by self-reported questionnaires which can result in an overestimation of duration and frequency of PA [45] and under-estimations in energy intake [46]. Strengths of our study are the execution in a randomized controlled trial, inclusion of a relatively large study population with almost no differences in baseline characteristics, and the availability of short and long term data, which provided the opportunity to investigate development of changes over time and maintenance of lifestyle counseling.

4.2. Conclusion

Our study showed that the counseling by NP resulted in quite similar lifestyle changes when compared to a GP consultation. Both groups showed significant improvements in healthy lifestyle. However, lifestyle counseling by the NP did not result in better lifestyle changes compared to one consultation with the GP and thereafter usual care. Furthermore, at the three-year follow-up only small relapses were found of lifestyle changes after one year, which shows that long-term maintenance of lifestyle changes is possible.

4.3. Practice implications

For the GOAL-study, more intensive contact with the NP resulted in similar lifestyle changes as less intensive contact with the GP. However, both groups showed improvements in lifestyle and therefore it can be suggested that lifestyle counseling in primary care could also be performed by NPs, to reduce the barriers of GPs (such as a lack of time) and still provide tailored advice regarding healthy lifestyle to patients at cardiovascular risk.

Conflict of interest

The authors declare no conflict of interest.

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References


