Impact of group nutrition education and surplus value of Prochaska-based stage-matched information on health-related cognitions and on Mediterranean nutrition behavior

F. W. Siero, J. Broer¹, W. J. E. Bemelmans² and Betty M. Meyboom-de Jong²

Abstract

This study compares the effect of two interventions focussed on the promotion of Mediterranean nutrition behavior. The target groups are persons with three risk factors for development of cardiovascular disease. The study region is a socio-economically deprived area in the Netherlands. The first intervention consisted of three meetings in which the positive health effects of a Mediterranean diet were discussed in group sessions. In the additional intervention stage-matched information based on the Trans-theoretical Model of behavior change was given. Both intervention groups were compared with a control group, which received only a printed leaflet with the Dutch nutritional guidelines. At baseline the three subgroups were comparable and after 16 weeks both intervention strategies resulted in significant changes in comparison with the control condition. For fish consumption, both strategies resulted in more positive attitudes, social norms, stronger intentions, more progress in stage of change and better nutritional intake. For fruit/vegetables consumption, the effects of both strategies were limited to stage of change and nutritional intake. Additional individually stage-matched tailored letters did not result in more progress on any of the dependent variables. We conclude that substantial nutritional behavior change can be achieved by interactive group education in socio-economically deprived population groups.

Introduction

Coronary heart disease (CHD) is the leading cause of death in the Netherlands. In a socio-economical deprived region in the Netherlands, the eastern region of Groningen province, the standardized mortality rate for CHD is 29% higher than the national average (Broer, 1997). The average per capita income in this area is 10% below the national average, which classifies this region as one of the poorest in the Netherlands (Bloemberg et al., 1992). The Public Health Department in Groningen has launched several primary prevention programs to reduce cardiovascular disease (CVD) risk factors at the population level (smoking, unhealthy nutrition pattern). For effective prevention of CVD, a high-risk strategy whereby individuals with a combination of risk factors or symptoms of CVD are approached more intensively must supplement a population based approach (Epstein, 1993).

The Dutch national guidelines for healthy nutrition recommend a reduction in the fat intake to 30% or less and a saturated fat intake to 10% or less, and an increase in consumption of carbohydrates to 50% of the total caloric intake. The consumption of complex carbohydrates and fiber is encouraged, amongst others, by means of more frequent consumption of vegetables and fruit. At population level, only 1% complies with all nutritional guidelines, and only 20 and 3% meet the recommenda-
tions for total and saturated fat, respectively (Hulshof et al., 1993). Evidently there is great need for more effective health education or more realistic nutrition targets.

Overweight and an elevated serum cholesterol are established risk factors for development of CVD, but Dutch general practitioners give dietary advice to 14% of the targeted patients and only 3% of patients with an elevated cholesterol level are referred to a dietician (van der Weijden et al., 1994). Training of general practitioners for better implementation of treatment guidelines is complicated because improved knowledge is not matched by working in agreement with nutritional guidelines (van der Weijden et al., 1998). Although general practitioners are aware of the benefits of a healthy diet for patients at high risk for CVD, they often do not bring nutrition into their interaction with patients as often as they could (Truswell et al., 1999). In order to modify nutrition patterns of population groups at high risk for development of CVD, in particular low-income groups, special effort has to be developed (Ammerman et al., 1992). Against this background an intervention study was launched in which the impact of two types of health education interventions were assessed. One was an intensive education strategy in which elements of the so-called Mediterranean diet were promoted in group sessions. The Mediterranean diet is associated with low CHD mortality (Blackburn and Menotti, 1993). This diet is rich in vegetables, fruit, cereals and edible fats that are mostly olive oil, but contains much less meat (Renaud et al., 1995). The Mediterranean diet is transferable to other population groups as well (Kouris-Blazos et al., 1999). Our nutrition education program concentrates on the Mediterranean diet adapted to the Dutch national nutritional guidelines (Vos et al., 1996). In the second intervention the additional value of a stage-matched individual approach (Prochaska and DiClemente, 1983) was tested.

**Group nutrition education**

The relative efficacy of dietary advice given in primary care, whether given by a general practitioner, practice nurse or a standard leaflet, is limited (Neil et al., 1995). A more intensive intervention than is usually available in primary care is needed (Steptoe et al., 1999). Our intervention focussed on three elements: (1) group-oriented education instead of an individual approach, (2) transfer of knowledge about a Mediterranean diet and information about attitudinal and normative aspects of dietary behavior, and (3) improvement of skills related to shopping and food preparation.

Because the impact of brief individual counseling appears to be limited we chose to develop nutrition education at the group level. The advantage of group-oriented nutrition education is the presence of peers. Sharing of experiences between participants can underpin the importance of change in life style and promote behavior change (Schwartz, 1997; Velicer, 1999). With respect to the informational aspect, the second element of the intervention, according to the behavior change model of Ajzen (Ajzen, 1991), a more healthy nutrition behavior is dependent on the intention to change eating behavior in the direction of the Mediterranean diet, which in turn is dependent on the three types of beliefs about the Mediterranean diet. Therefore, it is essential that elements in the education program are based on relevant attitudinal, normative and control beliefs. Of the three types of beliefs, social norm appeared to be of minor importance for the intention to eat in a healthy fashion (Stafleu et al., 1991). The participants received information about content, pro’s and con’s of a Mediterranean diet. Key elements that distinguish a Mediterranean diet from a ‘common’ cardio-protective diet are high intake of fruit, vegetables, fish (instead of red meat) and use of olive oil or a diet margarine with ω3 polyunsaturated fatty acids (Renaud et al., 1995). Finally, to improve skills (the third element of the intervention), we emphasized in our program how to deal with the social context of food choice and food preparation. Specific guidelines for buying and preparation were given.

**Stage-matched education information**

The Transtheoretical Model of behavior change (Prochaska and DiClemente, 1983) provides a
useful framework for an approach in which individually stage-matched nutrition information is given. The model defines change as a gradual, continuous and dynamic process. Behavior change is not a one-time event but a process that occurs in stages, over an extended period of time. People move from pre-contemplation (not intending to change), to contemplation (thinking about and making plans to change behavior), to preparation (active planning to change), to action (overtly making changes) and into maintenance (having maintained the altered behavior for several months and trying to sustain change and resist temptation to relapse). In health-related behavior the majority of people relapse and return to earlier behaviors. The ‘stages of change model’ suggests that different approaches are needed for clients at different stages of change. In the early stages motivational interventions are more effective and at later stages skill training interventions may be more appropriate for individuals who already have decided to change (Curry et al., 1992). The balance of (dis)advantages of nutritional behavior depends on the stage. In the earlier stages people see more disadvantages and in the latter stages advantages prevail. The stages of change model has been used successfully for 12 different behaviors (Prochaska et al.; 1994) and has been used for nutritional behavior in different countries (De Graaf et al., 1997; Steptoe, 1999).

In order to evaluate the effectiveness of the educational intervention, the additional value of the Prochaska-based stage-matched information and to analyze the whole process of change, we measured not only the behavior (consumption of fish and fruit/vegetables) but also the components that precede the changes in behavior. These are attitudes, social norm, self-efficacy and intention to eat fish and fruit/vegetables according to our guidelines. Although we used serum cholesterol for risk identification we did not emphasize this risk indicator as an outcome measure in our program. Using the Transtheoretical Model of behavior change we tested the effectiveness of intensive group education and the additional value of individually tailored health education applied to the adoption of a Mediterranean diet in people who are at high risk for development of CVD.

Our first hypothesis stated that nutrition education on a group level would result in a more positive attitude, social norm and self-efficiveness, a stronger intention to use a Mediterranean diet, and more progress in stage of change. Secondly we expected that nutritional education would result in behavior change, e.g. a better compliance with a Mediterranean nutritional pattern measured in terms of actual fish and fruit/vegetable consumption. The third hypothesis was that individually tailored nutrition education had an additional impact on the mentioned outcome indicators. From the perspective of the behavior change model of Ajzen (Ajzen, 1991) the stage of change of Prochaska can be considered as an alternative, more comprehensive measure for intention. The Transtheoretical Model of Prochaska and DiClemente (Prochaska and DiClemente, 1983) claims that the stage concept not only refers to intention but also to the dynamics of behavioral change (attitude and behavior elements). From that point of view it is interesting to find out whether the stage of change measure has a unique, additional value above the measure of intention. Therefore, we tested whether the effect of group nutrition education on stage of change dimension of Prochaska disappears after removing the joint variance with intention.

Method

Participants and design

Participants

Before the start of the study, inclusion criteria were determined. For participation in the study the presence of a mean serum cholesterol between 6 and 8 mmol/l was needed as well as two or more of the following CVD risk factors: high blood pressure (diastolic 95 mm Hg or above, systolic 160 mm Hg or above, or use of anti-hypertension medication), a body mass index (BMI) above 27 kg/m², smoking, diagnosis of CVD or a first-degree relative with a history of CVD before the
age of 60 years. Exclusion criteria were age over 70 year, diabetes mellitus and medication (use of aspirin, anti-coagulants or cholesterol lowering drugs). Three initiatives were developed to identify potential participants. First, all inhabitants older than 30 years of age of two counties within a region with a high CVD mortality received a written invitation to participate in a screening program for blood pressure. Secondly, the registration systems of general practitioners (CVD risk factors) and pharmacies (use of anti-hypertension drugs) in these two counties were screened for identification of patients. Finally, a local radio program discussed the project, and invited potential participants to have their serum cholesterol measured and to register risk factors for CVD in order to be included in the study after informed consent. Potential participants received an informed consent form for participation in the study to the home address. After signing the informed consent, participants were randomized for type of nutrition information. The study protocol was approved by the Medical Ethical Committee of the University of Groningen.

**Design**

In order to test the hypotheses about the effects of group education and the additional value of Prochaska-based stage-matched information, three conditions were used: (A<sub>1</sub>) a control condition in which ‘care as usual’ was given, (A<sub>2</sub>) health education in a group-oriented context and (A<sub>3</sub>) health education in a group-oriented context plus individual stage-matched information.

In order to minimize leakage of information about a Mediterranean diet between intervention and control groups, health education (A<sub>2</sub> and A<sub>3</sub>) was limited to one county (Winschoten). The intervention group for nutrition education (A<sub>2</sub> and A<sub>3</sub>) consisted of 10 subgroups of 10 participants each. Five subgroups were randomly selected from the 10 subgroups to receive additional tailored health education. Between the baseline measurement (pre-test) and first post-test measurement at 16 weeks, five participants dropped out.

After baseline and post-test at 16 weeks, screening of participants was planned at t = 52, t = 104, t = 156 and t = 208 weeks. In this article we present the results of the baseline and t = 16 weeks measurement. All data were self-reported by participants. They received questionnaires during examinations and could return these by mail.

**Interventions**

**Care as usual (control condition)**

The control group (A<sub>1</sub>) received care as usual in the form of a leaflet with the Dutch national nutrition guidelines. This leaflet was sent by mail without direct interaction with the general practitioner.

**Group nutrition education**

The intervention groups (A<sub>2</sub> and A<sub>3</sub>) were subdivided in groups which were invited for three sessions of 2 h each. Partners were allowed to join the meetings as well. In the first session the emphasis was on raising consciousness and increasing knowledge of a healthy Mediterranean nutrition pattern. The nutrition guidelines for a Mediterranean diet, adapted to the Dutch situation, entails consumption of more bread, more root and green vegetables, more fish, less meat (beef, lamb and pork to be replaced with poultry), no day without fruit, sufficient dairy products, oil instead of butter in case of baking, and, within all three conditions, butter and cream to be replaced with a diet margarine supplied by the study. Diet margarine was the only product supplied by the study. The relation between nutrition pattern and CVD was demonstrated in lay terms with help of visual material. Information about healthy food products from the Mediterranean region and diet variation possibilities was presented, and 10 concrete nutritional guidelines were explained. The second session intended to promote a positive attitude towards a Mediterranean diet. This was done by recapitulation of the information of the first meeting, public discussion of a nutritional knowledge quiz, explanation of how to read product information on labels of food products, demonstration of video film about shopping for food and
product choice in local supermarkets, distribution of a booklet with locally adjusted Mediterranean recipes and assignment of home work in the form of trying to read printed product information, and testing some recipes from the booklet. The third session dealt with improving skills in preparing a Mediterranean diet. This was done by handing out a booklet with a list of (saturated) fat content of food products, exchange of dietary experiences between participants and discussion of how to behave on special occasions (parties, weekends, restaurants, etc.). Booklets with core information of the education program were handed out to participants after each session (and sent to participants who were not able to attend a session). Throughout the group sessions explicit effort was made to promote interaction between participants and asking questions was encouraged.

**Tailored health education**

The participants in this condition received, on top of the group nutrition education, information about the consequences of the Mediterranean diet. After a short general introduction, in a next section of the letter participants with negative beliefs with regard to price, health and body aspects, and preparation of a Mediterranean diet received, dependent on their answers on the questionnaire, specific information. Extra information about price and/or body weight in relation to the consumption of fish and fruit/vegetables was given when the belief was negative (score < 4 on a six-point scale) and the aspect was judged as important (score > 3 on a six-point scale). When participants had a negative belief about the preparation of fish (score < 4 on a six-point scale), extra information about this aspect was given. In the case of a negative belief about the consequences of a Mediterranean diet for CVD (score < 4 on a six-point scale), extensive information about this the relationship was given. In case participants in the (pre)contemplation stage already showed a positive attitude towards all these elements of the Mediterranean diet they were reinforced in this respect.

Participants in later stages (preparation, action, maintenance) also received specific suggestions about the improvement of skills in preparing a Mediterranean diet in case of a low self-efficacy score (< 4 on a six-point scale) for fruit/vegetable or fish consumption. Participants who had indicated they valued opinions of family members (score < 4 on a six-point scale) and also were confronted with negative normative beliefs (score < 4 on a six-point scale) were informed how to influence and convince significant others.

**Dependent variables**

**Stage of change**

Apart for the baseline and the measurement 16 weeks later the participants were classified into the five stages of change for a Mediterranean nutrition pattern, with respect to three aspects of a Mediterranean diet: consumption of fish and fruit/vegetables. This stage of change measure reflects participants’ readiness to adopt a Mediterranean diet. This measure has been validated (Curry et al., 1992). Participants were classified in the following stages: pre-contemplation, contemplation, preparation, action and maintenance. The stage of change was based on four questions with regard to whether or not participants used sufficient Mediterranean food products (fruit/vegetables and fish consumption). Sufficient, in the context of this study, means two or more pieces of fruit per day, four or more serving spoons of vegetables per day and twice per week replacement of red meat by fish at dinner. For fruit the first two questions were ‘Do you eat two or more pieces fruit per day?’ and ‘if yes, how long (more than 6 months/less than 6 months)?’. The corresponding stages are: maintenance (for those who answered more than 6 months) and action (for those responded with less than 6 months). If ‘no’ was
answered on the first two questions, the last two questions were: ‘Do you intend to eat two or more servings of fruit per day in the coming 6 months?’ If ‘no’ the stage is pre-contemplation and if the answer was ‘yes’, we asked ‘Do you intend to start eating two or more servings of fruit per day within the coming month?’ If the answer was ‘no’ the corresponding stage is contemplation and if ‘yes’, preparation. The same type of questions was used for the assessment of stages of change for the consumption of vegetables and fish.

Beliefs and attitudes

For the purpose of the application of the tailored health education condition participants were asked to indicate their agreement with six consequences of the partial behaviors of a Mediterranean diet (fruit plus vegetables combined and fish consumption). Due to the size of the questionnaires, fruit/vegetables were combined. A literature review showed that hedonic aspects of food attitudes (‘liking’) have more impact on intention to consume foods than evaluative aspects such as good/bad. Short-term rewards, like tastiness of food and figure/posture, appear to be more important than long-term rewards like prevention of CVD (Stafleu et al., 1994). A pilot study in the study region was done in order to identify obstacles and barriers for a healthy dietary behavior. Participants had a similar risk profile as our target group. It appeared that digestibility of food, tastiness and health relevance were important aspects in the target group. In contrast to our expectation in this socio-economically deprived area, price was not a decisive factor for food choice. On basis of this information the consequences we choose were: ‘beneficial for slimming’, ‘tasty’, ‘inexpensive’, ‘reducing the occurrence of CVD’, ‘easy to prepare’ and ‘digestibility’ (six-point scales). Attitudes were measured per partial Mediterranean behavior with three bipolar six-point scales (useless–useful, negative–positive and unpleasant–pleasant) with Cronbach’s $\alpha = 0.77$ for fruit/vegetables and Cronbach’s $\alpha = 0.79$ for fish.

Social norm, self-efficacy and intention

These were measured with six-point Likert scales for fruit/vegetables (combined) and fish consumption. Social norm was based on one item per partial Mediterranean behavior that referred to the reaction of the members of the family to the use of Mediterranean products. Strictly speaking, when we talk about ‘social norm’ we refer to the concept ‘normative belief’. Self-efficacy was measured by two items per partial Mediterranean behavior with Cronbach’s $\alpha = 0.69$ for fruit/vegetables and Cronbach’s $\alpha = 0.79$ for fish. Intention was measured by asking if the participant intended to start eating specific Mediterranean products (fish and fruit/vegetables) in the coming 2 weeks.

Food-frequency questionnaire (FFQ)

We constructed a FFQ adapted for measurement of specific Mediterranean products. The basis of our FFQ consisted of two other FFQs. One of them gives a reliable estimate of fat intake (Feunekes, 1993). The other gives valid information about intake and energy percentages of macronutrients (fat, carbohydrate and protein) and fiber (Ocke, 1996). Our FFQ consists of 165 food items and 10 questions to estimate portion sizes (Bemelmans et al., 2000). Each subject was asked to report the usual frequency of consumption and the usual portion size of foods during the previous 4 weeks. The frequencies were reported as the number of times per day, week or month. At the first visit the FFQ was given to the participant to be completed at home. A dietician checked the FFQ for completeness and discrepancies. A validated nutritional software package (Komeet©) and the nutrition database of the Agricultural University of Wageningen in the Netherlands were used to analyze nutritional data (Komeet©, 1997). The average dietary intake is expressed as gram product of interest per day (fish and fruit/vegetables). Before analyzing the data we decided to exclude records with unrealistic values for food intake. Intake of food products which were more than 3 SD from the mean were considered invalid. For the combined fruit/vegetable intake, two records at the baseline and two records at the post-measurement were excluded from analyses (above 980 g/day). For fish consumption, three records at baseline and seven at the post-measurement were
excluded (above 110 g/day). A validation study for the FFQ with a 3-day, 24-h recall method was done with 43 participants at \( t = 52 \) weeks. This validation study showed good reliability at the macro-nutrient level between FFQ and the dietary history method (Bemelmans et al., 2000).

## Results

### Characteristics of participants

Slightly over half of the participants were female (55%). A large majority (85%) belonged to a low socio-economical class as classified by educational level (primary school, lower vocational education). Mean age (years) was 52.7 (SD 9.6) for men and 55.7 (SD 9.5) for women. No differences were noted between intervention and control group in this respect. Only 13% of participants ate their meals alone and the rest in the presence of others.

At baseline marked differences existed between partial Mediterranean behaviors. Almost two-thirds of participants were in the action or maintenance stage for fruit, one-third for vegetable consumption and only 12% for fish consumption. Intervention and control groups did not differ in distribution over stages of change for fish, fruit or vegetable consumption at baseline.

### Effects of nutrition education

In order to test the first and second hypothesis about the effectiveness of the two interventions (group nutrition education and additional individually tailored nutrition education), both interventions have been compared with the control condition by means of analysis of covariance with the pre-test scores as covariate. Means for attitude, social norm, self-efficacy, intention, stage of change and nutritional intake, and corresponding F-tests are presented in Tables II and III, respectively.

In the case of diverging means between the three conditions, Table II presents also the significant contrasts between the control condition and the two intervention conditions.

### Fish consumption

The group education intervention seems to influence attitude, social norm and intention mainly in terms of fish consumption (Tables II and III). Compared to participants in the control condition, participants in the two education conditions have a more positive attitude towards fish consumption \( (P < 0.001; \text{adjusted } M = 4.4 \text{ for the control condition versus adjusted } M \text{ is equal 4.8 and 4.9 for, respectively, the group education and the group plus tailored education condition}) \) and they think more positively about the reactions of the other members of the family (social norm) towards fish consumption \( (P < 0.01; \text{adjusted } M = 4.4 \text{ for the control condition versus adjusted } M \text{ is equal 4.8 and 4.9 for, respectively, the group education and the group plus tailored education condition}) \). The two intervention conditions do not have any significant effect on self-efficacy compared with the control condition.

In comparison with the control condition the participants within the group education and the tailored education condition intended to consume more fish \( (P < 0.001; \text{adjusted } M = 3.3 \text{ for the control condition versus adjusted } M \text{ is equal 4.0 and 4.2 for, respectively, the group education and the group plus tailored education condition}) \). The stage of change for fish consumption moved significantly from contemplation to preparation after exposure to group education and the group plus tailored education condition \( (P < 0.001; \text{adjusted } M = 3.2 \text{ and 3.4 for, respectively, the group education and the group plus tailored education condition}) \).

### Fruit/vegetables consumption

For fruit/vegetables consumption a shift in stage of change from preparation towards the action was noted within both intervention conditions \( (P < 0.05; \text{adjusted } M = 3.5 \text{ for the control condition versus adjusted } M \text{ is equal 3.9 and 4.0 for, respectively, the group education and the group plus tailored education condition}) \). In comparison with the control condition, the participants within the group education and the group plus tailored education condition seem to have a more positive attitude towards the consumption of more fruit/vegetables. Although the adjusted means in Table
Table I. Stages of change of the participants at the baseline for the diet components (frequencies and percentages)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Eating fruit</th>
<th></th>
<th>Eating vegetables</th>
<th></th>
<th>Eating fish</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Pre-contemplation</td>
<td>48</td>
<td>18.3</td>
<td>147</td>
<td>58.3</td>
<td>196</td>
<td>76.0</td>
</tr>
<tr>
<td>Contemplation</td>
<td>6</td>
<td>2.3</td>
<td>3</td>
<td>1.2</td>
<td>4</td>
<td>1.6</td>
</tr>
<tr>
<td>Preparation</td>
<td>43</td>
<td>16.4</td>
<td>22</td>
<td>8.7</td>
<td>26</td>
<td>10.1</td>
</tr>
<tr>
<td>Action</td>
<td>10</td>
<td>3.8</td>
<td>4</td>
<td>1.6</td>
<td>9</td>
<td>3.5</td>
</tr>
<tr>
<td>Maintenance</td>
<td>155</td>
<td>59.2</td>
<td>76</td>
<td>30.2</td>
<td>23</td>
<td>8.9</td>
</tr>
<tr>
<td>N</td>
<td>262</td>
<td>252</td>
<td>258</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

There is a discrepancy between the reported number of participants in this table and Table II because of the list-wise deletion of missing values in the simultaneous analysis on the dependent variables (MANOVA).

Table II. Effects of the three intervention conditions [control (A1), group education (A2) and group education ± individually tailored nutrition education (A3)] on the dependent variables for fish and fruit/vegetables [mean (SD)]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Range</th>
<th>Fish</th>
<th>Fruit/vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A1 (n = 149)</td>
<td>A2 (n = 48)</td>
</tr>
<tr>
<td>Attitude</td>
<td>1–6</td>
<td>4.3 (0.91)</td>
<td>4.2 (0.84)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.4 (0.84)</td>
<td>4.7 (0.68)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.4a</td>
<td>4.8b</td>
</tr>
<tr>
<td>Social norm</td>
<td>1–6</td>
<td>4.1 (1.22)</td>
<td>4.0 (1.15)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.4 (1.11)</td>
<td>4.7 (0.85)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.4a</td>
<td>4.8b</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>1–6</td>
<td>4.1 (1.15)</td>
<td>4.4 (1.16)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.1 (1.27)</td>
<td>4.5 (1.10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4.1</td>
<td>4.4</td>
</tr>
<tr>
<td>Intention</td>
<td>1–6</td>
<td>3.3 (1.26)</td>
<td>3.2 (1.22)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.3 (1.22)</td>
<td>4.0 (1.24)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>adjusted 3.3a</td>
<td>4.0b</td>
</tr>
<tr>
<td>Stage of change</td>
<td>1–5</td>
<td>1.9 (1.46)</td>
<td>1.6 (1.07)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.0 (1.57)</td>
<td>3.1 (1.71)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>adjusted 1.9a</td>
<td>3.2b</td>
</tr>
<tr>
<td>Food intake (FFQ)</td>
<td>#</td>
<td>24.9 (34.9)</td>
<td>22.6 (23.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25.0 (23.5)</td>
<td>40.6 (29.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24.1a</td>
<td>40.3b</td>
</tr>
</tbody>
</table>

Adjusted means with an unequal superscript (a, b) differ by row at the P < 0.05 level.

Adjusted’ refers to ANCOVA-adjusted means with the post-test as dependent variable and the pre-test as covariate.
FFQ: n (A1) = 152, n (A2) = 49, n (A3) = 38.
No. range: fish intake 0–232 g/day; fruit/vegetable intake 49–1260 g/day.

‘Adjusted’ refers to ANCOVA-adjusted means with the post-test as dependent variable and the pre-test as covariate.
FFQ: n (A1) = 152, n (A2) = 49, n (A3) = 38.
No. range: fish intake 0–232 g/day; fruit/vegetable intake 49–1260 g/day.
Adjusted means with an unequal superscript (a, b) differ by row at the P < 0.05 level.

II depict the predicted differences, the effects are marginally significant (P < 0.10) and only supported by a marginal significant contrast between the group plus tailored education condition and the control condition (P < 0.059).

In comparison with the control condition, individually tailored nutrition education resulted in significantly higher attitude scores (fish and fruit/vegetables), higher social norm (fish), higher intention scores (fish) and higher stages of change (fish and fruit/vegetable consumption). Although individually tailored nutrition education showed
**Mediterranean diet intervention study**

Table III. F-tests for the differences between the three intervention conditions (control, group education and group education + individually tailored nutrition education) on the dependent variables for fish and fruit/vegetables consumption

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Fish</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Fruit/vegetables</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>d.f.</td>
<td>P</td>
<td>F</td>
<td>d.f.</td>
<td>P</td>
<td>F</td>
<td>d.f.</td>
<td>P</td>
</tr>
<tr>
<td>Cognitive aspects</td>
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<td>2–226</td>
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<td>2.5</td>
<td>2–230</td>
<td>0.10</td>
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<td>2–206</td>
<td>0.01</td>
<td>&lt;1</td>
<td>2–207</td>
<td>NS</td>
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<td>2–227</td>
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<td>2–178</td>
<td>0.05</td>
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<td>0.001</td>
<td>6.43</td>
<td>2–235</td>
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Covariate in the ANCOVA was the pre-test, dependent variable was the post-test.

Consistently slightly higher mean scores for the dependent variables compared to group nutrition education, none differed significantly. It appears that the given individually tailored nutrition education did not add anything substantial compared to the given group nutrition education.

With regard to the behavioral effects, participants in the control group had at the baseline measurement the highest average fish consumption (25 g/day), while fruit/vegetable consumption was comparable between subgroups. Analysis of covariance with adjusted post-test nutritional intake as dependent variable and with pre-test intake as covariate shows that, compared with the control condition, both fish intake (P < 0.001) and fruit/vegetable intake (P < 0.01) were significantly higher in the two intervention groups. In particular, fish intake was twice as high in both the intervention groups (adjusted M = 24.1 g/day for control condition versus adjusted M = 40.3 and 42.1 g/day, respectively, for the group education and group plus tailored education condition). Compared with the control condition (adjusted M = 398 g/day), fruit/vegetable intake increased with 10% (adjusted M = 464 g/day) and 16% (adjusted M = 493 g/day) in, respectively, group education and group plus tailored education. Although participants who received group education plus tailored education seem to show a higher increase in both fish and fruit/vegetables intake, these effects were not significantly better compared to those who only received group nutrition education.

A last question that deserves attention is the status of the stage of change construct of Prochaska. As stated in the introduction of this study, the ‘stage of change’ concept claims an additional value above the intention concept within the tradition of Ajzen (Ajzen, 1991). In order to evaluate the exchangeability of this concept with intention, we did a step-down analysis of variance. In that analysis we tested if the effects of the intervention conditions on the stage of change for fish and for fruit/vegetables remained significant after removing the common variance of stage of change with intention. Notwithstanding substantial post-test correlations between intention and stage of change (r = 0.53 for fish consumption and r = 0.32 for fruit/vegetable consumption), the effects of the intervention conditions on stage of change remained significant, indicating that the effects of the intervention conditions refer to a unique part of the stage of change construct. We conclude that the concept of stage of change of Prochaska offers an additional value above the intention concept in the model of Ajzen.

**Discussion**

The goal of our study was to bring about a nutritional behavior change in a low educational level population in a economically deprived area.
in the Netherlands. The participants were all at high risk for development of CVD. First of all we aimed to improve knowledge, attitudes, social norm and feelings of control in relation to a Mediterranean-style diet. Secondly, we wanted to achieve an improvement in actual nutritional behavior in terms of fish and fruit/vegetable consumption. Thirdly, we investigated the impact of nutrition education by means of two types of interventions (three group education sessions and the additional value of individually tailored information) as compared to care as usual through distribution of leaflets with guidelines for healthy nutrition.

We found that nutrition advice about a Mediterranean-style diet resulted in significant improvement in attitude, social norm, intention and stage of change in relation to fish consumption. For fruit/vegetable consumption we found no significant effects on cognitive variables and a moderate, but significant, improvement in stage of change in both intervention groups compared to the control group.

Supposedly, an impact on cognitive variables with respect to fruit/vegetable consumption was hard to achieve due to high scores on attitude, social norm and self-efficacy at baseline. The improvement in cognitive indicators, stage of change and behavior for fish consumption was more pronounced due to lower and a less skewed distribution of these indicators at baseline. For fish, three-quarters of the participants were initially in the pre-contemplation or contemplation stage, while for fruit/vegetables, two-thirds (fruit) and one-third (vegetables) of the participants were in action or maintenance stage.

Interestingly, the intake level of fruit in our study is also high in relation to the intake elsewhere. We compared the nutritional intake in our study with data from the Dutch national food consumption survey (Bemelmans et al., 2000), and found that the participants in our study at baseline had a slightly higher intake of fish (23 versus 18 g/day), a significantly higher intake of fruit (276 versus 139 g/day) and a slightly lower intake of vegetables (143 versus 166 g/day). This might be explained by socially desirable reporting of food intake (Brug et al., 1998). In particular, the high fruit consumption may also be related to the fact that a large majority of the participants in our study were overweight (whereby a diet low in fat and rich in fruit is recommendable). Overweight individuals give biased dietary information, and this may distort the relation between dietary intake and diseases related to being overweight (Braam et al., 1998). The fact that the high scores on the cognitive variables for fruit were matched by a high fruit intake makes it understandable that little to no change occurred in fruit-related indicators. Besides that, we note that the general population has been exposed to campaigns promoting fruit and vegetable consumption for quite some years, and may be saturated in this respect. Due to this, marginal gains are hard to achieve. The health benefits of fish consumption have been much less widespread and of much lower intensity in the Netherlands. For this reason it was easier to bring about results in fish-related indicators. If we now look back at the cut-off points for the stages of change variable we think that we would consider setting more challenging goals for behavior modification in terms of vegetable consumption.

Overall our nutrition education program was, due to the composition of our target group, more behaviorally and less cognitively oriented. Concise recommendations like ‘eat fish, twice per week’, ‘no day without two pieces of fruit’, ‘consume vegetables both at lunch and dinner’ were repeated frequently throughout the educational sessions and repeated in the handouts. The aforementioned behavioral aspects are reflected in the questionnaire used to assess the stages of change. This may have contributed to the significant differences on the stage of change variable for fruit/vegetables consumption. Reviewing the evidence we conclude that our first hypothesis was confirmed with the exception of cognitive aspects of fruit and vegetable consumption.

In spite of the importance of behavioral control for changes in nutrition behavior, it is remarkable that no effect was detected for self-efficacy. Taking into account the clear differences for the other
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cognitive and behavioral measures we are puzzled how this can be explained. One possibility is that the operationalization of self-efficacy was imperfect and did not discriminate sufficiently. Another possibility is that confrontation with the realization of the intended behavior undermines self-efficacy. Once people really try to change their eating behavior, they feel that it is not as easy as they thought it would be. Finally, perceived situational barriers, like limited availability of specific Mediterranean products, may have a negative impact on self-efficacy (Anderson et al., 1998).

The second hypothesis on behavior change was very clearly confirmed for fish consumption and to a lesser extent for fruit/vegetable consumption. Fish intake in the intervention groups doubled and the combined fruit/vegetable intake increased by a fifth. Looking at all indicators in Table III for the control group (group A1), we conclude that the ‘intervention’ used in the control condition, leaflets with guidelines for a healthy diet, did not have any impact at all, while the participants in this condition were also a CVD high-risk group. This conclusion is worrisome, from the perspective that our control condition reflects ‘care as usual’ in the health sector. Evidently, there is need for more focus on interventions in which group dynamic elements are incorporated. To achieve behavior change a single advice without instructions and discussion in a group context seems not sufficient. Multiple encounters and a more intensive approach are needed (Neil et al., 1995). Moreover, in the field of health education the use of standard leaflets is of limited value. Our study population was at high cardiovascular risk and of low educational level. To what extent outcomes of this study can be generalized to other groups of people depends on the perceived cardiovascular risk in those groups. It is likely that people with a higher educational level may benefit from this approach as well because a healthy life style is more easily adopted in higher socio-economic strata (van Leer et al., 1995).

The third hypothesis was rejected. Although participants who received individually tailored information in addition to the three group education sessions had slightly better scores on outcome indicators, these differences were not significant. One could conclude that in our study tailoring nutrition information according to stage of change had no additional value. Other studies suggest that the opposite is true (Campbell et al., 1994; Brug, 1997). However, this discrepancy can be explained in several ways. One explanation is that our main intervention was intensive. It consisted of three interactive group sessions while other programs compared tailored information that consisted of stage-matched printed information with a standard letter with nutritional guidelines. Apparently the mix of educational elements in our group sessions, which were offered to all participants irrespective of their stage of change, was sufficiently effective to result in good outcome measures. Another possible explanation is that we did not use feedback about nutritional behavior. Brug et al. (Brug et al., 1996) used, in addition to the stages of change model, feedback about individual nutritional behavior whereby people could compare their own behavior with targets of nutritional guidelines and with behavioral data of a reference group. On the basis of our study we cannot conclude anything about the impact of individually stage-matched tailored letters (without group education) compared to group sessions as such. Brug (Brug, 1997) demonstrated that individual stage-matched tailored letters are more effective in changing nutritional behavior than personal general nutrition information letters.

Another explanation is that we offered information in a systematic and sequential manner: consciousness raising, improving attitude and skills training. This sequence overlaps with the sequence used in the Transtheoretical Model of behavior change. We think that multiple contacts are needed for three reasons: (1) as part of an interactive approach, and use of social learning principles and feedback information in the change process (Bandura, 1977), (2) the quantity of information to be discussed for nutritional behavior, and (3) to allow for progress in stages of change during the intervention program.

The implication of our research is that group education can at least compete in efficacy with
tailored information through personal letters in people of low socio-economic class. After all, there is not any indication for an additional impact of tailored information above group education. While individually tailored letters can be used for larger-scale programs, group education is more easily implemented in local programs in primary health care organizations. Regarding the costs of nutritional advice in primary health care, we note that individual nutritional advice by a dietician for hypercholesterolemia is 8 times more cost-effective compared to treatment with cholesterol-lowering drugs (DeVries and Katan, 1991). When the nutrition education component of our program were to be replicated in the Dutch primary health care setting with a group size of 10 persons by a dietician in private practice we estimate the cost at 80 Euro per participant. This makes group nutrition education of patients with hypercholesterolemia certainly cost-effective compared to treatment with drugs. We expect that, due to a more intense exposure to information and the explicit use of interaction between participants, the duration of behavior change will be of longer duration in a group program. Future results (three post-measurements with 1-year intervals are being planned) will show how lasting the behavior change will be in our program. We conclude that it is possible to realize significant behavior change in CVD high-risk groups for in socio-economically deprived areas by means of three sessions of a structured nutrition education program.

Acknowledgements

J. B. and F. S. contributed equally to this research, which was financially supported the Dutch Prevention Fund (grant no. 28–2757). Unilever Research developed the margarines and supplied them to the participants. We appreciate the enthusiastic support of the students Marike Kauer, Ella Bakker and Sandra Hermers during the preparation of this study. Afie Dotinga gave an invaluable contribution during the implementation. Our gratitude goes to Bram Buunk who constructively criticized a previous draft of this manuscript.

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Received on November 22, 1999; accepted on April 5, 2000