Stages of change for fruit, vegetable and fat intake: consequences of misconception

Lilian Lechner, Johannes Brug, Hein De Vries, Patricia van Assema and Aart Mudde

Abstract
In order to study whether the Stages of Change concept of the Transtheoretical Model is applicable to fruit, vegetable and fat intake, data on two different study populations were analysed. Two methods of classifying stages of change were compared in both study populations. The first, more traditional, classification method was based on intentions and self-rated intake. In the second classification method, estimated level of consumption (using a food frequency questionnaire) of fruit, vegetables and fat was included. Differences between both classification methods in distributions of respondents over stages of change were large, especially for vegetable and fat intake. Many subjects who were in maintenance based on the traditional classification method were classified in the precontemplation stage if the alternative classification method was used, since these subjects were unaware of their unfavourable dietary intake. Nutrition education that uses the Stages of Change as a base for developing educational messages should not provide these subjects with information aimed at sustaining the present behaviour but with information that creates awareness of personal dietary behaviour. Considerations should be given to including more objective behavioural assessment methods in Stages of Change classification methods when the Transtheoretical Model is applied to nutrition research.

Introduction
The relationship between the consumption of fruit, vegetables and fat, and the prevention of numerous diseases has become more explicit in recent years. Many studies have shown that people with moderate to high consumption of fruit and vegetables have a lower risk of several kinds of cancer, cardiovascular diseases, hypertension and stroke (Gerster, 1991; Weisburger, 1991; Block et al., 1992; Hertog et al., 1993). Consumption of high fat diets, especially diets high in saturated fats, is considered a risk factor for a number of chronic diseases like cardiovascular diseases, various kinds of cancer, diabetes mellitus and obesity (Dutch Nutrition Council, 1986, 1991; Surgeon General, 1988; National Research Council, 1989).

Increased knowledge of the health effects of fruit, vegetables and fat intake has led to the development of guidelines for daily intake. The Netherlands Bureau for Food and Nutrition recommends adults eat three to four serving spoons (approximately 150–200 g) of vegetables and two pieces of fruit (approximately 200 g) per day (Netherlands Bureau for Food and Nutrition Education, 1993). Also, the Dutch Nutrition Council recommends adults reduce their dietary fat intake to 35% or less of total calories, especially by reducing intake of saturated fat (Dutch Nutrition Council, 1986, 1991). Only a small proportion of the Dutch population eats according to these guidelines (Hulshof et al., 1994). Health education interventions aimed at increasing fruit and vegetable consumption and decreasing fat intake are therefore necessary.

Health education interventions aimed at chan-
growing people's dietary behaviour will be more effective if they are based on insights into how people change their behaviour (Glanz et al., 1994). Several theories can be used for understanding behavioural change in general and change in dietary behaviour in particular (Glanz and Mullis, 1988; Glanz and Eriksen, 1993). One of the theoretical frameworks that is very popular nowadays as a framework to understand the process of behaviour changes is the Transtheoretical Model of Prochaska and colleagues (Prochaska and DiClemente, 1983; Prochaska et al., 1991). In this model different theoretical insights are used to explain how people change their behaviour over time. An important concept in the model is the so-called Stages of Change. This Stages of Change model suggests that people do not change their behaviour in a dichotomous step from unhealthy to healthy behaviour, but that the dynamic process of behavioural change can be divided into different stages. In order to change their behaviour, people can move from precontemplation (not interested in change) via contemplation (thinking about change) to preparation (actively planning to change within a short period). Subsequently, people can move to the action stage (actually enacting the new behaviour) and, finally, to maintenance (sustaining the new behaviour). In their movement through the stages, people can relapse and fall back to earlier stages. Moreover, movement through the stages often involves a cycling and recycling process (Prochaska and DiClemente, 1983; Prochaska et al., 1991).

The Stages of Change model, which has its origin in research on addictive behaviours, has been applied extensively on smoking cessation behaviour (Prochaska and DiClemente, 1983; Prochaska et al., 1991). One of the implications of the model is that people in different behavioural stages need different information, tailored to their specific stage, to motivate them to proceed in the change process to action and maintenance. The stages of change were also similarly applied to numerous other behaviours, such as exercise (Lechner and De Vries, 1995a,b; Marcus et al., 1992a,b), and to other behaviours like participation in mammography screening, using sunscreen protection, weight control and condom use by Prochaska et al., (1994). The usual way to divide subjects into the different stages is based on self-reported behaviour and intentions. Subjects are asked whether they intend to change their behaviour within the next 6 months (contemplation), whether they plan to do this within the next 30 days (preparation), whether they have already changed their behaviour recently (action) and whether they have sustained the healthy behavioural change for a significant amount of time, often operationalized as over 6 months (maintenance) (Prochaska and DiClemente, 1983; Prochaska et al., 1991).

Applications of the Stages of Change model to nutrition behaviour were reported recently in some studies (Curry et al., 1992; Glanz et al., 1994; Greene et al., 1994; Kramisch-Campbell et al., 1994). All of these studies applied the Stages of Change model to fat reduction. Only one application to fibre consumption was reported (Glanz et al., 1994). These studies based their classification of subjects in stages on the subjects' self-reports of intention and behaviour. If subjects thought they were on a healthy diet, they were placed in the action or maintenance stages. This resulted in similar distribution patterns over the different studies: a relatively high proportion of the subjects were in action or maintenance, while relatively few respondents were in the precontemplation, contemplation or preparation stages (Curry et al., 1992; Glanz et al., 1994; Greene et al., 1994).

An important issue in changing dietary behaviour seems to be people's awareness of their own behaviour. Weinstein proposed that awareness of risk behaviour is one of the key issues in motivating people to move from precontemplation to further stages of behaviour change (Weinstein, 1988). The prevalence of lack of awareness of dietary behaviour was demonstrated in two studies in The Netherlands (Brug et al., 1994; Lechner et al., 1997), in which large differences between the objective assessment of dietary fat, fruit and vegetable intake and the self-rated, subjective intake of fat, fruit and vegetables of the Dutch population.
Stages of change for fruit, vegetable and fat intake were found. Furthermore, a study by Bowen et al. (1994) found that those subjects with the highest fat intake consistently underestimate the amount of fat in their diet.

This lack of awareness could have consequences for the application of the Stages of Change model to dietary behaviour. It seems questionable to apply the Stages of Change model based on subjective, self-rated intake to dietary behaviour, when subjects do not have an accurate perception of their actual behaviour. In the studies on stages of change in fat reduction, it was found that fat consumption levels declined from precontemplation to maintenance (Curry et al., 1994; Greene et al., 1994; Kramisch-Campbell et al., 1994) and it was argued that this association between stages and fat consumption could be seen as an indication for the validity of the way subjects were divided in the different stages. At the same time, Greene et al. (1994) showed that among subjects eating more fat than the US recommendation, 40% were classified as maintainers based on their self-reports. Curry et al. (1992) showed similar results: among male maintainers the average fat intake was more than 35% of total energy intake. Glanz et al. (1994) reported an average fat consumption among maintainers of 32% of calories which indicates that at least a substantial proportion of maintainers consumed more fat than is recommended. This study also reported, with respect to fruit and vegetable consumption, an average daily amount of 2.15 servings of fruit and vegetables for subjects in action and 3.11 servings of fruit and vegetables for subjects in maintenance with regard to fibre intake (Glanz et al., 1994). Both scores are below the recommended five servings of fruit and vegetables per day. This difference between actual behaviour and subjective perceptions of behaviour creates a serious threat to the internal validity of a stage algorithm that is only based on subjective perceptions of behaviour. Therefore, it has been argued that subjects who are unaware of the fact that they do not meet the dietary guidelines, and who might therefore consider themselves as actors or maintainers, might better be considered as precontemplators (Lechner et al., 1997; Brug et al., 1997). Hence, a stage classification method that validates subjective estimation of dietary intake with a more accurate assessment of consumption seems recommendable. Until now, with respect to fruit, vegetable and fat consumption, alternative classification methods of the Stages of Change model, which are based on a combination of both subjective estimation of consumption and estimated actual consumption, have not been reported.

The present study aims to apply both the traditional staging classification method (which is based on intention and subjects' self-rated intake) and an alternative classification method (which combines estimated actual consumption, intention and self-rated consumption) to fruit, vegetable and fat intake. It was hypothesized that a large number of subjects who are classified as being in maintenance by means of the traditional method will be in precontemplation under the alternative classification method. The differences, the consequences and the practical implications for nutrition education of both staging classification methods are studied, using two different samples.

Methods

Respondents and procedure

Study 1

Data collection among two study populations were analysed. The data concerning fruit and vegetables were collected by means of a telephone survey among 670 adults from the Dutch general public. A total of 402 subjects completed the survey (response rate = 60%). Fifty percent were male; the mean age of the respondents was 43 years (SD = 16); most of the respondents had a spouse (73%). Thirty-five percent of the respondents had a high level of education (higher vocational school or university), 36% a medium level (secondary vocational school or high school) and 29% a low level of education (primary or basic vocational school). Thirty-six percent had a higher income than the Dutch average. The distribution of demographics such as age, gender and educational level...
was comparable to the Dutch adult population in general (Dutch Central Bureau for Statistics, 1994).

Study 2

The data concerning fat intake were obtained from a random sample of 689 employees of a major oil company in The Netherlands, by means of written questionnaires. A total of 507 completed questionnaires were returned (response rate = 74%). The mean age of the respondents was 39 years (SD = 7.7); 83% of the respondents were male; most of the respondents had a spouse (88%). Thirty-four percent of the respondents had a high level of education (higher vocational school or university), 59% a medium level (secondary vocational school or high school) and 7% a low level of education (primary or basic vocational school).

Questionnaire

The questionnaires included questions about consumption of fruit, vegetables (study 1) and fat (study 2), intention and demographic variables.

Study 1

The distinction between fruit and vegetables was made since earlier research indicated that people have different motivations for consumption of these food groups (Brug et al., 1995a,b; Lechner et al., 1997). Self-rated intake, consumption levels and intentions were assessed in relation to fruit consumption and vegetable consumption. Self-rated intake was assessed by asking the respondents to indicate their intake level of fruit and vegetables on a five-point scale, ranging from very low to very high. Consumption levels were assessed with a food frequency questionnaire (estimated consumption level). The consumption levels of fruit and vegetables were assessed by asking respondents to indicate the frequency and portion size in which they ate vegetables and fruit during the last month. Portion size for vegetables could be given either in serving spoons or in grams, but were coded as grams (1 serving spoon = 50 g, according to The Netherlands Bureau of Food and Nutrition Education instructions). The food frequency questionnaire was tested in a small scale study (N = 47) in which the reproducibility (test–re-test correlation was 0.77 between first and second administration) and the relative validity in classifying subjects according to intake levels were assessed in relation to a validated comprehensive Dutch food frequency questionnaire (Pearson correlation = 0.58) (Goldbohm et al., 1994). The food frequency questionnaire was applied in several studies (Brug et al., 1995b, 1996; Lechner et al., 1997). Intention to increase fruit and vegetable intake was assessed by asking the respondents whether they intended to increase their intake of fruit and vegetables within 6 months and within 1 month.

Study 2

Self-rated intake, consumption levels and intentions were assessed in relation to consumption of fat. Self-rated intake was assessed by asking the respondents to indicate their intake level of fat on a five-point scale, ranging from very low to very high. The estimated consumption level of fat was assessed with a 25-item validated food frequency questionnaire from which a fat score, ranging from 12 to 60, can be calculated (Van Assema et al., 1992). Fat scores of 22 for women and 25 for men correspond with the approximated upper levels of recommended dietary fat intake in The Netherlands (test–re-test correlation was 0.71; validation in comparison to a 7-day dietary record: r = 0.59). This questionnaire was used in several studies before (Van Assema et al., 1994; Brug et al., 1996, 1997). Intention to decrease fat intake was assessed by asking the respondents whether they intended to decrease their fat intake within 6 months and within 1 month.

Classification into stages of change

Two methods were used to classify subjects into stages of change separately for fruit and vegetable intake (study 1) and for fat intake (study 2). Figures 1 and 2 show these two classification methods graphically. The figures report the classification methods applied to consuming more vegetables (study 1), but the methods are basically the same for the consumption of more fruit (study 1) or less fat (study 2).
Stages of change for fruit, vegetable and fat intake

Study 1

The traditional method of classifying stages of change (see Figure 1), which is in accordance with earlier research on stages of change in dietary behaviour, is based on intentions and subjects’ self-rated intake (Curry et al., 1992; Glanz et al., 1994; Greene et al., 1994; Kramisch-Campbell et al., 1994). In the traditional method of classifying stages of change for fruit and vegetables, subjects were classified in the combined action/maintenance stage if they rated their fruit and vegetable consumption as sufficient or high. In this study, for fruit and vegetables no further division was made between action and maintenance, since earlier research indicated that hardly any subjects regard themselves as being in action, but rather in maintenance regarding their fruit and vegetable intake (Lechner et al., 1997). Respondents were classified in preparation when they reported an intention to change their dietary behaviour (increase fruit and vegetable intake) within 30 days and in contemplation when they intended to make the dietary change within 6 months but not within 30 days. Respondents were in precontemplation when they did not consider themselves as eating a high fruit and vegetable diet, were not in the process of changing their dietary behaviour, and had no intention to change their diet with respect to vegetables or fruit.

In the alternative method of classifying stages of change, the stages classification was additionally linked to the consumption levels of fruit or vegetables, as assessed by the food frequency questionnaire (see Figure 2). For fruit and vegetables, respondents were placed in the combined action/maintenance stage if their estimated consumption levels of fruit and vegetables were according to the Dutch dietary guidelines (over 150 g of vegetables per day and at least two pieces of fruit per day). Respondents with diets low in fruit or vegetables were divided into the other stages of change similar to the traditional classification method, but a distinction was made between precontemplators who were aware and those who were unaware of their low fruit and vegetable intake.

Study 2

In the traditional method of classifying stages of change for fat intake, respondents were classified as being in action when they reported they were presently trying to eat less fat, and were classed in maintenance when they reported they were eating a low fat diet and were not presently trying to lower their fat intake. Respondents were
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classified in preparation when they reported an intention to reduce their fat intake within 30 days and in contemplation when they intended to make the dietary change within 6 months but not within 30 days. Respondents were in precontemplation when they did not consider they ate a low fat diet, were not in the process of changing their fat intake and had no intention to reduce their fat intake.

In the alternative method of classifying stages of change, the stages classification was additionally linked to the estimated consumption levels of fat, as assessed with a food frequency questionnaire (see Figure 2). Respondents were only classified as being in action or maintenance when they had low consumption levels of fat. When these respondents with low consumption levels of fat reported they were presently trying to reduce their fat consumption, they were classified as being in action. Respondents with low fat consumption levels, who were not in the process of reducing their fat intake, were classified as being in maintenance. Respondents with high fat diets were divided into the other stages of change similar to the traditional staging classification method, but a distinction was made between precontemplators who were aware and those who were unaware of their high fat intake.

Statistical analysis

To calculate the level of agreement in classification between the traditional and alternative classification method, Cohen's \( \kappa \) values (Fleiss, 1981) were computed for each stage separately. For these analyses subjects were divided into the precontemplation, contemplation, preparation, action and maintenance stages, according to both classification methods. Differences in mean fruit, vegetable and fat intake between the stages were assessed using analysis of variance with Scheffé's multicomparison test (significant differences for \( P < 0.05 \)).

Results

Study 1

According to the traditional classification method, most respondents were in the action/maintenance stage with respect to their consumption of vegetables (89%) and fruit (71%) (see Table I). Only a small percentage of the respondents were in precontemplation based on the traditional classification method with regard to vegetables and fruit intake. However, a high proportion of the respondents who were placed in the action or maintenance stage based on the traditional classification method did not meet the dietary guidelines. Therefore, the alternative classification method (which included estimated consumption levels) displays a substantially different distribution (see Table I), revealing that the majority of respondents were in precontemplation with regard to vegetables (59%) and fruit intake (35%). Most of these subjects in precontemplation were unaware of their unfavourable consumption patterns. For fruit and vegetables, in both the traditional and the alternative classification methods few respondents were classified in the contemplation or preparation stage.

For vegetable consumption, Cohen's \( \kappa \) values were very low for the agreement in the precontemplation stages (0.10) and the action/maintenance stages (0.10). For fruit consumption, Cohen's \( \kappa \) values between the precontemplation stages (0.51) and between the action/maintenance stages (0.55) were higher than for vegetable intake, showing a stronger but still not more than moderate similarity in classification between both classification methods. Agreement within the contemplation stages (vegetables = 0.49; fruit = 0.94) and within the preparation stages (vegetables = 0.66; fruit = 0.84) was relatively high between both classification methods, especially for fruit intake.

The average daily consumption of fruit and vegetables for the different stages of change is presented in Table II. Since the alternative classification is partly based on estimated consumption levels, consumption for fruit and vegetables in action/maintenance are according to the guidelines by definition for this classification. Therefore, the differences between the earlier stages and action/maintenance were less often statistically significant in the traditional classification method, compared to the alternative classification method. For both fruit and vegetable consumption, analyses of the
Stages of change for fruit, vegetable and fat intake

Table I. Distribution of respondents over stages of change for fruit and vegetable intake, using two classification methods (study 1)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Vegetables (N = 402)</th>
<th>Fruit (N = 402)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional method (%)</td>
<td>Alternative method (%)</td>
</tr>
<tr>
<td>Precontemplation</td>
<td>8</td>
<td>59 (51*, 8b)</td>
</tr>
<tr>
<td>Contemplation</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Preparation</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Action/maintenance</td>
<td>89</td>
<td>37</td>
</tr>
</tbody>
</table>

The alternative method of classifying stages of change distinguishes between unaware precontemplators and aware precontemplators.

Table II. The average daily consumption level of vegetables (in g) and fruit (in pieces) for the different stages of change, based on two methods of classifying the stages of change (study 1)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Vegetables (N = 402)</th>
<th>Fruit (N = 402)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional method</td>
<td>Alternative method</td>
</tr>
<tr>
<td>Precontemplation</td>
<td>111</td>
<td>1.02</td>
</tr>
<tr>
<td>unaware (PU)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Precontemplation</td>
<td>68</td>
<td>65</td>
</tr>
<tr>
<td>aware (PA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contemplation (C)</td>
<td>90</td>
<td>54</td>
</tr>
<tr>
<td>Preparation (Pr)</td>
<td>81</td>
<td>72</td>
</tr>
<tr>
<td>Action/maintenance</td>
<td>160</td>
<td>236</td>
</tr>
<tr>
<td>(A/M)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Significant differences in Scheffé's multicomparison test (P < 0.05)  
PA < A/M      PU, PA, C, Pr < A/M  
PU > PA       PA, C, Pr < A/M  
PU > > PA

alternative classification method showed that subjects in the action/maintenance stages had a significantly higher fruit and vegetable intake than subjects in the precontemplation (aware and unaware), contemplation and preparation stages. For both fruit and vegetable consumption in the alternative classification method, respondents who were unaware of their insufficient consumption had a significantly higher daily intake than respondents who were aware of their insufficient consumption.

Study 2

According to the traditional classification method, most respondents were in the action and maintenance stages with respect to their consumption of fat (52%), with only a small percentage of respondents in precontemplation (14%) (see Table III). The alternative classification method displays a different distribution (see Table III), revealing that the majority of respondents were in precontemplation with regard to their fat intake (55%), most of whom were unaware of their high fat intake. With respect to fat intake, the proportion of respondents in preparation was relatively high in both classifications.

For fat intake, Cohen's k values between the precontemplation stages (0.17), and between the action (0.20) and maintenance stages (0.16) were very low and comparable with the k values for vegetables intake. Agreement within the contem-
Table III. Distribution of respondents over stages of change for fat intake using two classification methods (study 2)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Fat (N = 507)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional method</td>
<td>Alternative method</td>
<td></td>
</tr>
<tr>
<td>Precontemplation</td>
<td>14</td>
<td>55 (42\textsuperscript{a}, 13\textsuperscript{b})</td>
<td></td>
</tr>
<tr>
<td>Contemplation</td>
<td>8</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Preparation</td>
<td>26</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>12</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td>40</td>
<td>9</td>
<td></td>
</tr>
</tbody>
</table>

The alternative method of classifying stages of change distinguishes between \textsuperscript{a}unaware precontemplators and \textsuperscript{b}aware precontemplators.

Table IV. The average daily consumption level of fat (mean fat consumption score) for the different stages of change, based on two methods of classifying stages of change (study 2)

<table>
<thead>
<tr>
<th>Stage</th>
<th>Fat (N = 507)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Traditional method</td>
<td>Alternative method</td>
<td></td>
</tr>
<tr>
<td>Precontemplation unaware (PU)</td>
<td>30.6</td>
<td>31.7</td>
<td></td>
</tr>
<tr>
<td>Precontemplation aware (PA)</td>
<td>28.7</td>
<td>29.2</td>
<td></td>
</tr>
<tr>
<td>Contemplation (C)</td>
<td>27.7</td>
<td>29.0</td>
<td></td>
</tr>
<tr>
<td>Preparation (Pr)</td>
<td>27.1</td>
<td>21.2</td>
<td></td>
</tr>
<tr>
<td>Action (A)</td>
<td>28.9</td>
<td>22.1</td>
<td></td>
</tr>
<tr>
<td>Maintenance (M)</td>
<td>30.0</td>
<td>31.7</td>
<td></td>
</tr>
</tbody>
</table>

Significant differences in Scheffé's multicomparison test (P < 0.05)

- PA > Pr, A
- PA, PU, C, Pr > A, M
- PA > Pr

Discussion

In this research, two methods were used to classify subjects of two study populations into stages of change regarding their fruit and vegetable intake (study 1) and their fat intake (study 2). Besides a more traditional classification method, which is based on subjective, self-rated intake and intention to change, an alternative classification method of stages was used, where a more objective assessment of consumption was included in the classification method. There were some clear differences in classification between both methods, evident in both studies. The distributions over the different stages in both studies showed that many subjects who were in action or maintenance according to the traditional classification method were classified in the precontemplation stage according to the alternative classification method, because they did not meet the dietary guidelines and had no intention to change their behaviour. Since misconception of fruit intake (study 1) was less frequent than misconception of vegetable intake (study 1) and fat intake (study 2), differences in distribution over the stages between both classification methods were less substantial for fruit consumption. Comparison of the alternative classification method presented in this research with other dietary studies, which used the stages of change classification method based on self-rated behaviour (Curry et al., 1992; Glanz et al., 1994; Greene et al., 1994), shows that the alternative classification method resulted in a higher proportion of subjects in precontemplation instead of maintenance.
The differences between both classification methods were also confirmed by the calculated \( \kappa \) values between the different stages of both methods. For the precontemplation stages and the action/maintenance stages, the level of agreement in classification between both methods was very low for vegetable and fat intake (Fleiss, 1981), and only moderately high for fruit intake. For all three behaviours, the level of agreement was rather high between the contemplation stages and between the preparation stages, indicating that people who are (actively) considering changing their diet are more aware of their actual intake.

In the first study, only small proportions of subjects intended to increase their consumption of fruit and vegetables. The low percentages may result from the fact that most respondents believed that they already ate enough fruit and vegetables. Self-rated dietary behaviour has been identified as a significant predictor of intention to change dietary behaviour (Brug et al., 1994). Comparable proportions of subjects in contemplation and preparation stages were found in another Dutch study on fruit and vegetable consumption (Lechner et al., 1997). Studies in the US showed higher proportions of subjects in contemplation or preparation stages (Glanz et al., 1994; Kramisch-Campbell et al., 1994). Although no research was done to explain these differences, they may have been due to a higher awareness of nutrition in the US, compared to The Netherlands.

The alternative classification method in the first study shows a clear difference in consumption of fruit and vegetables between respondents who were aware and those who were not aware of their low consumption. The first group had a lower fruit and vegetable intake than the second. In view of these consumption patterns, one might expect these respondents to have increased their consumption in the past and therefore consider themselves to be in maintenance. It is not likely that these persons are contemplating change if they feel that they are currently meeting the recommendations. However, as they have not reached the dietary recommendation levels yet, they should be stimulated to contemplate further changes.

The two studies used food frequency questionnaires to assess objective or actual levels of consumption of fruit and vegetables (study 1) and fat (study 2). This means that we could only give an approximation of the actual fruit, vegetable and fat intake. Since data were gathered by use of telephone surveys (study 1) and relatively short written questionnaires (study 2), it was not possible to use more extensive methods like multiple day food records or multiple 24 h recalls, in order to get a more precise estimation of actual consumption level. However, despite the fact that this research used two different methods of collecting data (telephone versus written questionnaire), two different study populations (general public versus predominately male worksite employees) and different dietary behaviours (high fruit and vegetable diet versus low fat diet), the findings in both studies are quite comparable. These similar findings strengthen the importance of attending to the problems that arise when using a stage classification method based only on subjects' self-rated intake for dietary behaviour.

One of the most important implications of the Transtheoretical Model is that subjects in different stages of change use different processes of change in order to proceed in the behavioural change process (Prochaska and DiClemente, 1983). This implicates that health education messages should be tailored to the stage of change subjects are in (Lechner and De Vries, 1995b; Brug et al., 1997). Subjects in maintenance should be encouraged to sustain their present behaviour. However, it seems unjustifiable to stimulate subjects who wrongly think they are in maintenance to sustain their present diet. Since this group does not yet meet the dietary guidelines, nutrition education should focus on making them aware of their misconception and of the need to make further changes. Health educators should take into account that the group of consumers who are unaware of their undesirable dietary behaviour may need to be treated as a separate group with different educational targets.

We conclude that altering the method for classifying subjects to stages of change for dietary behaviours by using a combination of the subjects'
self-rated answers on traditional staging questions and objective assessments of dietary behaviour is useful for research into motivational factors for changing dietary behaviour and for identifying stage-tailored nutrition education goals.

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