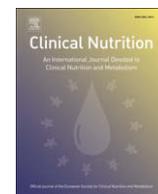




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Original Article

Effects of the PRo-active Interdisciplinary Self-MANagement (PRISMA, Dutch DESMOND) program on dietary intake in type 2 diabetes outpatients: A pilot study

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ABSTRACT

Background & aims: To investigate the effect on dietary intake of the PRo-active Interdisciplinary Self-MANagement (PRISMA) program, developed analogous to DESMOND, in overweight type 2 diabetes patients.

Methods: All type 2 diabetes patients referred to the Diabetes Outpatient Clinic of the VU University Medical Center Amsterdam with a BMI >25 kg/m², were eligible for inclusion to the PRISMA program. At baseline and after 3, 6 and 12 months of follow-up, macronutrient intake, anthropometric, biomedical and psychosocial measures were evaluated by using Generalized Estimation Equations.

Results: Included into the study were 38 patients, of which 22 completed a 1-year follow-up. After 6 months energy and macronutrient intake were significantly decreased. Reductions after 12 months were still significant for protein, unsaturated fat and dietary fiber and borderline significant for energy and saturated fat intake. Patients positively evaluated the program, and most patients held the view that they had learned something from PRISMA.

Conclusions: The PRISMA program reduced energy and macronutrient intake up to 6 months. After 6 months, attention should be paid to patients' food product choices. Follow-up counselling might further improve long-term outcome. This pilot study shows that the PRISMA program is promising in decreasing dietary intake in newly diagnosed and established overweight type 2 diabetes patients in secondary care.

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1. Introduction

Type 2 diabetes mellitus is worldwide rapidly increasing and is associated with macro- and microvascular complications, depression and increased mortality-risk.¹ As a result of this epidemic, health care resources are being continuously challenged, to achieve tight metabolic control in this patient population.²

Recently it has been suggested that group based diabetes education encouraging self-management and life-style change could be more effective compared to individual treatment only.³ Several diabetes education programs have been developed in Europe, but evidence for long-term effectiveness remains limited for programs using didactic learning approaches.⁴ Lower than expected effectiveness might be explained by insufficient founding

of the program on psychological theories, since trials have shown that improvement of personal attitudes and motivations could be more effective in diabetes education than knowledge transfer only.⁵

Accordingly, a diabetes education program called DESMOND (Diabetes Education and Self-Management for Ongoing and Newly Diagnosed) had been developed in the UK based on psychological learning principles and patient's empowerment.⁶ It has recently been demonstrated that DESMOND could be effective in weight loss, smoking cessation and improvement of beliefs about diabetes in newly diagnosed diabetes patients.⁷

In the Netherlands, the PRo-active Interdisciplinary Self-MANagement (PRISMA) program, analogous to DESMOND, has been developed for a type 2 diabetes population both including newly diagnosed and established type 2 diabetes patients.

Knowledge about dietary behaviour (change) of diabetes patients is rare,⁸ and especially the effect of education programs on dietary intake of type 2 diabetes patients.⁹ Therefore we investigated the longitudinal effect of the PRISMA program on energy and

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macronutrient intake, body weight, waist circumference, HbA1c and cholesterol levels as well as emotional well-being, and explore the perceptions, views and experiences of the participants about the PRISMA program in a pilot study.

2. Materials and methods

2.1. Patients

From March 2006 until March 2007, consecutive patients diagnosed with type 2 diabetes who were first referred to the Diabetes Outpatient Clinic of the VU University Medical Center Amsterdam, were referred to the PRISMA program. Patients were not referred if they were unable to participate in a group program (for example if they were housebound or unable to communicate in Dutch). For this study, only overweight type 2 diabetes patients were included ($\text{BMI} > 25 \text{ kg/m}^2$). All patients gave informed consent. This pilot study was approved by the medical ethical review board of the VU University Medical Center Amsterdam.

2.2. PRISMA program

The PRo-active Interdisciplinary Self-Management (PRISMA) program is a course based on the Diabetes Education and Self-Management for Ongoing and Newly Diagnosed (DESMOND) program developed in the UK of which the curriculum has been described in detail elsewhere.⁶ Briefly, the PRISMA program has been adapted according to the Dutch situation for patients with both established and newly diagnosed type 2 diabetes in secondary care where DESMOND was primarily aimed at newly diagnosed patients in primary care. Therefore, PRISMA spends more time on the topic of insulin and the measurement of blood glucose. In the interaction between newly diagnosed patients and those with established diabetes, who had not been satisfied with results thus far, exchange of experiences was encouraged. Also, examples of food choices were changed, based on more common products in the Netherlands.

The philosophy of the program is based on patient empowerment¹⁰ and grounded in four psychological models: (I) the self-regulation theory¹¹; (II) dual process theory¹²; (III) self-determination theory¹³; and (IV) the social learning theory.¹⁴

The program was performed at the VU University Medical Center Amsterdam for 2 daily periods of 3.5 hours over 2 weeks with a group size of maximal 10 patients plus possible partners. The meetings were accompanied by 2 trainers consisting of a registered dietician, diabetes nurse specialist or medical psychologist. Trainers were instructed according to a standardized training program which was accompanied by peer-reflection to ensure the quality of information delivery.

The PRISMA program triggers patients, by using a non-didactic learning approach, to consider their own personal risk factors and to choose a specific goal of behaviour change to achieve.

The following topics were discussed at the meetings:

Session 1: the patient's individual story, type 2 diabetes, the effect of insulin or oral hypoglycaemic agents, hyper- or hypoglycaemia, monitoring of blood glucose levels, nutrition (carbohydrates and body weight) and in which stage of change the patients find themselves with respect to their nutrition and physical activity.

Session 2: a retrospective of meeting 1, complications and personal risk factors, nutrition (fat), physical activity, the patient's individual diabetes action plan.

After this program, individual diabetes care by a registered dietician, diabetes nurse specialist and/or medical psychologist could optionally be started according to the individual goals formulated by the patients in their diabetes action plan.

2.3. Measurements

Data were collected with regard to age, gender, social status, education and ethnicity. A detailed history was obtained about medication use, complications, co-morbidity and diabetes duration. Height (cm) was measured with a stadiometer at baseline (SECA 220, Almere, The Netherlands). All other measurements were taken at baseline and at 3, 6 and 12 months of follow-up, unless specified otherwise. Weight (kg) of patients was measured wearing indoor clothing without shoes on a calibrated scale (SECA 880, Almere, The Netherlands). Body Mass Index (BMI) was calculated as $\text{weight (kg)}/\text{height}^2 \text{ (m)}$. Waist circumference (cm) was measured at the level midway between the lowest rib margin and the iliac crest.

Nutritional intake was retrospectively assessed for the previous month by using a validated food frequency questionnaire for hospital- and outpatients¹⁵ adapted from Feunekes et al.¹⁶ To assess the consumption of energy, saturated and unsaturated fats, carbohydrates, protein, dietary fiber and alcohol, the Dutch Food Composition Table was used.¹⁷

Emotional well-being was assessed with the World Health Organization-Five Well-Being Index (WHO-5)¹⁸ which has been found to be valid in type 2 diabetes patients.¹⁹ The degree to which the positive feelings were present in the last 2 weeks was scored on a 6-point scale ranging from 0 (not present) to 5 (constantly present) which were converted into a score from 0 (worst thinkable well-being) to 100 (best thinkable well-being). A score < 50 implies impaired emotional well-being and ≤ 28 is indicative for depression.²⁰

Health related quality of life was assessed by the SF-36 health survey²¹ at baseline only. The following eight perception scales were analyzed: physical health, bodily pain, general health, vitality, social functioning, physical role, emotional problems and mental

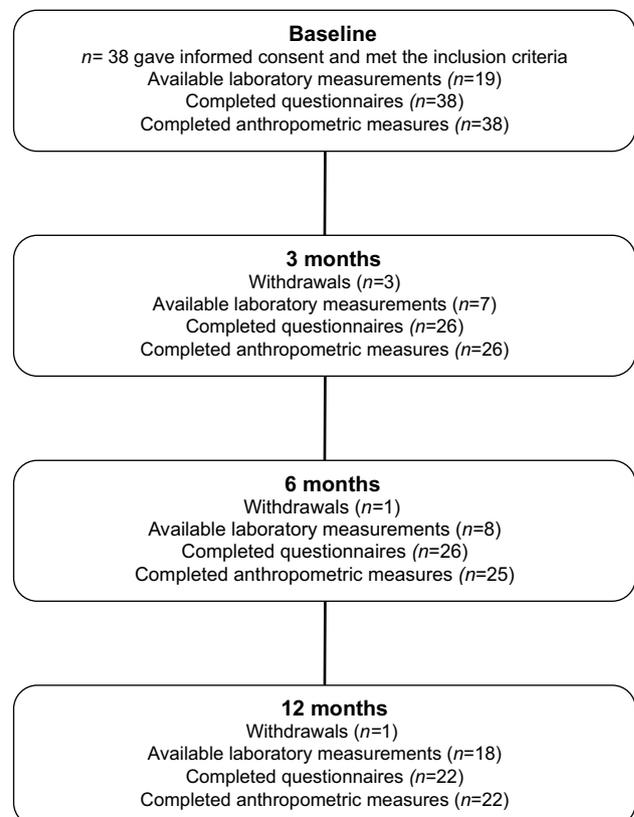


Fig. 1. Flow diagram of the study.

Table 1
Baseline characteristics of the participants with type 2 diabetes ($n = 38$).

	Number (%) or mean (SD)
Male gender n (%)	23 (60%)
Age (years)	59 (11)
Education n (%) ^a	
Higher	12 (32%)
Medium	22 (58%)
Lower	4 (11%)
Ethnicity n (%)	
Caucasian	29 (76%)
Surinamese or Antillean	5 (13%)
Moroccan	1 (3%)
Other	3 (8%)
Aggregated WHO-5-score	58.3 (24.1)
Impaired emotional well-being (≤ 50)	10 (27%)
Depression (≤ 28)	5 (13%)
Quality of life score (SF-36)	
Physical functioning	63.0 (28.1)
Role-physical	40.1 (42.9)
Bodily pain	46.1 (10.3)
General health	63.4 (11.8)
Vitality	47.2 (11.5)
Social functioning	45.1 (11.1)
Role-emotional	57.0 (45.1)
Mental health	57.6 (9.4)
Medication use n (%)	
Oral hypoglycemic agents	20 (52%)
Insulin mono therapy	8 (21%)
Combination therapy ^b	10 (26%)
Co-morbidity n (%)	33 (87%)
HbA1c (%)	8.1 (1.9)
Total cholesterol (mmol/L)	4.4 (1.5)
HDL cholesterol (mmol/L)	1.2 (0.3)
LDL cholesterol (mmol/L)	2.4 (1.2)
Triglycerides (mmol/L)	1.7 (0.8)
Body weight (kg)	93 (16)
Body Mass Index (kg/m ²)	32 (5)
Waist circumference (cm)	107 (13)
Men	107 (14)
Women	107 (12)

^a High: graduated bachelor or master; Mid: graduated high school or vocational school; Low: primary education, junior high school.

^b Including both oral hypoglycemic agents and insulin treatment.

health. For each scale, the scores were summed and transformed to a scale from 0 (worst health) to 100 (best health).

Self-efficacy with respect to diet behaviour was assessed according to the principles of motivational interviewing²² by asking the patients to rate both their confidence and their concern about their ability to perform according to recommended dietary intake and to control their weight. These questions were scored at a scale ranging from 0 (less important/not confident) to 10 (very important/very confident) with a higher score representing greater self-efficacy.

Laboratory measurements were performed according to the frequency of usual care and were included if they matched the frequency of the study protocol (i.e. at baseline, 3 and 6 months with a margin of 3 weeks and at 12 months with a margin of 6 weeks). HbA1c was assayed by using high-performance liquid chromatography (BioRad, Veenendaal, the Netherlands) with an inter- and intra-assay coefficient of variation of 4.3 and 6.1%, respectively. Serum total cholesterol, high-density lipoprotein (HDL)-cholesterol and triglycerides were assessed by using an enzymatic colorimetric assay (Roche, Mannheim, Germany). Subsequently, low-density lipoprotein (LDL) cholesterol was calculated according to the Friedewald formula (all participants had triglycerides ≤ 4.5 mmol/L).²³

Table 2
Dietary intake at baseline ($n = 38$) and reference values from Dutch Nutritional Diabetes Guidelines.

	PRISMA mean (SD)	Dutch Nutritional Diabetes Guidelines ²⁵
Protein (en%)	16 (3)	10–20
Fat (en%)	34 (7)	20–35 ^a
Saturated fat (en%)	12 (3)	≤ 10
Monounsaturated fat (en%)	11 (3)	–
Polyunsaturated fat (en%)	7 (3)	≤ 12
Carbohydrates (en%)	46 (7)	≥ 40
Dietary fiber (gram)	25 (8)	30–40
Alcohol (gram)	2 (0–53) ^b	–

^a For subjects having BMI > 25 kg/m².

^b Median (range).

After the PRISMA program, participants were asked to fill in a brief questionnaire to evaluate the program. The questions were related to the duration of the program, level and amount of the information delivery, if the participants had learned something from the program, whether they had changed their behaviour, which information they found valuable and if they had the view that there were topics not covered by the program.

2.4. Statistical analyses

Data analysis was performed with Stata Statistical Software for Windows release 9.0 (Stata corporation, College Station, Texas, USA). Because of the repeated measurements, statistical analysis was performed by using generalized estimation equations (GEE). GEE is a longitudinal technique which takes into account that observations within one patient could be dependent from each other.²⁴ All available observations for each patient were used in the analysis. To assess the difference compared to baseline in nutritional, biomedical and psychosocial outcomes after 3, 6 and 12 months, time was treated as a categorical variable and represented by dummy variables. In case of skewed data, analysis was performed after log transformation. Stratified analyses were performed in the case of effect modification (P -value for interaction term ≤ 0.10). Results are presented as the mean difference compared to baseline (β) and 95% confidence intervals (95% CI) after adjustment for baseline values unless reported otherwise. A P -value less than 0.05 was considered statistically significant.

3. Results

3.1. Patients

Out of 57 eligible patients, 7 did not give informed consent and 7 did not meet the inclusion criteria. Another 5 patients were excluded because their BMI was ≤ 25 kg/m², and therefore different treatment goals compared to overweight type 2 diabetes patients. Thus, 38 patients were included, of which 22 completed the study up to 12 months (Fig. 1). Table 1 shows baseline characteristics. The median disease duration for type 2 diabetes was 3 years (interquartile range: 0–10 years).

3.2. Dietary intake

Table 2 shows baseline dietary intake with reference to the Dutch Nutritional Diabetes Guidelines.²⁵ About half (17 out of 38) of the patients consumed more than 35% of their total daily energy intake as fat and 28 (74%) of the patients consumed more than 10% of energy intake as saturated fat. Most patients ($n = 31$; 82%) consumed at least the recommended proportion of their energy

intake as carbohydrates. Most patients ($n = 33$; 86%) consumed less than the recommended 30 g of dietary fiber a day. Almost all participants ($n = 35$; 92%) met the criteria for protein consumption. Taking all the criteria together, no patient fully complied with the Dutch Nutritional Diabetes Guidelines.

Table 3 shows that after 6 months energy and macronutrient intake were significantly decreased. After 12 months energy and saturated fat intake were only borderline significant, while protein, unsaturated fat and dietary fiber were significantly reduced (Fig. 2).

3.3. Body weight

Fig. 3 shows that body weight slightly increased at 12 months but this was not statistically significant. Patients with weight loss as individual goal as a result of the PRISMA program did not lose significantly more weight ($P = 0.83$, $P = 0.56$ and $P = 0.31$ for statistical interaction after 3, 6 and 12 months respectively) or reduce waist circumference compared to patients who did not have this goal ($P = 0.69$, $P = 0.13$ and $P = 0.47$ for statistical interaction after 3, 6 and 12 months respectively).

3.4. Biomedical outcomes

Table 4 shows that HbA1c tended to decrease after 12 months of follow-up and LDL cholesterol slightly increased, but total cholesterol levels were not significantly altered. Additional adjustment for changes in HbA1c levels and body weight did not change these results.

3.5. Psychosocial outcomes

At baseline, almost half of the participants reported impaired emotional well-being (WHO-5 score < 50 ; Table 1). After adjustment for baseline values, the aggregated WHO-5 did not significantly change after 3, 6 and 12 months ($\beta = 0.9$, $P = 0.76$; $\beta = 1.2$, $P = 0.79$ and $\beta = -9.6$, $P = 0.09$ respectively). After 12 months of follow-up, no significant difference was found in self-efficacy scoring regarding the patient's importance and confidence to control their weight or to choose the right nutrition for their diabetes (data not shown).

Table 3
Change from baseline dietary intake after the PRISMA program.

Energy and macronutrients	3 months		6 months		12 months	
	β^a (95% CI) ^b	P	β (95% CI)	P	β (95% CI)	P
Energy (kcal)	-364 (554 to -174)	<0.01	-338 (-488 to -188)	<0.01	-220 (-478 to 37)	0.09
Protein (gram)	-9.7 (-16.8 to -2.6)	<0.01	-11.6 (-18.0 to -5.2)	<0.01	-8.4 (-16.5 to -0.3)	0.04
Protein (en%)	1.5 (-0.1 to 3.2)	0.07	1.1 (-0.6 to 2.5)	0.22	0.3 (-0.9 to 1.6)	0.60
Fat (gram)	-14.9 (-24.6 to -5.2)	<0.01	-17.1 (-24.9 to -9.1)	<0.01	-10.7 (-20.2 to -1.2)	0.03
Fat (en%)	-0.9 (-3.4 to 1.6)	0.48	-2.5 (-5.1 to -0.1)	0.04	-1.6 (-4.1 to 1.1)	0.22
Saturated fat (gram)	-5.7 (-9.0 to -2.4)	<0.01	-4.8 (-7.5 to -2.1)	<0.01	-3.2 (-7.5 to 1.2)	0.16
Saturated fat (en%)	-0.5 (-1.5 to 0.4)	0.27	-0.4 (-1.6 to 0.8)	0.50	-0.6 (-1.8 to 0.7)	0.35
Monounsaturated fat (gram)	-5.2 (-8.6 to -1.8)	<0.01	-6.1 (-9.1 to -3.2)	<0.01	-4.3 (-7.7 to -0.9)	0.01
Monounsaturated fat (en%)	-0.6 (-1.7 to 0.6)	0.34	-1.2 (-2.3 to -0.2)	0.02	-1.1 (-2.2 to 0.3)	0.13
Polyunsaturated fat (gram)	-2.3 (-5.1 to 0.6)	0.12	-4.6 (-7.5 to -1.6)	<0.01	-2.3 (-4.3 to -0.3)	0.02
Polyunsaturated fat (en%)	0.4 (-0.5 to 1.3)	0.39	-0.8 (-1.9 to 0.3)	0.14	0.1 (-0.8 to 0.7)	0.87
Carbohydrates (gram)	-43.2 (-67.1 to -19.4)	<0.01	-29.1 (-50.5 to -7.5)	<0.01	-17.8 (-56.3 to 20.7)	0.37
Carbohydrates (en%)	0.2 (-1.5 to 1.9)	0.80	3.1 (0.6 to 5.5)	0.01	1.7 (-0.7 to 4.1)	0.16
Dietary fiber (gram)	-2.2 (-5.0 to 0.6)	0.13	-3.3 (-5.5 to -1.1)	<0.01	-2.6 (-4.8 to -0.4)	0.02
Alcohol (gram) ^c	-0.4 (-0.9 to 0.1)	0.13	-0.7 (-1.7 to 0.3)	0.15	-0.3 (-0.7 to 0.2)	0.30
Alcohol (en%) ^c	-0.2 (-0.7 to 0.3)	0.46	0.1 (-0.3 to 0.6)	0.55	0.0 (-0.4 to 0.4)	0.99

^a β : Mean difference compared to baseline after adjustment for baseline values.

^b 95% CI: 95% Confidence interval for β .

^c Data are presented as geometric mean difference (95% CI) after log transformation.

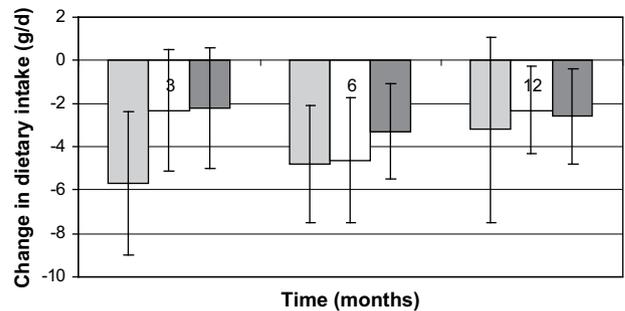


Fig. 2. Change in saturated fat, polyunsaturated fat and dietary fiber intake from baseline, 12 months after PRISMA program. (Vertical lines indicate 95% Confidence Interval; light grey bar: Saturated fat; white bar: Polyunsaturated fat; dark grey bar: Dietary Fiber.)

3.6. Perceptions, views and experiences of the PRISMA participants

Thirty patients had filled in an evaluation-form after the PRISMA program. The majority of the patients experienced the program as good or excellent ($n = 35$; 92%), found the information delivery clear ($n = 37$; 97%) and were of the opinion that the educational level was sufficient ($n = 34$; 90%). The duration of the program (2 sessions in 2 weeks) was found to be too short for 11 (29%) of the patients but the session duration (3.5 hours) was considered sufficient by 30 (80%) of the patients. Most patients ($n = 37$; 97%) thought that they had learned something of the program and 12 (32%) found that the program had changed their perception about diabetes. In addition, 5 (13%) reported that they were more aware of their diabetes and its consequences and 8 (20%) of the participants mentioned that they had changed their nutritional habits. Almost 70% ($n = 27$) reported that they particularly valued the education about type 2 diabetes, glucose, insulin and hypoglycaemia. Further, half the patients ($n = 19$) found the information about nutrition and physical activity particularly valuable. The formulation of a diabetes action plan was most valued by 21 (56%) of the participants.

4. Discussion

The PRo-active Interdisciplinary Self-Management (PRISMA) program significantly reduced energy and macronutrient intake,

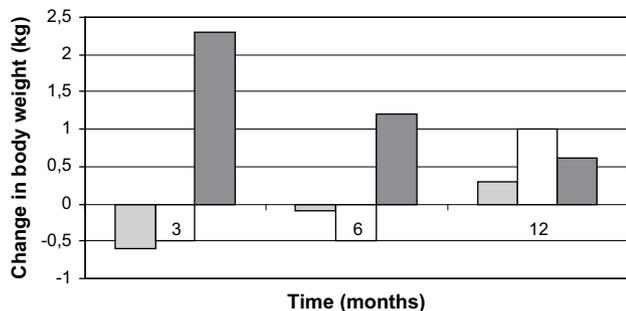


Fig. 3. Change in body weight from baseline, 12 months after PRISMA program for the total study group (light grey bar; $n = 38$) and for patients with and without a weight action plan (white bar; $n = 16$ and dark grey bar; $n = 10$ respectively).

including saturated fat intake, in overweight type 2 diabetes patients after 6 months of follow-up. After 12 months dietary intake was still reduced, but adherence had clearly decreased.

The reduced consumption of total and saturated fat in grams, suggests a positive effect of PRISMA. Most participants consumed more saturated fat relative to their total energy intake at baseline than recommended by the Dutch Nutritional Diabetes Guidelines.²⁵ This is comparable to the consumption of saturated fat in other studies in type 2 diabetes patients in the Netherlands^{26–28} and Europe.^{29–31} A high intake of saturated fat is an important risk factor for cardiovascular disease, which is the main cause of death in Europe³² and it is generally accepted that saturated fat intake should be limited and replaced by mono- and poly-unsaturated fats.³³ However, also a decrease in unsaturated fat consumption was found. Although this contributes to a reduced energy intake, several studies demonstrated the benefits of unsaturated fat on the risk of cardiovascular disease, and there are indications that it may also play a role in glycaemic control.^{32–35}

Two recent systematic reviews showed that dietary advice could be effective in the reduction of cardiovascular risk factors and that interventions which included group work could be effective in improving eating behaviour,^{9,36} and thus should be implemented as in the PRISMA program.

With respect to dietary fiber intake, an unfavourable trend was observed after the PRISMA program. This can be explained by the total decrease in food consumption. Almost all participants consumed already less dietary fiber at baseline than recommended. Insufficient dietary fiber consumption in diabetic subjects was also found in other countries. In addition, both in Mediterranean regions and Eastern Europe, dietary fiber consumption among diabetes patients is markedly lower than 30 g/day.^{29–31,37} The general population in The Netherlands also has a low dietary fiber consumption. The Dutch National Nutritional Survey demonstrated a mean dietary fiber consumption of 20 g/day.³⁸ There are indications that dietary fiber may play a role in improving glycaemic control, the regulation of blood lipids and body weight.^{25,39–41} Therefore, education on intake of

dietary fiber rich products should be intensified in future PRISMA programs.

An important finding is the loss of adherence after 1 year of follow-up. Firstly, although participants could receive follow-up treatment of a registered dietician, additional post-hoc analyses revealed that out of 16 patients who had a weight action plan only 6 (34%) received nutritional counselling after the program. And, although the lack of weight loss both in patients with and without weight goals can be partly explained by improved glycaemic control, the long-term results clearly indicate that more attention should be paid to dietary follow-up counselling in future. Follow-up treatment might be currently offered too optional. Follow-up counselling could include specifically equipped follow-up consultations according to the psychological principles of PRISMA^{11–14} with the possibility of visit-reminders and/or a return-group meeting once a year. Moreover, evidence suggests that there is potential for the application of computer tailoring techniques for promoting healthy behaviour.⁴²

Secondly, the generic fall in adherence after 12 months might be related to the psychosocial complexity of the study group. Insulin resistance has been associated with poor quality of life in the domains of physical functioning and general health.⁴³ Compared to the general Dutch population, quality of life scores of the PRISMA participants were lower on all the SF-36 domains except for general health.⁴⁴ Compared to studies in both newly diagnosed, screening detected and ongoing diabetes patients, PRISMA participants still had remarkably lower scoring on the domains of physical role, social functioning, emotional role and mental health.^{45,46} For physical functioning, bodily pain and emotional role PRISMA participants were comparable with other ongoing diabetes patients but not with newly diagnosed or screening detected diabetes patients in The Netherlands.^{45,46} Another finding was a negative mood in nearly half of the participants, which suggests the complexity of our study group in the secondary care setting. Diabetes has been associated with depression in several studies.^{47–49} Depression in diabetes patients may contribute to poor glycaemic control, obesity, non-adherence to treatment and impaired quality of life.⁵⁰ These results suggest that psychosocial complexity of the patient group may influence the effect of the program and that other disciplines such as e.g. medical psychology should be involved in follow-up counselling if impaired emotional well-being is present.

Thirdly, the reduced adherence after 12 months could also in part be attributed to lack of statistical power. The DESMOND program found an effect on weight, but the sample size of this study was markedly larger than our study group.⁷ Although this is rightly viewed as an important limitation of the present pilot study, it is all the more valuable that several dietary intake variables had indeed changed significantly. By using a longitudinal data analysis technique we were able to use all available data and not only the 22 participants that fully completed the study after 1 year which reduces the effect of selective missing data (24). Moreover, with a 0.6 reduction in HbA1C from a baseline of 8.1%, this effect would certainly be regarded as clinically significant.

It is important to recognise that the participants positively evaluated the PRISMA program. However, just 8 participants self-reported alteration of their dietary intake after the program. This again stresses the demand for follow-up nutritional counselling.

Our goal was to increase self-efficacy by the PRISMA program. However, it remained relatively stable after PRISMA. This might be due to limited sensitivity of self-efficacy scoring in this population by using our method. The revised Summary of Diabetes Self-Care Activities Questionnaire may offer a solution in the assessment of diabetes self-management because it was found to be valid, sensitive to change and generalizable for diabetes subpopulations.⁵¹

Table 4

Change from baseline blood levels at 12 months after PRISMA program.

	β^a (95% CI) ^b	P
HbA1c (%)	–0.6 (–1.3 to 0.1)	0.11
Cholesterol levels (mmol/L)	0.4 (–0.1 to 0.8)	0.09
LDL cholesterol levels (mmol/L)	0.3 (0.1 to 0.6)	0.02
HDL cholesterol levels (mmol/L)	–0.0 (–0.2 to 0.1)	0.54
Triglycerides (mmol/L) ^c	0.2 (–0.4 to 0.7)	0.57

^a β : Mean difference compared to baseline after adjustment for baseline values.

^b 95% CI: 95% Confidence interval for β .

^c Data are presented as geometric mean difference (95% CI) after log transformation.

However, this questionnaire barely includes detailed topics regarding nutritional behaviour and questions with respect to the patients' confidence in the ability to perform the desirable behaviour. Therefore, further research is needed about the proper assessment of self-efficacy with respect to dietary intake.

5. Conclusion

In conclusion, this pilot study shows that the PRISMA program could be effective for overweight type 2 diabetes patients in decreasing macronutrient intake, including saturated fat intake, after 6 months of follow-up. The PRISMA program, which is positively evaluated by most patients, should further improve on long-term follow-up treatment, including patients' food product choices. Adaptations should consider the psychosocial complexity of the type 2 diabetes patients under treatment.

5.1. Practice implications

The applicability of education programs founded on psychological principles, as the PRISMA program, seems promising for decreasing dietary intake in both newly diagnosed and established overweight type 2 diabetes patients in secondary care. Although decreased food intake may also result in reduced dietary fiber and reduced unsaturated fat intake, it is worthwhile to consider this topic in further programs by giving more attention to food product choices. Since this study also points attention to the psychosocial complexity of type 2 diabetes patients, psychosocial assessment tools during the program could be useful. To improve nutritional follow-up counselling, return-group meetings, follow-up consultations especially founded on the psychological principles and computer tailoring techniques may have potential. After this pilot study further investigation about the PRISMA program should ideally include the use of a randomised controlled design, cost-effectiveness and the development of current programs in primary care and for diabetes subpopulations such as type 1 diabetes.

Conflict of interest

The authors have no conflict of interest to declare.

Statement of authorship

AL and PW designed the study. AL and MH coordinated and carried out the study. JK carried out data analyses and drafted the manuscript. AL, MH, FS developed the PRISMA program. All authors contributed to writing the manuscript and read and approved the final manuscript.

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