

# The Mediterranean diet as a nutrition education, health promotion and disease prevention tool

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## Abstract

*Objective:* While epidemiological research on the protective role of the Mediterranean diet (MD) is highly publicised, little is known about MD education interventions. This exploratory study aimed to provide insight into methodology and effectiveness of the MD as a nutrition education and health promotion tool.

*Design and setting:* Two searches were conducted within PubMed using the terms 'Mediterranean diet' and 'Education' or 'Intervention'. Abstracts yielded were screened for distinct studies in which participants were instructed on the application of MD principles in their diet. Four studies met this criterion. These were further analysed for sample/target population, and intervention design, duration, tools, evaluative measures/tests and outcomes.

*Results:* Interventions targeted both healthy and at-risk populations and lasted between 12 weeks to 1 year, including follow-up. They used individual counselling, tailored computer-based counselling, group education, internet-based education, cookery classes and printed materials. Outcomes were measured using food diaries, FFQ, questionnaires on psychosocial factors and on usage of the educational tools, as well as anthropometrics and biomarkers. Interventions showed statistically significant increases in participants' intake of vegetables, legumes, nuts, fruit, whole grains, seeds, olive oil and dietary PUFA and MUFA, and statistically significant decreases in total cholesterol, ox-LDL-cholesterol, total:HDL-cholesterol ratio, insulin resistance, BMI, body weight and waist circumference.

*Conclusions:* MD education interventions may be cost-effective strategies for helping to protect against and treat a variety of health problems in different populations. Details of such interventions need to be publicised internationally. This introductory review could help inform the design of future targeted MD nutrition education.

## Keywords

Mediterranean diet  
Health promotion  
Nutrition education  
Intervention design  
Intervention outcomes

The Mediterranean diet (MD) gained much recognition and worldwide interest in the 1990s as a model for healthful eating habits. This 'popularity' has continued to increase, among both the general public and the scientific community<sup>(1–3)</sup>.

The principles underlying the MD form the basis of different sets of dietary guidelines from around the world, where the emphasis is on increasing intake of vegetables, fruits, nuts, grains, pulses, fish and low-fat dairy products, and opting for monounsaturated fats such as olive oil<sup>(4–6)</sup>. The MD is highly advocated for its health-promoting and disease-preventing characteristics; yet, ironically, during recent decades there has been a gradual abandoning of the MD diet by the populations of the Mediterranean, especially among the younger generations<sup>(1,7–14)</sup>. Simultaneously, while epidemiological research on the protective role of the MD is highly publicised, little is known about the use and effectiveness of MD education interventions. The purpose

of the present paper was to carry out a preliminary exploratory study of published articles on the MD as a nutrition education tool. This was not a full-scale systematic review, but more of an introduction to the phenomenon.

## Methodology

Two online searches were conducted within PubMed citation database using the terms 'Mediterranean diet' and 'Education' or 'Intervention'. The 258 abstracts yielded were screened for distinct studies with a clear 'education' component, education being defined as some form of instruction to participants on the application of MD principles in their diet. Four studies met this criterion and these were further analysed for sample/target population, and educational intervention design, duration, tools, evaluative measures/tests and outcomes. Full details of

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**Table 1** A Mediterranean diet educational intervention with healthy Canadian females

Articles	Sample/target population	Educational intervention			Outcomes
		Duration	Design and tools	Evaluative measures/tests	
Goulet <i>et al.</i> (2008) <sup>(15)</sup>	Canadian healthy female adults ( <i>n</i> 73), ages 30–65 years.	12-week programme (plus follow-up after 12 weeks at week 24).	Two group sessions, three individual sessions and four 24 h recalls (phone interview) promoting a Mediterranean food pattern.	FFQ at weeks 0, 6, 12, 24 using a Mediterranean score (MedScore) for analysis. Questionnaire at weeks 0, 12 and 24 including questions on socio-economic variables and barriers and benefits associated with adoption of a MD. Anthropometric measures at baseline and week 24.	<ul style="list-style-type: none"> <li>- The MedScore increased from 21.1 ± 3.6 at baseline to 28.6 ± 4.4 after 6 weeks of intervention (<i>P</i> &lt; 0.0001) with no further increase at week 12.</li> <li>- Decrease in dietary energy density.</li> <li>- Decrease of 11.3% in plasma ox-LDL after 12 weeks (<i>P</i> &lt; 0.0001).</li> <li>- Higher MD score was significantly correlated with a decrease in ox-LDL concentrations (<i>r</i> = -0.30; <i>P</i> = 0.01).</li> <li>- Increases in servings of fruits (<i>r</i> = -0.25; <i>P</i> &lt; 0.05) and vegetables (<i>r</i> = -0.24; <i>P</i> &lt; 0.05) were associated with decreases in ox-LDL concentrations.</li> <li>- Small but significant decreases in body weight and waist circumference (0.5 kg and 1.2 cm, respectively; <i>P</i> &lt; 0.01).</li> <li>- Increase in partial MedScore for legumes, nuts and seeds (Increase in consumption) as well as increase in partial MedScore for sweets (decrease in consumption) were significantly associated with changes in waist circumference (<i>r</i> = 0.36, <i>P</i> = 0.001; <i>r</i> = 0.24, <i>P</i> = 0.05; respectively).</li> <li>- MD adherence not associated with an increase in daily dietary or energy economic cost.</li> <li>- Women without children associated with better dietary response to the MD intervention (OR, 3.6; 95% CI 1.3, 10.0).</li> <li>- Women who planned food purchases as a function of weekly food discounts associated with better dietary response to the MD intervention (OR, 3.3; 95% CI 1.3, 8.8).</li> </ul>
Goulet, Lapointe <i>et al.</i> (2007) <sup>(16)</sup>					
Goulet <i>et al.</i> (2007) <sup>(17)</sup>					
Lapointe <i>et al.</i> (2005) <sup>(18)</sup>					

MD, Mediterranean diet.

**Table 2** Comparison of two educational interventions promoting Mediterranean diet nutrition behaviour among an at-risk Dutch population

Educational intervention					
Articles	Target/sample Population	Duration	Design and tools	Evaluative measures/tests	Outcomes
Siero <i>et al.</i> (2000) <sup>(19)</sup>	Dutch adults with low SES, at least three risk factors for CVD (hypercholesterolaemia plus at least two other CVD risk factors) ( <i>n</i> 236), ages 42–65 years; split between two intervention groups and a control group.	16 weeks (plus follow-up at weeks 16 and 52).	Intervention group 1: three sessions on the positive health effects of the MD. Intervention group 2: three sessions on the positive health effects of the MD plus individual stage-matched tailored letters based on Prochaska's Trans theoretical Model of behaviour change and promoting MD consumption. Control group: Mailed printed leaflet with the Dutch nutritional guidelines and usual care by general practitioner.	At baseline, biochemical and clinical assessment.  At weeks 0 and 16 (intervention groups 1 and 2 and control group), FFQ focusing on Mediterranean type foods.	At week 16, significant changes in intervention groups compared to control group: – For fish consumption, both strategies resulted in more positive attitudes, social norms, stronger intentions and 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.
Beelmans <i>et al.</i> (2000) <sup>(20)</sup>				At week 52, FFQ plus measures of serum total cholesterol and BMI.	At week 52: – Intake of fish, fruit, poultry and bread increased in intervention group more than in the control group. – Within intervention group, intake of fish (+100%), poultry (+28%) and bread (+6%) increased significantly ( $P < 0.05$ ). – Within intervention group, total and saturated fat intake decreased more than in the control group (net differences were 1.8 en% (95% CI 0.2, 3.4) and 1.1 en% (95% CI 0.4, 1.9), respectively). – The intervention group did not have significantly lower serum cholesterol level more (–3%) than the control group (–2%) (net difference 0.06 mmol/l, 95% CI –0.10, 0.22). – Initially, in intervention group, BMI decreased more, but after 1 year the intervention and control groups gained weight equally (+1%).

SES, socio-economic status; MD, Mediterranean diet.

**Table 3** The Mediterranean Eating internet-based educational intervention with healthy Scottish females

Articles	Target/sample population	Duration	Educational intervention		Outcomes
			Design and tools	Evaluative measures/tests	
Papadaki & Scott (2006) <sup>(21)</sup>	Healthy Scottish female adults (n 72), ages 25–55 years; randomised to either an intervention (n 53) or control (n 19) group.	6 months	Intervention group provided with internet-based MD nutrition education and dietary and psychosocial feedback over a 6-month period through a new <i>Mediterranean Eating</i> website. Control group received minimal dietary feedback and only general healthy-eating brochures.	At baseline and month 6, 7 d estimated food diaries. Assessment of website user satisfaction through website visit counts, questionnaire, and focus group interviews.	At 6 months: – Intervention group had significantly increased their intake of vegetables, fruits and legumes, as well as the MUFA:SFA ratio in their diet, and had significantly increased plasma HDL-cholesterol levels and a reduced ratio of total:HDL-cholesterol. – Control group increased their intake of legumes. – Website login frequency decreased over the 6-month study. – Most sections of the website were viewed as being very helpful. – Majority of participants perceived the overall website to be extremely interesting, informative, novel, trustworthy, easy to understand, useful, user-friendly, attractive and encouraging. – The recipes section was the most visited. – Lack of time was the main barrier to using the website on a weekly basis.
Papadaki & Scott (2005) <sup>(22)</sup>					

MD, Mediterranean diet; MUFA:SFA, monounsaturated/saturated fatty acid ratio.

this analysis can be seen in Tables 1–4. A brief summary of each study is given below.

**Results**

**Study 1**

A group of Canadian healthy female adults participated in a 12-week programme promoting the Mediterranean food pattern<sup>(15–18)</sup>. The programme comprised two group sessions and seven individual sessions with a dietitian (three counselling sessions plus four 24 h recalls). During the first group session, a dietitian explained the major principles and health benefits of following a MD. Four weeks after the beginning of the intervention, subjects participated in a Mediterranean cooking lesson during which they had to produce a complete meal. Individual sessions took place during weeks 1, 6 and 12 to evaluate dietary changes and to select further objectives to increase adherence to the MD. During individual sessions, the dietitian used the FFQ and the Mediterranean food pyramid to promote dietary changes compatible with the participant’s food preferences. Unannounced qualitative 24 h recalls were performed by a dietitian over the telephone at weeks 2, 4, 8 and 10. The objective was to reinforce the key principles of the MD and provide participants with additional support.

Evaluation using FFQ took place at intervals during the programme and 12 weeks after the end of the programme (week 24). Adherence to the programme, also as evidenced by a MD score, led to a small but significant decrease in weight and waist circumference, a reduction in dietary energy density, and was associated with a decrease in circulating oxidised LDL. Adopting a MD pattern of food intake was not associated with increased daily dietary or energy economic cost. Women without children or who used available food discounts to plan their food shopping showed a better dietary response to the MD advice given.

**Study 2**

A study with Dutch adults from a socio-economically deprived area, and who had hypercholesterolaemia and at least another two risk factors for CVD, compared the use of two types of MD education interventions (intervention group 1 – group education; intervention group 2 – group education plus individual tailored letter) with a ‘care as usual’ (control) group<sup>(19,20)</sup>. Both intervention groups participated in three 2 h interactive group sessions, in which they were briefed on CVD risk factors and on the basic components of the healthy MD; a positive attitude to the MD was encouraged and they were given practical tips on how to adopt a MD food pattern. Booklets with core information from the course were also distributed (or mailed to non-attendees) at the end of each session. A container of diet margarine was also distributed. Members of intervention group 2 also received a Prochaska-based individualised letter in-between group

**Table 4** The Mediterranean Lifestyle Program with American postmenopausal women with type 2 diabetes

Articles	Educational intervention			Outcomes
	Target/sample Population	Duration	Design and tools	
Toobert <i>et al.</i> (2003) <sup>(23)</sup>	US postmenopausal women with type 2 diabetes ( <i>n</i> 279), ages <75 years; randomised to either MLP (Treatment, <i>n</i> 163) or UC (Control, <i>n</i> 116) groups.	6 months	Treatment group – MLP participants – took part in an initial 3 d retreat, followed by 6 months of weekly meetings, to learn and practise MLP components. Control group – UC participants – was given normal care by general practitioners.	At month 6: – The MANCOVA for HbA <sub>1c</sub> and serum lipids revealed significant differences in favour of the MLP participants [Wilks' $\lambda = 0.94$ , $F(5,224) = 2.77$ ; $P = 0.019$ ]. – There were no statistically significant differences between the MLP and UC groups on total cholesterol, triglycerides, and LDL and HDL cholesterol, but differences favoured the MLP condition. – The MANCOVA for the plasma fatty acid profile neared statistical significance ( $P = 0.059$ ) in favour of the MLP participants. – The overall MANCOVA for body composition was significant [Wilks' $\lambda = 0.96$ , $F(2,229) = 4.20$ ; $P = 0.015$ ]. – There was a significant decrease in BMI in favour of the MLP group (drop of 0.37 in BMI). – There was a significant decrease in weight in favour of the MLP group (covariate-adjusted 6-month follow-up). – The MANCOVA across all quality-of-life dimensions revealed overall improvement in favour of the MLP participants. [Wilks' $\lambda = 0.95$ , $F(4,234) = 2.95$ ; $P = 0.021$ ]. – The MLP group improved and the UC group slightly worsened on blood pressure and flexibility, but the overall MANCOVA for these 6-month differences did not achieve statistical significance. – The MLP group had significantly greater improvements than the UC group in all of the five targeted behavioural risk factors: eating patterns, physical activity, social support, stress management, smoking and psychosocial variables (self-efficacy, social support, and problem-solving ability).
Toobert <i>et al.</i> (2002) <sup>(24)</sup>			At baseline and month 6, biomedical assessment (serum lipids, plasma fatty acids and HbA <sub>1c</sub> ), measures of BMI, central obesity (waist-to-hip ratio), blood pressure, flexibility (range of motion and sit-and-reach) and quality of life assessment.	

MLP, Mediterranean Lifestyle Program; UC, Usual Care; MANCOVA, multivariate analysis of covariance.

session two and three. The letter contained additional MD-related information and was tailored to their attitude, self-efficacy, social norm and stage of change. The control group just received a leaflet with the Dutch Nutritional Guidelines and usual care by a general practitioner. The educational aspect of the intervention lasted for 16 weeks.

FFQ that emphasised Mediterranean type foods were administered at baseline and weeks 16 and 52. Biochemical and clinical assessments were conducted at weeks 0 and 52, measuring, amongst others, serum cholesterol, HDL-cholesterol and triglycerides, as well as weight and height. The various results obtained showed that substantial dietary behaviour change can be achieved even by a brief interactive group education intervention on the positive health effects of the MD. Such group education competes in efficacy with individual tailored letters. In fact, there were a number of beneficial changes in dietary habits in the intervention groups compared with the control group, including increased fish, fruit, vegetable and (in the long-term) bread and poultry consumption, and decreases in total fat and saturated fat intake. However, at week 52 the intervention group had not lowered their serum cholesterol levels significantly more than the control group. Moreover, BMI had increased for both intervention and control groups, and total fat and saturated fat intake were still too high.

### Study 3

A study with Scottish healthy females aimed to evaluate the effectiveness of a 6-month internet-based, stepwise, tailored-feedback intervention promoting key components of the MD<sup>(21,22)</sup>. A *Mediterranean Eating* website was developed based on various theories including the Health Belief Model, Social Cognitive Theory and the Theory of Planned Behaviour. Aesthetically the website was given a 'Mediterranean feel' and provided healthy eating, shopping and cooking tips, adjusted to reflect and promote the MD. A new set of approximately twenty Mediterranean recipes was added every fortnight. The recipes were inspired primarily by Greek and other Mediterranean dishes. However, recipes for popular Scottish dishes prepared in a Mediterranean style (e.g. with a greater variety and amount of vegetables) were also included. An intervention and a control group were set up. Participants in the intervention group were given information on secure access to the website, and they were emailed weekly and encouraged to visit the website and the updated sections. Eventually, they also received dietary and psychosocial feedback on their food intake. Control group participants received very little feedback and only healthy-eating brochures.

A process evaluation of the website which took place as the intervention progressed indicated that, overall, the majority of the intervention participants perceived the website to be extremely interesting, informative, useful, trustworthy, easy to understand, novel, attractive, encouraging and user-friendly. The recipes section was

the most visited. Visits to the website decreased over the duration of the intervention, with lack of time being reported by participants as a prime barrier to using the website on a weekly basis.

Comparative analysis of 7 d estimated food intake diaries at baseline and at 6 months revealed that the intervention group had significantly increased their intake of vegetables, fruits and legumes, as well as the MUFA:SFA (mono-unsaturated/saturated fatty acid) ratio in their diet. They also had significantly increased plasma HDL-cholesterol levels and reduced the ratio of total:HDL-cholesterol. The control group also increased their intake of legumes, but saw no other significant beneficial changes compared to baseline. The authors concluded that such an online intervention holds promise in encouraging a greater consumption of plant foods, together with increasing monounsaturated fat and decreasing saturated fat in this type of population.

### Study 4

This study tested the effectiveness of a comprehensive self-management *Mediterranean Lifestyle Program* (MLP) in reducing cardiovascular risk factors in American postmenopausal women with type 2 diabetes<sup>(23,24)</sup>. Subjects were randomised to a treatment (MLP) or control (usual care (UC)) group. All intervention materials and venues were given a 'Mediterranean feel' and the programme comprised education and training in preparing a Mediterranean-type low-saturated fat diet, stress management, physical activity, smoking cessation (where necessary) and group support skills. The intervention lasted for 6 months: it started with a 3 d non-residential retreat, followed by weekly 4 h meetings which consisted of 1 h each of physical activity, stress management, group Mediterranean potluck dinner and support groups. In the programme, a dietitian individualised carbohydrate and fat intake for each participant in order to optimise blood glucose and lipid concentrations, while still being faithful to the dietary patterns of the MLP.

At month 6 – the end of the intervention – compared to baseline, the MLP treatment group had significantly greater improvements compared with the UC control group on serum lipids, HbA<sub>1c</sub>, BMI, weight and quality of life. They also fared significantly better with respect to physical activity, stress management/coping, smoking cessation and psychosocial variables (self-efficacy, social support and problem-solving ability). The authors proposed that, through the MLP, such a target group can make comprehensive lifestyle changes that may lead to clinically significant improvements in glycaemic control, some CHD risk factors and quality of life.

## Discussion

This brief introductory overview of interventions which had a clear MD education component indicates that such education can have a positive impact on food intake and,

consequently, strong potential for reducing health risk factors. The interventions targeted both healthy and at-risk populations and lasted between 12 weeks to 1 year, including follow-up. The MD education component used individual counselling, tailored computer-based counselling, group education, internet-based education, cookery demonstrations and classes, and take-home printed materials. Outcomes studied included adherence to the MD diet and its impact or relation to body weight, waist-to-hip ratio and lipid profiles. Outcomes were measured using food diaries and FFQ, often using MD scores to assess adherence to the diet, questionnaires on psychosocial factors and on usage of the educational tools, as well as anthropometrics and biomarkers. Interventions showed statistically significant increases in intake of vegetables, legumes, nuts, fruit, whole grains, seeds, olive oil and dietary PUFA and MUFA, and statistically significant decreases in total cholesterol, ox-LDL-cholesterol, total:HDL-cholesterol ratio, insulin resistance, BMI, body weight and waist circumference.

In two of the studies, it was also proposed that using MD nutrition education may be a relatively cost-effective strategy for improving health and reducing health-risk factors. Similarly, in a recent study in Australia, which evaluated the economic performance of ten nutrition interventions, MD intervention emerged among the most cost-effective, where economic performance was expressed as cost per QALY (quality adjusted life year) gained<sup>(25)</sup>. The authors concluded that such nutrition interventions can constitute a highly efficient component of a strategy to reduce the growing disease burden linked to over- or under-nutrition.

This brief overview also reinforces the proposition made earlier that there seems to be a gap in the literature with respect to implementation and evaluation of MD education interventions. The four studies reported all took place outside the Mediterranean region. Little seems to be known internationally on how Mediterranean nations themselves are promoting the MD in their public health campaigns. It is likely that many interventions are carried out, but are not reported beyond the countries' borders. For example, in the early 2000s, the then Maltese Health Promotion Department published a leaflet on the value of the MD which it often used as a basis for presentations in different community settings and which was disseminated widely through health fairs, in schools and from its outreach offices. The Department also launched a Cancer Prevention recipe book that included recipes following the MD approach<sup>(26)</sup>. In addition, traditional Maltese healthy foods are regularly promoted during Home Economics lessons in Maltese schools. Interestingly, a study with Cretan primary school children concluded that attempts to introduce the principles of the MD to children through nutrition education requires innovative, enthusiastic and highly motivated teachers<sup>(27)</sup>.

Undoubtedly, one can adopt various channels and media for using the MD as a nutrition education and

health promotion tool. The four studies reported earlier used a variety of media and, even when there was little face-to-face interaction, personalisation made a difference. Essentially, messages are more effective if they are based on theory, targeted, made easily accessible and their applicability is clear for the intended audience. Even food labelling may be a vehicle for promoting the MD. Recently, the US-based Oldways group launched the *Mediterranean Mark* for food packaging as a 'gold standard for healthy eating' and to help consumers identify 'Med Diet food'<sup>(28)</sup>. Such labelling could serve as a valuable point-of-purchase educational tool complementary to other MD education strategies.

## Conclusion

MD education interventions may help protect against and treat a variety of health problems in different populations. More extensive research is required to review interventions which have used MD education and strategies which were effective in bringing about positive health behaviour change. Mediterranean countries themselves need to publicise the outcomes of their campaigns in international fora and scientific publications. In the meantime, the results of this introductory review could help inform the choice and design of future MD nutrition education for specific target populations.

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