

# General practitioners can offer effective nutrition care to patients with lifestyle-related chronic disease

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## ABSTRACT

**INTRODUCTION:** Nutrition is a key priority for the management of lifestyle-related chronic disease, and the demand on general practitioners (GPs) to provide nutrition care is increasing.

**AIM:** The aim of this systematic review was to investigate the effectiveness of nutrition care provided by GPs in improving the nutrition-related behaviour and subsequent health outcomes of individuals with lifestyle-related chronic disease.

**METHODS:** A systematic literature review was conducted using the Cochrane Library, MEDLINE and ISI Web of Knowledge databases. Randomised controlled trials that investigated a nutrition care intervention feasible within general practice consultations, and that utilised outcome measures relevant to nutrition-related behaviour or indicators of health, were included in the review.

**RESULTS:** Of the 131 articles screened for inclusion, nine studies, totalling 9564 participants, were included in the review. Five interventions observed improvements in the nutrition behaviour of participants, such as a reduction of energy consumption, reduction of meat consumption, increase in fruit and vegetable intake, increase in fish intake and increase in fibre intake. Seven interventions observed improvements in risk factors, including in weight, serum lipid levels and blood pressure. Some inconsistencies in findings were observed in the reviewed studies.

**DISCUSSION:** This systematic review demonstrates that GPs have the potential to provide nutrition care that improves the nutrition behaviour and risk factors in individuals with lifestyle-related chronic disease. However, the consistency and clinical significance of the intervention outcomes are unclear. Further investigation regarding the development of nutrition care protocols and the attributes of nutrition care that result in improved outcomes are required.

**KEYWORDS:** Chronic disease; general practice; general practitioners; nutritional management

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## Introduction

Lifestyle-related chronic diseases, such as overweight and obesity, Type 2 diabetes and cardiovascular disease, account for over 60% of deaths worldwide.<sup>1</sup> As a result, the prevention and management of these conditions are a key focus of primary health care systems.<sup>2</sup> General practitioners (GPs) are extensively involved in the health care of individuals with lifestyle-related

chronic disease,<sup>3</sup> and over one-third of consultations involve this care.<sup>4</sup>

The importance of optimal nutrition for the prevention and management of lifestyle-related chronic disease is well documented.<sup>5,6</sup> Additionally, nearly two-thirds of the risk factors for overweight and obesity, Type 2 diabetes and cardiovascular disease relate to

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poor nutrition behaviour.<sup>7</sup> Improvements in the nutrition behaviour of individuals, such as reducing saturated fat and sodium intake, have been shown to reduce risk factors associated with lifestyle-related chronic disease, such as hyperlipidaemia and hypertension.<sup>6</sup> In order to assist individuals to improve their nutrition behaviour, GPs may provide nutrition care within a consultation.<sup>8,9</sup> Nutrition care is a core principle of best practice guidelines for the management of chronic disease, and includes practices such as the assessment of a patient's nutrition intake, the provision of nutrition-related advice, and the evaluation of nutrition behaviour on patients' health outcomes.<sup>10,11</sup> As a result of increasing presentation rates of lifestyle-related chronic disease in general practice,<sup>4</sup> the demand on GPs to provide nutrition care is growing.

GPs hold diverse perceptions regarding the level of complexity involved in providing nutrition care,<sup>8</sup> as well as their role in providing nutrition care.<sup>12,13</sup> However, patients perceive nutrition care to be an important part of the care provided by GPs for lifestyle-related chronic disease management.<sup>14</sup> Furthermore, many patients prefer to receive nutrition care from GPs, despite having access to nutrition-specific health care professionals such as dietitians.<sup>14</sup> 'Effective' health care is perceived by GPs to incorporate appropriate investigation, diagnosis and management of conditions in order to assist patients to improve their health status.<sup>15</sup> Therefore, it is important that the nutrition care provided by GPs is effective at improving the nutrition behaviour and subsequent risk factors in patients with lifestyle-related chronic disease. Some health professionals hold anecdotal perceptions that GPs are ineffective at improving the nutrition behaviour and associated risk factors in patients.<sup>12</sup> Therefore, the following paper is a systematic review of published literature that investigates the effectiveness of nutrition care provided by GPs in improving the nutrition behaviour and subsequent risk factors in individuals with lifestyle-related chronic disease.

## Methods

All applicable items from the PRISMA guidelines for reporting of systematic reviews were included.<sup>16</sup>

## Search strategy

A literature search was conducted using the Cochrane Library, MEDLINE and ISI Web of Knowledge databases. The following search terms and Medical Subject Headings (MeSH) were used to identify all relevant peer-reviewed publications:

- **For nutrition care:** Nutrition Care OR Nutrition Advice OR Nutrition Therapy (MeSH) OR Diet (MeSH) OR Diet Therapy (MeSH) OR Food Habits (MeSH) OR Health Education (MeSH).
- **For lifestyle-related chronic disease:** Chronic Disease OR Overweight OR Obesity OR Weight Loss OR Hypertension (MeSH) OR Type 2 Diabetes Mellitus (MeSH) OR Hypercholesterolemia OR Hyperlipidemia OR Cardiovascular Disease.
- **For general practitioner:** General Practitioners (MeSH) OR Family Physicians (MeSH) OR Primary Care Physicians (MeSH) OR Family Doctor OR Family Practice OR General Practice.

All randomised controlled trials (RCTs) published in English with at least one search term from each category were included for consideration. No limitation was applied regarding the year of publication. Cross-matching reference lists and forward citation searching was conducted in order to identify additional studies for consideration.

## Study selection

Studies that investigated the effectiveness of nutrition care provided by GPs by measuring patients' nutrition behaviour and/or changes to risk factors for lifestyle-related chronic disease were included in the review. The inclusion criteria were studies of adult populations (>18 years of age). Specific eligibility criteria were also developed in relation to the intervention:

1. The nutrition care must have been provided by a GP or international equivalent, such as a family physician or primary care physician. Studies investigating the effectiveness of other primary care health professionals, such as practice nurses, nutritionists and/or dietitians were not included.
2. The effectiveness of the intervention must have been investigated using a control group,

such as a 'no care' group, or a 'usual care' group. Studies comparing the effectiveness of nutrition care between different health professionals were not included.

3. The nutrition care must have occurred in general practice consultations. Interventions investigating other aspects of the general practice setting, such as self-help resources or computer technologies in the absence of GP-facilitated nutrition care, were not included.
4. The intervention must have included identical baseline and follow-up measurements of either nutrition-related behaviour or biological indicators of health. Interventions that did not assess changes to these measurements over time were not included.

The article selection process is illustrated in Figure 1.

### Data extraction

Articles for inclusion were selected independently by two researchers (LB and CJ) using the same search strategy. Relevant articles were identified independently, and differences in selections were discussed prior to reaching final consensus. A third party was not required in the process of study selection. For each study the sample description, intervention protocol, outcome variables and results were extracted by careful review of each manuscript into a spreadsheet for comparison, and they are summarised in Table 1.

### Outcomes assessed

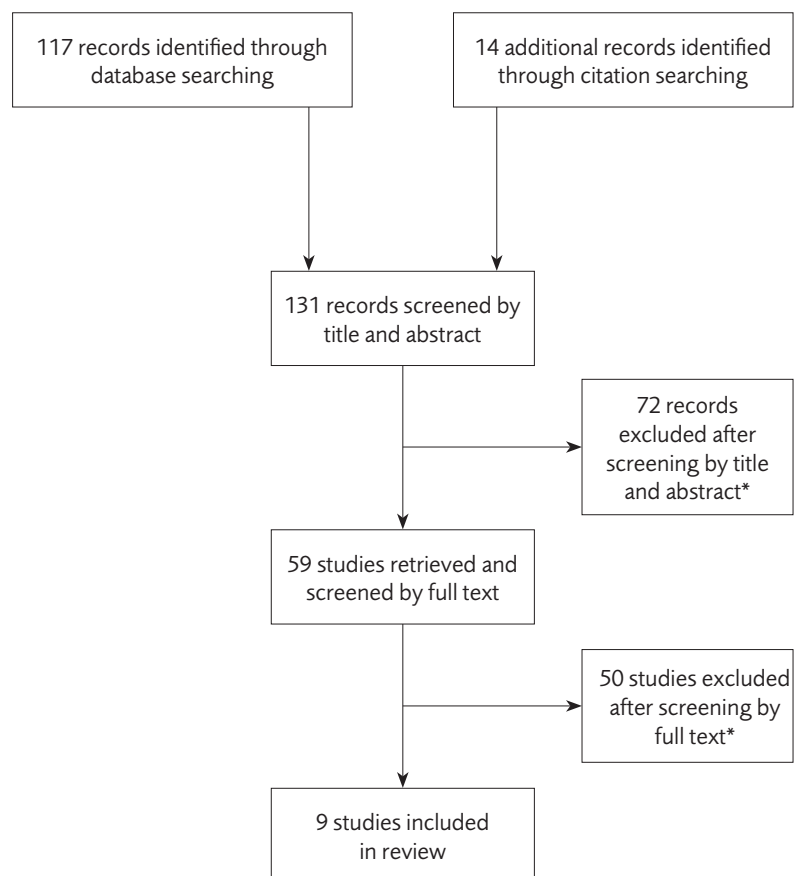
Relevant study outcomes to the review were those that reflected patients' nutrition behaviour, and those reflecting patients' modifiable risk factors for lifestyle-related chronic disease. Many studies that were reviewed also included outcome measures that reflected other lifestyle behaviours, such as smoking and physical activity. These studies were only included in the review if they also measured patients' nutrition behaviour or risk factors for lifestyle-related chronic disease. Nutrition behaviour outcomes included overall dietary intake, energy consumption, and macro-nutrient intake. Risk factors included body weight, Body Mass Index (BMI), waist circumference, blood pressure, and serum lipid levels.

## WHAT GAP THIS FILLS

**What we already know:** The demand on general practitioners (GPs) to provide nutrition care to patients with lifestyle-related chronic disease is increasing. However, it is unclear whether GPs are effective at improving the nutrition behaviour and associated risk factors in these patients.

**What this study adds:** This systematic review demonstrates that GPs have the potential to provide nutrition care that improves the nutrition behaviour and risk factors in individuals with lifestyle-related chronic disease. However, the consistency and clinical significance of the intervention outcomes are unclear. Further support is needed for GPs to provide nutrition care to patients.

Figure 1. Study eligibility flow chart



\* **Exclusion criteria:**

- Did not address the main objective of the study (n=72)
- Provision of nutrition care was by non-GP (n=28)
- Was not an RCT (n=11)
- Study population not adults (n=9)

Table 1. Studies selected for inclusion in review.

Study details	Sample	Intervention protocol	Outcome measures	Follow-up period	Summary of findings
1. Christian et al., <sup>19</sup> USA (2008)	Overweight (BMI >25 kg/m <sup>2</sup> ), men and women with Type 2 diabetes.	<b>A:</b> Intervention group, n=155. Patients identified goals for nutrition and physical activity using a tailored computer programme. Progress towards goals was reviewed every 3 months by PCP. <b>B:</b> Control group, n=155. Patients were provided with a pack of health education materials, including nutrition information. Patients were reviewed every 3 months by PCP but no prompts for nutrition advice provided.	<i>Nutrition behaviour measures:</i> Energy intake.* <i>Risk factor measures:</i> Weight, BMI, waist circumference, HbA1c, serum lipids, blood pressure.	12 months	32% of participants in the intervention group lost 6 or more pounds at the completion of follow-up, compared with 18.9% of controls (odds ratio, 2.2; <i>p</i> =0.006). No other differences in outcome measures were observed between groups.
2. Martin et al., <sup>20</sup> USA (2008)	Overweight (BMI >25 kg/m <sup>2</sup> ), low-income women	<b>A:</b> Intervention group, n=68. Patients received 6 x 15 min physician-counselled consultations on the topic of weight loss. Each visit was one month apart, and patients received oral and written information. <b>B:</b> Control group, n=69. Patients received no directed advice for weight loss and were seen as needed for regular medical care.	<i>Nutrition behaviour measures:</i> Usual dietary intake.† <i>Risk factor measures:</i> Weight.	18 months	Participants in the intervention group lost more weight than participants in the control group (-1.52 kg vs +0.61; <i>p</i> =0.01) at 9 months post intervention, but not at 12 months or 18 months. No other differences in outcome measures were observed between groups.
3. Sacerdote et al., <sup>21</sup> Italy (2006)	Men and women seeking health care from their GP.	<b>A:</b> Intervention group, n=1592. Patients received 1 x 15 min GP-administered nutrition care session based on Italian Guidelines for Correct Nutrition 1998. <b>B:</b> Control group, n=1587. Patients received 1 x 15 min GP-administered 'sham' nutrition care session without use of brochure or provision of personalised advice.	<i>Nutrition behaviour measures:</i> Usual dietary intake.† 'Healthy Diet score'.‡ <i>Risk factor measures:</i> Weight, blood pressure.	12 months	Participants in the intervention group reduced their BMI (-0.41 kg/m <sup>2</sup> ; <i>p</i> =0.02), reduced their intake of meat and increased their intake of fruit and vegetables, fish products and olive oil ( <i>p</i> <0.001). No other differences in outcome measures were observed between groups.
4. van der Veen et al., <sup>22</sup> Netherlands (2002)	Men and women with lifestyle-related chronic disease (hyperlipidaemia, hypertension or Type 2 diabetes)	<b>A:</b> Intervention group, n=71. GPs assessed each patient's SOC re: improving nutrition behaviour and then provided SOC-matched counselling. GPs provided from 1 to 3 consultations, each 2 weeks apart. Note: depending on the SOC, this sometimes included referral to a dietitian. <b>B:</b> Control group, n=72. Patients received 'usual care' from their GP.	<i>Nutrition behaviour measures:</i> Usual dietary intake.† <i>Risk factor measures:</i> Height, weight, waist and hip circumference, serum lipid levels.	12 months	Participants in the intervention group reduced their saturated fat intake more than participants in the control group (-5.7% vs -2.6%; <i>p</i> =0.001). Participants in the intervention group consumed less energy (0.8 mJ), lost weight (-0.7 kg), and reduced their BMI (-0.3 kg/m <sup>2</sup> ) at 6 months post intervention, but not at 12 months. No other differences in outcome measures were observed between groups.

Table 1 cont.

Study details	Sample	Intervention protocol	Outcome measures	Follow-up period	Summary of findings
<b>5. Ockene et al.,<sup>23</sup> USA (1999)</b>	Men and women with hyperlipidaemia (upper 25th percentile of population)	<p><b>A:</b> Physician training group, n=333. GPs participated in nutrition counselling training and then provided patients with one nutrition counselling consultation.</p> <p><b>B:</b> Physician training + office-support group, n=315. GPs participated in nutrition counselling training and also utilised office-based support (mainly information pamphlets and patient blood test results) to assist in providing patients with one nutrition counselling consultation.</p> <p><b>C:</b> Control group, n=279. Patients received 'usual care' from their GP.</p>	<p><i>Nutrition behaviour measures:</i></p> <p>Usual dietary intake.<sup>†</sup></p> <p><i>Risk factor measures:</i></p> <p>Height, weight, blood pressure, serum lipid levels.</p>	12 months	Participants in the physician training + office-support group reduced their saturated fat intake (-10.3%; $p=0.01$ ) and lost weight (-2.3 kg; $p<0.001$ ). The average consultation times for the two intervention groups were 5.5 mins more than the control group. No other differences in outcome measures were observed between groups.
<b>6. Beresford et al.,<sup>24</sup> USA (1997)</b>	Men and women seeking health care from their GP	<p><b>A:</b> Intervention group, n=859. During one consultation, GPs provided patients with a booklet on healthy eating (based on social learning theory and national dietary guidelines) and verbally encouraged patients to improve their dietary behaviour.</p> <p><b>B:</b> Control group, n=959. Patients received 'usual care' from their GP.</p>	<p><i>Nutrition behaviour measures:</i></p> <p>Total and relative intake of fat and fibre.<sup>§</sup></p> <p><i>Risk factor measures:</i></p> <p>Weight, height, BMI, serum lipid levels.</p>	12 months	Participants in the intervention group reduced their fat intake more than participants in the control group (-1.52% energy from fat vs -0.48% energy from fat, $p<0.01$ ). Participants in the intervention group increased their fibre intake more than participants in the control group (0.5 g/1000 kcal vs 0.36 g/1000 kcal, $p<0.05$ ).  No other differences in outcome measures were observed between groups.
<b>7. Salkeld et al.,<sup>25</sup> Australia (1997)</b>	Men and women with lifestyle-related chronic disease (hyperlipidaemia, hypertension or overweight (BMI >30 kg/m <sup>2</sup> ).	<p><b>A:</b> Video intervention group, n=269. GPs were trained in a CVD risk reduction programme and provided a video to each patient in one consultation.</p> <p><b>B:</b> Video and self-help intervention group, n=231. GPs were trained in a CVD risk reduction programme and provided a video and self-help resources to each patient in one consultation.</p> <p><b>C:</b> Control group, n=255. GPs assessed each patient's CVD risk factors and provided them with feedback on their results in conjunction with usual care.</p>	<p><i>Nutrition behaviour measures:</i></p> <p>Dietary fat intake.<sup>  </sup></p> <p><i>Risk factor measures:</i></p> <p>Weight, BMI, blood pressure, serum lipid levels.</p>	12 months	Participants in all groups reduced their serum cholesterol levels. Males in the video plus self-help group significantly reduced their diastolic blood pressure (-4.0 mm Hg; $p=0.0002$ ), and females in the control group significantly reduced their diastolic blood pressure (-4.0 mm Hg; $p=0.001$ ). No other differences in outcome measures were observed between groups.

Table 1 cont.

Study details	Sample	Intervention protocol	Outcome measures	Follow-up period	Summary of findings
<b>8. Alli et al.,<sup>26</sup> Italy (1992)</b>	Men and women with hypertension taking antihypertensive medication.	<b>A:</b> Intervention group, n=40. GPs provided 'simple' dietary advice to patients 6 times over a 12-month period, using a leaflet on low sodium nutrition. <b>B:</b> Control group, n=37. Patients received 'usual care' from their GP.	<i>Nutrition behaviour measures:</i> Nil. <i>Risk factor measures:</i> Weight, height, blood pressure.	12 months	No differences in outcome measures were observed between groups.  Many participants openly stated that they were non-compliant with the dietary advice provided by the GP.
<b>9. Logsdon et al.,<sup>18</sup> USA (1989)</b>	Men and women seeking health care from their GP.	<b>A:</b> Intervention group, n=1409. GPs provided one 15-minute consultation promoting healthy behaviours, including nutrition, in line with preventive guidelines. <b>B:</b> Control group, n=809. Patients received 'usual care' from their GP.	<i>Nutrition behaviour measures:</i> Usual dietary intake, <sup>†</sup> alcohol intake. <i>Risk factor measures:</i> Weight.	12 months	Participants in the intervention group were more likely to lose weight (>5 lb, $p<0.05$ ) and reduce behaviours of heavy drinking ( $p<0.01$ ) than participants in the control group. No other differences in outcome measures were observed between groups.

\* Energy Intake was assessed using a validated food frequency questionnaire.

† No measurement description of 'usual dietary intake' was provided in these studies.

‡ 'Healthy Diet Score' was calculated by the authors based on the 1998 Italian Guidelines for Correct Nutrition.

§ Total and relative intakes of fat and fibre were assessed using a validated food frequency questionnaire.

|| Dietary fat intake was assessed using an adapted food questionnaire.

BMI = Body Mass Index, CVD = cardiovascular disease, GP = general practitioner, lb = pounds, mins = minutes, PCP = primary care physician, SOC = stage of change

Outcomes were assessed through differences in mean from 0 to 18 months after each intervention. Additional outcomes measured within this timeframe were also included, such as six-month and nine-month outcomes.

### Quality assessment

The methodological quality of each study was assessed by two independent researchers (LB and CJ) using the American Dietetic Association Quality Criteria Checklist (QCC).<sup>17</sup> The QCC is a tool commonly used to assess studies in the field of nutrition. The checklist includes 10 criteria that assess the applicability to practice and scientific validity of each study. Through this tool, the quality attributes of each study were classified as positive, neutral or negative.

### Results

Of the 131 articles originally screened, nine intervention studies were chosen for the

review.<sup>18-26</sup> The reasons for excluding 122 articles fell within four criteria, as shown in Figure 1. Of these articles, 72 were immediately excluded because they did not investigate the effectiveness of nutrition care provided by GPs. Of the studies that did investigate the effectiveness of nutrition care, the interventions were often conducted by a research assistant, practice nurse or other health professional (n=28).<sup>27-30</sup> These studies were excluded because they did not investigate the effectiveness of nutrition care provided by GPs. Additionally, a number of studies were excluded because they were not deemed to be randomised controlled trials (n=11).<sup>31</sup> For example, one study compared the effectiveness of nutrition care provided by GPs to the nutrition care provided by dietitians and did not incorporate a control group.<sup>32</sup>

The nine interventions included in the review consisted of 9564 participants, 5533 participating in an intervention, and 4031 acting as controls. The studies were published between 1989<sup>18</sup> and

2008,<sup>19</sup> and four date from after 2000.<sup>19–22</sup> Five of the studies were conducted in the USA,<sup>18–20,23,24</sup> three were conducted in Europe,<sup>21,22,26</sup> and one was conducted in Australia.<sup>25</sup> The number of participants included in each study ranged from 77<sup>26</sup> to 3179.<sup>21</sup> The interventions incorporated between one and six consultations with a GP, where the GP provided basic nutrition care to the participant. Three of the studies included nutrition-related training for the GPs prior to the intervention,<sup>18,23,25</sup> and two of the studies utilised the national dietary guidelines as supporting material for the nutrition care.<sup>21,24</sup>

Each study's sample description, intervention protocol, outcome variables and results are presented in Table 1. Eight studies incorporated at least one nutrition behaviour outcome, typically in the form of usual dietary intake.<sup>18–25</sup> All nine studies incorporated at least one risk factor outcome, such as weight, waist circumference, serum lipid levels or blood pressure.<sup>18,19,21–26</sup> Eight interventions utilised a follow-up period of 12 months,<sup>18,19,21–26</sup> and one intervention utilised a follow-up period of 18 months.<sup>20</sup>

Five interventions observed improvements in the nutrition behaviour of participants, such as a reduction of energy consumption of 0.7 MJ/day,<sup>22</sup> a reduction in excessive alcohol consumption of 36%,<sup>18</sup> a reduction of meat consumption to three serves or less per week,<sup>21</sup> and a reduction of fat intake of 5–10%.<sup>22–24</sup> The interventions also observed an increase in fruit and vegetable intake by two serves per week,<sup>21</sup> an increase in fish intake to at least one serve per week,<sup>21</sup> and an increase in fibre intake of 0.55 g/1000 kcal.<sup>24</sup> The five interventions that were conducted most recently observed significant reductions in participants' body weight of 0.4–2.3 kg, or 0.2–0.81 kg/m<sup>2</sup>.<sup>19–23</sup> Reductions in serum cholesterol levels of 0.46–0.83 mmol/L, and reductions in diastolic blood pressure of 4.0 mm Hg were also observed.<sup>25</sup>

The quality attributes of each study are displayed in Table 2. Two of the studies received a 'positive' quality assessment rating,<sup>19,24</sup> and seven received a 'neutral' quality assessment rating.<sup>18,20–23,25,26</sup> Both of the studies that received a 'positive' quality assessment rating incorporated nutrition behaviour

measures and risk factor measures.<sup>19,24</sup> However, only one of these studies observed an improvement in the nutrition behaviour of participants (specifically, reduced fat and increased fibre intake),<sup>24</sup> and one observed an improvement in participants' body weight.<sup>19</sup> Due to the nature of the interventions, some of the quality assessment criteria were not feasible to meet, such as the use of blinding by the GPs. Furthermore, a neutral rating was allocated to many of the assessment criteria due to lack of information in the articles, rather than poor intervention design. Common information missing from articles included the method for allocating participants to groups, the reasons for participant withdrawal, and if 'intention-to-treat' statistical analysis was implemented.

## Discussion

### Summary of main findings

This systematic review investigated the effectiveness of nutrition care provided by GPs in improving the nutrition behaviour and subsequent risk factors in individuals with lifestyle-related chronic disease. The interventions suggest that GPs may be effective at providing nutrition care to individuals with lifestyle-related chronic disease. Interestingly, the studies that observed improvements in participants' nutrition behaviour were not necessarily the same studies that observed improvements in participants' risk factors. For example, Beresford et al.<sup>24</sup> observed improvements in participants' energy, fat and fibre intake, but not any improvements in risk factors such as weight or serum lipid levels. Conversely, Martin et al.<sup>20</sup> observed improvements in participants' body weight, but not any measures of nutrition behaviour. It is possible that the different findings were due to differences in the outcomes measured. For example, five of the studies measured 'usual dietary intake' but did not specify which nutrients were analysed to assess the effectiveness of the intervention.<sup>18,20–23</sup> Furthermore, three of the interventions only measured one component of dietary intake (e.g. energy intake), and therefore reduced the likelihood of observing improvements in nutrition behaviour.<sup>19,24,25</sup>

Of the three interventions that provided nutrition-related training to GPs, one observed

Table 2. Quality assessment attributes for each study assessed using the Quality Criteria Checklist (QCC).<sup>17</sup>

Study	Criteria scores										Overall quality rating*
	1. Clear research question	2. Participant selection free from bias	3. Comparable study groups	4. Participant withdrawals described	5. Use of blinding	6. Description of intervention protocol	7. Outcomes clearly defined	8. Appropriate statistical analysis	9. Conclusions supported by results	10. Unlikely funding bias	
1. Christian et al. <sup>19</sup>	+	+	+	+	∅	+	+	+	+	+	+
2. Martin et al. <sup>20</sup>	+	+	∅	+	∅	∅	+	+	+	+	∅
3. Sacerdote et al. <sup>21</sup>	+	∅	+	+	∅	∅	+	+	+	+	∅
4. van der Veen et al. <sup>22</sup>	+	∅	+	+	∅	+	+	∅	∅	+	∅
5. Ockene et al. <sup>23</sup>	+	+	∅	-	∅	+	+	∅	+	+	∅
6. Beresford et al. <sup>24</sup>	+	+	+	+	+	+	+	∅	+	+	+
7. Salkeld et al. <sup>25</sup>	+	+	∅	∅	∅	-	∅	∅	+	+	∅
8. Alli et al. <sup>26</sup>	+	∅	∅	+	∅	∅	+	∅	+	+	∅
9. Logsdon et al. <sup>18</sup>	+	+	+	-	∅	-	∅	+	+	+	∅

\* + Positive overall score: This overall score is given if criteria 2, 3, 6, 7 of the QCC and one additional criterion have received a positive score.

∅ Neutral overall score: This score is given if more criteria are met than for a negative overall score but an overall positive score is not reached.

- Negative overall score: This score is given if 6 or more QCC criteria are not met.

significant improvements in participants' dietary fat intake and body weight,<sup>23</sup> another observed improvements in participants' serum lipid levels and blood pressure<sup>25</sup> and one observed improvements in participants' alcohol behaviour and body weight.<sup>18</sup> Interestingly, two of the studies incorporated four identical outcome measures into the interventions (dietary fat intake, body weight, blood pressure and serum lipid levels), but observed contradictory outcomes. Therefore, the impact of nutrition-related training on the effectiveness of the nutrition care provided may differ under various circumstances. The inconsistencies observed in the reviewed studies indicate that the positive impact of nutrition-related training for GPs requires further investigation.

No association was apparent between the magnitude of outcomes and the number of consultations that were incorporated into the interventions. For example, of the six interventions that observed significant reductions in participants' body weight, three interventions incorporated one consultation each,<sup>18,21,23</sup> two interventions incorporated between three and four consultations each,<sup>19,22</sup> and one intervention incorporated six consultations.<sup>20</sup> Therefore, it would appear that the number of consultations is not a determining factor for the effectiveness of nutrition care provided by GPs. This suggests that effective nutrition care can be provided in relatively few consultations, and may not have a significant influence on GPs' workload.



### Comparison with existing literature

Typically, weight loss interventions that involve lifestyle modification observe significant improvements in outcomes measured six months after the intervention and then trend back towards baseline 12 months after the intervention.<sup>33</sup> As a result, the overall effectiveness of the reviewed studies may be underestimated because the final follow-up measures in each study were taken at least 12 months after the intervention commenced. Previous literature indicates that short-term improvements in risk factors persist to improvements in long-term disease risk reduction and are therefore important.<sup>34,35</sup> Interestingly, two studies in the current review observed similar trends, with participants losing a significant amount of weight at six months<sup>22</sup> and nine months<sup>20</sup> after the intervention, but regressing back towards baseline body weight at 12 months and 18 months after the intervention.

Despite observing significant improvements in patients' nutrition behaviour and risk factors, the current review does not compare the magnitude of effect of GP-facilitated nutrition care with other health professionals or services that provide nutrition care to individuals with lifestyle-related chronic disease. Of note, a 12-month intervention utilising a commercial weight loss programme (Weight Watchers) observed an average weight loss of 5.06 kg for completing participants, which is higher than the observed weight loss reported in the reviewed studies (0.4–2.3 kg).<sup>19–23,36</sup> However, the commercial programme involved a relatively high participant burden, with weekly meetings and 'weigh-ins', and also observed a lower completion rate (61%) than the reviewed studies (64–93%). This finding indicates that high-intensity interventions may result in improved health outcomes, but the overall impact may be reduced due to high attrition rates.<sup>37</sup> The provision of nutrition care by GPs is important because the general practice setting provides exposure to individuals who prefer to receive nutrition care from GPs rather than other health professionals or services.<sup>14</sup>

### Implications for practice

The interventions that were reviewed demonstrate the potential for GPs to provide effective

nutrition care to patients. However, the studies that were reviewed may not reflect the current nutrition care practices of GPs. Each of the interventions included a 'usual care' group that acted as a control, and suggests that the usual practices of GPs do not include nutrition care. It is important that GPs provide nutrition care to patients when appropriate in order to promote healthy nutrition behaviour and improve associated risk factors. Furthermore, each of the intervention studies in the review utilised a protocol for the provision of nutrition care. This suggests that in order to replicate the outcomes of the studies, GPs may require a nutrition care protocol for daily practice, and the development of appropriate protocols consequently requires investigation.

### Strengths and limitations

Many of the outcome measures that improved following the nutrition care interventions are key indicators of chronic disease management, such as weight and dietary intake.<sup>38</sup> However, none of the studies explored the clinical significance of the outcomes. Clinical significance of health outcomes, such as body weight, are usually estimated as losses greater than 5% of initial body weight.<sup>39</sup> For each study that measured body weight, the results were reported in absolute terms rather than as a percentage of initial body weight. Therefore, the clinical significance of the health outcomes is difficult to determine, and requires further investigation.

The quality of the reviewed interventions requires consideration, with two studies receiving positive quality scores, and seven receiving neutral quality scores. Due to the nature of the interventions, some of the quality assessment criteria were not feasible to meet, such as the use of blinding by the GPs. Furthermore, a neutral rating was allocated to many of the assessment criteria due to lack of information in the articles, rather than poor intervention design. Common information missing from articles included the method for allocating participants to groups, the reasons for participant withdrawal, and if 'intention-to-treat' statistical analysis was implemented. In addition, the nutrition behaviour of participants was usually monitored using self-reported data, and it is therefore important to

carefully consider the reliability of this data due to the potential variability in reporting.<sup>40</sup>

An important limitation to the current review is that the eligibility criteria for included studies is restrictive, and does not account for alternative interventions conducted by non-GP health professionals or supplementary services available in the primary health care setting. Typically, primary health care systems allow individuals to select the type of treatment to be received, as well as the type of health care provider.<sup>41</sup> The reviewed interventions do not account for individual preferences regarding their health care,<sup>42,43</sup> and other nutrition care services that are not provided by GPs. Consequently, the factors that promote the use of GPs as a source of nutrition care within the primary health care system warrant exploration.

Finally, this review focuses on the influence of nutrition care on individuals' nutrition behaviour. However, westernised societies have previously been described as 'obesogenic', whereby nutrition behaviour is influenced by the built and food environments.<sup>44</sup> As a result, the ability of GPs to provide nutrition care that assists in reducing lifestyle-related chronic disease at a population level requires further investigation.

## Conclusion

It appears that GPs have the potential to provide nutrition care that improves nutrition behaviour and risk factors in individuals with lifestyle-related chronic disease. However, the consistency and clinical significance of the intervention outcomes are unclear. Further investigation regarding the development of nutrition care protocols, as well as the attributes of nutrition care that result in improved outcomes, is indicated.

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**COMPETING INTERESTS**

None declared.