



ELEMENTS OF EFFECTIVE NUTRITION EDUCATION FOR ADULTS WITH DIABETES MELLITUS IN RESOURCE-POOR SETTINGS: A REVIEW

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ABSTRACT

This review article highlights the key factors that need consideration in planning an effective nutrition education programme for adults with type 2 diabetes mellitus in resource-poor settings.

Type 2 diabetes is increasing to epidemic levels globally. Low socio-economic status is associated with poorer health outcomes and a higher economic burden. Individuals with diabetes cite dietary adherence as the most difficult self-care area. Effective nutrition education achieves the desired goals and outcomes, which include appropriate change in dietary behaviour, improved glycaemic control, plasma lipid levels, blood pressure and body weight, as well as improved potential mediators (knowledge, skills and attitudes). Elements that contribute to a successful nutrition education programme include interventions tailored to the needs, abilities and socio-cultural context of the target group, the active involvement of the patient, a behaviour-focused approach based on appropriate theory, suitable delivery methods and individual/group approaches. Adequate contact time with an educator (> 10 hours), the educator's competence, provision of social support and follow-up intervention are also crucial.

Effectively educating diabetic individuals from resource-poor settings in nutrition is a challenging task. It needs innovative and skilled educators who are sensitive to the unique needs of the target group and who use appropriate approaches to address these needs.

OPSOMMING

Hierdie artikel beklemtoon die sleutelfaktore wat in oorweging geneem moet word wanneer 'n effektiewe voedingsopleidingprogram vir volwassenes met tipe 2-diabetes uit hulpbron-arm agtergronde beplan word.

Tipe 2-diabetes is besig om globaal tot epidemiese vlakke toe te neem. Lae sosio-ekonomiese status word geassosieer met swakker gesondheidsresultate en 'n hoër ekonomiese las. Dieetnakoming word deur persone met diabetes as die moeilikste selfversorgingsgebied uitgewys.

Doeltreffende voedingsopleiding bereik die gewenste doelwitte en resultate wat toepaslike veranderinge in dieetgedrag, verbeterde glisemiese beheer, verbeterde bloeddruk, bloeddruk en liggaams-gewig, en verbeterde potensiele bemiddelaars (kennis, vaardighede en houdings), insluit. Elemente wat tot 'n suksesvolle voedingsopleidingprogram bydra, sluit ingrypings in wat geskoei is op die behoeftes, vaardighede en sosiaal-kulturele konteks van die teikengroep, aktiewe betrekking van die pasiënt, gebruik van 'n benadering wat ingestel is op gedrag en gegrond is op toepaslike teorie, toepaslike metodes van aflewering en individuele/groepbenaderings, geskikte duur en kontaktyd (> 10 uur), een wat vir sosiale ondersteuning en opvolgintervensie sorg, en deur 'n bedrewe verskaffer bemiddel word.

Om diabetiese individue uit hulpbron-arm agtergronde op te lei in voeding is 'n uitdagende taak wat vindingryke en bedrewe opvoeders verg. Hierdie opvoeders moet sensitief wees vir die unieke behoeftes van die teikengroep en toepaslike benaderings volg om genoemde behoeftes aan te spreek.

INTRODUCTION

The prevalence of diabetes is increasing globally to such high levels that it is being referred to as 'an epidemic' (Wang *et al.* 2005:174; Wild *et al.* 2004:1047). Diabetes is a complex disease associated with considerable morbidity, mortality and loss of quality of life (Narayan *et al.* 2000:78). Diabetes places a significant economic burden on health care systems and individuals suffering from the condition (Narayan *et al.* 2000:79; Ramachadran *et al.* 2007:252). Groups with a low socio-economic status tend to bear the brunt of this burden, as they spend a higher proportion of the family's income on diabetes care (Narayan *et al.* 2000:79; Ramachadran *et al.* 2007:255). They have also been noted to be among those with poor long-term diabetic outcomes (Bell *et al.* 2001:128; Chin, Zhang & Merrell 1998:1091; Roper *et al.* 2001:1389) and poor glycaemic control (Levetan, Levitt & Bonnici 1997:368). It is therefore critical that special attention, as well as feasible and effective diabetes management strategies, be directed specifically at populations in resource-poor settings.

Patient education, also referred to as diabetes self-management education (DSME), is a cornerstone of treatment for diabetes (ADA 2007a:30). Diabetes education is the process of providing the diabetic with the knowledge, skills and motivation that are needed to perform self-care, manage crises and make the lifestyle changes required to successfully manage their condition (Clement 1995:18). An extensive body of literature exists that demonstrates that DSME significantly improves health outcomes (Asha, Pradeepa & Mohan 2004:101; Ellis *et al.* 2004:103; Norris, Engelgau & Narayan 2001:561; Norris *et al.* 2002:1159; Warsi *et al.* 2004:1647).

Medical nutrition therapy (MNT) is an integral component of diabetes treatment and self-management education (ADA 2007:30). MNT, both as an independent variable and in combination with other

components of DSME, has been shown to be effective in improving health outcomes (Pastors *et al.* 2002:609; Pastors *et al.* 2003:828). MNT can prevent or postpone the onset or slow the progression of costly complications of diabetes. In non-insulin dependent diabetes there is potential for cost savings through decreasing or discontinuing the use of oral hypoglycaemic agents when diet and exercise alone can provide the desired outcomes (Gagliardino & Ectchegoyen 2001:1005; Hampton, Bodansky & Stickland 1998:166; PADA 1995:89). MNT has also been shown to produce similar outcomes to those of oral glucose medication alone (Franz *et al.* 2003:30).

Nutrition education (NE), an element of MNT, is defined as any set of learning experiences designed to facilitate the voluntary adoption of eating and other nutrition-related behaviours conducive to health and well-being (PADA 1996:1183). NE assists in improving an individual's nutrition knowledge, modifying his/her eating behaviour and improving physiological outcomes (Franz *et al.* 1995:95; Glasgow, Toobert & Hampson 1996:19; Glasgow *et al.* 1997:32; Shabbidar, Fathi & Shirazifard 2006:156). The latter include blood glucose and haemoglobin A_{1c} (HbA_{1c}) (Franz *et al.* 1995:1013-1014; Lemon *et al.* 2004:1810; Miller *et al.* 2002:256; Wilson *et al.* 2003:26), blood lipids, blood pressure and body weight (Franz *et al.* 1995:1013-1014; Lemon *et al.* 2004:1810).

Despite the established role of MNT in enhancing diabetes control, many individuals with diabetes are not benefiting from NE programmes. Some of the reasons for this include: culturally incompatible programmes (Anderson-Loftin *et al.* 2002:247; Brown *et al.* 2005:527), programmes that only target knowledge transfer and those that do not actively involve the patients (Clement 1995:1205; Knight, Dornan & Bundy 2006:495). The problem may further be compounded by the fact that, when compared with other diabetes self-management areas, dietary self-management is noted to be the most difficult (Anderson-Loftin *et al.* 2002:247; Glasgow *et al.* 1997:558). This is particularly apparent among low-income groups (Cox *et al.* 2004:163).

Diabetic individuals from resource-poor settings are also faced with unique issues that may limit their ability to benefit from education programmes. They have a higher prevalence of low literacy, which poses a challenge to the appropriate understanding of diabetes and its management (Eakin *et al.* 2002:27). Language barriers may contribute to a lack of motivation to seek appropriate health care (Anderson-Loftin *et al.* 2005:556; Glazier *et al.* 2006:1675). Low income levels and limited access to transport hinder their access to continuous quality care (Cox *et al.* 2004:29; Eakin *et al.* 2002:18; Glazier *et al.* 2006:29). Cultural beliefs may also mitigate against taking on a greater role in self-care (Eakin *et al.* 2002:18; Glazier *et al.* 2006:29). Therefore, they may experience more barriers to self-managed care than their counterparts in higher socio-economic settings.

Given that educating patients to better manage their diabetes is a feasible strategy due to low technical complexity, low capital requirements and cultural adaptability (Narayan *et al.* 2006:175), effective NE programmes could be utilised to bring about the desired outcomes in diabetics. This, consequently, would reduce diabetes-related complications and the associated socio-economic burden, which is of particular concern in resource-poor settings.

To design effective nutrition education programmes for diabetic individuals from resource-poor settings, it is essential that the developers be knowledgeable about those characteristics that contribute to a successful programme. In this review we define a resource-poor setting as a geographical location with limited infrastructure (facilities and services) and a population with low income. Although several interventions have been implemented in resource-poor settings, there is a lack of consolidated data on the factors that specifically contribute to the effectiveness of nutrition education programmes. The main objective of this

article was to review published reports on nutrition education interventions in diabetes care since 1995. The specific objectives were:

- to identify the elements that contribute to an effective nutrition education programme for adults with diabetes in resource-poor settings, and
- to provide guidance to health professionals intending to plan NE programmes for diabetic populations in resource-poor settings.

The methods for finding the selected material included the use of the databases Medline, PubMed and Cumulative Index to Nursing and Allied Health (CINAHL), which were searched for the terms effectiveness, nutrition education, dietary intervention, self-management education, type 2 diabetes, low-income, and resource limited/poor setting. Studies were included if they involved adult participants diagnosed with type 2 diabetes and dietary intervention, if the outcomes were reported and if the articles had been published between 1995 and the present date (November 2008). Only articles in English and those that used human participants were included. The samples were not restricted to any continent. Review articles that met the criteria were also included.

An effective nutrition education programme

An effective NE programme achieves the desired goals and outcomes that relate to an appropriate change in dietary behaviour (Contento, Randell & Basch 2002:12). An appropriate change in dietary behaviour is reflected in healthy food choices and eating habits (Contento *et al.* 2002:12; PADA 1996:1184). The primary outcome expected from this change is improved glycaemic control (ADA 2007b:48; Pastors *et al.* 2003:827). Other desirable outcomes include improved lipid profile, blood pressure and body weight (ADA 2007b:48; Pastors *et al.* 2003:827). Potential mediating factors, including knowledge, attitudes and skills related to diabetes and diet, are also expected to improve (Peyrot 1999:64-5).

Active involvement of the learner/patient

The responsibility for diabetes care lies primarily with the individual with diabetes (Anderson & Funnel 2000:597). To acquire the knowledge, skills and attitudes necessary for appropriate self-care behaviours, including diet, he/she needs to be actively involved in the learning and decision-making processes. The active involvement of the learner has been shown to be more effective in improving diabetes self-management outcomes than the didactic teaching approach (Elasz *et al.* 2001:125; Glazier *et al.* 2006:1687; Knight *et al.* 2006:498; Norris *et al.* 2001:583).

Strategies that actively engage the learner in the learning and decision-making processes in diabetes education include hands-on activities such as meal preparation (Anderson-Loftin *et al.* 2002:249; Rosal *et al.* 2005:227; Trento *et al.* 2001:996), collaborative goal setting and problem solving (Peyrot & Rubin 2007:2435; Rosal *et al.* 2005:228), cognitive reframing (Ellis *et al.* 2004:103; Rosal *et al.* 2005:228), group discussions (Anderson-Loftin *et al.* 2002:249; Banister *et al.* 2004:807; Trento *et al.* 2001:24), story telling (Anderson-Loftin *et al.* 2002:249) and role playing (Trento *et al.* 2001:996).

Behaviour-focused approach based on appropriate theories/models

Research indicates that the correlation between knowledge and behaviour change is low (Clement 1995:1205; Day 2000:73; Norris *et al.* 2001:580), and that education programmes that incorporate behaviour change strategies are more effective in changing behaviour (Brown 1999:52; Campbell *et al.* 1996:379; Clement 1995:18; Contento *et al.* 2002:12.). Therefore, nutrition education programmes for individuals with diabetes must go beyond knowledge, and target dietary and other nutrition-related behaviours.

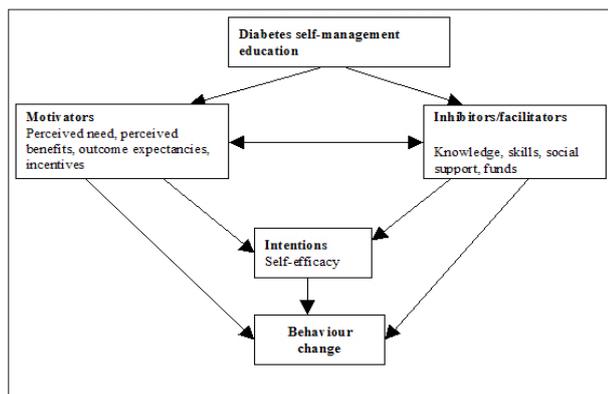


FIGURE 1

Conceptual framework of the relationships between factors of behaviour change targets in diabetes interventions. Based on factors of targets in diabetes interventions by Peyrot and Rubin (2007:2437)

The factors that should be targeted to help individuals change their dietary and other health behaviours include psychosocial factors that are antecedents of behaviour, such as personal factors (attitudes and beliefs), behavioural capabilities (knowledge and skills) and environmental factors that facilitate or impede change (Contento *et al.* 1995:326). Peyrot and Rubin (2007:2434) have suggested targeting the following factors in diabetes interventions:

- Motivators (factors that predispose one to action, such as perceived need, perceived benefits of treatment, outcome expectancies, rewards/incentives and cues to action)
- Inhibitors/facilitators (barriers such as a lack of funds, skills and support or resources for action)
- Intentions (proximal cause of behaviour change, i.e. individuals must have an intention to change, be ready to change and have a goal towards which they can work)
- Triggers (events that shift a person from being predisposed to action into an action state). (Figure 1 shows a framework of these factors).

Behaviour change is a complex process. Therefore, a theoretical foundation is recommended for planning behaviour intervention programmes (Anderson, Funnel & Hernandez 2005:515; Fischer & Glasgow 2007:2433; Knight *et al.* 2006:498). Theory facilitates our understanding of the relationships that exist between the factors that influence behaviour change (Anderson *et al.* 2005:518; Chapman *et al.* 1995:27; McKenzie, Neiger & Smeltzer 2005:147-148). The appropriate use of education and behaviour theory helps to ensure congruence between the planned interventions and the expected outcomes (McKenzie *et al.* 2005:145-146).

The most commonly used theories in diabetes education include the Health Belief Model (HBM), the Theory of Planned Behaviour (TPB), Socio-Cognitive Theory (SCT) and the Trans-Theoretical Model (TTM). The HBM (Rosenstock, Strecher & Becker 1988:15) emphasises perceived threat as a motivating force and perceived benefits (fewer barriers) as providing a preferred path to action. The HBM, as applied to dietary adherence for diabetes management, includes beliefs about personal susceptibility to the secondary complications of diabetes, the severity of diabetes and its complications, the belief that dietary adherence will render benefits in preventing the complications, the perception that barriers and other costs related to dietary adherence are not excessive, and that individuals have the ability to make the recommended dietary changes (Chapman *et al.* 1995:75).

The TTM (Prochaska & Velicer 1997:38-48) views behaviour change as a process in which the individual progresses through a series of six distinct stages of change. To successfully use this model, it is necessary to identify the participant's stage and then match the offered education to that stage. Ruggiero (2000:13) has discussed the application of TTM in diabetes, providing

guidelines for assessment and behaviour change interventions for diabetes care. The model was utilised in a randomised controlled trial to distinguish the diabetes-related characteristics of individuals at different stages of change towards healthier, low-fat diets (Vallis *et al.* 2003:1469). In this study, overweight individuals with type 2 diabetes identified to be in the action stages (action and maintenance) had healthier eating behaviours than those in the pre-action stages (pre-contemplation, contemplation and preparation) (Vallis *et al.* 2003:1472).

The SCT (Bandura 2001:52) describes learning as a reciprocal interaction between an individual's cognitive processes, the environment and behaviour (reciprocal determinism). This is the basis for including interventions at the level of both the environment and the individual. The model has several constructs, but those commonly applied in diabetes include reinforcement (Miller *et al.* 2002:254), behaviour capability (knowledge and skills necessary to perform a behaviour) (Miller *et al.* 2002:254) and self-efficacy (confidence in one's ability to successfully perform a specific behaviour) (Garret *et al.* 2005:321).

The TPB is an extension of the Theory of Reasoned Action (TRA) (McKenzie *et al.* 2005:152-153). The TRA states that an individual's intention to perform a given behaviour is a function of his/her attitudes toward performing the behaviour and the normative beliefs about what relevant others think they should do, weighted by the motivation to comply with those others. Perceived behavioural control, the additional concept in PTB, asserts that behavioural intent and behaviour are also influenced by the degree of control people feel they have over circumstances, or in being able to perform a given behaviour. The more favourable the attitude and subjective norm with respect to a behaviour and the greater the perceived degree of control, the stronger the individual's intentions to perform the behaviour (McKenzie *et al.* 2005:152-153). Chapman *et al.* (1995:25) applied the TPB theory to older diabetic adults. They found that the intention to consume certain high-fat foods was strongly related to subjective norms, attitudes towards dietary adherence and perceived control.

Appropriate medium of delivery and group/individual settings

Education programmes could be delivered using a face-to-face approach, written material, the telephone and electronic methods. The face-to-face method is used most commonly (Ellis *et al.* 2004:103; Knight *et al.* 2006:486) and the one associated with better health outcomes in DSME programmes (Ellis *et al.* 2004:103; Warsi *et al.* 2004:1646), even among disadvantaged populations (Glazier *et al.* 2006:1687).

Individual and group approaches have both been used in diabetes patient education in almost equal frequencies (Elsy *et al.* 2001:124). However, very few studies have directly compared the effectiveness of group versus individual formats for delivering a specific intervention. Rickheim *et al.* (2002:272), in a randomised controlled trial comparing the effectiveness of the two approaches, observed that both approaches showed improvements in body weight, psychosocial adjustments, mental health and attitudes towards diabetes and glycaemic control, but with a slightly more marked reduction in HbA_{1c} in the group setting. Another randomised controlled trial comparing group education versus individual consultations delivered as routine diabetes care in type 2 diabetics observed that, after two years, the group participants had better health outcomes. They had sustained their levels of HbA_{1c}, while the levels of those in individual settings had worsened. The individuals in group setting also had increased HDL cholesterol levels and had reduced their body mass index (BMI) and triglyceride levels (Trento *et al.* 2001:999).

A systematic review of randomised controlled trials showed that group delivery was more effective for lifestyle programmes

(interventions focusing on diet and physical activity) (Norris *et al.* 2001:583). However, group versus individual delivery was found not to be a statistically significant predictor of glycaemic control in a meta-analysis by Norris *et al.* (2002:1164). Clement's review of DSME (1995:1208) observed that small groups and one-on-one education might be equally effective in enhancing self-care behaviours and glycaemic control, and suggests that an optimum programme is one that uses both formats. Brown (1999:56-7) concluded that a combination of the two approaches achieved higher knowledge gains in diabetes self-management programmes and supported the use of small groups of ten participants or fewer.

A combination of the above-mentioned approaches could provide more benefits than those offered by either alone. Group processes encourage changes in beliefs and values as members share their knowledge, beliefs and skills and use the experience of others as a model (Garret *et al.* 2005:322; Maldonado *et al.* 1995:61). In a group setting, individuals can obtain emotional support from people with similar experiences (Garcia & Suarez 1996:29; Van der Ven 2003:16). Group education is also cost effective and efficiently utilises scarce resources (Mensing & Norris 2003:16; Wilson 1997:32). One-on-one education allows better tailoring to each individual's needs and better interaction based on non-verbal signals (Maldonado *et al.* 1995:61; Wilson 1997:70). It is useful in exploring long-term intrapersonal problems (Van der Ven, 2003:88) or in initial education, when educational objectives need to be strictly selected, especially in the presence of severe emotional distress (Maldonado *et al.* 1995:61).

Wilson (1997:71) has suggested using telephone contacts to follow up on progress and to provide individual counselling after or in between group sessions as a way of combining the two methods. The latter is more feasible in resource-poor settings. A combination of the two approaches was utilised in a DSME pilot programme for low-income Spanish-speaking patients in which the majority of the sessions were dedicated to the group format. The study observed significant improvements in glycaemic control at three and six months (Rosal *et al.* 2005:331).

Tailored intervention

Education programmes must be matched to the needs and abilities of the patient (Clement 1995:1210; PADA 1996:1184; Fischer & Glasgow 2007:2746) if they are to be effective. Messages and materials that are customised to address the unique needs and concerns of specific patients have been shown to be effective in changing health-related behaviour (Clark 2002:183-4; Kreuter & Strecher 1996:103).

To design a targeted education programme, a needs assessment is recommended (Eakin *et al.* 2002:28; PADA 1996:1183-1184; Rosal *et al.* 2005:227). This exercise helps to provide a better understanding of the target group in terms of aspects such as knowledge, attitudes, barriers and facilitators to behaviour change, needs and preferences for diabetes education (PADA 1996:1183-4; Rosal *et al.* 2005:227).

Different methods can be used to conduct a needs assessment (McKenzie *et al.* 2005:72-83). However, the use of focus groups has been a major strategy in developing or adapting self-management interventions, especially in low-income and minority groups (Benavides-Vaello *et al.* 2004:238; Blanchard *et al.* 1999:919; Brown, Garcia & Winchell 2002:168). The informal style of focus groups is conducive to identifying barriers to care, exploring health beliefs, identifying education needs and gathering information to improve intervention programmes (Benavides-Vaello *et al.* 2004:238). The synergy promoted by the group interaction produces ideas and statements that would not be generated with other types of methods. Respondents can qualify, clarify and build upon responses, thus conveying more thoughtful and in-depth information (Betts, Baranowski & Hoerr 1996:280; Blanchard *et al.* 1999:919).

Needs/abilities that need special consideration

Literacy levels

A high proportion of low-income populations have low literacy levels (Anderson-Loftin *et al.* 2002:248; Rosal *et al.* 2005:226), therefore the content of the education programme should be simple so as to increase comprehension and compliance (Anderson-Loftin *et al.* 2002:249; Brown 1999:231; Rosal *et al.* 2005:226; Ziemer *et al.* 2004:1719).

Strategies and educational materials that enhance understanding should be incorporated, e.g. the use of visual materials, action-oriented teaching, repetition of key concepts and skills, facilitation of frequent timely feedback (Rosal *et al.* 2005:226) and the practice of focusing on a few dietary concepts at a time (Anderson-Loftin *et al.* 2005:557). Other strategies include minimal reading activities, such as group discussions, demonstrations, video shows (Brown *et al.* 2002:168) and visits to real-world settings such as grocery stores (Brown *et al.* 2002:261; Mensing & Norris 2003:99).

Socio-cultural context

Attitudes and beliefs about foods tend to reflect cultural values. Cultural food practices not only affect taste preferences, but also shopping habits, manners, communication and personal interactions (Nestle *et al.* 1998:51). Family and friends provide a source of modelling and peer pressure for consuming particular foods or trying new foods (Nestle *et al.* 1998:51). Therefore, consideration of the socio-cultural context of the target group/patient is very crucial to increasing programme acceptance and effectiveness (Eakin *et al.* 2002:34).

Several studies have demonstrated that culturally sensitive interventions are effective in improving glycaemic control and dietary behaviours (Anderson-Loftin *et al.* 2002:245; Anderson-Loftin *et al.* 2005:560-562; Brown & Hanis 1999:25; Brown *et al.* 2002:259). Aspects that have been used in diabetes patient education to increase cultural relevance include using the patient's preferred language, integrating cultural dietary preferences into healthy dietary strategies, integrating cultural traditions associated with food, such as family gatherings, incorporating family members (Anderson-Loftin *et al.* 2002:249; Brown *et al.* 2005:528), using ethnic food models to teach meal planning (Anderson-Loftin *et al.* 2002:249; Anderson-Loftin *et al.* 2005:557; Brown & Hanis 1999:231), using culturally familiar experiences such as drama (Rosal *et al.* 2005:227), and having open, non-judgmental discussions about health beliefs and practices (Brown *et al.* 2005:528).

Locality

Patients with low incomes and low educational attainment tend to have low education programme attendance rates (Corkery *et al.* 1997:257; Noel *et al.* 1998:896) and high attrition rates (Corkery *et al.* 1997:257). Therefore, programme planners should incorporate aspects that enhance participation. A programme in a convenient locale that is easily accessible by public transport is crucial to solving the transport problem that is often cited as a barrier to participation in a programme (Eakin *et al.* 2002:27). Community settings such as schools, churches and community centres could be utilised as a strategy to overcome the socio-economic barriers to participation (Brown *et al.* 2002:168). These settings may be more convenient for and familiar to the participants (Brown *et al.* 2002:261) and their use is becoming more common, especially in under-served communities (Anderson-Loftin *et al.* 2002:528; Brown & Hanis 1999:230; Brown *et al.* 2002:168).

Appropriate nutrition education content and approach

The content of the NE should be based on assessed individual/group needs (Funnel *et al.* 2008:99). In newly diagnosed individuals, initial self-management education (survival skills) is necessary. This includes basic meal planning and exercise

guidelines, signs and symptoms and prevention of hypoglycaemia for those on medication, nutritional management during short illnesses and blood glucose monitoring (Franz 2004:814-815). Thereafter, the topics/content that are emphasised should be based on the patient's lifestyle, level of nutrition knowledge, and experience in planning, purchasing and preparing meals. Suggested essential nutrition education topics include, among others, sources of carbohydrates, proteins and fats; nutrition labels; modification of fat intake; grocery shopping guidelines; guidelines for eating out and for special occasions; behaviour modification techniques; and tips for solving problems (Franz 2004:801-815). Appropriate meal planning approaches that enhance motivation and adherence to the diet are necessary (Franz 2004:823). The plate model, a visual approach to planning meals (Camelon *et al.* 1998:98), has been shown to improve the understanding of meal planning principles and the ability to plan healthy meals in individuals with type 2 diabetes in under-served populations (Raidil *et al.* 2007:4). This approach to meal planning could be useful in resource-poor settings, as it is simple, versatile and promotes understanding and memory retention (Camelon *et al.* 1998:98).

Provision of social support

Social support is an important element in dietary behaviour change (Adamson & Mathers 2004:541; Sherman *et al.* 2000:209). Social interactions can provide good models for healthy eating, and feedback that can reinforce or modify one's self-evaluation. Peers, family and professionals can provide emotional support as well as challenge a patient's stereotypes or negative expectations regarding the proposed change (Adamson & Mathers 2004:541; Nestle *et al.* 1998:51). Social persuasion helps to enhance confidence in individuals, and can assist diabetic individuals to improve their self-care behaviours (Lorig 2003:41). A study by Mau *et al.* (2001:1773) concluded that incorporation of social support (family member or friend) in an education program for individuals with diabetes or at risk of diabetes increased the likelihood of progressing from pre-action to action/maintenance stage for dietary fat intake and exercise. The study also concluded that individuals who advanced to action/maintenance stage had healthier dietary and exercise behaviours.

Suitable programme duration and contact time

There is very little guidance in the literature on the appropriate dosage (length and contact time) for diabetes education interventions. A few studies, however, do point to the fact that sufficient duration and contact time are necessary for a programme to be effective. A meta-analysis by Norris *et al.* (2002:25) showed that HbA_{1c} levels decreased with increased contact time between the participant and the educator. Similarly, in a study of dosage effects of diabetes education for Mexican Americans, Brown *et al.* (2005:527) found that individuals who attended more sessions showed greater improvement in metabolic control. In another study, the same authors observed a maximum benefit effect of self-management education on glycaemic control at six months for Mexican Americans (Brown *et al.* 2002:265). A systematic review by Glazier *et al.* (2006:1687) concluded that interventions for the socially disadvantaged, including low-income groups, should be of high intensity (> 10 contact hours) and delivered over a long duration (≥ 6 months).

Provision of follow-up intervention

The maintenance of outcomes in individuals with diabetes is a challenge, and more so in minority groups and those with a low income (Eakin *et al.* 2002:32). In the meta-analysis by Norris *et al.* (2002:1159), the benefits of DSME were found to decline one to three months after the intervention. It therefore seems that follow-up intervention is necessary to maintain the achieved outcomes (Clement 1995:1208; Norris *et al.* 2001:563; Norris *et al.* 2002:1164). Additional group sessions at periodic intervals to reinforce previously learned self-management information and

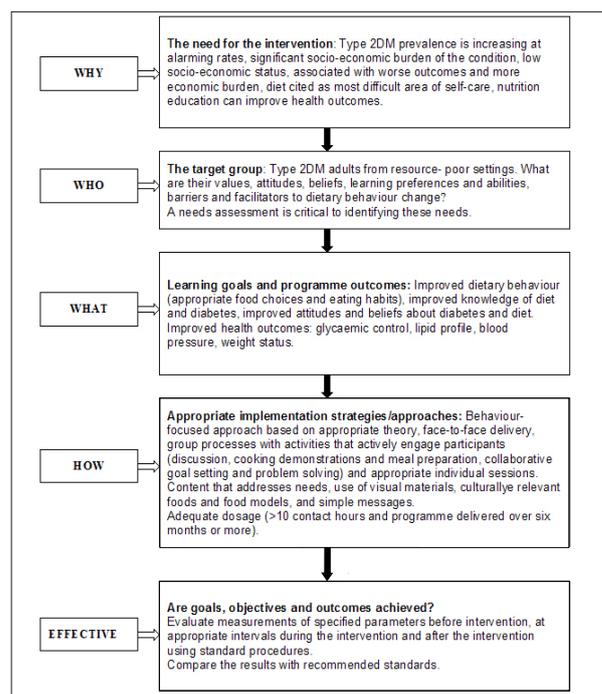


FIGURE 2
A conceptual framework for developing an effective nutrition education programme for adults with type 2 diabetes mellitus in resource-poor settings. Adapted from Murphy (2004:191)

to provide social support are a feasible option in resource-poor settings (Brown *et al.* 2002:169).

Competent educator

An effective NE programme is a programme that is delivered by a competent educator (Mensing & Norris 2003:99; PADA 1996:1186). Characteristics of personal competency of successful nutrition educators include strong skills in interpersonal relationships, communication and listening, and interviewing skills (Knight *et al.* 2006:498; PADA 1996:1186), as well as skills in facilitating behaviour change (Fischer & Glasgow 2007:30; Mensing *et al.* 2007:97). In addition, the basic competencies of a dietetic/nutrition professional are also necessary. These include an understanding of the fundamentals of the food and nutrition sciences, knowledge of the physiological and psychological determinants of eating behaviour, and an understanding of the environmental and social implications of the food system (PADA 1996:118). A registered dietician is the professional who is recommended to conduct nutrition education for individuals with diabetes (Mensing *et al.* 2007:97; Wilson *et al.* 2003:2500). However, in resource-poor settings, this professional category is often not adequate or available. Therefore, other health professionals should be trained to offer nutritional education (IDF 2005:22-25). Trained peer educators could also be utilised to deliver the education (Mau *et al.* 2001:1171; Two-Feathers *et al.* 2005:1552).

Table 1 summarises the elements that contribute to effective diabetes education, including MNT, derived from the reviewed studies. A conceptual framework of the factors that must be considered when planning an effective nutrition education programme for adults with diabetes mellitus in resource-poor settings is shown in Figure 2.

CONCLUSION

The results of this review indicate that effective nutrition education interventions for diabetic adults in resource-poor

TABLE 1
Summary of elements of effective nutrition education in adults with type 2 diabetes mellitus in resource-poor settings

TYPE OF INTERVENTION	SAMPLE	SETTINGS/INTERVENTION	KEY OUTCOMES	EFFECTIVE ELEMENTS (S)
Meta-analysis/reviews				
Eakin <i>et al.</i> , 2002	15 studies (1987-2001)	Low-income/minority DSME including MNT	Efficacy Reach, implementation and maintenance	Needs assessment Convenient locality
Glazier <i>et al.</i> , 2006	17 studies (1986-2004)	Low socio-economic status Minority groups Industrialized countries RCT DSME including MNT	Clinical outcomes Self-management Provider management	Tailored interventions Trained educator Behaviour change focused Active patient participation Addresses socio-cultural context High-intensity interventions Needs assessment Face-to-face delivery One-on-one education
Randomised controlled trials (RCT)				
Brown & Hanis, 1999	n = 247 Mexican-American Low-income Low literacy	One-year intervention 12 weeks of group sessions 14 biweekly support sessions DSME including MNT	HbA _{1c} , fasting blood glucose Diabetes knowledge Diabetes-related health beliefs BMI, blood pressure Total cholesterol	Intensive intervention Cultural appropriate Community setting Needs assessment Minimal reading education materials
Goldhaber-Fiebert <i>et al.</i> , 2003	n = 75 Low-income Rural Costa Ricans	Community based Group nutrition and exercise programme 11 weekly nutrition classes (1.5 hours) Tri-weekly walking groups (1 hour)	HbA _{1c} , fasting blood glucose BMI, blood pressure Total cholesterol Triglycerides	Community settings Peer and family support Offering classes at different time to improve attendance Culturally sensitive
Rosal <i>et al.</i> , 2005	n = 25 Low-income Spanish	Pilot study 10 weeks of group sessions Two individual sessions Community centre DSME including MNT	HbA _{1c} lipid profile Dietary intake Self-monitoring of glucose	Tailored messages Intensive intervention Repetition of key concepts Family support Using preferred language Use of visual materials
Other study designs				
Anderson-Loftin <i>et al.</i> , 2002	n = 23 Rural African-Americans Low-income Low literacy	Quasi-experimental (longitudinal) Pilot study, five months MNT- 4 low-fat classes, 6 discussion groups Follow-up (One home visit + weekly telephone calls)	Fasting blood glucose, HbA _{1c} BMI, blood pressure Total cholesterol, triglycerides, Home glucose monitoring Dietary habits Health services utilisation Cost of care	Experiential teaching methods Group discussions Culturally competent characteristics
Anderson-Loftin <i>et al.</i> , 2005	n = 97 Rural African-Americans Low-income Low literacy	4 weeks MNT (low-fat dietary strategies) Five months of group discussions Weekly telephone follow-up	BMI Dietary behaviours	Focusing on one dietary concept Culturally competent characteristics Experiential teaching methods
Bannister <i>et al.</i> , 2004	n = 70 Low-income	One group pre-test post-test Community clinic DSME including MNT 4-hour group class plus individual consultation by dietician Monthly support meetings	HbA _{1c} BMI Medication Costs	Community site Follow-up activities Hands-on demonstrations Family participation
Brown <i>et al.</i> , 2005	n = 216 Mexican-American Low income and literacy level	Comparison of dosage effects 52 contact hours vs. 26 hours Groups randomised, but no control DSME including MNT	HbA _{1c} , fasting blood glucose Diabetes knowledge Diabetes-related health beliefs BMI, blood pressure Total cholesterol Triglycerides Home glucose monitoring	Attendance of more sessions with extended version
Two-Feathers <i>et al.</i> , 2005	n = 151 African-Americans Latinos Low SES	Community setting One group pre-test post-test One group pre-test post-test Delivered by trained community residents	Diabetes knowledge HbA _{1c} BMI Dietary behaviours Blood pressure, total cholesterol Triglycerides Home glucose monitoring	Community site Culturally tailored education materials
Mau <i>et al.</i> , 2001	n = 147 Rural Hawaiians	Community setting Quasi-experimental 6-month programme Addressing lifestyle behaviours Delivered by trained peers	Dietary behaviours (fat, fibre, calories) Physical activity	Culturally tailored Family support TTM model

RCT – Randomised controlled trial
BMI- Body mass index
SES - Socio-economic status



settings are those that address their unique needs and abilities. Effective NE comprises certain key elements: these include addressing low literacy levels by use of visual materials; experiential teaching methods; repetition of key concepts; few dietary concepts at a time; and tailoring the education to the socio-cultural context. An intensive programme (> 10 contact hours and extended duration of \geq six months), follow-up intervention and support from peers and family are also crucial elements. A convenient locality, such as a community setting, is also important for enhancing participation in NE programmes. Other elements that may not be unique to this population include the active participation of the learner, face-to-face delivery and the use of behaviour change techniques/theories.

Planners of NE programmes for individuals with diabetes in resource-poor settings must be sensitive to the unique needs of this population and plan interventions that address these needs. A comprehensive needs assessment will serve as a cornerstone for planning a tailored NE programme. The planners must also be clear on the goals and objectives of the programme, use appropriate implementation strategies/approaches, including a competent educator, and evaluate the programme for effectiveness at appropriate intervals.

This review has some limitations. The studies that met the inclusion criteria were few, and most of the studies were done in under-served low-income populations in the USA, thus it is not clear how these results relate to other resource-poor settings, particularly in developing countries. However, the results provide a base for planning NE education programmes for adults with type 2 diabetes in resource-poor settings.

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