Perspectives in Practice

Evaluation of Nutrition Education Interventions for Older Adults: A Proposed Framework

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ABSTRACT

This study was undertaken to identify nutrition interventions that could provide a basis for designing effective and measurable nutrition education programs for older adults. The authors conducted a literature search of articles published from 1990-2003 using Medline and Agricola. Key words were "elderly," "older adults," "nutrition intervention," and "nutrition education." Of 128 references identified, 25 studies included intervention and/or evaluation components and targeted adults over age 55 years. Although interventions tended to report limited success in behavior change, certain features had positive outcomes. These included limiting educational messages to one or two; reinforcing and personalizing messages; providing hands-on activities, incentives, cues, and access to health professionals; and using appropriate theories of behavior change. Based on these findings, a theoretical framework that includes these features but is set within a social and environmental context is proposed as a guideline for designing nutrition interventions for older adults.

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Prevention programs to reduce chronic disease risks have traditionally focused on children and younger adults. However, many researchers have started to focus their interest and attention on older adults. This change in outlook has come about due to demographic changes; people are now living longer, and consequently the older population is increasing rapidly and medical expenditure is rising with the onset of several major chronic diseases (1,2). In addition, knowledge of the nutrition needs of older adults has changed and it has become quite clear that some of the nutrient needs of older adults are different from those of younger adults (3-5). The need to educate older adults to enable them to modify their dietary practices is evident. A question that arises frequently is whether nutrition interventions made at a later age can improve health status and quality of life and reduce health care expenditure.

To begin to answer the question about the effects of nutrition interventions on the health status of older people, we reviewed the literature to examine the number, types, and effectiveness of published nutrition education programs that have targeted older adults between January 1990 and April 2003. This review included the educational methods and program evaluation criteria used. Our primary objective was to identify successful intervention programs that could provide salient points for designing appropriate, effective, and measurable nutrition education programs to select groups of older adults, and, based on some of these criteria, suggest a framework as a guideline in designing effective programs.

METHODS

We conducted a literature search of articles published between January 1990 and April 2003 to determine the number, design, and outcome of nutrition education programs aimed at older adult populations. We selected this publication timeline because it provided a follow-up to another review of the literature on older adults conducted in the early 1990s (6), and it enabled us to examine more recently published articles that were pertinent to our inclusion criteria. We used Medline and Agricola to search for journal articles. The key words were "elderly," "older adults," "nutrition intervention," and "nutrition education." In addition, articles were identified through cross-references. When articles were pilot studies, we searched for follow-up studies or contacted the principal investigator to inquire about follow-up publications. The inclusion criteria were community-based intervention articles with measurable outcomes or evaluation components and participants who were 55 years of age or older. Review articles were excluded.

Our study did not recalculate any of the results of the studies reviewed or evaluate the content of the educational material presented. Rather, we focused on the successful components of the studies and extracted the unique features of each study that may have contributed to its partial or complete success. The Table presents a summary of the successful intervention programs and their research designs, interventions, and significant outcomes. Aspects of the programs that were identified by the authors of the articles or made apparent in the description of the programs to have contributed to the full or

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partial success of the interventions are summarized. Studies that did not report any intervention effects linked to the objectives of the study are not included in the Table (7-10). Pilot studies were reviewed only if follow-up studies were not published (10). If more than one article was published on the same study, they are combined in the table (11-14). The articles are shown in reverse chronological order in the Table.

RESULTS AND DISCUSSION

General Characteristics of Studies Reviewed

We identified 128 references, but only 25 studies fit the inclusion criteria. The articles excluded did not have an intervention or an evaluation component, were review articles, or the study participants were not within the required age category. The interventions varied in design, target population, age range, and attrition rate. The studies tended to include small numbers of participants, although these ranged from 24 (15) to 12,430 (16). Two studies did not target older adults specifically, but because approximately 44% (17) and 56% (18) of the participants were 50 years of age or older, they were included in our review. Overall, 10 (40%) of the studies reviewed included fewer than 100 participants (9,11,12,15,19-25). About four studies targeted a specific ethnicity, racial background, educational level, or socioeconomic status (7,18,21,26). The level of attrition ranged from zero (15,19,21,24,27,28) to 64% (29), but only 53% of the studies with an attrition rate actually reported analyzing the data of those who did not complete the program (7,8,11-14,16-18,23,25,30).

Eight of the 25 studies targeted older adults who were at risk for or had a chronic disease such as diabetes (7,11,12,22,25), hypertension (23,31), hypercholesterolemia (8), or peripheral vascular disease (28), and one targeted functionally impaired persons (19). The rest of the studies reported or implied the target population to be generally healthy and mobile.

Successful Study Components

Most of the studies reviewed had limited success but point to features that resulted in positive outcomes and could be used to design potentially successful nutrition intervention programs (Table). Positive outcomes appeared more probable when nutrition messages were limited to one or two; were simple, practical, and targeted to specific needs (eg, in interventions to lower sodium intakes in persons with hypertension [23] or to increase milk consumption [29,32]). Study participants with a specific health condition were generally more successful in making the dietary change. In fact, studies that provided nutrition education to motivated persons or addressed older adults' health concerns were generally more successful. Our review showed that motivated persons such as those who initiated calls to obtain information (17) were more successful in reaching their goals. One of the behavior change theories, the Health Belief Model (33), involves using concepts such as a person's perception of his/her chance of developing a condition, and of how serious the condition and its consequences would be, as motivating factors for behavior changes. These components of the model would be quite applicable to older adults because of the heightened possibility of ill health. Several theories of behavior modification were used to design interventions, particularly in the more recent studies (Table). These theories were applied in a variety of ways and appeared most successful when participants were expected to assess their readiness for change and set their own achievable goals (11-14,17,19,24,25,27,28,30), or when hands-on activities were incorporated in the intervention (24,27). This allowed participants to exercise control and incorporate change into their lifestyles. There was also greater likelihood of achieving a change in behavior when active interaction existed between program participants and health professionals (34). One study that used the Health Belief Model in developing educational material but had little or no contact with participants reported limited success (9). Theories of behavior change are based on understanding what motivates people and on principles of communication. Their effective application depends on the design of the studies. We need to expand our knowledge of how best to use them to effect change in nutrition behavior. It is unclear from the study descriptions whether theoretical constructs were always applied in the most effective way.

Age did not appear to be a limiting factor in increasing one's knowledge, as seen from positive knowledge gain in several of the interventions.

Incentives were seldom used as motivational tools, but whenever incorporated in the study design, incentives appeared to be ingredients for success (11,12,19,27). Attrition rates were also lower in studies that used incentives and motivational cues to reinforce intervention messages (19,27). Other studies for different age and population groups have also reported this to be true (35). It is a challenge to keep participants involved in an intervention program, as shown by the high attrition rates in some studies (Table). Sometimes, intervention programs can be quite burdensome and a balance is needed to ensure that the requirements of the intervention are not too demanding, yet sufficient to obtain appropriate information and to allow participants time to process and incorporate information into their lifestyles.

Overall, increased nutrition knowledge was the most successful outcome reported, whereas behavior change and/or positive biochemical or anthropometric outcomes were quite variable. Age did not appear to be a limiting factor in increasing one's knowledge, as seen from positive knowledge gain in several of the interventions. Several studies were not included in the Table because no significant intervention effects were reported (7-10). Some limitations identified in those studies include providing information by mail, insufficient contact, short intervention, and insensitive evaluation tools. Inadequate study design, participant retention, and analytical methodology may explain the limited success in nutrition intervention among older adults more than the age of participants.

Limitations of the Studies Reviewed

Our research indicates that there is a paucity of evidence-based research on community nutrition interventions for older adults. Few studies were well designed and ran-

Table. Selected nutrition education programs for older adults (1990-2003)

Reference	Participants	Study design and intervention	Main significant outcomes	Characteristics linked to positive outcomes
Patterson et al., 2003 (16)	• Healthy, postmenopausal women with fat intake ≥32% of energy • N=12,430 • Age range: 50-79 yrs • Attrition rate: 14%; profile reported	• The Women's Health Initiative Dietary Modification trial (DM) is a program to reduce dietary fat to 20% and saturated fat to 7% of total energy, increase daily servings of fruits and vegetables to five or more and grain servings to six or more. This study assessed changes in fat intake among participants in the first two years of the DM. • Self-selected, with control • Length: two yrs; DM included 18 sessions in year 1, the intensive phase, and four visits/yr after year 1	**Between baseline and year 1** Dietary/behavioral: decrease in percent energy from fat in intervention group (from 38.5% to 24.3%), and in control group (from 38.4% to 35.7%); decrease in fat intake (by 24 g/d) in intervention group compared to control group **Between baseline and year 2** Dietary/behavioral: decrease in percent energy from fat in intervention group (from 38.5% to 25.4%), and in control group (from 38.4% to 36.0%); decrease in fat intake (by 23 g/d) in intervention group compared to control group	• Use of behavioral theory • Individualized goals • Self-monitoring • Use of reinforcements and motivators • Social support provided • Focus on relapse prevention
Bernstein et al., 2002 (19)	• Functionally impaired, community-dwelling • N=70 • Mean age: 78 yrs; range; 70+ yrs • Attrition rate: 0%	• Education program to increase consumption of fruits, vegetables and calcium-rich foods • Random, nutrition intervention group and exercise intervention group • Length: eight home visits, biweekly telephone contacts and monthly letters for six mo	**Between baseline and end of intervention** Dietary/behavioral: increase in intake of fruits (by 1 serving/d), vegetables (by 1 serving/d) and dairy products (by 1 serving/d) in nutrition intervention group, and no change in intake of these foods in exercise group; increase in intake of α-carotene in nutrition intervention group (by 549 μg) and decrease in intake of α-carotene in exercise group (by 5.7 μg); greater increase in intake of β-carotene in nutrition intervention group (increase of 2,408 μg) compared to exercise group (increase of 103 μg) Biochemical: increase in blood concentrations of α-carotene (by 0.09 μg/L) and β-carotene (by 0.2 mmol/L) in nutrition intervention group	• Recommendations tailored to participants' dietary patterns and lifestyles • Use of behavior modification techniques • Incentives and rewards provided

Miller et al., 2002 (11,12)	• Diabetic • N=98 • Mean age: 72.6 yrs; range: 65+ yrs • Attrition rate: 6%; profile reported	• Education program to improve food label knowledge, blood glucose and lipoprotein levels • Random, with control • Length: 1½-2 h/wk for 10 wk	**Between baseline and end of intervention** Knowledge: greater increase in total knowledge score in intervention group (58% increase) than in control group (1% increase) Biochemical: greater decrease in fasting plasma glucose levels in intervention group (18.8 mg/dL decrease) than in control group (1.4 mg/dL decrease); greater decrease in glycated hemoglobin concentrations in intervention group (0.5% decrease) than in control group (no change)	• Intensive program • Education delivered by highly-trained health professionals • Use of learning and behavioral theory (social cognitive theory, theory of meaningful learning, information processing model) • Emphasis on decision-making skills • Limited number of messages • Concepts reinforced • Interactive intervention, tailored to individual needs • Incentives provided
Marcus et al., 2001 (17)	• Healthy • N=1,717 • Age range: 18+; approximately 44% aged 50+ • Attrition rate: 24%; profile reported	• Education intervention by telephone to increase fruit and vegetable consumption • Random, with control • Length: six-min counseling session by telephone, two mailed educational packets • Follow-up: after four and 12 mo	Dietary/behavioral: greater intake of fruits and vegetables (by approximately 0.62-0.88 servings/d) in intervention group than in control group at end of intervention, sustained at four-mo and 12-mo follow-up	• Use of behavior theory (transtheoretical model) • Single message • Concrete suggestions provided • Education packets targeted to callers
Barr et al., 2000 (32)	• Healthy, with dairy product intake ≤1.5 servings/d • N=204 • Mean age: 65.2; yrs range: 55-85 yrs • Attrition rate: 2%; profile not reported	• Intervention to assess effects of advice to increase skim or low-fat milk intake by three cups/d, without other dietary guidance • Multicenter, randomized, controlled trial • Length: 12 wk	Dietary/behavioral: increase in intake of calcium (by 729 mg/d), Vitamin D (by 5.8 μg/d) and a number of other nutrients in intervention group, between baseline and end of intervention	• Single message • Recommendation easily incorporated into participants' diets
Hermann et al., 2000 (20)	• Healthy • N=76 • Mean age: 69 yrs range: 55+ yrs • Attrition rate: 5%-12%; profile not reported	• "Healthy Living" program on applying Food Guide Pyramid, Dietary Guidelines for Americans and Nutrition Facts Label to food selection, preparation and safety practices • Self-selected, no control • Length: 1 session/wk for eight wk	**Between baseline and end of intervention** Dietary/behavioral: increase in intake from grain group (by 1.1 servings/d), vegetable group (by 0.7 servings/d), and milk group (by 0.9 servings/d), and decrease in intake from fats, oils and sweets group (by 0.9 servings/d) Biochemical: decrease in total serum cholesterol (by 5%)	• Use of behavioral theory • Dietary recommendations translated into understandable actions

(continued)

Reference	Participants	Study design and intervention	Main significant outcomes	Characteristics linked to positive outcomes
Taylor-Davis et al., 2000 (34)	• Healthy, white • N=480 • Mean age: 69.4 yrs; range: 60-74 yrs • Attrition rate: 20%; profile not reported	• Education intervention via newsletters and telephone to improve nutrition knowledge, attitude and behavior • Random, control and two intervention groups—one received only newsletters while the other also received motivational telephone interviews • Length: 10 wk	**At end of intervention** Knowledge: highest nutrition knowledge test score in intervention group which received newsletters and telephone interviews (58% correct), followed by intervention group which received newsletters only (52%), and control group (41%) ($P<0.05$ for all pairwise comparisons); greatest perceived nutrition knowledge in group which received newsletters and telephone interviews; higher interest in nutrition in intervention groups than in control group Dietary/behavioral: greater avoidance of fat in intervention group that received newsletters only than in control group; greater readiness to increase fiber intake in intervention groups than in control group	• Use of learning theory (nutrition communication model, adult learning theory) • Understandable, concrete messages • Newsletters contained large print • Newsletters could be read at participants' convenience, and allowed extended time to process information • Telephone interviews involved interpersonal interaction
Campbell et al., 1999 (18)	• Healthy, African American • N=3,737 • Mean age: 53.8 yrs; range: 18+ yrs; 56% aged 52+ yrs • Attrition rate: 22.7%; profile reported	• Intervention to increase fruit and vegetable consumption by at least 0.5 servings/d, for reduced risk of cancer • Random, control (delayed intervention group) and intervention group • Length: two yrs	Dietary/behavioral: increase in intake of fruits and vegetables in intervention group (by 0.61 servings/d) between baseline and end of intervention; higher intake of fruits and vegetables in intervention group compared to control group (by 0.85 servings/d) at end of intervention, especially among adults over 65 yrs (by 1.04 servings/d)	• Use of behavioral theory (transtheoretical model, social cognitive theory, social support model) • Individual, social network and community levels targeted • Culturally sensitive programs
Whelton et al., 1998 (31)	• Hypertensive • N=975 • Mean age: 66.5 yrs; range: 60-80 yrs • Attrition rate: 9%; profile not reported	• Intervention to determine whether weight loss of obese participants and decreased sodium intake of all participants could reduce need for antihypertensive medication (Trial of nonpharmacologic interventions in the elderly—TONE) • Multicenter, randomized, controlled clinical trial; obese participants assigned to control or one of three intervention groups—sodium reduction, weight loss, or combination of sodium reduction and weight loss; nonobese participants assigned to control or sodium reduction intervention group • Length: 30 mo	Biochemical: decrease in urinary sodium in sodium reduction intervention groups (by 45.2 mmol/d) and increase in other groups (by 1.4 mmol/d) between baseline and nine mo, sustained at 18 and 30 mo Anthropometric: greater weight loss in weight loss intervention groups (3.8 kg) than in other groups (0.9 kg) between baseline and 9 mo, sustained at 18 and 30 mo Clinical: lower incidence rate of combined outcome measure (high blood pressure, treatment with antihypertensive medication or a cardiovascular event) following attempted withdrawal of antihypertensive medication in sodium reduction intervention group compared to other groups (incidence rate, 0.69, 95% CI, 0.59-0.81), and, among obese participants, in weight loss group compared to other groups (incidence rate, 0.70, 95% CI, 0.57-0.87)	• Use of behavioral theory (social action theory) • Program customized to meet participants needs • Frequent contact with health professionals • Participants self-motivated to reduce dependency on medication

Dornelas et al., 1998 (13) and Wylie-Rosett et al., 1994 (14)	• Healthy, overweight • Mean age: 71.2 yrs; range: 55+ yrs • Attrition rate: 30%; profile reported	• Nutrition and exercise intervention to decrease weight • Self-selected, with control in 40-wk trial only • Length: 40-wk trial followed by 2-yr intervention • Follow-up: after one yr	**Between baseline and end of intervention** Biochemical: decrease in blood glucose levels (by 0.8 mmol/L), sustained at follow-up Anthropometric: decrease in weight (by 4%), sustained at follow-up	• Focus on behavior modification • Optimal use of professional staff time
Sharpe et al., 1996 (26)	• Healthy, low-income, primarily African American women • N=131 • Mean age: 73.6 yrs; range: 58-91 yrs • Attrition rate: 30%; profile not reported	• Education program to improve nutrition knowledge, attitudes and behaviors • Self-selected, with control • Length: six h in three mo	**Between baseline and end of intervention** Knowledge: greater improvement in nutrition knowledge test score in intervention group compared to control group, specifically on questions about recommendation to eat fruits/vegetables five times a day (P=0.02) and which of four given foods is least nourishing (P=0.04) Dietary/behavioral: increase in frequency of eating fruit in intervention group (by 0.3 times/d)	• Focus on key concepts • Simple, straightforward recommendations • Materials in large print • Personalized messages • Engagement of multiple senses
Constans et al., 1994 (29)	• Healthy • N=150 • Mean age: 68.5 yrs; range: 62-78 yrs • Attrition rate: 64%; profile not reported	• Education program to increase calcium intake to at least 800 mg/d for reduced risk of osteoporosis • Self-selected, with control • Length: two yrs	Dietary/behavioral: increase in calcium intake in intervention group (119 mg increase), particularly by women (154 mg increase), between baseline and end of intervention	• Single message • Emphasis on disease prevention may have motivated participants
Doshi et al., 1994 (21)	• Healthy, primarily African American women • N=31 • Mean age: 71.8 yrs; range: 55-88 yrs; • Attrition rate: 0%	• Nutrition and physical activity intervention to decrease prevalence of obesity and improve lipid profiles for reduced risk of cardiovascular disease • Self-selected, no control • Length: two sessions/wk for 10 wk	**Between baseline and end of intervention** Biochemical: decrease in total cholesterol (by 4%), low-density lipoprotein cholesterol (by 8%), and total cholesterol to high-density lipoprotein cholesterol ratio (by 0.3) Anthropometric: reduction in waist circumference (by 1.6 cm)	• Self-selected, highly motivated participants • Intervention targeted to specific population needs • Services accessible, affordable and acceptable to participants • Participants enjoyed combination of nutrition and fitness education
Grace et al., 1994 (28)	• Patients with peripheral vascular disease (PVD) • N=170 • Age range: 55+ yrs • Attrition rate: 0%	• Education program to reduce dietary cholesterol and control weight, blood pressure, and blood glucose levels • Self-selected, control, placebo, and intervention groups; all patients in intervention group received monthly newsletters, and a subgroup (n=18) also received individual counseling • Length: 18 mo	**Between baseline and end of intervention, in subgroup which received counseling** Dietary/behavioral: 72% of patients met individualized goals Biochemical: decrease in serum cholesterol (by average of 18 mg/dL) in 78% of patients who had this goal Anthropometric: decrease in weight (by average of 3.8 kg) in 85% of patients who had this goal	• Intervention tailored to individual lifestyles and health needs • Active involvement of patients in defining goals • Clear and practical messages

(continued)

Reference	Participants	Study design and intervention	Main significant outcomes	Characteristics linked to positive outcomes
Gough et al., 1992 (22)	• Diabetic (NIDDM) • N=51 • Mean age: 70.9 yrs; range: 61-84 yrs • Attrition rate: 25%; profile not reported	• Education program to increase knowledge and skills related to diet, exercise, weight control, and blood glucose monitoring • Self-selected, no control • Length: 7.5 h in three wk • Follow-up: after three and 12 mo	Knowledge: improvement in knowledge test score (by 66%) between baseline and end of intervention, sustained at 12-mo follow-up; no correlation found between age and change in knowledge test score Biochemical: reduction in fasting blood glucose level (by 10%) between baseline and three-mo follow-up, not sustained at 12-mo follow-up Anthropometric: decrease in weight (by 1.3 kg) and in body mass index (by 0.5 kg/m^2) between baseline and three-mo follow-up, not sustained at 12-mo follow-up	• Limited number of messages • Education materials in large print to help overcome problems with eyesight • Concepts reinforced • Variety of educational methods used
Kupka-Schutt et al., 1992 (30)	• Healthy • N=125 • Mean age: 72.2 yrs; range: 65+ yrs • Attrition rate: 17%; profile reported	• Education program to improve dietary behavior • Random, control and two intervention groups—one received model-based education and the other received lectures on the seven dietary guidelines • Length: 1 h/wk for four wk	Dietary/behavioral: decrease in number of subjects (by 37%) who chose less than recommended number of dairy servings, and decrease in intake of fat as a percentage of total energy (by 2.5%) in model-based intervention group, between baseline and end of intervention	• Use of behavioral theory (Mitic's nutrition instruction model) • Needs of participants identified • Instruction individualized • Practical advice provided
Colson and Green, 1991 (23)	• Hypertensive (H) and normotensive (N) • N=59 • Mean age: 73 yrs; range: 62-88 yrs • Attrition rate: 29%; profile reported	• Education program with emphasis on sodium restriction • Self-selected, H and N control (C) and H and N treatment (T) groups • Length: 1 h/wk for eight wk • Follow-up: after six wk	**Between baseline and end of intervention** Knowledge: improvement in sodium knowledge test score in NT group (by 10%) and in HT group (by 17%) Dietary/behavioral: decrease in sodium intake in HT group (by 182 mg) and increase in HC group (by 236 mg)	• Single message • Individuals with medical need motivated to adhere to program
Dennison et al., 1991 (24)	• Healthy, low-income • N=31 • Mean age: 76.5 yrs; range: 63-85 yrs; • Attrition rate: 0%	• Education program to improve food choices, and assess effectiveness of computer-assisted instruction • Self-selected, control and two intervention groups—group 1 used computers, group 2 did not • Length: four hours in two wk	**Following intervention** Dietary/behavioral: lower saturated fat intake in both intervention groups (9.4% of total energy in group 1; 9.2% in group 2) compared to control group (12.9%) Psychosocial: higher score on satisfaction questionnaire in group 1 than in group 2 ($P< 0.05$)	• Computer use involved active participation • Hands-on, experiential activity • Individualized messages

Campbell et al., 1990 (25)	• Uncontrolled diabetic (NIDDM) • N=70 • Mean age: 58.5 yrs • Attrition rate: 11%; profile reported	• Education program to achieve total fat intake ≤30% of total energy and total carbohydrate intake ≥50% of total energy • Random, no control, intensive (I) and conventional (C) groups. • Length: I group—22 h in 11 wk; C group-mean of 14 h in 3 days • Follow-up: after 1, 3, and 6 mo	**Between baseline and end of intervention** Dietary/behavioral: increase in percent total carbohydrate intake of C group (from 41% to 47%) and of I group (from 38% to 50%), and decrease in percent total fat intake of C group (from 42% to 35%) and of I group (from 45% to 29%) Biochemical: decrease in total serum cholesterol in I group (by 11%), sustained at six-mo follow-up	• Intensive, long-term program • Simplified, repeated messages • Use of behavioral theory (cognitive motivational theory)
Hackman et al., 1990 (27)	• Healthy • N=141 • Mean age: 67.6 yrs; range: 56-84 yrs • Attrition rate: 0%	• Nutrition education through gardening to encourage change in dietary behavior and promote psychological well-being • Self-selected at three sites, no control • Length: two meetings/mo and two home visits/mo for five mo	**Between baseline and end of intervention** Dietary/behavioral: increase in intake of whole grains and starchy vegetables at two sites (by 0.4 and 1.1 servings/d), vegetables and fruits at one site (by 0.4 servings/d), dairy products at two sites (by 0.2 and 0.5 servings/d) and water at all three sites (by 0.8, 1.5 and 2.3 servings/d) Psychosocial: increase in nutritional attitude score (by 8-15%) at all three sites and increase in gardening attitude score (by 22%) at two sites	• Use of behavioral theory (theories of perception of control and social support) • Active role of participants • Incentives provided • Participants encouraged to recognize and value their skills • Practical aspects of food production linked to nutrition
Hermann et al., 1990 (15)	• Healthy • N=24 • Age range: 60-88 yrs • Attrition rate: 0%	• "Healthy Aging" nutrition and fitness program to improve nutritional status and knowledge • Self-selected, no control • Length: 1 h/wk for 12 wk	**Between baseline and end of intervention** Knowledge: improvement in nutrition knowledge score (by 22%) Biochemical/physiological: decrease in serum triglycerides (by 12%), total cholesterol (by 4%),low-density lipoprotein cholesterol (by 5%), ratio of total cholesterol to high-density lipoprotein cholesterol (by 0.6), systolic blood pressure (by 13%) and diastolic blood pressure (by 11%); increase in high-density lipoprotein cholesterol (by 7%) Anthropometric: decrease in weight (by 0.9 kg)	• Participants were motivated and receptive to program content

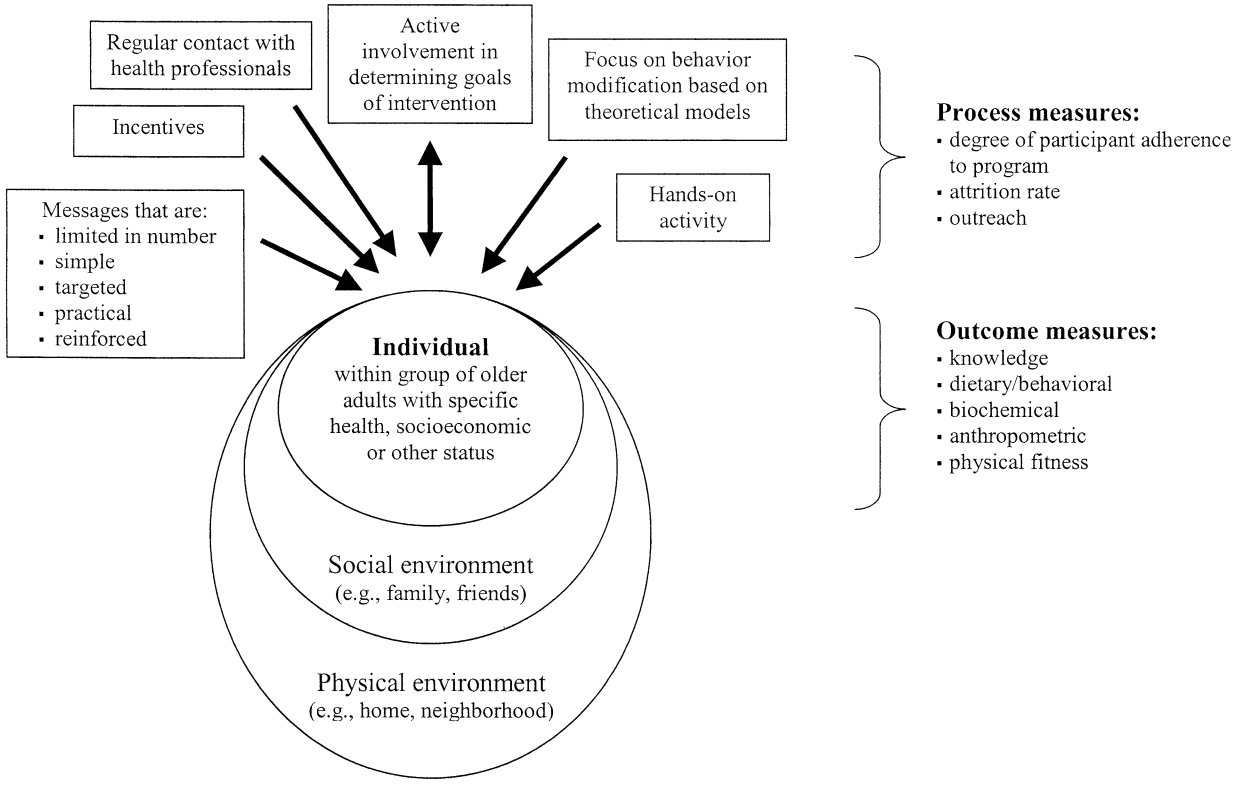

Figure. A framework for designing a nutrition education intervention for older adults.

domized with well-matched intervention and comparison groups. Randomization is needed to determine intervention effects and avoid selection bias. Most of the studies did not include power or sample size calculations and used small convenience samples, which limited their ability to detect intervention effects and generalize their findings. Often, the interventions were of insufficient duration to be effective, the health status and motivational levels of participants were not assessed, and participant needs were not targeted. Subjects' demographic profiles, including socioeconomic status and racial/ethnic backgrounds, were not always reported, and it does not appear that these characteristics were taken into consideration in the design of some of the studies. In addition, the high attrition rates in some studies cast doubt on their internal validity.

To achieve behavior change among the elderly we need to learn from what has worked and broaden our interventions to change or modify not only individual behaviors but also the environment in which members of the population live. Traditionally, nutrition education interventions have solely targeted persons to bring about changes in knowledge, attitudes, and skills. Major drawbacks of this strategy are that behavior change is short-term, the interventions do not reach large numbers, and their effects are not sustained. The public health implications of such interventions may therefore be limited (36). Campbell et al. (18) used an ecologic model in their intervention to increase fruit and vegetable consumption among an African American population. The intervention, conducted in African American churches, was culturally sensitive and targeted activities at the individual, social network, and community levels. Although the target population was not older adults, 56% of participants were aged 52 years or older. The intervention effect was highest among participants over age 65 years. This ecologic approach was encouraged in a report released by the Institute of Medicine that suggested interventions at multiple levels are most likely to sustain behavior change (37). Another Institute of Medicine report recommended using a conceptual model to frame interacting factors and practices (38).

A Framework for Nutrition Intervention

Based on the information obtained from this review, and on the concept that intervention at the individual level is not sufficient to effect sustainable behavior change, we suggest that future interventions be designed using the framework shown in the Figure. A combination of individual-level and environmental-level interventions may be more likely to be effective, in part because of their additive effects. At the individual level, we indicate with arrows the components that may need to be taken into consideration based on our findings from the studies reviewed. These components include nutrition messages that are limited in number, simple, targeted, practical, and reinforced; the use of incentives; regular contact with health professionals; and hands-on activities. It is also recommended that participants take part in setting program goals and remain active in assessing those goals throughout the intervention. An interactive process is essential to the long-term success of a program. In addition, we suggest segmentation of the group based on the premise that dietary habits are complex behaviors influenced by individual factors such as socioeconomic status,

health status, cultural background, educational level, and nutrition knowledge.

The framework suggests that persons are an integral part of their social and physical environments, and therefore interventions to modify the environment in which lifestyle choices are made are important to the goal of changing behaviors (39-41). Such interventions include modifications in the social, physical, and community (home and neighborhood) environments that have an influence on how persons make lifestyle decisions. For older adults in particular, interpersonal relations and social networks, as well as the physical environment (eg, the availability of walking trails in the neighborhood), can have an important effect on health behaviors (38,42). Evidence of possible effectiveness of environmental interventions has been demonstrated in smoking cessation research (43) and in dietary modification to increase fruit and vegetable consumption (39).

We also suggest using formative research in the initial phase of an intervention to match participants' needs with the aim of the intervention. This will assist in identifying segments of the population and subjects' level of readiness to change. These can be acknowledged and incorporated in the research design and intervention. The research design also needs to specify the unit of randomization and include adequate sample size and minority representation. Recruitment procedures and eligibility criteria need to be clear. The intervention plan should specify the setting, type of intervention contacts (eg, professional, lay person), duration and frequency of intervention, and measures of adherence. Process evaluation of interventions should be included in the study to determine whether the intervention was delivered and received as intended. Such measures may include assessment of attrition rates, intervention adherence, and outreach.

CONCLUSION

The ultimate goal of nutrition research and public health is to transfer acquired knowledge to populations so persons can make educated choices about their diets and lifestyles to achieve and maintain good health throughout life. Although good nutrition and appropriate lifestyle habits must start early in life to achieve a healthy old age, certain dietary modifications are also needed in later life to adjust to the physical and metabolic changes that occur with age. However, transference of information is minimal as indicated by the paucity of intervention programs for older adults. The results of this study suggest that we need to learn what constitutes well-constructed intervention programs targeting older adults and to develop and test these programs. This must be done before we can answer the question about whether nutrition education has a lasting influence on dietary behavior, biochemical changes, and, ultimately, health improvement or health maintenance among older adults. Considering the large population of older adults and the potential health expenditures, we cannot afford not to pursue this knowledge.

APPLICATIONS

Targeting nutrition education to older adults is necessary to prevent or delay the spiral toward ill health and disability. Based on our review, it appears (despite the limited number of well-planned interventions to date) that it is possible to impart knowledge to this population group. We need to learn more about how to achieve sustainable changes and study the consequences of these changes over the long term. Dietetics professionals are encouraged to target older adults in their intervention programs and to use the features suggested in our framework to plan interventions. Grouping older adults by a characteristic such as health or functional status may allow nutrition and health messages to be specific. In addition to using interpersonal methods, it is necessary to understand the presence and importance of social support and network in older persons' lives and the environmental context in which they live to plan a program that has the greatest chances for success.

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APPLICATIONS

A Call for Research: What Works When Teaching Older Adults to Improve Their Nutrition Practices?

Benefits of nutrition education in controlling health care costs and safeguarding older adults' quality of life have received scant attention. Indeed, data for cost-benefits of community-based nutrition education—versus individual nutrition counseling—for older adults are not available (1). The preceding study by Sahyoun et al (2) makes a strong case that educational interventions can make a positive difference for older learners. Using appropriate teaching and behavioral change methods, dietetics professionals can and should help older adults make educated choices about their diets and lifestyles in order for them to maximize their nutritional status and enjoy healthful aging.

Sahyoun et al (2) found only 25 community-based nutrition education studies since 1990 that reported outcomes for older adults. Knowledge gains were the most frequent outcome; behavior changes and physiologic improvements were variable. Dietetics professionals are encouraged to apply the authors' proposed guidelines and use multiple approaches within the human ecological model when designing future nutrition education intervention programs. One of the article's messages is that dietetics professionals must consider experimental designs more carefully. Sahyoun and colleagues advocate more thorough descriptions of the audience and assessment of their needs and interests. Additionally, components of behavioral change theory should be incorporated.

The researchers' goal was to help dietetics professionals identify the salient points of successful programs. Dietetics professionals should be aware that these points have yet to be validated, ie, rigorously tested to confirm that they truly contributed to significant outcomes, because the authors could not identify with certainty which of a study's components were responsible for program success. In one example, Sahyoun et al (2) described an unsuccessful program as having the limitation of "providing information by mail," but among studies with significant outcomes, there was one that had provided newsletters. Supplying contact in addition to mailed educational packets, however, even via short bouts of dietary advice over the telephone, resulted in better outcomes.

Dietetics professionals would be helped even more if future review authors would provide details on the educational methods used and the intensity of each intervention. If review authors supplied details about studies with insignificant effects, such as by adding a table for comparative purposes, dietetics practitioners would be able to learn much from these studies as well. Describing programs as having "insufficient contact" and "short interventions" provides little specific information to guide dietetics professionals in their teaching practices, but interested readers could refer to the original studies for more details.

Drawing additional conclusions from a similar literature review (3), dietetics professionals would benefit if they collaborated in designing comprehensive studies, such as by working with those whose expertise is in evaluation. They should differentiate reports of self-perceived versus verified nutrition behaviors and should measure several kinds of outcomes at longer follow-up intervals after interventions have ceased. We learn, individually and collectively, from our successes and our failures, and I encourage dietetics professionals and the *Journal* to report on each. Both the need for new research on best practices and the rewards of effectively reaching the myriad of older audiences with nutrition education are great.

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