

Development of Nutrition Education Materials for Prevention and Management of Diabetes Mellitus for Older Adults*

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ABSTRACT

Nutrition is important in the management of diabetes mellitus, however, there are few little education materials specifically designed for older adults. The objective of this study was to develop nutrition education materials for prevention and management of diabetes mell for older adults. Materials developed were a booklet and four leaflets. The contents of materials were based on lesson plans. After several revisions of the draft of materials, illustrations and icons appropriate to the contents were designed using Illustrator 9.0 and Photoshop 6.0. The booklet was composed of five chapters and 40 pages. The first chapter began with an introduction about diabetes and diabetes management by diet, exercise and medication. The second chapter dealt with ideal body weight, calculation of adequate caloric intake and food exchange list. The third chapter provided information for meal planning and sample menus. The fourth chapter focused on practical tips on nutritional care of diabetes, by providing tips on reducing sugars, fat and salt, and suggestions on eating for special occasions. The fifth chapter dealt with information in case of low blood sugars, exercise and foot care. The topics of the four leaflets were "Diabetes, what is it and care", "Food exchange list and meal planning", "Healthy eating for diabetes", "Special care for diabetes : low blood sugars, exercise and foot care". Each leaflet was composed of six sections and was printed in large paper (B4 size) for older adults. The draft of educational materials were reviewed by four nutrition professionals and finally pilot-tested with ten adults aged 50 and older. The characteristics of the developed materials are as follows ; i) messages are delivered using simple, specific information, ii) messages focused on practical applicable tips, iii) various pictures, illustrations and artwork were created and inserted to enhance understanding and interest, iv) sections including risk factor assessment, calculation of ideal body weight and meal planning were designed to induce the user's participation, v) sample menus and food pictures were inserted in the booklet, vi) characteristics of older adults and transformed characteristics are diversely used to help the user feel familiarity. These materials are self-explanatory and can be used by older adults. These materials also can be used widely in nutrition education at public health centers or senior centers.

KEY WORDS : older adults · nutrition education materials · diabetes mellitus.

Introduction

The proportion of older adults, aged over 65, reached to 7.9% of total population in 2001 and is expected to increase

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to 14% in 2022 (National Statistical office 2001). With the rapid increase in the elderly population, older adults suffering from chronic conditions are also increasing. Diabetes mellitus followed by heart diseases, dementia, and liver diseases, were the most prevalent diseases (101 per 1,000) among adults aged 60 and over (National Statistical Office 1998). In addition, the complications of diabetes mellitus are serious. According to American Dietetic Association (1986), the risk for heart diseases was 2 – 4 times higher and the risk for stroke was 2 – 6 times higher among diabetic patients compared to normal adults. One-tenth of diabetic patients suffer from end-stage renal diseases requiring dialysis or kidney transplants.

Kim et al (1991) reported that diabetic patients showed high levels of blood lipids and were more likely to suffer from atherosclerosis or heart diseases.

Nutritional care, as well as exercise, is very important in diabetes management (Pakes 1995). Much research on nutrition and diabetes mellitus has focused on metabolic studies or clinical studies (Choi 1993 ; Kim et al. 1991 ; Yang, Kim 1999a). In contrast, nutrition counseling or education has received attention during the past several years in Korea, and education programs for diabetic patients were implemented through public health centers and hospitals (Cho, Sung 1998 ; Moon et al. 1994 ; Son, Kim 2001). Yang, Kim (1999b) reported that diabetic patients showed undesirable eating habits, such as preference for foods high in fat or high in salt, drinking, smoking and eating too much sugar.

Studies on nutrition education or counseling for diabetes management showed promising results. More specifically, diabetic patients who received group education showed more interest toward diet therapy as well as significant increase in nutritional knowledge (Cho, Sung 1998 ; Kendall, Jansen 1990). In another study, diabetic patients in the experimental group received counseling on diet therapy and behavioral modification skills (Moon et al. 1994). Diabetic patients who received nutrition counseling, compared to control groups, showed better food attitudes and decreased blood glucose level. In a study with female diabetic patients, Son, Kim (2001) conducted seven sessions of nutrition education programs for diabetic older adults. The program started with nutrition assessment and provided information on diet guidelines, serving size and food exchange list. This program also used a practical approach by including food selection skills using food models and meal planning. After participating in 7-sessions of nutrition education, there was a significant increase in nutritional knowledge such as reducing salt, animal fat and alcohol. Subjects in this study also improved some dietary behaviors by increasing vegetable consumption and decreasing sugar intake (Son & Kim 2001).

For effective nutrition education, it is important to use or develop educational materials that are reliable and attractive. There are many stages to develop valid and attractive materials ; constructing contents based on scientific accuracy and relevance, incorporating illustrations or figures, pre-testing the materials through focus group interviews or peer reviews and revising the materials (Pennington & Hubbard 2002). While the interest toward nutrition education for the

diabetes management is growing, educational materials specifically designed for older adults are lacking. In a survey with dietitians working at public health centers, it was noticeable that dietitians spend much time on developing educational materials and that they wanted to have standard educational materials for older adults (Kim 2000). In a needs assessment study for developing nutrition education materials for older adults, dietitians pointed out the need to develop visually appropriate materials by using large fonts and interesting illustrations (Kim et al. 2001). In addition, they mentioned the need to develop education materials that are easily understood and attractive for older adults. The purpose of this study was to develop nutrition educational materials for diabetes management specifically designed for older adults.

Methods

1. Framework for developing educational materials

Topic for educational materials was chosen as nutritional management for diabetes. As to the types of educational materials, we decided to develop a booklet and leaflets for adults aged 50 years and older, taking into account the results of needs assessment regarding nutrition education materials for older adults (Kim et al. 2001). More specifically the target audiences are adults aged 50 and older who are literate. These materials were designed to provide basic information on diabetes mellitus, dietary management for diabetes mellitus, and skills for dietary change. These materials were developed to be self-explanatory, as well as to be used in nutrition education for older adults.

To create educational materials more systematically, lesson plans were developed first. Lesson plans consisted of five sessions. Topics and contents of lesson plans were decided based on publications on nutrition and diabetes (Korean Dietetic Association 1999 ; Mo et al. 2000 ; Monk et al. 1996 ; Rickheim et al. 2000). Four nutrition professionals reviewed lesson plans. Subtopics for the booklet were identified based on the lesson plans (Table 1).

2. Constructing contents of educational materials

A booklet was created for nutritional management of diabetes mellitus. Based on professional journals and publications on nutrition for older adults, nutrition and diabetes, and existing educational materials (Geil, Holzmeister 1999 ; Korean Dietetic Association 1999 ; Rickheim et al. 2000 ;

Table 1. Framework for developing a booklet of nutritional management for diabetes mellitus

Section	Topics
Introduction to diabetes mellitus	1. What is diabetes? : types, symptoms and complications
	2. Assessment of diabetes risk factors
	3. Diabetes management through diet, exercise and medication
Ideal body weight and food exchange list	1. Assessment of ideal body weight and obesity
	2. How much energy intake is adequate for me?
	3. Food exchange list
Meal planning	1. Meal planning using food exchange list
	2. Sample menu for two days
Eat wisely to control diabetes mellitus	1. Reducing sugars, salt and fat
	2. Tips for snacking and beverages
	3. Tips on eating during holidays or eating-out
More about the diabetes management	1. In case of low blood sugar : symptoms and care
	2. Maintaining normal blood sugar during exercise
	3. Foot care caution

Schlenker 1998), the draft of a booklet was made. Four leaflets were developed by choosing important themes in the booklet.

The contents of the booklet and leaflets were revised more than five times by a research team considering the validity of contents, comprehension, and appropriateness of words. In addition, the drafts were modified by including the comments from four nutrition professionals (including three dietitians). A writer was also involved in the process of revising the materials, to make them more readable and easily understood.

3. Developing educational materials

After several revisions of contents of materials, booklets and leaflets were designed and edited by including illustrations, pictures, and figures created by artists and graphic designers. Illustrations and icons appropriate to each content were designed using Illustrator 9.0. Photoshop 6.0 was used to adjust colors of the pictures or illustrations. Characters (e.g., older adults) were created, and a variety of transformed characters were inserted in educational materials. Pagemaker 6.5 program was used to combine the created materials into a booklet or leaflets.

4. Pretest of educational materials

These materials were tested with ten adults aged 50 and older by one-to-one interviews. This pilot study was designed to check the relevance, comprehension and attractiveness of the educational materials. Subjects were recruited at two pu-

blic health centers and by personal contacts. Subjects were asked to read and review the educational materials thoroughly. The investigator met the subjects a week later and interviewed the subjects by asking to point out the sections, sentences, words or illustrations that were difficult to understand or needed to be modified. In addition, subjects were also asked to respond to closed-format questions (5-point scales) to evaluate the degree of understanding, sufficiency of information provided, attractiveness, font size, illustrations, and usefulness of materials in daily lives. The educational materials were revised again based on the results of the pilot study.

Results and Discussion

1. Booklet for nutritional management of diabetes mellitus

The booklet was titled as "prevention and treatment of diabetes mellitus for older adults" and was produced in letter-size papers, consisting of 40 pages. It was composed of five chapters, as in Table 1, and each chapter started with an introductory page with illustrations of older adults (Fig. 1). Four nutrition professionals reviewed the draft of the booklet in the process of developing a booklet. The major comments were : i) present information on the food exchange list simply (e.g., divide the meat and fish group into low- and medium-fat, instead of three groups), ii) include more examples of activities for older adults in the activity figure, iii) delete some



Fig. 1. Introductory page of a chapter in the booklet.

of the detailed information (e.g., insulin use, medication), iv) suggest a menu considering the caloric intake for diabetic patients. In addition, they checked the sentences and words and suggest the changes if needed. The following describes the booklet developed in this study.

1) Introduction to diabetes

The first chapter began with an introduction about diabetes, such as what diabetes is, types, symptoms and complications of diabetes. These were mainly explained by illustrations and characteristics of older adults to increase the familiarity to the user and make the materials attractive (Kim et al. 2001). The self-assessment for diabetic risk factors was provided and was designed to induce the participation of the user. In addition, suggestions and tips for diabetes management (diet, exercise, and medications) were included. In diet therapy, the importance and tips for eating regularly, eating a variety of foods, and eating adequately were stressed using the characters of grandchildren. In designing the messages, simple concepts were presented with smaller amounts of information, considering the decreased cognitive functioning in older adults (Weinrich, Boyd 1992).

The advantages of physical activity, such as improved

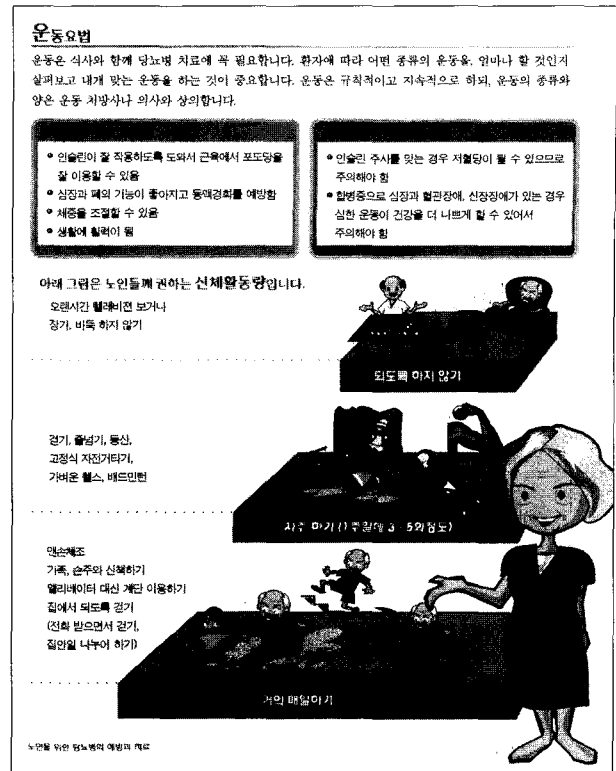


Fig. 2. A page of booklet showing the physical activity guide for older adults.

glucose tolerance, weight control and reduction of risk factors for atherosclerosis, were presented in diabetes management through exercise (Franz 1987). The guide for physical activity was also developed using illustrations (Fig. 2) by modifying the activity pyramid for older adults (Rickheim et al. 2000). In this guide, physical activity and exercise were categorized into “almost everyday”, “3 – 5 times per week”, “avoid if possible” activities. The physical activities appropriate to each category were decided by considering the physical characteristics of older adults and incorporating the suggestion of the professor majoring in physical education. The page of a diabetes management through medications was simplified just by including the figures to record the time for meals and insulin and the name of medications, following the suggestions of nutrition professionals who reviewed the draft of materials.

2) Ideal body weight and food exchange list

The second chapter dealt with ideal body weight, calculation of adequate caloric intake, and the food exchange list (Korean Dietetic Association 1995 ; Lee et al. 1999). Obesity is a major risk factor for diabetes mellitus and maintaining ideal or adequate body weight is the first step in the preven-

tion and management of diabetes mellitus. This section was designed to involve the learners' participation, and to let them calculate ideal body weight and to assess the obesity using waist-hip ratio (Fig. 3). The example of assessing adequate caloric intake was shown in the booklet and let the user calculate the adequate caloric intake based on the user's activity level. In assessing ideal body weight or adequate caloric intake, older adults were asked to use a calculator or get as-

sistance from nutrition educators.

The food exchange list, developed by Korean Dietetic Association (1995), was introduced using a pie graph, to make it simple and to enhance understanding (Fig. 4). Foods in the food exchange list were shown in illustrations and simple words. According to the comments from nutrition professionals, the meat and fish group was divided into two groups (low-, medium-fat group) based on the idea that high-fat foods are not recommended for diabetes patients.

3) Meal planning

The third chapter included information for meal planning and sample menus. The concept of meal planning might not be familiar to older adults, thus the tips for meal planning were presented step by step. First, a table for food exchange units appropriate to caloric intake level (from 1,400 to 2,100kcal per day) was presented to allow the user to figure out the recommended numbers of food exchange units considering caloric intake (Korean Dietetic Association, 1997). Secondly tips for meal planning were suggested by asking older adults to use a variety of foods in meal planning as major staples (grains), side dishes (vegetables, meat, fish) and snacks (fruits, dairy foods). The example of applying food exchange units in daily diet was shown and the section to practice meal planning was followed.

Sample menus (1,600 to 1,800kcal) for two days and food pictures for each meal were inserted in the booklet (Fig. 5). In planning the sample menu, such criteria as nutrition, taste, cost and using easily digested foods were considered (Choi,

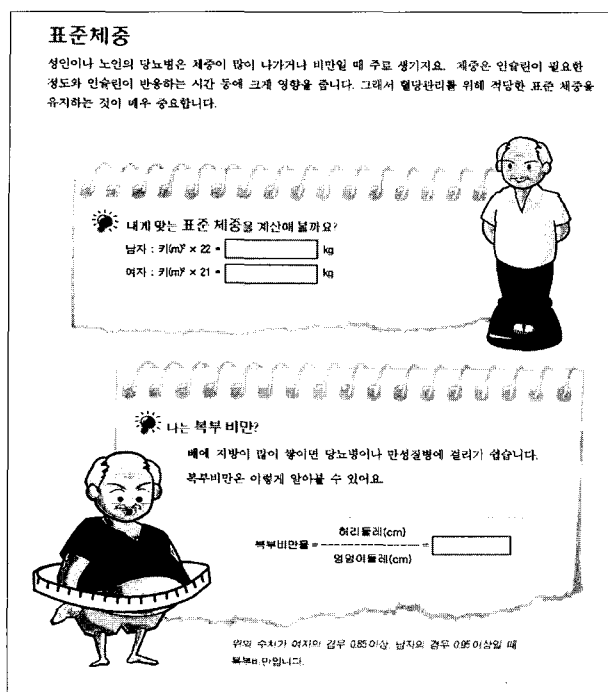


Fig. 3. A page of booklet showing self-assessment of ideal body weight and obesity.

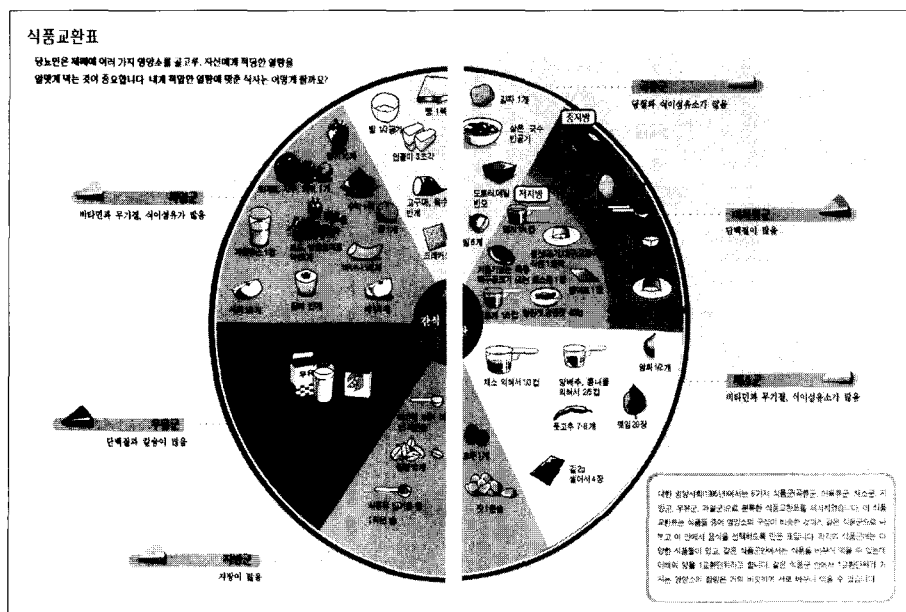


Fig. 4. A page of booklet showing food exchange list.

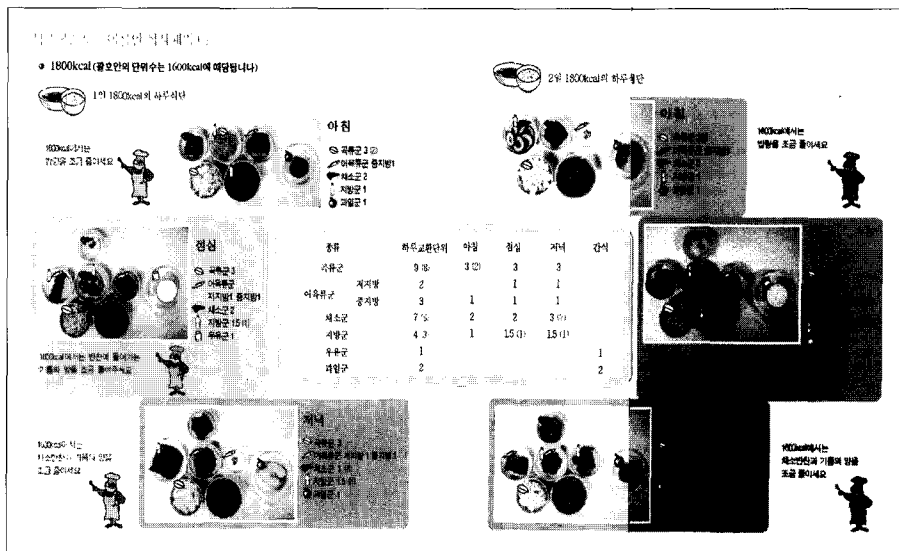


Fig. 5. A page of booklet showing example of menu (1,800kcal) for a day.

Park 2001). The food exchange units were reduced in 1,600 kcal menu, by decreasing the amount of cooked rice, side dishes and oils used in cooking foods. We cooked the foods in 1,800kcal menu and took pictures of each meal (breakfast, lunch and dinner). The food pictures and food exchange units of each meal were shown in the booklet.

4) Eat wisely to control diabetes mellitus

The fourth chapter mainly included suggestions on nutritional care of diabetes mellitus. More specifically, this chapter started with what desirable eating is and food selection for snacks and drinks. For nutritional management of diabetes mellitus, it is important to apply how to reduce sugars, fat and salt in eating meals (Korean Dietetic Association 1999 ; Geil, Holzmeister 1999). Thus, the tips on reducing sugars, fat and salt were stressed in this chapter. For example, to reduce salt consumption, methods such as reducing sauces in foods (soy sauce, red bean paste), using natural flavors (vinegar, garlic, mustard, sesame), reducing processed foods and salt-preserved foods, and reducing invisible salt (e.g., mayonnaise, ketchup) were stressed. Finally, there were tips on eating on such occasions as holidays and eating-out (Fig. 6). In summary, this section focused on practical methods of applying nutritional concerns rather than providing nutritional information.

5) More about the diabetes management

The fifth chapter dealt with information in case of low blood sugars, exercise and foot care. Low blood sugars are common symptoms of diabetes mellitus. This section showed

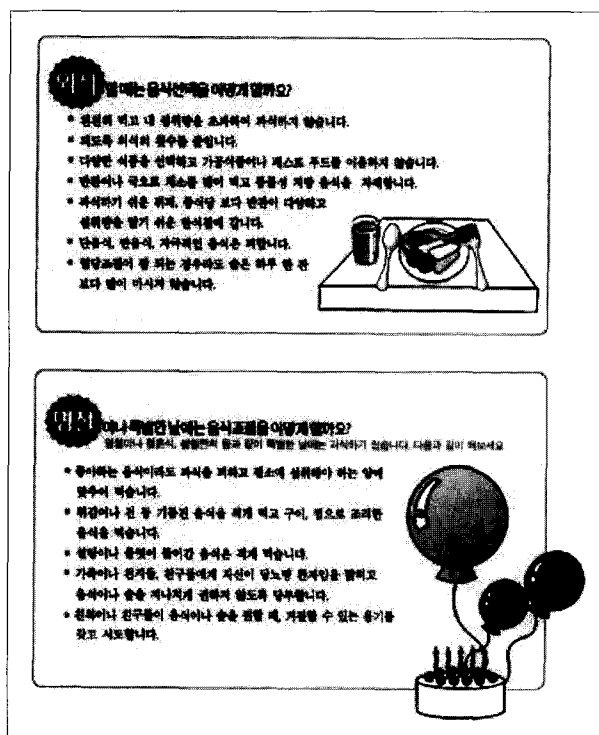


Fig. 6. A page of booklet showing tips on eating out and holidays.

what the symptoms of low blood sugars, when it happens and how to treat (Korean Dietetic Association 1999, Fig. 7). Maintaining adequate blood glucose level is also important before or during physical activity and exercise, and the tips on care (e.g., eating snacks during different levels of physical activity) were shown in the booklet (Geil, Holzmeister 1999). In addition, the importance and tips on foot care, which are one of the major concerns for diabetic patients, were shown.

Finally, games were provided to reinforce the information presented. Games included meal planning using food stickers and word puzzles. In the meal planning game, the illustrations of dining table were prepared for breakfast, lunch and dinner and the user was asked to choose and put food stickers among 80 food illustrations on the dining table. This game was designed to practice the information in the booklet and to induce interest. Word puzzles were designed to reinforce the important themes in diabetes management (Fig. 8). The answers were shown at the bottom of the page.

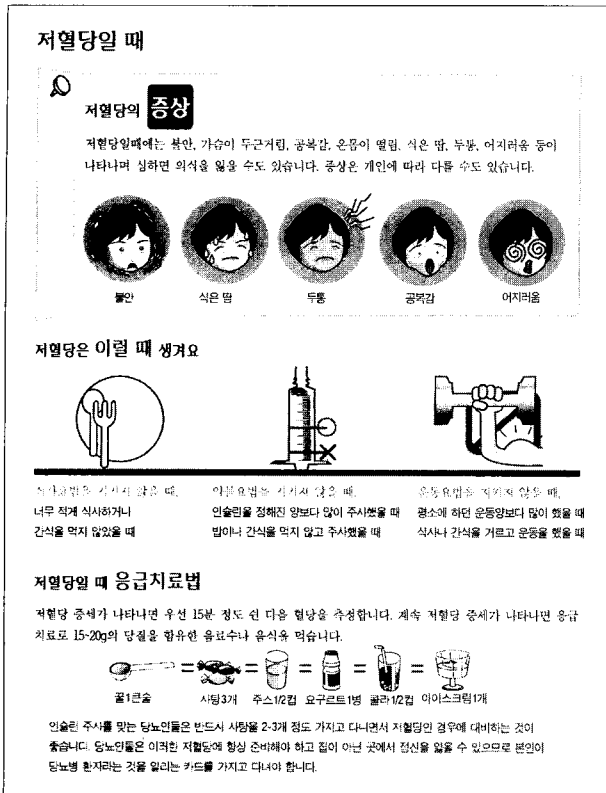


Fig. 7. A page of booklet showing cares in case of low blood sugars.

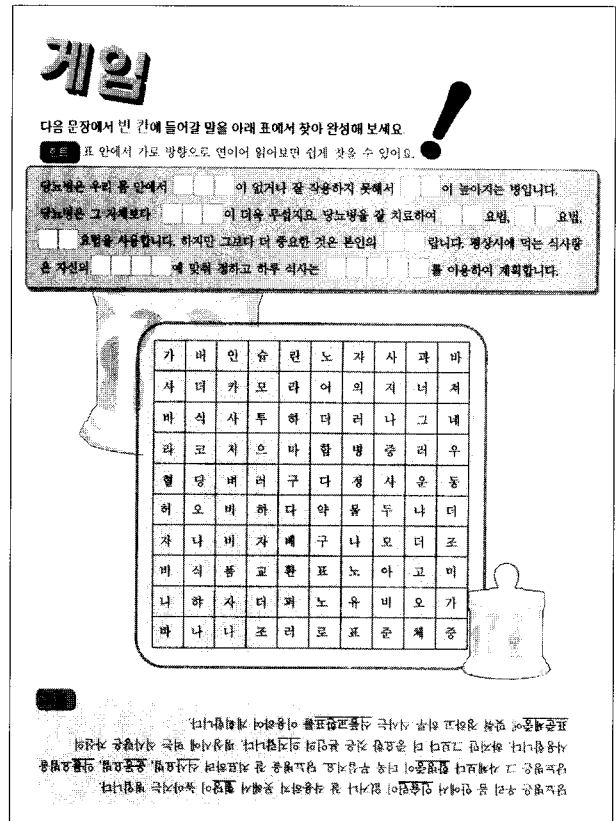


Fig. 8. A page of booklet showing a game.

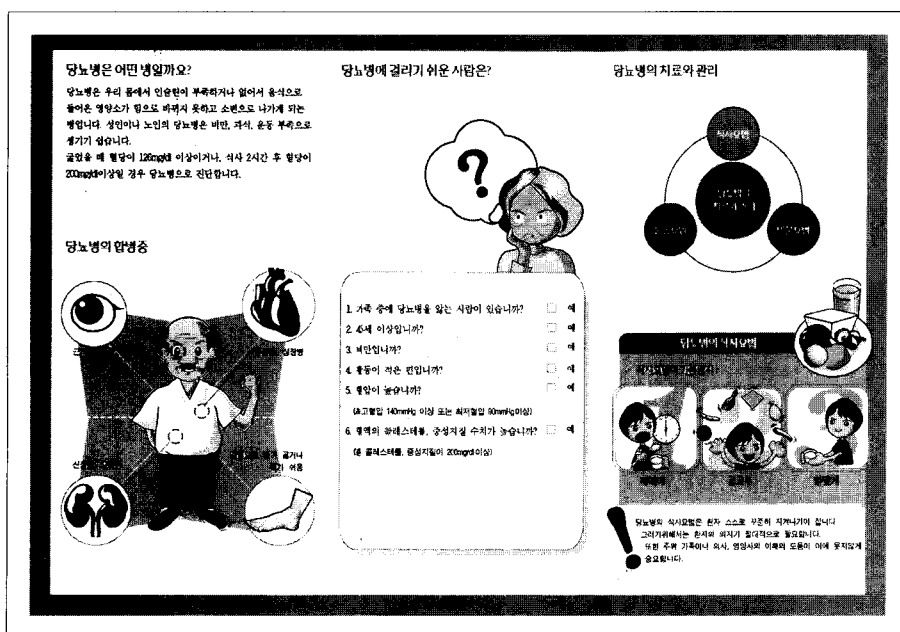


Fig. 9. Leaflet "Diabetes, what is it and care".

2. Leaflets for nutritional management of diabetes mellitus

Four leaflets on diabetes were also developed. Each leaflet was composed of six sections and was printed on large paper (B4 size) for older adults. It was printed using large type (13 point after the process evaluation with older adults). The principles of KISS (keep it simple and specific) and provision of practical information were considered in developing the leaflets on diabetes mellitus (Kim 2000 ; Lancaster et al. 1997).

The first leaflet, “Diabetes, what is it and care”, started with an explanation of what diabetes is and addressed risk factors and complications of diabetes mellitus, and three ways of diabetes management (diet, exercise and medication). In the leaflets, written explanations were kept minimal, instead, illustrations and characters of older adults and grandchildren

were used to introduce the information (Fig. 9).

The second leaflet was titled “Weight management and adequate caloric intake is important for diabetes”. It dealt with assessing ideal body weight and caloric requirement using simple methods. It also presented the pie graph of the food exchange list, as in the second chapter of the booklet. Six food groups in the exchange list were presented using different colors and showed how to use these foods in meal planning. On the back page of the leaflets, tips on meal planning and sections for practicing meal planning were shown.

The third leaflet was titled “Healthy eating for diabetes mellitus”. This leaflet has information on snack, sugar, fat and salt, and tips on beverages and eating out. The front page of the leaflet is presented in Fig. 10. Again, presenting prac-

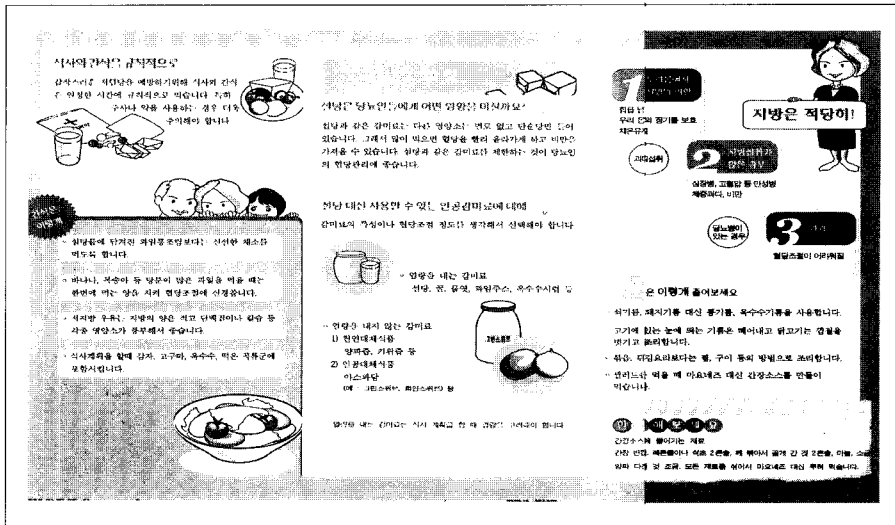


Fig. 10. Leaflet “Healthy eating for diabetes”.

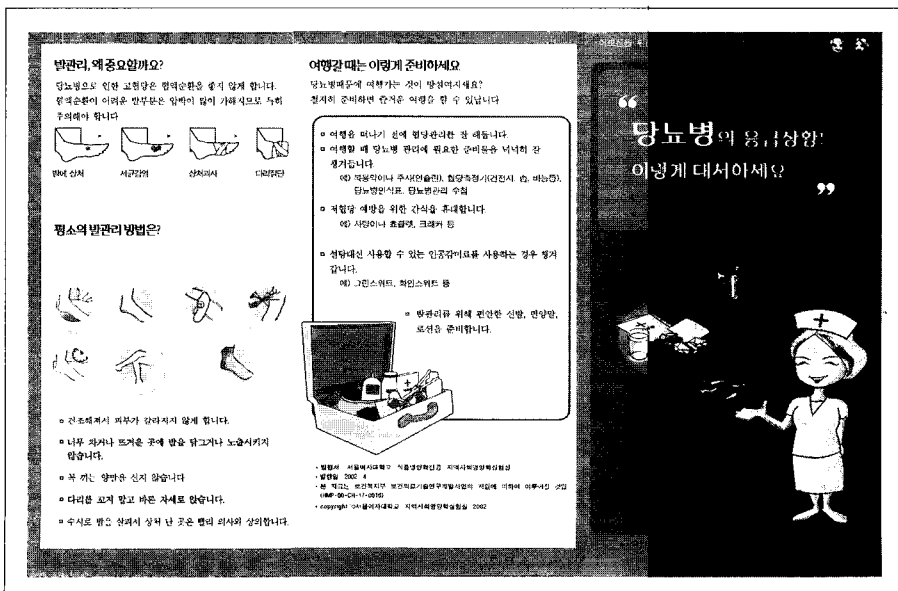


Fig. 11. Leaflet “Special care for diabetes”.

tical applicable information and layout of simple presentation were focused in this leaflet.

The fourth leaflet, “Special care for diabetes”, addressed low blood sugars, foot care and care during travel (Fig. 11). Care in case of low blood glucose was shown using illustrations of foods containing 15 – 20g of carbohydrates. The damage of the foot resulting from diabetes mellitus was introduced and simple methods of care were shown using illustrations.

3. Characteristics of the educational materials

The characteristics of the developed materials, a booklet and four leaflets for nutritional management of diabetes mellitus, are as follows :

- Messages are presented using simple words and sentences for older adults.
- The materials included how-to information rather than providing fact-based nutrition information.
- A variety of pictures, illustrations and artwork were created and inserted in the booklet and leaflets, to enhance understanding and interest.
- Food exchange list, one of the important concepts in nutritional management of diabetes mellitus, was introduced using graphic illustrations to present information in a simple way and to increase understanding.
- The booklet and leaflets had sections for participation of the learners, including risk factor assessment, calculation of ideal body weight and caloric requirement, and meal planning. These were designed to induce the motivation, interest and involvement toward nutritional management of diabetes mellitus.
- The sample menus and food pictures were inserted in the booklet. This will help the learner to understand calories of meals and to plan meals.
- Nutritional concerns of diabetes care were explained using practical applicable tips. More specifically, tips on reducing sugars, fat and salts, and tips on holidays and eating-out are shown.
- Games were included in the booklet to reinforce the information presented and to increase the interest.
- Characters of older adults and transformed characters were diversely used in the booklet and leaflets to help the user feel the familiarity.

In future research, it might be desirable to expand the research and develop educational materials for diabetes mellitus of other target audiences, such as those for children and

gestational diabetes.

4. Process evaluation of educational materials

Pilot-test of educational materials was done with ten adults aged 50 and older (mean age : 66.8 ± 7.5 years, 6 women, 4 men). Three of them received less than elementary school education and needed more assistance in evaluation, four persons were middle school or high school graduates, and three persons received college or higher education. Subjects responded that the most helpful chapter in the booklet was “Eat wisely to control diabetes mellitus” (n = 5), followed by “Introduction to diabetes mellitus”, “More about the diabetes management” (n = 2, respectively), “Meal planning” (n = 1). With respect to the leaflets, leaflets titled as “Eat wisely to

Table 2. Evaluation of educational materials

Variables	Booklet N(%)	Leaflets N(%)
<u>Degree of information provided</u>		
Very sufficient	3 (30.0)	1 (10.0)
Sufficient	6 (60.0)	7 (70.0)
On average	0 (0.0)	1 (10.0)
Insufficient	1 (10.0)	1 (10.0)
Very insufficient	0 (0.0)	0 (0.0)
<u>Degree of understanding</u>		
Very easy to understand	4 (40.0)	4 (40.0)
Easy to understand	4 (40.0)	3 (30.0)
On average	0 (0.0)	0 (0.0)
Difficult to understand	2 (20.0)	2 (20.0)
Very difficult to understand	0 (0.0)	1 (10.0)
<u>Attractiveness or interest</u>		
Very attractive	7 (70.0)	3 (30.0)
Attractive	2 (20.0)	4 (40.0)
On average	1 (10.0)	3 (30.0)
Unattractive / very unattractive	0 (0.0)	0 (0.0)
<u>Font size</u>		
Very small	2 (20.0)	2 (20.0)
Small	3 (30.0)	3 (30.0)
Adequate	5 (50.0)	5 (50.0)
Large / very large	0 (0.0)	0 (0.0)
<u>Illustrations to understand contents</u>		
Very helpful	6 (60.0)	7 (70.0)
Helpful	3 (30.0)	3 (30.0)
On average	1 (10.0)	0 (0.0)
Did not help / did not help at all	0 (0.0)	0 (0.0)
<u>Usefulness of materials in daily lives</u>		
Very useful	7 (70.0)	6 (60.0)
Useful	3 (30.0)	4 (40.0)
On average	0 (0.0)	0 (0.0)
Useless / very useless	0 (0.0)	0 (0.0)

control diabetes mellitus” and “More about the diabetes management”(n = 4, respectively) were chosen as being the most helpful. This result indicates that subjects liked practically applicable information or tips for dietary change.

Responses to the closed-format questions are shown in Table 2. Subjects responded that the information in the educational materials was “very sufficient” or “sufficient” (booklet : n = 9, leaflets : n = 8). Most subjects also indicated that the booklet and leaflets were attractive and easy to understand. The illustrations were “very helpful” or “helpful” to understand the text. Subjects also responded very positively on the usefulness of these materials in daily lives. However, some subjects (n = 5) expressed that font sizes (10.5 or 11

point in the text) were small (Table 2). Thus, larger font sizes were used in the revised materials (12 point in the text of booklet, 13 point in the text of leaflets).

The major comments from open-ended questions and interviews are shown in Table 3. Major comments from this pilot study were as follows : i) it was “very easy” or “easy” to understand the contents in the materials, ii) some older adults have difficulty in understanding the assessment procedures (e.g., assessing ideal body weight and caloric requirement), iii) they liked the graphic presentation of food exchange list, but some of them wanted more explanation regarding exchange units, iv) several subjects suggested that they need help in meal planning section, v) illustrations and pictures enha-

Table 3. Evaluation of the booklet using open-ended questions and interviews

Chapter	Major comments	Revisions
Introduction to diabetes mellitus	<ul style="list-style-type: none"> It's somewhat difficult to understand some words (Chinese meaning). It would be better to use larger font size and reduce the text or sentences. Illustrations enhanced understanding of contents. Overall, it's not difficult to understand. 	<ul style="list-style-type: none"> There were changes in some words to make it easy to understand (e.g., eat too much, drink too much). Text and sentences were reduced (about to 2/3 after revision) throughout the booklet. Used larger font size (12 points in text, 14 point for subtitles, 20 points for titles) throughout the booklet.
Ideal body weight & food exchange list	<ul style="list-style-type: none"> Some older adults had difficulty in calculating IBW or adequate caloric intake. It's somewhat difficult to understand formulas or units (e.g., kcal, squares in calculation). It would be better to include example of calculation. Need more explanation about food exchange unit. Subjects liked graphic presentation of food exchange unit. 	<ul style="list-style-type: none"> Add the information, “to use calculator or get help from others to assess IBM or adequate caloric intake”. In the revised booklet, units were expressed in Korean and examples to assess IBM or adequate caloric intake were included. Most of food exchange unit was expressed using cups, numbers, to enhance understanding.
Meal planning	<ul style="list-style-type: none"> Overall, the explanation was not difficult to understand, but subjects might need help in meal planning from educators. There are many side dishes in example of meals. 	<ul style="list-style-type: none"> No changes in the number of side dishes ; each meal was composed of rice, soup and 3 – 4 side dishes.
Eat wisely to control diabetes mellitus	<ul style="list-style-type: none"> It's easy to understand, but there is too much information. It's better to use larger font size. Some words are difficult (e.g., aspartame, sports drink). It's interesting to have 'how-to' information (e.g., how to make soy dressing for salads). Good to have substitution skills (e.g., how to reduce salt intake, selection of drinks). Many subjects agreed on the tips of eating during holidays or eating-out. 	<ul style="list-style-type: none"> Reduced the amount of information and tips for dietary change. Used larger font size. Some words are deleted or modified to increase understanding.
More about the diabetes management	<ul style="list-style-type: none"> The amount of snack before/after exercise is too less. It's better to have more information on exercise (e.g., exercise type, duration). It's good to know about foot care. There's too much information and illustrations on foot care. 	<ul style="list-style-type: none"> The snack amount was based on scientific literature and was not changed. Information on foot care and illustrations were reduced (included 6 tips for foot care).
Games	<ul style="list-style-type: none"> In word puzzles, there were too many questions (long sentences). It's interesting. The games helped understanding of what I read/learned. 	<ul style="list-style-type: none"> Hints (words in the box) were reduced, to make it easy.

nced the understanding of the information presented greatly, vi) some words (e.g., aspartame, sports drink) were not easy to understand and needed to be changed, vii) overall, the materials covers topics very well and were attractive. Based on these responses, the booklet and leaflets were revised. The major modifications were : i) text and sentences were reduced (about to 2/3 after revision) to make it more simple and easy to understand, ii) used larger font size, iii) some words were replaced with simple words for understanding. Through several revisions in the process of developing and pilot testing of the booklet and leaflets, these materials are self-exploratory and can be used by older adults. These materials also can be used widely in nutrition education at public health centers or senior centers.

Summary and Conclusion

The objective of this study was to develop nutrition education materials for nutritional management of diabetes mellitus for older adults. A booklet and four leaflets were developed following the topics of lesson plans consisting of five sessions. The booklet (letter size, 40 pages) was composed of five chapters, including introduction to diabetes, ideal body weight and food exchange list, meal planning, eat wisely to control diabetes mellitus and more about the diabetes management. The topics of the four leaflets were "Diabetes, what is it and care", "Food exchange list and meal planning", "Healthy eating for diabetes", "Special care for diabetes : low blood sugars, exercise and foot care". Each leaflet was composed of six sections and was printed in large paper (B4 size) for older adults. The drafts of educational materials were reviewed by the researchers and four nutrition professionals and finally pilot-tested with ten adults aged 50 and older. The characteristics of developed materials are as follows :

- 1) Messages are presented using simple words and sentences for older adults.
- 2) Messages focused on practical applicable tips. For example, tips on reducing sugars, fat and salts, and tips on holidays and eating-out are shown.
- 3) A variety of pictures, illustrations and artwork were created and inserted in the booklet and leaflets, to enhance understanding and interest.
- 4) Food exchange list was introduced using graphic illustrations, to present information in a simple way and to increase understanding.

5) To induce motivation and involvement, there are sections for participation of the learners, including risk factor assessment, calculation of ideal body weight and caloric requirement, and meal planning.

6) The sample menus were presented and food pictures were inserted in the booklet. This aim is to help the learner to understand calories of meals and to plan meals.

7) Games are included in the booklet to reinforce the information presented and to increase interest.

8) Characters of older adults and transformed characters are diversely used in the booklet and leaflets to help the user feel the familiarity.

These materials are self-explanatory and can be used by older adults. These materials also can be used widely in nutrition education classes at public health centers or senior centers

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