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Original Article

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Development of a scale that assesses diet-related life skills in dialysis patients with diabetes

Hatsue Hamano, Keiko Tasaki[1)*], Tomomi Horiguchi[1)], Yuya Asada[1)], Michiko Inagaki[1)]

Abstract

Objectives: Hemodialysis patients with diabetes are at high risk of developing specific nutritional disorders; therefore nutritional care is important. To achieve this, it is necessary to improve patients' dietary self-management skills. Therefore, this study aimed to develop a diet-related life skill assessment scale for dialysis patients with diabetes and to verify its reliability and validity.

Method: A draft scale consisting of 59 items with 5 factors was developed based on the World Health Organization health education model of life skills. Valid responses were obtained from 211 dialysis patients with diabetes (168 males and 43 females). Data were analyzed using exploratory factor analysis, a criterion-related validity study, and reliability test.

Results: As a result of the exploratory factor analysis, 37 items were extracted from the following seven factors: 1:"Dialogue to find the best diet for oneself," 2:"Diet planning based on one's own physical condition," 3:"Self-analysis and self-adjustment to diet therapy," 4:"Trust and gratitude to those close to oneself," 5:"Empathy for those with the same disease," 6:"Thoughts on basic dietary therapy for renal protection," and 7:"Preparedness to continue with the diet therapy." The overall Cronbach's alpha coefficient was 0.93, and the cumulative contribution rate was 62.4%. This scale was significantly correlated ($p < 0.01$) with the Diabetes-specific self-management skills scale ($r = .508$) and the self-care scale for hemodialysis patients ($r = .659$). The scores of the group aware of the benefits of diet in diabetes were significantly higher than those of the group unaware of such benefits ($p < 0.01$).

Conclusion: The reliability and validity of the diet-related life skills assessment scale were confirmed, and it was suggested that this scale be used to support dialysis patients with diabetes in the self-management of their diet.

KEY WORDS

Dialysis patients with diabetes, Dietary therapy, Seif-management, Life skills assessment scale

Introduction

With the recent advances in dialysis technology, the number of patients with a long history of hemodialysis has been rising[1)]. In Japan, the number of chronic hemodialysis patients has exceeded 330,000, ranking second globally in terms of the number of dialysis patients per population[1-2)]. The mean patient age is 69.09 years, which is 0.34 year higher than the previous year; thus, as of 2019, the average age of all patients requiring dialysis is advancing yearly[1)]. Furthermore, the incidence of protein-energy wasting (PEW), which indicates a peculiarly low nutritional state, is high among dialysis patients[3-5)] and is highly associated with mortality, complication development, and frailty[6)]. In particular, PEW tends to induce frailty in hemodialysis patients[7)], and 13.5% of non-elderly patients are frail[8)].

Department of Chronic Care, Division of Health Sciences, Graduate School of Medical Sciences, Kanazawa University
1) Faculty of Health Sciences, Institute of Medical Pharnaceutical and Health Sciences, Kanazawa University
* Corresponding author

Frailty leads to a decrease in self-care and quality of life (QOL) and affects the prognosis of dialysis patients. The combination of physical activity and adequate nutrition is the most effective way to prevent frailty[9]. As for physical activity, the effects of exercise therapy have been reported extensively[10-12]. Hence, intervention methods are becoming clearer. Regarding nutrition, the intake of amino acids including branched-chain amino acids[13], and drugs to enhance gastrointestinal function[14] is reportedly effective in preventing frailty. However, the awareness of diet, eating habits, and eating behaviors, which are the basis of nutrition, is insufficiently reported, and intervention methods for nutrition and diet remain obscure. Therefore, dietary measures for preventing low nutrition must be studied.

This study focused on hemodialysis patients with diabetes[1], who account for more than 40% of hemodialysis patients in Japan and are considered to have low nutrition. In hemodialysis patients with diabetes, hyperglycemia-induced catabolism causes muscle loss, and muscle mass decreases significantly within 1 year after dialysis initiation compared with those in hemodialysis patients without diabetes[15,16]. Therefore, hemodialysis patients with diabetes are at a high risk for PEW. Hence, dietary self-management is the mainstay of frailty treatment and is crucial for dialysis patients with diabetes to maintain their nutritional status while preserving good glycemic control. However, hemodialysis patients with diabetes face difficulties in maintaining their nutritional status. These difficulties include changing from a diabetic diet to a nephrologic diet[17] and unbalanced food intake[18] because of different life patterns between dialysis days and nondialysis days. Therefore, considering nutritional interventions specifically for hemodialysis patients with diabetes is necessary to prevent from experiencing a low nutrition status, avoid progression to frailty, and maintain and improve QOL.

Previously, we clarified the "The Process of Using Health Information by Elderly Hemodialysis patients"[19]. In this process, patients actively try to collect and utilize dietary information. However, we found two patterns: (1) patients make their own decisions without receiving professional advice or evaluation from healthcare providers, and (2) patients seek advice from healthcare providers or others with the same disease but are dissatisfied because they do not receive an appropriate response. In both processes, the patients could not utilize the health information well, leading to behaviors, such as missing meals, and dietary restrictions. Thus, communicating with healthcare providers and other patients, as well as understanding and judging health information, are important self-management skills that dialysis patients should have in order to utilize health information and link it to self-care. According to Honjo[20], the ability to perform self-care is an acquired ability that can be improved through learning, and people with diseases and disabilities should be supported so that they can identify their strengths and gradually demonstrate their abilities[19,21]. Therefore, hemodialysis patients with diabetes should utilize their own strengths, and communicating with people around them, including the medical personnel, and understanding and judging the acquired health information can help improve their low nutrition status.

Therefore, we focused on the concept of life skills[22] as a strategy to help patients acquire these skills. The World Health Organization defines life skills as the abilities necessary for constructively and effectively dealing with daily life's various problems and demands. Life skills are used in educational settings for improving the health of adolescents who are susceptible to various factors and environments[23-25]. Life skills should also be acquired by dialysis patients with diabetes for the following reasons. First, the core concepts of life skills are similar to those of communication, thinking, and judgment, which are necessary for hemodialysis patients, as revealed in our previous study results. Second, dialysis patients with diabetes, who need to adjust to a new treatment environment, such as switching from a diabetic diet to a new nephrotic diet, frequent hospital visits, and time constraints, has a similar situation to inexperienced adolescents. Therefore, the concept of life skills might contribute to the development of a method that supports dialysis patients with diabetes in improving their self-management ability for eating.

Several diet-related scales for dialysis patients[26-28] have already been reported. However, none of them focus on life skills related to diet for maintaining nutrition. Acquiring these life skills will help improve self-care ability, mitigate low nutritional status, and

maintain and improve QOL in dialysis patients with diabetes. Therefore, this study aimed to develop a scale that evaluates the dietary-related life skills of dialysis patients with diabetes, and to verify its reliability and validity.

Methods

1. Conceptual framework

We used a health education model that applies "life skills" proposed by WHO[22] to develop skills to cope with the effects of social factors. In skill formation, the model focuses on 10 core skills: decision-making, problem-solving, creative thinking, critical thinking, communication, interpersonal relationships, self-awareness, empathy, coping with emotions, and coping with stress. Furthermore, the life skills education program consists of five main areas such as decision-making and problem-solving, creative thinking and critical thinking, communication and interpersonal relationships, self-awareness and empathy, and coping with emotions and stress and coping with stress as complementary life skills.

Considering that hemodialysis patients with diabetes are susceptible to treatment and their living environment, acquiring these life skills is necessary to improve their self-care ability and maintain their QOL throughout their long-term hemodialysis life. Therefore, a mutually complementary life skills model consisting of five main domains was used as the conceptual framework for this study.

2. Creation of the draft scale

In addition to the results of the previous study by Hamano et al.[19], we conducted a literature review on "hemodialysis," "diabetic nephropathy," "diet," "skills," and "self-management" using a literature search tool, and added items related to diet for hemodialysis patients with diabetes based on the literature review[17,29,30]. The consistency of the items with the five complementary life skills was examined, and 59 items based on the five factors were created. Items 1–12, 13–26, 27–39, 40–49, and 50–59 refer to "decision-making and problem-solving," "creative thinking and critical thinking," "communication and interpersonal relationships," "self-awareness and empathy," and "coping with emotions and coping with stress," respectively.

During the creation of the items, four researchers who are experts in chronic care nursing and diabetes nursing conducted repeated examinations to ensure content validity.

Next, a self-administered questionnaire was administered to 10 nurses who had experience in caring for patients with diabetes from hemodialysis induction to maintenance dialysis to check the content validity. A four-point Likert scale was used in the questionnaire, with 1 as "not at all related" and 4 as "very related." Then, the Item-level Content Validity Index (I-CVI) was calculated. We also calculated the Scale-level Content Validity Index (S-CVI/Ave) by obtaining the average value of I-CVI for all the components and quality-evaluation indicators. The criteria for scale adoption were ≥0.78 for I-CVI and ≥0.90 for S-CVI/Ave, referring to the criteria of Polit FD[31] et al. Of the 10 nurse experts, 5 (50.0%) were qualified in diabetes or dialysis nursing. However, one item was corrected because of obtaining an I-CVI of <0.78. Meanwhile, all items achieved an S-CVI/Ave of ≥0.90. Therefore, the content validity of the 59 items was ensured.

In addition, three dialysis patients with diabetes who were in their 50–60s, which is the median age of the target population, were given a pretest and an interview. In the interview, they were asked about their understanding of the questions and the ease of answering them. No comments such as "difficult to understand" or "difficult to answer" were noted. Hence, we adopted the 59 items as the draft of the scale.

The 59-item scale uses a five-point Likert scale, with 5 as "very much applicable" and 1 as "not applicable at all."

3. Participants

We recruited adult postdialysis patients with diabetes attending a medical institution with a dialysis center. The exclusion criteria were as follows: with serious complications (blindness, cancer, paralysis, etc.) that may have a significant impact on physical and mental health, with impaired cognitive function, with difficulty in answering the questionnaire, and with a history of dialysis for <1 year. The survey period was from September 2020 to February 2021.

4. Survey contents

1) Draft scale (Table 1)

2) Scales to examine criterion-related validity

To measure dietary self-management and self-care in hemodialysis patients with diabetes, we selected two scales, with higher scores indicating better diet-related

Table 1: Draft items of Diet-related Life Skills Assessment Scale for Dialysis Patients with Diabetes

Core unit	Questionnaire item
Decision Making and Problem Solving	1. I take the right amount of calories for my body. 2. I eat the right amount of protein for my body. 3. I make a plan for a better diet based on my blood test results. 4. I make a diet plan to keep my blood sugar level good. 5. I make diet plans to manage my physical deconditioning. 6. I make my own decisions regarding my own diet rather than leaving it to a medical professional. 7. I choose what suits me best according to diet information acquired on TV, newspapers, magazines, and the Internet. 8. I keep track of my weight, blood sugar levels, and other results. 9. I have a specific plan for meal times and meal contents to avoid hypoglycemia symptoms. 10. If I cannot do it myself, I ask for help from my family. 11. I move my body by doing housework or walking to eat well. 12. I gather information about my food intake and appropriate ranges (e.g., required amount of food).
Creative Thinking and Critical Thinking	13. I think about the effects of salt on my body. 14. I think about the effects of phosphorus and potassium on my body. 15. I think about the effects of water on the body. 16. When I gain weight, I think of reducing or skipping meals. *R* 17. If the diet does not work, I plan to adjust with exercise and other foods. 18. I wonder if there is a better way to diet. 19. I think of applying my years of experience to my diet. 20. When hypoglycemia occurs, I identify the cause according to my blood sugar levels and diet. 21. When I find the diet difficult, I clarify what is difficult about it. 22. I clarify whether the information I have obtained about diet and nutrition applies to me. 23. I look at the test results and identify what was good and bad in my diet. 24. I analyze whether the information I receive about diet and nutrition is reliable. 25. When I gain too much weight, I look back at my diet and identify the cause. 26. When I eat less, I identify the cause of this behavior.
Communication and Interpersonal Relationships	27. I converse with medical personnel without worrying about other patients looking at me. 28. I communicate my thoughts even when they differ from those of the medical staff 29. I show gratitude and appreciation to my family members for supporting my diet. 30. I successfully refuse foods and supplements recommended by other dialysis patients that I do not think are necessary for me. 31. I discuss blood sugar levels and diet with other dialysis patients with diabetes. 32. I take care to maintain good relationships with medical personnel and other dialysis patients. 33. I communicate my dietary needs to my healthcare provider. 34. I discuss my diet with my healthcare provider until I am satisfied with it. 35. I choose medical personnel who can provide useful information, and talk to them myself. 36. I talk to the medical staff in charge so that they can understand me. 37. When my diet is not working, I ask for help from the medical staff myself. 38. I talk to my healthcare provider about the information I have learned from TV, newspapers, magazines, or the Internet. 39. I tell the people around me that I am on a diet.
Self-consciousness and Empathy	40. I am depressed when I am warned about my diet by a medical professional. *R* 41. I find accepting the nutritional guidance difficult because I feel that it is the same as before. *R* 42. I am determined to make diet therapy a lifelong job. 43. I blame my own behavior if the diet does not work. *R* 44. I am on a diet, and I owe it to my healthcare provider and my family. 45. When I see other dialysis patients being warned about their diet, I think of not wanting to be like them. *R* 46. I am interested in changes in the physical condition and behavior of other dialysis patients. 47. When I hear other dialysis patients talking to their healthcare providers, I feel like I can relate to them. 48. Whenever I see a dialysis patient who has trouble eating, I think about it with them. 49. I consider dialysis patients as my friends with the same disease.
Dealing with Emotions and Dealing with Stress	50. If I am going to do the diet, I will to try to make it as fun as possible. 51. I see nutrition guidance as a good opportunity to review my diet. 52. I try to change my mind to avoid thinking too much in a negative way even if the diet fails. 53. I do not hold on to my feelings of not being able to eat what I want to eat, but I tell people who can sympathize with me. 54. I believe that being familiar with food preparation and seasoning is necessary for treatment. 55. I try to distract myself with other things to avoid feeling so focused on the diet. 56. I am positive about changing my diet from diabetic diet to dialysis diet. 57. While I feel that I must eat, I also feel that I must not eat. *R* 58. The more weight I do not gain, the lesser the medical staff will chastise me. Hence, I try not to eat. *R* 59. I cope with stress so that I do not overeat.

R: inversion item

life skills.

(1) Diabetic-specific self-management skills scale[32)]

This scale was used to examine comorbid validity. It measures the cognitive skills of patients with diabetes in self-management. It is considered reliable, as confirmed by Cronbach's α coefficient (α =.79), with criterion-related validity and known-group validity. This scale consists of 25 items on five subscales: "Decision-making for diabetes self-management," "Ingenuity for diabetes self-management," "Effective communication for diabetes self-management," "Acceptance of diabetes," and "Coping with stress due to diabetes." A four-point scale is used to calculate the score, with 4 indicating "applies" and 1 indicating "does not apply." The score ranged from 25 to 100; the higher the score, the better the self-management skills are.

(2) Self-care scale for hemodialysis patients[33)]

This scale was used to examine comorbid validity. It measures the degree of behavior to solve one's own health problems by using the available care resources. It is reliable, as confirmed by Cronbach's α coefficient (α =.79), and has content and construct validity. This scale consists of 13 items on two subscales: "Life" and "Diet." It requires responses on a five-point scale (from 5 as "yes" to 1 as "no"), with scores ranging from 13 to 65. The higher the score, the better the self-care is.

3) Basic demographics, dialysis treatment, and diabetes treatment status

We asked the following eight items: age, gender, family structure, employment status, height, dry weight, diabetes treatment, and diabetic complications, dialysis duration, and number of dialysis sessions per week.

5. Data collection method

We sent information about the study to the head nurse of each medical institution or explained it in person. We then selected eligible patients and distributed the research protocol and anonymous self-administered questionnaire through the head of the dialysis center of the medical institution that gave consent. We also asked the patients to return the questionnaires with a self-addressed envelope. Ultimately, consent was obtained from 20 medical institutions of regional core hospitals including clinics in 7 prefectures in Japan.

6. Data analysis

All statistical data were analyzed using SPSS Statistics version 27.0, and the following methods were used.

1) Verification of reliability

(1) Item analysis

We checked the kurtosis, skewness, ceiling effect (mean + SD > 5), and floor effect (mean − SD < 1) of each item score. In the I-T analysis, we calculated the correlation between the item scores and the total score of the scale. In the G-P analysis, the total score of the scale was divided into the top group (25%) and the bottom group (25%), followed by mean score calculation.

(2) Internal consistency of the scale

To verify the reliability of the internal consistency of the scale, we calculated the Cronbach's α coefficients of the factors of the entire scale and subscales.

2) Validity verification

(1) Validation of construct validity

The items organized in the item analysis were examined by exploratory factor analysis using the unweighted least squares method and Promax rotation. The number of factors was determined by eigenvalues and scree plots, and items were deleted according to factor loadings of ≥0.35. Moreover, we checked the commonality, pattern matrix, and total variance and repeated factor analysis until the factor loading indices were stabilized. Then, the factors were named by interpreting them on the lower scale.

(2) Validation of criterion-related validity

Comorbid validity, which is part of the criterion-related validity, was examined by calculating the Spearman's rank correlation coefficients between the total scores of the self-management skills scale for patients with diabetes and those of the self-care scale for hemodialysis patients.

(3) Validation of the known groups

The scale's total score was compared with the mean score's difference by t-test between two groups (those who responded that they were on a diabetic diet and those who did not respond).

7. Ethical considerations

Consent was obtained after explaining the purpose of the study in writing to the person in charge of the target medical institution. Through the person in charge of the medical institution, a document explaining the purpose and methods of the research, freedom of cooperation, anonymity, and publication of the research results was distributed to the participants. In addition, we sent a letter requesting cooperation, stating that the return of the questionnaire would be regarded as consent. This study was approved by the Medical Ethics Review Committee of Kanazawa University (Approval No.978-2).

Results

1. Participants' attributes (Table 2)

Out of 419 hemodialysis patients with diabetes who received the questionnaire, 248 (59.1%) responded. Among them, 211 provided valid responses (85.1%) and thereby included in the analysis. Of these 211 participants, 168 (79.6%) were male, and 43 (20.4%) were female, with a mean age of 64.7 ± 11.3 (mean ± SD) years and a mean dialysis duration of 61.4 ± 45.7 months.

Table 2: Basic attributes of the patients (n = 211)

		n	%
Age	30s	4	1.9
	40s	17	8.0
	50s	46	21.8
	60s	64	30.3
	70s	59	28.0
	80s	21	10.0
Gender	Male	168	79.6
	Famale	43	20.4
Family structure	Living alone	43	20.4
	Living together	168	79.6
Employment	Yes	85	40.3
	No	125	59.2
	Unknown	1	0.5
Dialysis duration	1 year to <5 years	121	57.4
	5 year to <10 years	64	30.3
	>10 years	24	11.4
	Unknown	2	0.9
Dialysis frequency	2 times/week	10	4.7
	3 times/week	201	95.3
Diabetes mellitus treatment (multiple answers)	Oral hypoglycemic drug	92	43.6
	Insulin	70	33.2
	GLP−1	9	4.3
	Dietary therapy	100	47.4
	Exercise therapy	44	20.9
	No treatment	22	10.4
	Unknown	18	8.5
Diabetic complications (multiple answers)	Cardiovascular disorders	56	26.5
	Cerebrovascular disease	15	7.1
	Retinopathy	96	45.5
	Neuropathy	47	22.3
	Lower limb atherosclerosis	47	22.3
	Other	9	4.3
	Unknown	54	25.6

2. Item analysis

Of the 59 items in the draft scale, none corresponded to the ceiling effect (mean + SD > 5), whereas two items (Nos. 16, 57) corresponded to the floor effect (mean − SD < 1), thereby excluded from the analysis. In the I-T analysis, four items (Nos. 40, 43, 45, 58) did not significantly correlate with the total score ($|r| < 0.2$). G-P analysis was conducted on the 53 remaining items, and all of these items showed significant differences. Therefore, 53 items were selected as the draft of the scale.

3. Construct validity (Table 3)

For the 53 items, the sample validity of the Kaiser–Meyer–Olkin was 0.871, and Bartlett's sphericity tests revealed $p < .001$; thus, factor analysis was possible.

We conducted exploratory factor analysis using unweighted least squares and Promax rotation. According to the initial eigenvalues and scree plots, seven factors were required, and the items were selected on the basis of the criteria that the factor loadings should be above 0.35 and that multiple items should not have factor loadings above 0.35. The excluded items were Nos. 7, 11, 12, 19, 23, 27, 28, 30, 36, 41, 49, 50, 51, 52, 53, 59, and 16. Finally, 37 items with a seven-factor structure were obtained (cumulative contribution rate = 62.4%).

The first factor, which consists of the seven items of communication and interpersonal relations in the original plan, was named "Dialog to find the best diet for oneself" because it includes the content of finding the best diet by communicating with people around them, such as medical personnel and people with the same disease. The second factor, which consists of seven items in the decision-making and problem-solving sections of the original plan, was named "Diet planning based on one's own physical condition" because it includes planning to respond to body changes, as reflected in symptoms and examination results. The third factor consists of 9 items in total, and 8 of them belong to the creative thinking and critical thinking section of the original plan. We named it as "Self-analysis and self-adjustment to diet therapy" because it includes clarifying the causes of diet therapy failure in light of physical data and adjusting specific measures. The fourth factor, which consists of three items (one

Table 3: Diet-related Life Skills Assessment Scale for Dialysis Patients with Diabetes (n = 211)

Item Number	Item Content	Factor 1	2	3	4	5	6	7
Factor 1	**Dialogue to find the best diet for oneself** : Cronbach's α = 0.86 Contribution ratio: 30.2%							
	34. I discuss my diet with my healthcare provider until I am satisfied with it.	**0.891**	-0.039	-0.011	-0.058	-0.062	0.041	0.041
	38. I talk to my healthcare provider about the information I have learned from TV, newspapers, magazines, or the Internet.	**0.770**	0.021	0.030	-0.062	0.010	-0.202	0.070
	33. I communicate my dietary needs to my healthcare provider.	**0.728**	-0.152	0.201	-0.099	-0.160	-0.006	0.132
	35. I choose medical personnel who can provide useful information and talk to them myself.	**0.715**	0.021	-0.090	0.110	0.052	-0.021	-0.013
	37. When the diet is not working, I ask for help from the medical staff myself.	**0.693**	0.046	0.006	0.079	0.039	-0.018	-0.113
	31. I discuss blood sugar levels and diet with other dialysis patients with diabetes.	**0.573**	-0.068	-0.062	0.182	0.157	0.036	0.051
	39. I tell the people around me that I am on a diet.	**0.543**	-0.003	-0.007	-0.021	-0.027	0.080	0.149
Factor 2	**Diet planning based on one's own physical condition** : Cronbach's α = 0.87 Contribution ratio: 9.2%							
	1. I take the right amount of calories for my body.	-0.048	**0.758**	-0.162	0.018	0.032	0.056	0.034
	2. I eat the right amount of protein for my body.	-0.204	**0.728**	-0.059	0.037	0.027	-0.046	0.102
	4. I make a diet plan to keep my blood sugar level good	0.097	**0.699**	0.060	0.059	-0.018	0.100	-0.114
	6. I make my own decisions about my own diet rather than leaving it to a medical professional.	-0.042	**0.650**	0.109	-0.166	0.030	-0.004	0.220
	3. I make a plan for a better diet based on my blood test results.	0.184	**0.636**	-0.123	-0.052	0.098	0.239	-0.105
	5. I make diet plans to manage my physical deconditioning.	0.077	**0.623**	0.116	0.065	0.025	-0.032	-0.014
	9. I have a specific plan for meal times and meal contents to avoid hypoglycemia symptoms.	0.073	**0.379**	0.273	0.252	-0.185	-0.120	0.025
Factor 3	**Self-analysis and self-adjustment to diet therapy** : Cronbach's α = 0.86 Contribution ratio: 5.93%							
	22. I clarify whether the information I have obtained about diet and nutrition applies to me.	-0.032	0.019	**0.754**	-0.158	0.041	0.091	0.076
	21. When I find the diet difficult, I clarify what is difficult about it.	-0.012	0.096	**0.742**	-0.124	0.097	0.055	-0.124
	26. When I eat less, I identify the cause of this behavior.	-0.013	-0.189	**0.728**	0.128	-0.002	0.045	0.021
	18. I wonder if there is a better way to diet.	0.113	-0.162	**0.645**	-0.162	0.015	0.136	-0.066
	20. When hypoglycemia occurs, I identify the cause according to my blood sugar levels and diet.	-0.078	0.197	**0.643**	0.111	0.011	-0.231	0.071
	25. When I gain too much weight, I look back at my diet and identify the cause.	-0.072	-0.040	**0.541**	0.105	-0.104	0.255	0.093
	24. I analyze whether the information I receive about diet and nutrition is reliable.	0.255	0.128	**0.515**	-0.082	0.040	-0.026	-0.106
	17. If the diet does not work, I plan to adjust with exercise and other foods.	0.146	-0.067	**0.400**	0.140	0.227	0.124	-0.148
	8. I keep track of my weight, blood sugar, and other results.	-0.001	0.041	**0.361**	0.235	-0.195	-0.066	0.089
Factor 4	**Trust and gratitude to those close to oneself** : Cronbach's α = 0.78 Contribution ratio: 5.1%							
	10. If I cannot do it myself, I ask for help from my family.	0.033	0.116	-0.060	**0.802**	-0.031	0.064	-0.128
	44. I am on a diet, and I owe it to my healthcare provider and my family.	0.125	-0.071	-0.141	**0.689**	0.041	0.139	0.093
	29. I show gratitude and appreciation to my family members for the diet.	-0.100	-0.021	0.041	**0.677**	0.104	-0.030	0.069
Factor 5	**Empathy for those with the same disease** : Cronbach's α = 0.82 Contribution ratio: 4.5%							
	46. I am interested in changes in the physical condition and behavior of other dialysis patients.	-0.050	-0.017	0.021	0.074	**0.780**	0.061	0.061
	47. When I hear other dialysis patients talking to their healthcare providers, I feel like I can relate to them.	-0.033	0.027	0.019	0.013	**0.774**	-0.044	0.105
	48. Whenever I see a dialysis patient who is having trouble eating, I think about it with them.	0.262	0.147	0.017	-0.054	**0.609**	-0.102	-0.003
Factor 6	**Thoughts on basic dietary therapy for renal protection** : Cronbach's α = 0.82 Contribution ratio: 3.9%							
	14. I think about the effects of phosphorus and potassium on my body.	0.016	0.116	0.036	0.036	0.028	**0.803**	-0.065
	13. I think about the effects of salt on my body.	0.003	-0.006	0.163	0.101	-0.175	**0.661**	0.089
	15. I think about the effects of water on my body.	-0.235	0.093	0.136	0.028	0.117	**0.518**	0.199
Factor 7	**Preparedness to continue with the diet therapy** : Cronbach's α = 0.77 Contribution ratio: 3.6%							
	54. I believe that being familiar with food preparation and seasoning is necessary for treatment.	0.089	0.136	-0.117	0.082	-0.041	0.071	**0.697**
	56. I am positive about changing my diet from diabetic diet to dialysis diet.	-0.013	0.210	0.055	-0.023	0.105	-0.072	**0.550**
	42. I am determined to make my diet therapy a lifelong job.	0.101	0.349	-0.111	-0.095	-0.162	0.100	**0.537**
	55. I try to distract myself with other things to avoid focusing on my diet.	0.043	-0.168	0.085	0.200	0.235	-0.118	**0.513**
	32. I take care to maintain good relationships with medical personnel and other dialysis patients.	0.073	-0.137	0.032	-0.124	0.165	0.252	**0.479**
Total Cronbach's α = 0.93		Cumulative contribution ratio: 62.4%						

Interfactor correlation

	1	2	3	4	5	6	7
1	**1.000**	**0.471**	**0.501**	**0.312**	**0.473**	**0.164**	**0.259**
2		**1.000**	**0.556**	**0.443**	**0.199**	**0.391**	**0.486**
3			**1.000**	**0.401**	**0.258**	**0.405**	**0.513**
4				**1.000**	**0.246**	**0.144**	**0.351**
5					**1.000**	**0.074**	**0.127**
6						**1.000**	**0.354**
7							**1.000**

Factor extraction method: Unweighted least squares method
Rotation method: Promax with Kaiser normalization
KMO sample adequacy 0.87 Bartlett sphericity test p <.001
Response Method 1: Not at all applicable; 2: Not applicable; 3: Neither applicable nor not applicable; 4: Applicable; 5: Extremely applicable

from each of the three skill items in the original plan), was named as "Trust and gratitude to those close to oneself" because it includes trying to continue one's own diet therapy with the cooperation of those around the patient, mainly the patient's family. The fifth factor, which consists of the three items of self-consciousness and empathy in the original proposal, was named "Empathy for those with the same disease" because it indicates that the participants are interested in and sympathetic to the experiences of others with the same disease and try to think together with them. The sixth factor comprises three items belonging to the creative thinking and critical thinking section in the original proposal, and we named it "Thoughts on basic dietary therapy for renal protection," because it includes thinking about the effects of food content on the body. Finally, the seventh factor, which consists of five items of interpersonal relations, self-consciousness, and emotional and stress coping skills of the original plan, was named "Preparedness to continue with the diet therapy" because it includes changing one's mind and preparing one's heart to continue the diet.

4. Criterion-related validity (Table 4)

The correlation coefficients between the total score of this scale and the total scores of the Diabetes-specific Self-Management Skills Scale and the Self-Care Scale for Hemodialysis Patients were r =.508 and r =.659, respectively. Thus, our scale showed a statistically significant association with the two other scales ($p < 0.01$). The correlation coefficients between each subscale score of this scale and the total score of the self-management skills scale specific to diabetic patients were r =.217-.463. Additionally, the correlation coefficient between each subscale score of this scale and the total score of self-care scale for hemodialysis patients was r =.363-.585.

5. Known-group validity (Table 5)

Using t-test, we compared the total score of this scale between 100 participants who chose "diet" and 111 participants that did not choose "diet" for their own diabetes treatment. The score of the group who chose "diet" was significantly higher than that of the other group ($t = -6.17$ [$df = 209$], $p = 0.00$ [$p < 0.01$]). In addition, we compared the subscales, and the score of the group that chose "diet" higher in all subscales, although there was no significant difference in the fifth factor, "empathy for others with the disease."

6. Verification of reliability (Table 3)

The Cronbach's α coefficients were $\alpha = 0.86$, 0.87, 0.86, 0.78, 0.82, 0.82, and 0.82 for the first, second, third, fourth, fifth, sixth, and seventh factor, respectively; for the entire 37-item scale, it was $\alpha = 0.77$. The Cronbach's α coefficient for the entire 37-item scale was $\alpha = 0.93$.

Considerations

1. Reliability and validity of this scale

The components of the scale were examined by exploratory factor analysis. As a result, we extracted 37 items of 7 factors satisfying the criterion values of factor loadings and commonality. The cumulative contribution rate before rotation was 62.4%. Additionally, criterion-related validity and known-group validity were confirmed.

Regarding reliability, I-T correlation and G-P analyses revealed that all item are significantly correlated. In addition, the Cronbach's α coefficient for the entire scale and for each factor was greater than.700, thereby satisfying the acceptable standard for a measurement scale[30] and confirming internal consistency.

Hence, the validity and reliability of this scale have a certain explanatory power.

2. Characteristics of the factor structure of this scale

The dietary-related life skills scale for dialysis patients with diabetes consists of seven factors in which each of the five skills in the original proposal was aggregated and two new skills were added. The first factor, "Dialog to find the best diet for oneself," combines communication and interpersonal skills. It obtained a contribution rate of 30.2%, thereby considered to be the most important factor. In our previous study[19], dialysis patients could not utilize health information with confidence because of their low ability to interact with their healthcare providers; hence, a dialog is necessary. In dialysis treatment, patients visit a medical institution 2 to 3 times a week; thus, they have many opportunities to interact with medical personnel and

Table 4: Correlation of the total score of Diet-related Life Skills Assessment Scale for Dialysis Patients with Diabetes with those of Diabetes-Specific Self-Management Skills Scale and Self-Care Scale for HemodialysisPatients (n = 211)

	Diet-related Life Skills Assessment Scale for Dialysis Patients with Diabetes (37 items)							
	Total score	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
Diabetes-specific Self-Management Skills Scale	.508**	.217**	.462**	.383**	.463**	.223**	.408**	.375**
Self-care for Hemodialysis Patients Scale	.659**	.435**	.489**	.542**	.394**	.406**	.363**	.585**

Spearman's rank correlation coefficient
**p <.01

Table 5: Dietary awareness and scores with the Diet-related Life Skills Assessment Scale for Dialysis Patients with Diabetes (n = 211)

	Dietary awareness group (n=100 M±SD)	Dietary unawareness group (n=111 M±SD)	t-value	p-value
Factor1	19.8±5.2	17,5±4.7	3.32	<.01**
Factor2	23.7±4.2	20.3±4.6	5.67	<.001***
Factor3	31.5±5.2	27.1±5.8	5.74	<.001***
Factor4	10.1±2.9	9.0±2.6	2.86	<.01**
Factor5	9.1±2.7	8.4±2.1	1.95	.053
Factor6	12.2±1.6	11.1±2.0	4.33	<.001***
Factor7	18.7±2.7	17.0±2.9	4.55	<.001***
Total score	125.6 ± 16.5	111.1 ± 17.7	−6.17	<.001***

Independent samples test
***p<.001 **p<.01

other patients, with the same disease, making the environment conducive to utilize the modeling effects[34], such as learning new behavioral patterns and acquiring new response models by observing communication skills and the behavior of others. Therefore, interaction with surrounding people, such as medical personnel and fellow patients, is an essential factor for dialysis patients with diabetes to acquire life skills. The second factor, "Diet planning based on one's own physical condition," includes decision-making and problem-solving skills. We believe that this factor is appropriate because in the previous study[19], self-judgment in the selection of information was useful in the utilization of information. The third factor, "Self-analysis and self-adjustment to diet therapy," focuses on creative thinking and critical thinking skills.

Previous studies considered the first three factors important for patients' use of information. Yuanhong et al.[21] reported that it is important to strengthen patients' communication skills and critical literacy for self-management of patients who are on hemodialysis due to diabetic nephropathy. Deming[35] stated that in the management cycle, planning and reflecting on the actions taken enhance thinking skills. These studies suggest that the first three factors are valid life skills. However, scales that measure skills such as information utilization and communication skills remain unavailable. The acquisition of these factors has been recently considered important for dialysis patients with diabetes to improve their self-care ability for diet.

The fourth factor, "Trust and gratitude to those close to oneself," and the fifth factor, "Empathy for those with the same disease," are abilities combining interpersonal relationships and empathy. Okayama et al.[36] identified trust and closeness to those close to the patients (e.g., healthcare professionals and family members) as factors that improve the social skills of dialysis patients with type 2 diabetes. Meals are not only for nutritional intake; they are also a significant avenue for connecting people, and sharing of meals can improve communication, education, and social functioning[37]. Therefore, collaborative skills with others, including healthcare providers and patients, are an important factor for dialysis patients with diabetes to demonstrate their abilities and develop life skills in their new dialysis lifestyle.

The sixth factor, "Thoughts on basic dietary therapy for renal protection," is also appropriate because it contains the characteristic content necessary for critical thinking that should be learned for renal protection.

Finally, the seventh factor, as mentioned above, was "Preparedness to continue with the diet therapy." The results revealed that the total score on the scale and its subscales were higher in the group aware of the benefits of diet in diabetes than in the group unaware of such benefits. Previous studies[19] have described the importance of supporting the process of promoting self-awareness of one's own body and being willing for dialysis treatment to initiate proactive behavior in dialysis patients. Therefore, patients' awareness of and readiness for dietary treatment may lead to life skill improvement.

3. Clinical adaptation of this scale

As mentioned earlier, the scale's total score was higher in the diabetic diet group. Therefore, the Dietary-related Life Skills Assessment Scale for Dialysis Patients with Diabetes is a scale that can be used for self-care of patients with diabetic nephropathy in continuing diet therapy commensurate with dialysis treatment during dialysis induction. This scale can also

be used as a guideline for education to enhance life skill acquisition in patients who have already completed education in the dialysis induction phase.

Limitations and challenges of this study

The male to female ratio of the dialysis patients with diabetes in this study was 8:2. Since the ratio of male to female dialysis patients with diabetes in Japan is 7:3,[1] the ratio tends to be slightly higher for males. In addition, considering that this study only included patients who could answer the self-administered questionnaire, the mean age and the number of years on dialysis of the participants were lower than the national average. Therefore, our results may not be applicable to all dialysis patients with diabetes. In the future, the relationship between the content of patient education by nurses during dialysis induction, and dietary intervention, which both affect life skills, should be examined, and the appropriate evaluation criteria for this scale should also be clarified.

Conclusion

We developed a scale that evaluates diet-related life skills in dialysis patients with diabetes. This scale consists of 37 items and 7 factors, namely, "Dialog to find the best diet for oneself" (7 items), "Diet planning based on one's own physical condition" (7 items), "Self-analysis and self-adjustment to diet therapy" (9 items), "Trust and gratitude toward those close to oneself" (3 items), "Empathy for those with the same disease" (3 items), "Thoughts on basic dietary therapy for renal protection,"(3 items), and "Preparedness to continue with the diet therapy" (5 items).

Content validity, construct validity, criterion-related validity, and known-group validity were confirmed, and reliability was confirmed by internal consistency. Thus, the scale is reliable and valid.

Conflict of interest

There is no conflict of interest in this study.

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糖尿病透析患者における食事関連ライフスキル評価尺度の開発

濵野　初恵 , 多崎　恵子 [1)*], 堀口　智美 [1)], 浅田　優也 [1)], 稲垣　美智子 [1)]

要　旨

目的：糖尿病透析患者は，特有の栄養障害を引き起こすリスクが高いため栄養面からのケアが重要である。そのためには患者自身の食事自己管理能力を高める必要がある。そこで本研究では糖尿病透析患者を対象に食事に関連したライフスキル評価尺度を開発し，その信頼性と妥当性を検証することを目的とした。

方法：WHO のライフスキル健康教育モデルを参考に，5 因子 59 項目からなる尺度原案を作成した。糖尿病透析患者 211 名（男性 168 名，女性 43 名）より有効回答を得た。データ分析は，探索的因子分析，基準関連妥当性の検討，信頼性テストを行った。

結果：探索的因子分析の結果，第 1 因子『自分に合った食事療法を見いだす対話』，第 2 因子『自分の身体状況を捉えた食事計画』，第 3 因子『食事療法に対する自己分析と自己調整』，第 4 因子『身近な人への信頼と感謝』，第 5 因子『同病者への共感性』，第 6 因子『腎庇護に向けた基本的食事療法への思考』，第 7 因子『食事療法を継続していく心構え』の 7 因子 37 項目が抽出された。全体の Cronbach's α 係数 0.93，累積寄与率 62.4％であった。糖尿病患者特有の自己管理スキル尺度 (r =.508) および血液透析患者のセルフケア尺度 (r =.659) と本尺度は有意な相関を示した (p<0.01)。糖尿病食事療法を自覚している群の得点の方が有意に高かった (p<0.01)。

結論：食事関連ライフスキル評価尺度の信頼性・妥当性が確認され，本尺度が糖尿病透析患者の食事療法への自己管理支援に役立てられると示唆された。