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Effect of body composition of socially vulnerable elderly with diabetes and social support on self-care behavior

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Abstract

Purpose: This study is to identify the effects of body composition and social support that affect the self-care behavior of the elderly with diabetes in the socially vulnerable group.

Methods: The subjects of this study were 120 health care recipients registered at 5 public health centers in D city and aged 65 or older who were diagnosed with diabetes by their doctors. The data were analyzed by t-test, one-way ANOVA, Pearson's correlation, and hierarchical multiple regression.

Results: The results of this study showed that the higher the BMI, the abdominal fat percentage and the body fat percentage, the lower the self-care behaviors and social support, and the higher the basic metabolism, the higher the self-care activities. In the final model, the total explanatory power of these variables was 56.3%. **Conclusions**: Based on the results of this study, it is suggested that a self-care enhancement program considering the balanced body composition and high social support is developed and utilized in the socially vulnerable elderly with diabetes.

Introduction

The prevalence rate of diabetes in elderly people aged 65 years or older in Korea is 20.5%. In particular, as the age increases, the prevalence rate also increases. After age 70, the prevalence rate reaches 23.6%, indicating that one in four elderly people have diabetes [1]. Considering the current situation, the prevalence rate of diabetes in Korea is expected to double to 5,910,000 in 2050 [2]. In addition, in Korea, the proportion of elderly people receiving basic living allowance is 29.9%. The ratio of elderly recipients to total population is 6.0%, which is the highest rate among other age groups [3]. The prevalence rate of diabetes in the vulnerable group including the basic livelihood recipient and the near poverty group was higher than the upper 25% of the income level. About 60% of people with diabetes in the vulnerable class perceive their health condition as bad and frail [4].

In diabetic patients in Korea, it has been reported that only 29.5% of patients with diabetes have less than 6.5% of glycated hemoglobin, which is the diabetes treatment criterion [5]. Diabetic patients of the vulnerable group have a low rate of adjustment to management goals, and the screening rate of diabetic complications is lower than that of normal diabetics [6]. The low rate of diabetes control has been a serious cause of increased rate of onset of diabetes-related complications and mortality rate [1]. The cerebrovascular/cardiovascular diseases caused by diabetes are 2-4 times higher than without diabetes. Diabetic care is critical because, with aging, diabetic complications begin to occur, such as hypertension (67%), neuropathy (60-70%), non-traumatic limb amputation (60%), renal failure (44%), blindness (28.5%), etc [7].

However, diabetes complications can be prevented. Unlike other illnesses, prevention of complications is possible through appropriate self-management in daily life rather than depending entirely on medical staff [8]. Diabetes is a disease that must be accompanied by a change in self-management and personal lifestyle because it is difficult to prevent complications by a doctor's instructions or drugs alone. Given that average life expectancy and development of medical technology are likely to increase the duration of diabetes, proper self-care behavior in diabetic patients are essential for the prevention of dysfunction and various cardiovascular complications and for maintaining quality of life [9]. Because the increase in age and low-income levels are important factors that make it difficult to understand and use health information in everyday life [10], it is very important in nursing care to consider the age increase and low-income level for elderly patients with diabetes for exercising the self-care behavior.

For the elderly, the effects of decreased activity, decreased muscle mass, obesity, and inadequate diets have been pointed out as being factors decreasing tissue sensitivity to insulin and causing or aggravating elderly diabetes [11]. The World Health Organization (WHO) diagnoses obesity in the Asia-Pacific region with a body mass index (BMI) of 25kg/m^2 or higher and overweight is diagnosed when the BMI is 23kg/m^2 to 24.9kg/m^2 [12]. As BMI increases, the frequency of cardiovascular disease, diabetes, and dyslipidemia that are associated with obesity increases and mortality rates increase. BMI is highly

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correlated with waist circumference, and each factor is independently a risk factor for diabetes [13]. And it was reported that BMI and waist circumference were higher in low-income and low-educated groups [14]. Furthermore, the American Diabetes Association [7] reported that those who are overweight (BMI > 25kg/m^2) belonged to the high-risk group of diabetes, and the Korean Diabetes Association [15] suggests that being overweight (BMI > 23 kg/m^2) is a high-risk factor for diabetes. In addition, the elderly showed an increased risk of dyslipidemia due to weight gain and abdominal obesity due to poor health habits such as decreased activity as a result of aging. Managing body weight through self-care activities that correct lifestyle habits using diet and exercise therapy can be an important strategy for the prevention and treatment of diabetes [16].

Furthermore, patients with diabetes feel uncertainty about the future, anxiety, depression, sense of loss [17] and experience economic burden and social isolation. Unsatisfactory social support for diabetes leads to a lower quality of life for diabetic patients [18]. In particular, elderly people have the desire to depend on others to reduce their feeling of loneliness and isolation, and they learn lifestyle habits that affect the disease through social relations that can replace spousal or family support and through mutual encouragement [19]. Education on diabetes with peers can be a way to maintain the changes in lifestyle [20], and social support has been identified as a predictor to increase self-care behavior in diabetic patients [21]. In addition, if social support is decreased, the self-care of the individual becomes difficult and the physical function and emotional well-being are lowered [22]. In particular, low-income people do not have family or close friends to help them, and the diabetic self-care behavior level is low due to the misunderstanding that regular use of medication alone is enough to enable good management of diabetes [23].

The method of correcting weight gain, abdominal obesity and increase of dyslipidemia due to poor health habits as a result of aging is a strategy to prevent diabetes [17]. And social support for the elderly not only plays a protective role in the promotion of coping and adaptation to these problems, but also influences self-care behavior [20,22]. This study is to provide basic data for the development of the nursing intervention program for the self-care behavior of the elderly with diabetes in vulnerable groups by examining the effect of body composition and social support on self-care behavior of the socially vulnerable elderly with diabetes.

The purpose of this study is to identify the effects of body composition and social support that affect the self-care behavior of the elderly with diabetes in the socially vulnerable group. And the specific goals are as follows:

- To identify the body composition, social support and self-care behavior of the socially vulnerable elderly with diabetes
- To identify differences in self-care behavior according to general characteristics and health characteristics of the socially vulnerable elderly with diabetes
- To understand the correlation between the body composition/social support and self-care behavior in the socially vulnerable elderly with diabetes
- To understand the effect of the body composition and social support of the socially vulnerable elderly with diabetes on their self-care behavior

Methods

Study design

This study is to investigate the effects of body composition and social support of the socially vulnerable elderly with diabetes on their self-care behavior.

Setting and samples

The subjects of this study are 120 recipients of Socially vulnerable elderly, registered in 5 public health centers in the city of D, aged 65 or older and diagnosed with diabetes by their doctors. In addition, this study targeted the participants who voluntarily agreed in writing to participate in this study, understanding the contents of the questionnaire and the purpose of this study, receiving 24 points or higher for cognitive function (MMSE-K) and being able to communicate. As for the number of subjects, the study considered the dropout rate as well as the sample size at 98 as a result of the calculation with the two-sided test significance level α at 0.05, multiple regression analysis effect size at 0.15, and power 1-β at 0.90 in accordance with the G*Power 3.1 program. As a result, 120 copies were distributed. And, of these, 112 were finalized, except for 8 cases in which the answers to the questions were unsatisfactory or insufficient.

Ethical considerations

This study was conducted after the approval of research (IRB Protocol No; CUIRB-2014-0078-1) by the IRB of D University for the bioethics and safety of the subjects. And the guidelines of the IRB were followed during the study. Prior to the collection of data, the subjects were provided with explanation about the purpose of the study and that participation can be withdrawn at any time. In addition, written consent was signed to ensure the anonymity and autonomy of the subjects and that the collected data will be used for research purposes only. The subjects who participated in the study were given a small amount of compensation.

Measurements

Body composition

Body composition was measured using Inbody 230 (Biospace, Korea) using bio-electrical impedance. Body mass index (BMI) was classified into 'low body weight' (BMI<18.5 kg/m^2), 'normal' (18.5 kg/m^2≤BMI<23 kg/m^2), 'overweight' (23 kg/m^2≤BMI<25 kg/m^2), and 'obesity' (BMI≥25 kg/m^2). Body fat percentage refers to the proportion of fat in the body composition. Men and women were different in terms of body fat percentage, so the evaluation automatically classified from the Inbody results were used as is. For men, the standard is 10-20%, the mild obesity is 20-25%, and the obesity is over 25%. For women, the standard is 18-28%, the mild obesity is 28-33%, and the obesity is over 33%. The waist-hip ratio was calculated with the ratio of waist circumference to hip circumference. The standard range was classified as 0.80 to 0.90 for males and 0.75 to 0.85 for females. Males with waist circumference over 90cm and females with over 85cm were classified as obesity [14]. The standard range of basal metabolic rate is 1518 to 1774 Kcal for males and 1099 to 1261 Kcal for females. For males, less than 1518Kcal is below standard and more than 1775 Kcal is above standard. For females, less than 1099 Kcal is below standard and more than 1262 Kcal is above standard.

Social support

Social support was measured with an adapted tool (adapted by Lim *et al.)* called MOS-SSS (Medical Outcomes Study Social Support

Survey), which was originally developed by Sherbourne and Stewart. The tool consists of 19 questions of 4 sub-areas: 8 questions of emotional/informational support, 4 questions of material support, 3 questions of affectional support, and 4 questions of positive interaction. This is a 5-point Likert scale with possible scores ranging from 19 to 95. The higher the score, the higher the social support. Regarding the reliability of the tool when it was developed, Cronbach's alpha= .97. In the research of Lim et al. [24], Cronbach's alpha= .86. In this study, Cronbach's alpha= .86.

Self-care behavior

Self-care behavior was measured by the self-care behaviors measurement tool developed by Kim [25]. This tool consists of 20 questions: 5 questions of general health care, 7 questions of diet practice, 3 questions of medication, 2 questions of physical exercise, and 3 questions of glucose test. Each item is a 5-point scale, with possible scores ranging from 20 to 100 points. The higher the score, the higher the degree of self-care behavior. Cronbach's α = .85 at the time of tool development. In this study, Cronbach's α = .88.

Data collection

Data collection was conducted from May to June 2015. Five research assistants who had received preliminary guidance from the researchers explained the research objectives in advance, obtained written consent, measured the metabolic syndrome first and then conducted the survey. The questionnaire was distributed in the field and respondents were asked to respond in a self-recording format. For respondents with difficulty to write due to decreased vision, the researchers and the research assistants read the questionnaire personally so that respondents can provide answers. The time spent to measure the metabolic syndrome index and fill out the questionnaire was about 30 minutes.

Data analysis

The collected data were analyzed using IBM SPSS Win ver 20.0 as follows.

- The general characteristics, health characteristics, body composition, social support and self-care behavior of the subjects were calculated by frequency, percentage, mean, standard deviation, and range.
- One-way ANOVA and independent t-testing were analyzed for differences in self-care behavior according to general characteristics and health characteristics of the subjects.
- relationship between body composition, social support and self-care behavior was analyzed by Pearson's Correlation Coefficient.
- Hierarchical regression analysis was used to identify factors influencing the self-care behavior of the subjects.

Results

General characteristics of subjects

As for the general characteristics of the subjects, 21.1% of the subjects were males and 77.2% were females. And as for the age, 76-80 years old accounted for 34.8%. In the case of religion, 'No Religion or Other' was the most with 33.9% followed by Christianity (29.5%), Buddhism (25.0%) and Catholicism (11.6%). As for the educational level, 'Graduated Elementary School' was the most with 42.0%. 56.3% of the subjects were living alone, which was more than half. 86.6% of the subjects had a disease. 72.3% of the subjects exercised. Smoking was 8.9% and drinking was 15.2% (Table 1).

Degree of body composition, social support and self-care behavior

The mean BMI(kg/m^2) of the subjects was 23.65 ± 2.80. The body fat percentage (%) was 32.03 ± 7.15. Abdominal obesity rate (%) was .85 ± .05, which was somewhat higher than the median. The basal metabolic rate (kcal) was 1299.96 ± 135.84, somewhat lower than the median. Social support was moderate at 62.96 ± 16.53 and affirmative support as the sub-factor was slightly lower at 2.94 ± 1.09. The self-care behavior were 60.59 ± 19.19, which was somewhat higher than the median, and the medication as the sub-factor was 2.64 ± 4.00, indicating that the self-care behavior were the lowest (Table 2).

Differences in self-care behavior according to general characteristics of subjects

Self-care behavior according to general characteristics of the subjects were statistically significant in age (F = 2.88, p = .039), religion (F = 3.31, p <.023), exercise (t = 2.35, p = .020), and smoking (t= 3.02, p = .003).

As a result of Scheffé post-hoc tests, for age, self-care behavior of 76-80 years old was significantly higher than 71-75 years old. As for religion, 'Christianity' was significantly higher in self-care activities than in Buddhism, no religion, and other religions. The self-care behavior was significantly higher in the exercise group than in the non-exercise group. In addition, the self-care behavior was significantly lower in the smoking group than non-smoking group (Table 1).

Correlation between subject's body composition, social support, and self-care behavior

The self-care behavior of the subjects showed a statistically significant negative correlation with body mass index (r = -.33, p <.001), abdominal fat ratio (r = -.47, p <.001), and body fat percentage (r = -.52, p <.001). And there was a statistically positive correlation with basal metabolic rate (r=.32, p=.001). The social support showed a statistically significant negative correlation with body mass index (r = -.29, p = .002), abdominal fat ratio (r = -.29, p =.002) and body fat percentage (r = -.35, p <.001). In other words, the higher body mass index, abdominal fat percentage, and body fat percentage, the lower the self-care behavior. And the higher the basal metabolic rate, the higher the self-care behavior (Table 3).

Factors affecting self-care behavior

Hierarchical regression analysis was conducted in order to investigate the effect of the subject 's body composition and social support on their self-care behavior. From the general characteristics, age, exercise, smoking, and religion, which showed a statistical significance with the self-care behavior, were selected as major independent variables. Among them, exercise, smoking and religion were processed as variable number. In the first step of hierarchical regression analysis, social support was input. In the second step, the body mass index, abdominal fat percentage, body fat percentage, and basal metabolic rate were input. In the third step, age, exercise, smoking and religion were input. The results are shown in Table 4.

As a result of checking multi-collinearity of the multiple regression analysis in order to test assumptions about independent variables, the tolerance limits of the regression analysis ranged from 0.594 to 0.910 (over 0.1), and variation inflation factor (VIF) values ranged from

Table 1. Differences of Self-care Behavior according to General Characteristics and Health Condition in Subjects (N=112).

Variables	Categories	n(%)	Mean ± S.D	t/F	p	Scheffe
Gender	Male	24(21.1)	62.33 ± 19.23	-0.21	.836	
	Female	88(77.2)	63.13 ± 15.84			
Age(yr)	65-70a	16(14.3)	65.00 ± 16.11	2.88	.039	b<c
	71-75b	24(21.4)	58.00 ± 16.54			
	76-80c	39(34.8)	68.33 ± 15.42			
	81 or overd	33(29.5)	59.21 ± 16.66			
Religion	Buddhista	28(25.0)	59.61 ± 17.56	3.31	.023	a,d<c
	Catholicb	13(11.6)	64.46 ± 15.71			
	Protestantc	33(29.5)	69.88 ± 13.76			
	None or othersd	38(33.9)	58.89 ± 19.80			
Education level	No formal educationa	43(38.4)	60.51 ± 16.09	1.31	.274	
	Elementary schoolb	47(42.0)	63.06 ± 16.00			
	Middle schoolc or abovec	22(19.6)	67.50 ± 18.24			
Living status	Married children and spouse	17(15.2)	61.18 ± 17.99	0.65	.582	
	Unmarried children or relatives	12(10.7)	68.92 ± 12.37			
	Alone	63(56.3)	62.06 ± 16.51			
	As a couple	20(17.9)	63.70 ± 17.84			
BMI	Under weight	41(36.6)	64.07 ± 16.24	0.31	.734	
	Normal weight	5(4.5)	58.20 ± 23.64			
	Over weight	66(58.9)	62.62 ± 16.36			
Diseases	No	97(86.6)	69.98 ± 15.14	1.23	.235	
	Yes	15(13.4)	56.33 ± 23.25			
Exercise	No	81(72.3)	65.19 ± 16.67	2.35	.020	
	Yes	31(27.7)	57.13 ± 14.88			
Smoking	No	10(8.9)	48.40 ± 16.53	-3.02	.003	
	Yes	102(91.1)	64.38 ± 15.91			
Alchol	No	17(15.2)	60.12 ± 16.80	-0.77	.445	
	Yes	95(84.8)	63.46 ± 16.53			

Table 2. Degree of Body Composition, Social Support and Self-care Behavior in Subject (N=112).

Category	Mean ± S.D	Item Mean ± S.D	Possible Range	Observed Range
Body Composition				
BMI(kg/m^2)	23.65 ± 2.80			17.5-33.6
Abdominal obesity rate	0.85 ± .05			.71-1.01
Body fat percentage (%)	32.03 ± 7.15			12.3-48.1
Basal Metabolism(kcal)	1299.96 ± 135.84			1054-1725
Social support	**62.96 ± 16.53**		**19-95**	**33-95**
Emotional/informational support		3.06 ± 1.12	1-5	1-5
Material support		3.02 ± 1.31	1-5	1-5
Affirmative support		2.94 ± 1.09	1-5	1-5
Positive interaction		3.25 ± 1.23	1-5	1-5
Self-care behaviors	**60.59 ± 19.19**		**20~100**	**33~95**
General health care		2.56 ± 0.89	1-5	1-5
Diet practice		3.68 ± 1.33	1-5	1-5
Medication		2.64 ± 4.00	1-5	1-5
Physical exercise		3.53 ± 1.41	1-5	1-5
Glucose test		3.14 ± 1.06	1-5	1-5

Table 3. Relationship among Body Composition, Social Support and Self-care Behavior in Subject (N=112).

Variables	Social support	Self-care behavior
	r(*p*)	r(*p*)
BMI (kg/m^2)	-.29(.002)**	-.33(<.001)**
Abdominal obesity rate	-.29(.002)**	-.47(<.001)**
Body fat percentage (%)	-.35(<.001)**	-.52(<.001)**
Basal Metabolism (kcal)	.17(.076)	.32(.001)**

1.099 to 1.682 (under 10), indicating that there was no problem of multi-collinearity between independent variables. Also, as a result of checking the autocorrelation of the error, the Durbin-Watson statistic value was 1.429, which was close to 2, indicating no autocorrelation. As a result of the residual analysis, the standardized residuals ranged from -2.326 to 2.310, satisfying the homoscedasticity, and the normal distribution of the error term was tested to confirm the suitability of the set model (F = 14.01, p <.001).

Table 4. Affecting Factors of Body Composition and Social Support on Self-Care Behaviors in Subject

Step	Variables	B	SE	β	t(*p*)	Adj.R^2	F(*p*)
1	(Constant value)	32.98	4.274		7.716(<.001)	.323	54.06(<.001)
	Social support	.50	.067	.57	7.353(<.001)		
2	(Constant value)	101.31	24.722		4.098(<.001)	.478	21.29(<.001)
	Social support	.34	.065	.40	5.287(<.001)		
	Body Mass Index (BMI)	-.40	.455	-.07	-.868(.388)		
	Abdominal fat rate	-62.72	24.780	-.21	-2.531(.013)		
	Body fat percentage	-.51	.198	-.22	-2.552(.012)		
	Basic metabolism	.02	.009	.13	1.654(.101)		
3	(Constant value)	95.56	28.894		3.307(.001)	.563	14.01(<.001)
	Social support	.31	.061	.35	5.007(<.001)		
	Body Mass Index (BMI)	-.15	.437	-.03	-.333(.740)		
	Abdominal fat rate	-63.16	22.928	-.21	-2.755(.007)		
	Body fat percentage	-.58	.186	-.25	-3.110(.002)		
	Basic metabolism	.01	.009	.09	1.189(.237)		
	Age	-.02	.195	-.01	-.089(.929)		
	Exercise*	-3.61	2.420	-.10	-1.492(.139)		
	Smoking*	12.20	3.892	.21	3.136(.002)		
	Religion 1*	1.97	3.863	.04	.510(.611)		
	Religion 2*	7.79	2.929	.22	2.660(.009)		
	Religion 3*	-.07	2.829	-.01	-.023(.982)		

The result of applying social support to the model as the first step of the hierarchical regression analysis showed that the higher the social support, the greater the self-care behavior (β = .57, p <.001), and the explanatory power of this model was 32.3%. The result of inputting body mass index, abdominal fat percentage, body fat percentage, and basal metabolic rate as the second step of the hierarchical regression analysis, showed that the higher the abdominal fat rate, the lower the self-care behavior (β = -.21, p = .013), and that the higher the body fat percentage, the lower the self-care behavior (β = -.22, p = .012). Abdominal fat percentage and body fat percentage were further explained by 1.55%, and the explanatory power of this model was 47.8%. The result of inputting age, exercise, smoking, and religion as the third step of the hierarchical regression analysis, showed that the more the subjects smoke, the lower the self-care behavior (β=-.21, p=.002). Self-care behavior was performed more by subjects with Christianity as a religion. The abdominal fat rate, which was identified as the explanatory variable in the second step, was not statistically significant with decreasing explanatory power (β = -.21, p = .007). Smoking and religion were further explained by 8.5%. In the final model, the total explanatory power of these variables was 56.3% (Table 4).

Discussion

This study was conducted to identify the impact of the body composition and social support of the socially vulnerable elderly with diabetes on their self-care behavior in order to provide basic data on the development of an effective self-care program for the socially vulnerable elderly with diabetes. The main results of this study are as follows.

The self-care behavior score of the subjects was 60.59, which is higher than median. In a previous study [23] of low-income elderly diabetic patients, the level of self-care activities ranged from 0 to 112 with the average of 68.19. Direct comparison was difficult because the same tool was not used, but the result was similar to the results with a somewhat higher score. Among the sub factors of the self-care behavior, medication was 2.64, which was the lowest. In the case of low-income elderly diabetic patients, it is necessary to assess the diabetic education experience. In particular, drug-related education and information will need to be provided.

From the subjects' body composition, BMI (kg/m2) averaged 23.65, indicating a high risk of diabetes. Body fat (%) was 32.03% and abdominal fat percentage (%) was 0.85%, which was slightly higher than the median. Basal metabolic rate (kcal) was 1299.96kcal, which was slightly lower than the median. Abdominal obesity, overweight, and obesity are the main causes of morbidity of diseases, such as diabetes, cardiovascular disease, and metabolic disorders, and of mortality, and are caused by complex actions of social, cultural, and environmental factors as well as genetic predisposition [26]. And this was similar to the report that the diabetic group has a significantly higher body mass index than the non-diabetic group [27]. Although previous studies are rarely done and direct comparisons are difficult, it is found that overweight and obesity trends are present in the socially vulnerable elderly with diabetes.

The social support of the subjects in this study was 62.96, which was the medium. In this study, 56.3% of the subjects were living alone, which was more than half. As a result, affirmative support, the sub-factor of social support, seems to be somewhat low at 2.94. Direct comparison is difficult because the same research tool was not used. However, the results were similar to those of the study of social support and self-care of diabetic patients, which suggested that physical function and emotional well-being are lowered and patients have a difficulty in self-care as social support decreases [22]. In particular, in the case of low-income patients, it is necessary to provide education and nursing intervention program with reinforced social support based on a previous study that reported that diabetic patients had low levels of self-care behavior without any family or anyone to help them [23].

In this study, the hierarchical regression analysis was conducted in order to investigate the effect of the subject's body composition and social support on self-care behavior. In the first step of hierarchical regression analysis, social support was input. In the second step, the body mass index, abdominal fat percentage, body fat percentage, and basal metabolic rate were input. In the third step, age, exercise, smoking and religion were input. The result of applying social support to the model as the first step of the hierarchical regression analysis, showed that the higher the social support, the greater the self-care behavior, and the explanatory power of this model was 32.3%. The

result of inputting body mass index, abdominal fat percentage, body fat percentage, and basal metabolic rate, showed that the higher the abdominal fat rate, the lower the self-care behavior, and that the higher the body fat percentage, the lower the self-care behavior. Such results support the study result [16] that the method of correcting weight gain, abdominal obesity and increase of dyslipidemia due to poor health habits as a result of aging can be a strategy to prevent and treat diabetes. The results also support that the results of previous studies [22,23] that social support for the elderly not only plays a protective role in promotion of coping and adaptation to these problems, but also influences self-care behavior.

In addition, the result of inputting age, exercise, smoking, and religion as the third step of the hierarchical regression analysis, showed that the more the subjects smoke, the lower the self-care behavior. Self-care behavior was performed more by subjects with Christianity as a religion. The total explanatory power of these variables was 56.3%. The previous study showed that the general characteristics that affect the self-care of the elderly were economic level, age, social activity, spouse, and exercise [8,9], supporting some of the results of this study. Restraint from smoking is recommended as smoking increases the risk of developing diabetes and complications through mechanisms such as lipid metabolism abnormality [28] and increased insulin resistance [29] depending on the cumulative smoking amount.

There is a lack of precedent studies on body composition, social support and self-care behavior of the socially vulnerable elderly with diabetes, making active comparison to be difficult. However, the balanced body composition and high social support of the socially vulnerable elderly with diabetes have improved the patients' self-care behavior. Therefore, it can be used as a strategy for promoting self-care behavior.

A benefit of this study is that it has confirmed the influencing factors of self-care behavior according to body composition and social support of diabetic elderly people in vulnerable classes. However, the study also shows limitations in that the results cannot be generalized, as the subjects were not randomly selected.

Conclusion

This study was carried out to investigate the effects of body composition and social support of the socially vulnerable elderly with diabetes in accordance with their self-care behavior. The result of the study has shown that the higher body mass index, abdominal fat percentage and body fat percentage, the lower the self-care behavior, and that the higher the basal metabolic rate, the higher the self-care behavior.

Based on the results of this study, it is suggested that a self-care enhancement program considering the balanced body composition and high social support is developed and utilized in the socially vulnerable elderly with diabetes.

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