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Development and Application of Water Intake Intervention Program

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Abstract

This study is a single-group repetitive experiment conducted to develop the 'water intake intervention program' for the elderly living in the community to confirm its effectiveness. The intervention program was developed by applying Bandura's theory of self-efficacy and consisted of a total of 4 weeks of intervention and 2 weeks of voluntary intake. The pilot test for evaluating the developed program was conducted from May 20 to July 15, 2019. As a result of the study, the degree of moisture intake of the subjects was statistically significant in the water related knowledge as a result of preliminary and post-verification tests on the living together family type, water related knowledge and self-efficacy. As a result of repeated analysis of changes in water intake and blood components, hemoglobin, MCH, and MCHC among water intake and blood components increased, and MPV decreased, which was statistically significant. Based on the results of this study, it is required to study the effect of water intake on cardiovascular risk after revising and supplementing the water intake intervention program.

Keywords: Elderly; Water Intake; Blood component; knowledge of water intake; Self-efficacy; Water intake intervention program.

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1. Introduction

In aging society, increases in total support expenses and medical expenses lead to social and economic burdens. In this circumstance, it has been required to make efforts to solve the problem and pay attention to life quality in old age. Therefore, it is necessary to recognize the issue as a social issue, rather than a personal one, and to make joint efforts to apply it to the policy decision in each one of areas.

An appropriate level of energy and nutrient intake are important for health improvement and disease prevention. Water accounts for about 60% of an adult's body, and about 55% of an

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old man's body. Inappropriate fluid intake can increase morbidity rate and death rate (Picetti,Det al.,2017), and therefore for an improvement, it is required to change living habits. The literature research on the correlation between Korean elderly people's level of fluid intake and their health state was conducted. In the research on local elderly people by Joung,HY et al.(2019), their average amount of fluid intake on the basis of liquid state was 720mL. According to the research byJoung,HY et al.(2017), 45.7% had 600mL or less per day, and only 22.3% took more than 1000mL. Picetti, D et al.(2017) reported that 56% had more than six cups of water, and 9% drank less than three cups of water. Due to the loss of thirst mechanism, elderly people are easily exposed to the risk of water loss even if water can be supplied (Kim, SH., 2012). Water loss in the body can cause urinary stone, urinary tract infection, and cognitive function reduction, and chronic water deficit is reported to be the risk factor of hypertension, Venous thrombosis, coronary artery disease, and cerebral stroke (Thomas, DR et al., 2008; Masent, NA et al., 2014;Watso, JC et al., 2019). It is found that sufficient hydration status affects a decrease in morbidity rate of various diseases. As such, water loss causes not only dizziness, disorder, seizure, but can lead to severe problems like death if no treatment is made (Picetti, D et al.,2017). As described earlier, fluid intake is very important to elderly people. However, most of study subjects have a little perception of fluid intake so that they fail to perceive the correlations between insufficient hydration status and their physiological symptoms (e.g., heart failure, hypertension) and cognitive function change. It means that they lack relevant education(Picetti, D et al.,2017; Joung, HY et al., 2017). Studies related to fluid intake intervention are as follows: the research on the urinary change of the elderly hospitalized in geriatric hospital after fluid intake intervention; the research on the specific gravity and color of urine (four weeks and six weeks after intervention) of the elderly in nursing facility; the research on the effect of intervention on the blood pressure of the elderly after their back surgery; and the research on the change of adults' blood components(Kim, HJ et al., 2014; Kim, HK,. 2017). As such, most studies on fluid intake intervention for the elderly had been conducted under controllable situations (e.g., geriatric hospitals, nursing facilities) or by nursing staff who can find amounts of fluid intake and urine. It was hard to analyze the studies on the development and application of programs for the elderly living in communities. Therefore, in this study, a 'fluid intake intervention program' was developed and operated on the basis of the intervention research by Kim,JH et al.(2000), who applied the 'self-efficacy theory' to elderly people.

Self-efficacy is an individual's effective method for obtaining a successful expectation, and the more a person perceives self-efficacy, the more he or she can improve the ability to deal with a situation (Bandura, A et al., 1977; Bandura, A., 1982). In other words, self-efficacy refers to an individual's belief in his or her capacity to execute a certain job. Bandura,A(982) explained that one's experience of success can improve self-efficacy which helps him or her predict the capacity to overcome a difficult situation never experienced before. Therefore, the purpose of this study is to develop and operate a 'moisture intake intervention program by applying Bandura's 'self-efficacy theory' in order to increase study subjects' self-efficacy and achieve their goal of fluid intake successfully, and thereby to improve the elderly's perception of fluid intake, analyze the correlation between fluid intake and blood components, and find the efficiency of the program.

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2. Materials and Methods

2.1 Study design

In this study, a 'fluid intake intervention program' was developed and operated on the basis of the research (Joung,HY et al., 2019) with elderly people living in local communities. The study has the single-group repeated measure test design.

2.2 Study subjects

The subjects of this study were elderly people aged 65 or older living in W city of K province. The selected subjects were able to have communication, do activities of daily living, read a newspaper, understand the explanation of a questionnaire, and have no history of any medical doctor's recommendation or diagnosis of restricted fluid intake. In this study, a pilot test was conducted to find the efficiency of the developed program. In terms of sample size, thirteen subjects were selected on the basis of the research on the blood component difference after fluid intake, which was conducted by Kim, HK et al. (2017). Among them, two dropped out. Finally, eleven subjects' data were analyzed.

2.3 Development of fluid intake intervention program

The program had been developed from Dec. 2018 to May 2019. For the development, this researcher applied the 'self-efficacy theory' of Bandura,A etal.(1977) on the basis of the descriptive survey (Joung,HY et al., 2019) on fluid intake of elderly people living in local communities in 2018. The program consisted of four sessions, each of which had been performed 120 minutes. The program included the education about the effect of fluid intake on the human body, OX quiz, discussion and empathy for increasing self-efficacy, and positive feedback.

2.4 Study tools

2.4.1 General characteristics

As general characteristics, there were age, gender, whether to have a spouse, a type of cohabiting family, education, current disease history, whether to smoke, fluid intake, and coffee intake.

2.4.2 Amount of fluid intake

An amount of fluid intake is 1000mL per day in liquid state according to the 2015 dietary reference intakes for Koreans. Liquid types include water, barley tea, corn team, and cassia seed tea. The method of measuring an amount of fluid intake is to give the study subjects 200mL cups and stickers to measure an intake amount and to let them record the measured results. A study subject's daily fluid intake amount means the mean of the fluid intake amounts recorded for three days.

2.4.3 Knowledge of fluid intake

With regard to knowledge of fluid intake, there are ten questions about their physiological symptoms caused by fluid deficit. In each one of the questions, 1 point means 'yes'; 0 point 'I have no idea'; -1 point 'no'. The higher score one has, the more knowledge he or she has.

2.4.4 self-efficacy

Self-efficacy was based on the 'self-efficacy scale' developed bySherer, M et al. (1982). At the time of the development, the scale had 23 questions: 17 questions about general self-efficacy, 6 questions about social self-efficacy. In this study, elderly people as study subjects were taken into

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consideration, and therefore seven questions about general self-efficacy and three questions about social efficacy were selected from the developed scale and were applied. The content validity of the self-efficacy scale used in this study was confirmed by two professors of nursing science and one expert on gerontology before use. Each question was based on the five-point scale. The higher score one has, the more self-efficacy he or she has.

2.4.5 Test of blood components

As for blood components, Hematocrit (Hct), Hemoglobin (Hb), Mean corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC), mean platelet volume (MPV), and C-reactive protein (CRP) were tested.

In this study, the normal range for Hb of both men and women is 12.0 ~ 17.0g/dL; the normal range for Hct (the volume percentage of red blood cells in blood) is 36.0 ~ 54.0%; the normal range for MCH is 28.2 ~ 33.3pg; the normal range for MCHC (in 100cc red corpuscles) is 32.0 ~ 36.0g/d; and the normal range for MPV is 9.0 ~ 13.0fL. CRP is an acute inflammatory protein used for monitoring inflammation related to multiple infectious diseases and autoimmune diseases. The normal range for CRP is ≤0.50mg/dL, and its value is measured with a quantitative test.

2.5 Data collection method

To collect the study subjects, this researcher visited a senior citizen center situated in W city of K province. They agreed on their participation after the purpose and process of this study was explained. They were allowed to withdraw from the participation at any times and received the explanation of compensation in case of complaints or problems with blood gathering. This study had been conducted from May 20th to July 6th, 2019. The developed program had been operated four weeks from May 27th to June 22nd, 2019. In order to find the continuous effect of the program, this researcher didn't intervene except for text-messaging for encouraging fluid intake once every day for two weeks, after the operation of the program. Data about general characteristics, knowledge of fluid, self-efficacy, fluid intake amount, and blood examination were collected before the program and four weeks after the program. For the continuous effect, data about fluid intake amount and blood examination were collected six weeks after the program.

2.6 Data analysis method

The collected data were analyzed with SPSS/WIN 19.0 Program. For the general characteristics of the study subjects, frequency analysis and descriptive statistics were conducted. To find the correlation between fluid intake and self-efficacy according to general characteristics, χ^2-test was conducted. The pre-post analysis on knowledge of fluid and self-efficacy was conducted with Mann-Whitney U- test as a non-parametric test. To analyze the fluid intake and blood component differences, repeated measure ANOVA was conducted.

3. Results and Discussion

3.1 General characteristics

The general characteristics of this study are presented in Table 1.

Seven of the study subjects (63%) were women, and their average age was 77.6 years. Seven

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(63.6%)이 had their spouse. Regarding cohabitation, seven (63.6%) lived together with their spouse, and three (27.3%) with their children. All of the study subjects had at least one disease and were non-smokers. An amount of fluid intake refers to the mean of the intake amounts measured for three days. The subjects' daily average water intake was 4.8 cups (±1.2), and eight (72.7%) drank 4-5 cups of water, and only two (18.25%) had more than five cups of water (over 1000mL). The average coffee intake was 1.3 cups (±1.0), and all but two (18.2%, more than two cups) drank less than two cups of coffee.

3.2 Fluid intake and self-efficacy according to general characteristics

Table 2 shows the results of the analysis on fluid intake and self-efficacy depending on gender, age, whether to have a spouse, education, and a type of cohabiting family. Fluid intake was statistically significant (p=.038), but self-efficacy was not so, depending on a type of cohabitating family.

3.3 Differences in self-efficacy and knowledge of fluid intake after the operation of fluid intake intervention program

The results of the analysis on fluid intake and self-efficacy after the operation of the fluid intake intervention program are presented in Table 3. The self-efficacy difference before and after the program was not statistically significant. The average points of knowledge of fluid, however, increased from 2.1 to 4.1 so that it was statistically significant (p=.042).

Table 1. General characteristics (N=11)

Variables	Categories	n(%)	M(SD)
Gender	Male	4(36.4)	-
	Female	7(63.6)	
Age	70~79	9(81.8)	77.6 (2.77)
	≥80	2(18.2)	
Spouse	Y	7(63.6)	-
	N	4(36.4)	
Education	Elementary school	9(81.8)	-
	high school	2(18.2)	
Living together	with spouse	7(63.6)	-
	with children	3(27.3)	
	alone	1(9.1)	
Medical history	Y	11(100)	-
	N	0(0.0)	
Smoking	Y	0(0.0)	-
	N	11(00)	
Water intake	<3cup	0(0.0)	4.8 (1.28)
	>3~4cup	1(9.1)	
	>4~5cup	8(72.7)	
	>5cup	2(18.2)	

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Coffee intake	<1cup	5(45.5)	1.3 (1.00)
	1~2cup	4(36.3)	
	>2cup	2(18.2)	

Table2. Water intake and self-efficacy according to general characteristics (N=11)

Categories	**Water intake**		**Self -efficacy**	
	χ^2	*p*	χ^2	*p*
Gender	1.39	.491	11.00	.139
Age	2.59	.762	39.87	.262
Spouse	4.27	.109	6.67	.463
Education	.461	1.000	7.64	.366
Living together	6.51	.038*	16.76	.269

Table3. Changes in self-efficacy and Knowledge of water intake after application of the water intake enhancing program (N=11)

Categories	**Total score**	**Pre- test**	**Post- test**	***Z(p)***
		M(SD)	M(SD)	
Self-efficacy	5	3.6(.72)	3.5(.34)	-.04(.969)
Knowledge of water intake	10	2.4(3.14)	4.1(3.36)	-2.03(.042)*

3.4 Differences in fluid intake and blood components after the operation of fluid intake intervention program

3.4.1 Fluid intake difference after the operation of fluid intake intervention program

Table 4 presents the results of the analysis on the fluid intake difference before the program, four weeks and six weeks after the program. The subjects' average fluid intake was 4.8 cups before the program and was 6.2 cups four weeks after the program and 6.4 cups six weeks after the program. Therefore, the fluid intake difference was statistically significant (p<.001).

3.4.2 Blood component difference after the operation of fluid intake intervention program

The results of the analysis on the blood component difference before the program, four weeks and six weeks after the program are shown in Table 4. Among blood components, Hemoglobin (p=0.21), MCH (p=.005) and MCHC (p<.001) increased more after the program before the program, and their differences were statistically significant. In addition, MPV decreased more after the program before the program so that its difference was statistically significant (p<.001). Although CRP decreased more after the program before the program, its difference was not statistically significant.

Table4. Change in self-efficacy and Knowledge of after application of water intake intervention program (N=11)

Categories	**Pretest**	**4wks later**	**6wks later**	**F(*p*)**

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	M(SD)	M(SD)	M(SD	
Water intake	4.8cups(1.28)	6.2cups(.34)	6.4cups(.36)	20.34(<.001)
Hemoglobin	12.9(1.30)	12.6(1.41)	12.9(1.16)	4.69(.021)
Hematocrit	38.1(8.55)	37.6(3.52)	39.3(2.93)	.36(.573)
MCH	31.0(1.28)	31.6(1.18)	31.3(1.38)	11.03(.005)
MCHC	31.9(1.07)	33.6(1.01)	33.2(.82)	24.87(.<.001)
MPV	12.2(.70)	11.5(1.04)	11.5(.97)	24.87(.<.001)
CRP	0.14(.22)	0.13(.23)	0.08(.08)	1.18(.305)

4. Discussion

In this study, a type of cohabiting family affected fluid intake, but it was difficult to find a different study to compare. Given that elderly people living alone had worse physical health state or lower quality of life than those with cohabitation (Kim, KS., 2017), it is considered that a type of cohabitating family would influence their health. In this study, the subjects' average fluid intake was 4.8 cups (960mL) which were relatively more than the volume in a different relevant study. It is considered that the result would be influenced by their many chances to obtain information in a city where they lived and through a variety of programs performed in a senior citizen center, and by the three-day measuring period. Nevertheless, the volume fails to reach the reference intake for Koreans. Therefore, it is necessary to let them perceive the necessity of sufficient fluid intake. The significance of self-efficacy after the program was not verified, and therefore the result was different from that of the research byKim,JH et al. (2000). In this study a pilot test was conducted and there were the limitations due to the number of subjects and single-group design. Most of relevant studies had the intervention of physical activities so that their subjects were able to find their physical changes and increase satisfaction. On contrary, the program in his study was operated statistically and failed to affect self-efficacy. Given the point, it is necessary to conduct a repeated measure analysis by changing and improving the program. In this study, the subjects' knowledge of fluid and their daily intake amount increased for four weeks so that program was effective. The result was similar to the result by Joung, HY et al. (2017) who analyzed the correlation between knowledge of fluid and Dry Mouth (Xerostomia). It indicates that the improvement in perception is significant to behavioral change. With a rise in fluid intake, Hemoglobin and MCH, and MCHC increased. MCH and MCHC increased more four weeks after the program than before the program. The result was similar to that of the research by Kim, HK et al. (2017). It means that fluid intake can influence anemia improvement. In this study, MVP significantly decreased. It was reported that a rise in MPV leads to a higher possibility of blood clot, and is related to diabetes, hypertension, and hypercholesterolemia (Chu, SG., 2010). In addition, CRP (an overall inflammation response index) reduced after the program but was not statistically significant. Given that MPV and CRP are known to be predictive factors of cardiovascular disease, their positive differences are considered significant. Although the result of CRP directly related to cardiovascular disease was not significant, its reduction is considered to be noticeable. The correlations between hydration status, cardiovascular risk, and cognitive function have not been studied sufficiently. The necessity of continuous research is suggested. Therefore, it is expected to conduct a variety of research for improving living habits for fluid intake. In particular, given that cardiovascular disease is in the top of outpatient diseases of

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Korean elderly people, it is necessary to find a method of improving the self-care ability for the disease found most in elderly people (Jung, EY., 2019).

5. Conclusion

Reportedly, the insufficient hydration status of the human body is a cause of fatigue, and the continuous fluid loss increases the possibility of hypertension or cerebral stroke.

After the end of the intervention program, average fluid intake increased to 6.2 cups (1240mL) from the volume measured before the program. In short, about 1.4 cups (280mL) increased. According to the analysis on continuity two weeks after the end of the program, it was about 6.4 cups (1280mL) that met the reference intake for Koreans. Therefore, perception change is considered to affect a habit of fluid intake. In addition, Hemoglobin, MCH, and MCHC increased. It indicates that fluid intake positively influences anemia improvement. Although MPV and CRP related to cardiovascular risk factors reduced, only MPV was statistically significant. In particular, even though CRP as a critical indicator of cardiovascular disease was not statistically significant, its reduction means the correlation with fluid intake. If elderly people's habit of fluid intake is improved on the basis of the study results, it is expected to reduce the risks of cardiovascular disease and cerebral stroke as severe disorders, to improve life quality in old age, and to lessen the burden of medical expenses.

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