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Implementation of Transtheoretical Model Nutrition Education and Chromium Picolinate Supplementationon Improve Dietary Adherence Behavior, Chromium Consumption Pattern and Blood Glucose Level Diabetes Mellitus Patients

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ABSTRACT

Bali is one of the provinces in Indonesia that has a Diabetes Mellitus rate above the national prevalence. According to the results of the 2020 study, 56.9% of DM patients did not understand diet education and did not comply with the diet by 56.9% with abnormal blood glucose levels of 63.9%. The results confirmed that repeated exposure with the right method, especially with The transtheoretical model is very effective in increasing knowledge and adherence to diet and chromium consumption patterns in DM patients. Chromium is effective in improving blood glucose levels in people with Diabetes Mellitus (Types 1 and 2). Chromium improves glucose metabolism in patients with prediabetic glucose intolerance and all women with gestational diabetes. The purpose of this study was to determine the role of nutrition education using a transtheoretical model and the effect of chromium picolinate supplementation on dietary adherence behavior, chromium consumption patterns, and blood glucose levels in patients with diabetes mellitus. This type of research is quasi-experimental. The research design used was one group pretest-posttest. This design does not use a comparison group (control) but uses the first observation (pretest) which allows testing the changes that occur after the experiment or program (Notoatmodjo, 2010). The study was conducted at the Denpasar Health Center. The results showed that there were differences in the level of knowledge and consumption of chromium and blood glucose levels in DM patients. However, there was no difference in the attitude and level of dietary compliance of DM patients.

1. Introduction

Based on the 2019 Bali Provincial Health Profile, the district/city with the highest prevalence of diabetes mellitus sufferers based on a doctor's diagnosis in the population aged 15 years was found in Denpasar City with a recorded number of sufferers, namely 14,487 people (Bali Provincial Health Office, 2019). Denpasar City has 11 Public Health Centers, one of which is the Denbar Health Center II which shows the highest number of people with diabetes mellitus at 1,384 people. However, at Denbar health centre II, only 4% of the number of DM patients received health services according to standards, this figure was 56 people out of 1,384 people with DM at Denbar Health Centre II (Denpasar City Health Office, 2018). Meanwhile, based on data from the West Denpasar Health Center II in 2020, the number of type 2 diabetes mellitus patients who visited the health centre from January to December was 997 people consisting of 948 old cases and 49 new cases.

Based on the results of research by Laksmi D.P (2016), it is known that several DM communities in Denpasar have not involved nutritionists in the management of DM communities. Individual nutrition counseling in accordance with diet planning has never been done. The success of diet planning depends on the behavior and knowledge of people with Diabetes Mellitus in carrying out the dietary recommendations given, failure in meal planning is one of the obstacles in the treatment of Diabetes Mellitus. This problem occurs due to lower knowledge about health and disease prevention behavior. Lack of knowledge about the disease suffered will an uncontrolled disease development process, including early detection of disease complications. This is one of the risk factors for aggravating the occurrence of body metabolic disorders so that it has an impact on the survival of people with Diabetes Mellitus (Suyono, 2015). Therefore, the role of information technology becomes very important in supporting overcoming health problems. The use of information technology in supporting the implementation of the transtheoretical method of nutrition education model is needed to improve the process of nutrition education stages so that patients diet compliance increases. Research on the Implementation of the Transtheoretical Model of Nutrition Education in nutrition education to increase knowledge about the Diabetes Mellitus diet and good blood sugar control in outpatient Diabetes Mellitus patients in Bali has never been done. This method is one of the solutions to improve the patient's dietary adherence. One of the most influential on blood glucose levels with diabetes is diet. Therefore, people with Diabetes Mellitus must be able to regulate a healthy and balanced diet. Setting a healthy and balanced diet needs to be balanced with exercise and adequate rest. Through a good diet, blood glucose levels will be controlled. One way to improve blood glucose in people with Diabetes Mellitus is to eat foods containing chromium.

Chromium has been shown to be effective in improving blood glucose levels in patients with Diabetes Mellitus (Types 1 and 2), Gestational Diabetes Mellitus induced by steroid group preparations. Chromium improves glucose metabolism in patients with prediabetic glucose intolerance as well as in all women with gestational diabetes. A study was conducted on 180 adults with Type 2 Diabetes Mellitus in China, who were each given 250 mcg of chromium/day, 1000 mcg of chromium/day, and a placebo. Fasting blood glucose in the chromium group fell lower (126 mg/dl) than it (144 mg/dl). Postprandial blood glucose levels read after 2 and 4 months, in the chromium group also decreased more (189 mg/dl) than the placebo group (221 mg/dl). Meanwhile, the HbA1c value in the 1000 mcg chromium group dropped significantly, even up to 6.6% (Arisman, 2011).

Consumption of chromium important role in the management of Diabetes Mellitus. Therefore, research is needed that can describe the pattern of chromium consumption in people with Diabetes Mellitus. Based on the literature search, researchers have not found a description of the pattern of chromium consumption in people with Diabetes Mellitus in the province of Bali, so it is necessary to conduct research related to this. It is hoped that this research can be input for nutritionists in recommending foods high in chromium as a recommended food ingredient for people with Diabetes Mellitus, so that the disease can be managed properly and can prevent the occurrence of various chronic complications, such as cerebrovascular disease, coronary heart disease, coronary heart disease, and cardiovascular disease. leg blood vessels, complications in the eyes, kidneys, and nerves (Soegondo, et al., 2015). The purpose of this study was to determine the role of nutrition education with transtheoretical models and the effect of chromium picolinate supplementation on dietary adherence behavior, chromium consumption patterns, and levels of blood glucose in diabetes mellitus patients.

2. Method

This type of research is quasi-experimental. The research design used was three group pretest-posttest. This design uses a comparison group (control). This study also uses the first observation (pretest) which allows testing the changes that occur after the experiment or program (posttest) (Notoatmodjo, 2010). The study was conducted at the Denpasar Health Center from June to October 2017. The sampling technique or method used is a non-probability sampling technique with the consecutive method, namely sampling based on predetermined criteria to obtain the minimum number of samples required within a certain period of time. From the calculation, the number of samples needed for this study was 26 people and the total sample for the three groups was 104 people. The Research location: Treatment group 1 was selected at Denbar I health centre , Treatment group 2 was selected at Denbar II health centre, and the control group was selected at Densel IV Health Centre. Data Sample according to the sample criteria according to the number of samples required. Knowledge level data collection by interview by researchers and enumerators as well as recording blood sugar levels based on sample medical records. Provision of nutrition education by applying the transtheoretical model is carried out 2 times a week for 1 month, namely 8 meetings with 8 material topics for 30-45 minutes. Collecting data on the level of knowledge and attitudes by interviewing researchers and enumerators. Dietary adherence data, chromium consumption were taken through interviews using a questionnaire supported by dietary data collected by Semi of Quantitative FFQ method. Fasting blood sugar levels were recorded based on data from laboratory analysis.

The research procedure carried out was procurement of chromium picolinate supplements, socialization of the study of the benefits and side effects of supplements at the health centre, the selected subjects were divided into three groups, namely: treatment group 1 with 26 people, treatment group 2 with 26 people and control group with 26 people. Before treatment, the three groups measured blood glucose levels, weight, height, and diet using the Semi Quantitative Food Frequency Questionnaire method. Measuring knowledge and attitudes about diet Diabetes mellitus and measuring adherence to diet DM with the SQ FFQ method. Homogeneity test between groups. Giving Treatment for 30 days. The first treatment group was given chromium picolinate supplementation at a dose of 200 µg/ twice a day and antidiabetic drugs on the recommendation of a health center doctor as well as nutritional counseling about diabetes mellitus diet. The second treatment group was given chromium picolinate supplementation at a dose of 200 µg/twice a day on the recommendation of a health center doctor and antidiabetic

drugs as well as nutritional counseling using the transtheoretical method regarding diabetes mellitus diet. The third treatment group was given chromium picolinate supplement at a dose of 200 µg/ twice a day and antidiabetic drugs on the recommendation of a doctor. The control group was given OAD medication on the recommendation of a doctor. Observation of daily supplement consumption with a form, measurement of knowledge, attitudes, dietary compliance, and blood glucose levels were measured twice, namely before and after the intervention for 30 days. Analysis of differences in the level of knowledge, attitude, and practice of dietary adherence between treatment groups was analyzed using the Chi square test. The analysis of differences in blood glucose levels between treatment groups was analyzed using the chi square test. All procedures performed in studies were reported and obtained Ethical Clearance from RSUP Sanglah Denpasar No. 2256/UN.14.2/KEP/2017.

3. Result and Discussion

Diabetes Mellitus is a group of metabolic diseases characterized by hyperglycemia that occurs due to abnormalities in insulin secretion, insulin action, or both (Soegondo, et al., 2015). In the state of Diabetes Mellitus, the body is relatively lacking in insulin so that blood glucose regulation becomes chaotic. Through a good diet, blood glucose levels will be controlled. One way to improve blood glucose in people with Diabetes Mellitus is to eat foods containing chromium.

It is the arrangement of the type, frequency, and amount of food sources of chromium consumed in accordance with the standard requirements. Total chromium consumption is the amount of sample chromium intake obtained by interview method using the SQ-FFQ form processed with the USDA Food Search program. The recommended dose of chromium intake for people with Diabetes Mellitus is 200-1,000 mcg day. The distribution of samples according to the amount of chromium consumption is presented in Table 1.

Table 1. Distribution of Samples by Amount of Chromium Consumption in the Treatment and Control Group

Pattern of Chromium consumption		GROUPS												p
		Treatment Group I				Treatment Group II				Control Group				
		Pre		Post		Pre		Post		Pre		Post		
		f	%	f	%	f	%	f	%	f	%	f	%	
Intake Chromium (µg)														
	As recommended	22	84,6	25	96,15	16	61,54	23	88,46	13	50	14	53,85	0,05
	Not recommended	4	15,38	1	3,85	10	38,46	3	11,54	13	50	12	46,15	0,04
Total		**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	
Type of Chromium Source														
	currently	11		42,31		9		34,62		12		46,15		0,07
	less	15		57,69		17		65,38		14		53,85		0,06
Total		**26**		**100**		**26**		**100**		**26**		**100**		
Frequency														
	frequently	14		53,85		9		34,62		10		38,46		0,08
	infrequently	12		46,15		17		65,38		16		61,54		0,06
Total		**26**		**100**		**26**		**100**		**26**		**100**		

In addition to nutritional status, physical activity, diet can also affect blood glucose levels in Diabetes Mellitus (DM) patients. Dietary patterns that affect blood glucose levels in DM patients are energy, carbohydrates, fat and chromium. Chromium MET provide essential and necessary microelements to maintain carbohydrate and lipid metabolism (Grober, 2013). Significant

(adequate) chromium levels are needed by the body to maintain normal glucose levels (Sustrani, et al., 2004). Based on the amount of chromium consumption, most of the samples consumed chromium as recommended, namely as many as 22 samples (84.6%). The average amount of sample chromium consumption was 377.03 mcg/day. Foodstuffs that contain high sources of chromium in 100 grams of ingredients are skim milk, yogurt, sweetened condensed milk, papaya, banana, watermelon, avocado, and chicken eggs. Anderson (1998) in Roro (2010) stated that the consumption of 200 g per day was considered sufficient to improve the amount of glucose in people with mild glucose intolerance. However, people with more severe glucose tolerance and diabetes usually need more than 200 g per day. In contrast to the results of research by Roro (2010) which states that the average chromium intake of respondents with Diabetes Mellitus is 19.8 g/day.

On the other hand, based on the type of chromium food consumed, most of the samples with the type of chromium consumption were less, as many as 17 samples (63.38%). Food sources of chromium consumed are potatoes, corn, bread, biscuits, beef, chicken, fresh fish, eggs, green beans, broccoli, celery, carrots, tomatoes, cauliflower, oranges, apples, bananas, papaya, watermelon, cheese, butter, margarine, milk for diabetes patients, less sweetened sugar, tea, coffee, and yeast. The average type of chromium consumption in the sample is 4 types. From the results of the type of chromium consumption that was lacking, it showed that the type of chromium food consumed by most of the samples was still less varied. This may be due to lack of knowledge about food ingredients containing chromium. Knowledge of nutrition has an important role in the formation of one's eating habits, because this will affect a person in choosing the type and amount of food consumed. Someone who is based on good nutritional knowledge will pay attention to the nutritional content of each food that will be consumed.

The Result about frequency of chromium consumption, most of the samples with frequent consumption were 17 samples (65.38%). The average frequency of consumption of sample chromium is 4x a week. Food sources of chromium that are often consumed are chicken meat, fish, eggs, papaya, tomatoes, diabetasol milk, tea, coffee, tropicana sugar. While food sources of chromium that are rarely consumed are potatoes, corn, bread, biscuits, beef, green beans, broccoli, cauliflower, celery, watermelon, bananas, oranges, apples, cheese, butter, margarine, and yeast.

Healthy people normally have a level of 0.1-0.3µg/L chromium in the serum. However, chromium is dispersed in various tissues and organs so that total body content is difficult to estimate (Lee and Reasner, 1994 ; Porter et.al.,1999). Serum or urine levels do not reflect body storage of chromium, but a urinary excretion of 10µg is usual in the absence of oral supplementation or industrial exposure.Chromium is absorbed through the small bowel mucosa, the skin and the respiratory tract (Ducros, V, 1992). The mechanism by which chromium is secreted from the body is not completely understood:80% appears to be excreted via the urine and a small amount via perspiration, bile salts, and hair.Plasma chromium levels in diabetic patients have been found to be lower than those of non-diabetics (Morris BW., et.al.,(1988). Such a deficiency may be significant for people with disturbed glucose metabolism. Chromium is required for cellular uptake of glucose, and its deficiency causes insulin resistance (Scahchter,S. et.al 2001).

An indirect correlation has been found between chromium levels and the level of glucose (Lee NA and Reasner CA,1994). Chromium is active as a glucose tolerance factor together with nicotinic acid and glutathione (Ducros, V,1992).It seems that chromium increases the effect of insulin.The exact mechanism by which this effect is accomplished is as yet unknown, but it in all probability increases the ability of insulin to bind to its membrane receptors. Feng et al., (1999)

suggested that chromium carries out its biological role via interaction with the insulin-sensitive tissue or via enhancement of the sensitivity of the insulin receptor.

Rendell and Kirchain (2000) found between chromium levels and the level of glucagon as a result of addition of chromium to a hyperglycaemic group, as compared with a control group. Morris et.al, (1992) studied healthy persons and found that the plasma chromium level was inversely related to the level of insulin, which rises as a response to glucose intake. It has been demonstrated that carbohydrates causing increased insulin secretion also cause increased chromium secretion from reservoir in the body (Mertz,1993; Abraham et al.,1992).The most reliable method for detecting chromium deficiency is by adding it to the diet and then observing the clinical effects.If blood glucose decrease thereafter, a deficiency of chromium may be assumed (Kersteer (1988).

Blood glucose levels are the sugar content in the blood which is closely related to Diabetes Mellitus. The distribution of samples according to blood glucose levels in the treatment and control groups is presented in table 2.

Table 2.
Distribution of Samples According to Blood Glucose Levels
in the Treatment and Control Group

Biochemical parameters		GROUPS												p
		Treatment Group I				Treatment Group II				Control Group				
		Pre		Post		Pre		Post		Pre		Post		
		f	%	f	%	f	%	f	%	f	%	f	%	0,04
Fasting Blood Glucose Levels														0,04
	Normally	19	73,1	24	92,3	15	57,7	19	73,1	15	57,7	8	30,8	
	upper	7	26,9	2	7,69	11	42,3	7	26,9	11	42,3	18	69,2	
Total		**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	

Based on fasting blood glucose levels, the average fasting blood glucose level of the 78 samples was 187.34 mg/dl (SD± 48.08), with the highest blood glucose level being 300 mg/dl and the lowest being 107 mg/dl. Most of the samples with normal blood glucose levels were 24 samples (92.3%). Before being given chromium supplements, the average blood glucose level in treatment group I was 179.43 g (SD ± 56.17) and after being given chromium picolinate supplements for 1 month at a dose of 200 µg twice a day, there was a change in the average. Blood glucose levels in the treatment group I were 106.27 g (SD ± 98.75). The average decrease in blood glucose levels in the sample of treatment group I after giving chromium picolinate supplementation for 1 month was 40.77% significantly ($p<0.05$).This is different from the theory which states that a person is diagnosed with Diabetes Mellitus if the fasting blood glucose level is 126 mg/dl. This is because in people with diabetes there is a lack of insulin or the insulin quality is not good, so that glucose remains outside the cells which causes glucose in the blood to increase (Soegondo, et al., 2015).

Our data show the significant positive clinical effects of a supplemental dose of chromium picolinate 200µg twice a day on glucose level was lower significantly. The effect shows the favourable influence of chromium supplementation in this study group. The effect was not observed in the control group. There was no evidence of toxicity in this study and there have not been any

reported toxic effects in any of the human studies involving chromium supplementation (Anderson, et.al, 1997).

Blood glucose levels are certainly influenced by several factors such as consumption patterns which include the type, frequency, and amount of consumption. In addition, knowledge about nutrition, nutritional status, physical activity/exercise, and use of drugs can also affect blood glucose levels. In this study, it was found that most of the blood glucose levels of the samples were in the normal category because most of the samples had normal nutritional status, consumed chromium food ingredients as recommended, were active members of the association who routinely participated in diabetes gymnastics activities at the health centre, and routinely underwent treatment at the health centre.

One way to improve blood glucose levels in people with Diabetes Mellitus is to eat foods containing chromium. Chromium is an essential microelement and is needed to maintain the actual metabolism of carbohydrates and lipids. This compound has been shown to strengthen insulin action so that it can affect carbohydrate, lipid, and protein metabolism (Grober, 2013). The mechanism of action of chromium on insulin starts from absorption in the body, then chromium ions are bound by apocromodulin so that it is biologically active to become cromodulin. Chromodulin then binds to the insulin receptor and increases the activity of receptor kinases and thus increases insulin action. Chromium also shows the effect of stimulating activity in cells that lead to an increase in glucose uptake in muscle cells as an insulin cofactor, the action of chromium is consistent with increasing insulin sensitivity (Vincent, 2000).

According to Perkeni (2021) there are four management of DM, one of which is education. The success of DM management is very dependent on the behavior and knowledge of DM patients in undergoing the food recommendations given. Failure in meal planning is one of the obstacles in the treatment of DM. This problem occurs due to lack of knowledge about diet management. Lack of knowledge about diet management will result in the absence of a good attitude in the management of DM (Fatmah, 2014). Therefore, it is very important to increase knowledge about diet management for DM patients through counseling programs or nutrition education in the DM community in Denpasar. The distribution of the level of knowledge, attitudes and behavior of dietary adherence to the sample in the treatment and control groups can be presented in the following table 3.

Table 3.
Distribution of Level of Knowledge, Attitude and Behavior of dietary adherence to the sample In the treatment and control groups

Variable	Treatment Group I				Treatment Group II				Control Group				p
	Pre		Post		Pre		Post		Pre		Post		
	f	%	f	%	f	%	f	%	f	%	f	%	
Knowledge level :													0,08 0,07
good	13	50	9	23,4	16	61,54	18	69,2	14	53,85	14	53,85	
enough	9	23,4	5	19,2	7	26,9	6	23,07	10	38,46	6	23,08	
lack	4	15,4	4	15,4	9	34,61	2	7,69	2	7,69	6	23,08	
Total	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	
Perception :													0,07 0,06

good	19	73,1	15	57,69	16	61,54	17	65,4	16	61,54	14	53,85	
bad	7	26,9	11	42,31	10	38,46	9	23,4	10	38,46	12	46,15	
Total	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	
Diet Obedience :													0,07 0,07
Obedient	15	57,69	10	38,5	14	53,85	14	53,85	17	65,4	15	57,69	
Unobedient	11	42,31	16	61,53	12	46,15	12	46,15	9	23,4	11	42,31	
Total	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	**26**	**100**	

Based on the level of knowledge about the management of DM diet, most of the samples had a good level of knowledge, namely 18 samples (69.2%). The average level of knowledge is 75.09 ± 16.38 SD. The highest score is 100 and the lowest value is 40. Knowledge about the DM Diet was obtained by interview methods which included dietary goals, principles of meal regulation, recommended, restricted, and avoided use of food ingredients, meal portions, meal schedules, food processing methods, and circumstances. The results of the Chi Square statistical test showed that the chromium supplementation in the treatment group I showed a significant difference with the group that was not given chromium supplements ($p < 0.05$). Based on fasting blood glucose levels, the average fasting blood glucose level of the 78 samples was 187.34 mg/dl (SD± 48.08), with the highest blood glucose level being 300 mg/dl and the lowest being 107 mg/dl. Most of the samples with normal blood glucose levels were 24 samples (92.3%). Before being given chromium supplements, the average blood glucose level in treatment group I was 179.43 g (SD ± 56.17) and after being given chromium picolinate supplements for 1 month at a dose of 200 µg/twice a day, there was a change in the average Blood glucose levels in the treatment group I were 106.27 g (SD ± 98.75). The average decrease in blood glucose levels in the sample of treatment group I after giving chromium picolinate supplementation for 1 month was 40.77% significantly ($p<0.05$).

Based on the results of research related to the recommended amount of chromium consumption, most of the r with normal blood glucose levels as many as 29 people (87.9%). Based on fasting blood glucose levels, the average fasting blood glucose level of the 78 samples was 187.34 mg/dl (SD± 48.08), with the highest blood glucose level being 300 mg/dl and the lowest being 107 mg/dl. Most of the samples with normal blood glucose levels were 24 samples (92.3%). Before being given chromium supplements, the average blood glucose level in treatment group I was 179.43 g (SD ± 56.17) and after being given chromium picolinate supplements for 1 month at a dose of 200 g/Kg BW/day, there was a change in the average Blood glucose levels in the treatment group I were 106.27 g (SD ± 98.75). The average decrease in blood glucose levels in the sample of treatment group I after giving chromium picolinate supplementation for 1 month was 40.77% significantly ($p<0.05$).

This is in accordance with the results of a study conducted on 180 adults with Type 2 Diabetes Mellitus in China, each of whom were given 250 mcg of chromium/day, 1000 mcg of chromium/day, and a placebo. Fasting blood glucose in the chromium group fell lower (126 mg/dl) than the placebo group (144 mg/dl). Postprandial blood glucose levels read after 2 and 4 months, in the chromium group also decreased more (189 mg/dl) than the placebo group (221 mg/dl). (Arisman, 2011). Based on Sustrani, et al (2004) significant (adequate) levels of chromium are needed by the body to maintain normal glucose levels. Chromium makes insulin more efficient by helping the uptake of glucose from the bloodstream into cells. This trace element increases the number of insulin receptors on cell

membranes while facilitating the binding of insulin to cells. It also activates insulin kinase receptors which will eventually increase insulin sensitivity (Arisman, 2011).

Consumption of chromium that is in accordance with the recommendations can also indicate high blood glucose levels. This can be caused because the absorption of chromium can be influenced by dietary factors. Inorganic chromium in a neutral or basic environment reacts with hydroxyl ions (OH), which polymerize easily. This causes the deposition of chromium, thereby reducing absorption. Taking antacids significantly inhibits chromium absorption. Phytates mostly found in grains also reduce chromium uptake (Gropper et al., 2005). In addition, a number of factors that can inhibit the absorption of chromium are calcium, iron, manganese, zinc, and vanadium (Grober, 2013). Increasing age has been shown to decrease chromium concentrations in tissues (Gropper et al., 2005).

In contrast to the consumption of chromium that is not as recommended, it can also indicate normal blood sugar levels. Amino acids, such as methionine and histidine, act as ligands to increase chromium absorption. Vitamin C can increase the absorption of chromium. Consumption of 1 mg of chromium along with 100 mg of ascorbate was associated with an increase in plasma chromium concentrations compared with consumption of chromium in the absence of ascorbate (Gropper et al., 2005). Several types of drugs/nutrients such as aspirin, amino acids (histidine and glutamic acid), nicotinic acid, and oxalic acid if taken regularly can increase the absorption of chromium (Grober, 2013). Food processing can affect chromium levels in food. Chromium is easily dissolved from stainless steel cookware or cans into acidic foods. Thus, the use of stainless steel cookware can increase the amount of chromium in food (Gropper et al., 2005). Consumption of chromium that is not as recommended, but shows normal blood glucose levels can also be caused by consumption of foods containing fiber or magnesium which both function to stabilize blood glucose levels.

Based on the type of consumption of samples with blood glucose levels descriptively, it can be explained that of the 17 samples with the type of consumption of chromium that is less, as many as 14 samples (46.7%) with high blood glucose levels, but as many as 16 samples (53.3%) with normal blood glucose levels. When viewed from the frequency of consumption of samples with blood glucose levels descriptively, it can be explained that of the 28 samples with frequent consumption of chromium, as many as 20 samples (71.4%) with normal blood glucose levels and as many as 8 samples (28.6%) with high blood glucose levels. Meanwhile, when viewed from the number of samples consumed with blood glucose levels descriptively, it can be seen that of the 33 samples with the recommended amount of chromium consumption, as many as 29 samples (87.9%) with normal blood glucose levels and as many as 4 samples (12.1). %) with high blood glucose levels. From the above results indicate that the pattern of consumption of chromium has a relationship with blood glucose levels. Samples with less chromium consumption, mostly with normal glucose levels.

CONCLUSION

The purpose of this research is to prove the effectiveness of eduction based on a TTM in changing the self-care behavior of DM patients in terms of changes in stage of change, changes in behavior of chromium consumption pattern and blood glucose level. The result shows a significant change in behavior after the provision of TTM-based education marked by a change in the stages of behavior toward action and maintenance. In educating, health workers need to assess the stages of changes for each patient and provide interventions based on that. Changes in the behavior of Diabetes

Mellitus patients have an impact on the patient's-controlled blood glucose level. Controlling blood glucose level requires a combination of self-care behavior items. Health educators are necessary to carry out telephone-based TBI interventions with a minimum duration of six months. TTM-based educational interventions are provided with a combination of the counseling and education method using electronic media at the community level.

We conclude that supplemental chromium and high chromium food pattern has been shown to have beneficial effects to prove blood glucose level on people with varying degrees of glucose intolerance to overt diabetes mellitus patients. The results of our study suggest that chromium picolinate, given as a supplement to the regular antidiabetic treatment, improve glucose levels in elderly patients with NIDDM in a rehabilitation program, often allows for a decrease in the dose of the antidiabetic drugs, and in some instances even eliminates the need for these drugs. However, additional studies with larger numbers of patients and a longer period of treatment are needed to elucidate the mechanism of action and the long-term benefits of chromium supplementation.

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