

The Correlation between Self-Regulation and Intention with the Diet Adherence of Adults with Type 2 Diabetes Mellitus

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Abstract--- Success in the management of type 2 diabetes mellitus (T2DM) is determined by dietary compliance, intention and self-regulation. The purpose of this study was to determine the relationship between self-regulation and intention with T2DM diet compliance. A descriptive correlation design with a cross-sectional approach was employed. A total of 108 respondents spread across 5 health primary care centers in Surabaya participated in this study. The independent variables were self-regulation and intention. The dependent variable was diet adherence. The data was obtained through the Treatment Self-Regulation Questionnaire (TSRQ), intention and the Personal Diabetes Questionnaire (PDQ). The data was analyzed using Spearman Rho and ordinal regression with a value of $\alpha \leq 0.05$. There was a relationship between self-regulation ($p=0.000$, $r=0.612$) and intention ($p=0.000$, $r=0.646$) with an adherence to diet among the adults with T2DM. The multivariate test results showed that self-regulation is more dominant ($p=0.000$) than intention ($p=0.014$). Self-regulation and intention plays a role in establishing dietary adherence among adults with T2DM. Improved good self-regulation can increase the compliance of patients when they are adhering to the suggested diet. This means that their blood sugar can be controlled properly.

Keywords--- adherence; intention; self-regulation; diabetes mellitus

I. INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disease characterized by an increase in blood glucose level where the pancreas does not produce enough insulin. This causes serious damage to many systems of the body including the heart, blood vessels, eyes, kidneys and nerves [1]. Compliance when undergoing a diet is needed to control the blood glucose level [2]. Intention and self-regulation are 2 factors that can maintain and improve dietary compliance.

Statistics based on the International Diabetes Federation (2017) show that the number of diabetes mellitus (DM) clients in the world in 2017 reached 425 million people. It is estimated that by 2045, the number of DM clients will increase to 629 million people[4]. In Indonesia, the reporting of DM cases reached more than 10,267,100 in 2017. Epidemiologically, it is estimated that in 2030, the prevalence of DM in Indonesia will reach 21.3 million people. The preliminary study found that the prevalence of DM is more common in women with a value of 12.7%. In men, the prevalence value only reached 9%.

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The age range of 55-74 years has a high prevalence with DM with a value of 19.6%. East Java ranks 5th with a prevalence value of around 2.7%. This prevalence value has increased from 2013 by a value of 1.9% (Rikesdas, 2018). A preliminary study conducted obtained initial data on the T2DM clients totaling 89,594 people in December 2018 in 63 health centers in the 5 areas of Surabaya, Indonesia. The 5 health centers with the highest number of T2DM clients in January-March 2019 averaged 1080 clients per month.

DM management can be done using 4 main pillars, namely counseling, meal planning, physical exercise and hypoglycemic drugs. Diet is the basis of DM management and it aims to provide all of the essential food elements in addition to achieving and maintaining a steady body weight, meeting their energy needs, and preventing fluctuations in their blood glucose level [6]. Arsana (2012) states that patient glycemic control is strongly influenced by the patients' adherence to their dietary recommendations including the type, amount and schedule of the food consumed. Patient compliance is related to undergoing a diet that is very important when it comes to stabilizing their glucose levels[2]. According to Almatier (2005), T2DM patients who adhere to a regular diet can reduce the risk of short-term and long-term complications[7]. However, maintaining and increasing T2DM diet compliance in the long term is a challenge and it requires an understanding of the processes involved. This is very important when it comes to driving changes in the T2DM client's diet compliance behavior[8].

One model that has been used to explain the involvement of health behaviors is the Health Action Process Approach (HAPA). The model of the development of the Health Action Process Approach (HAPA) is a conceptual approach to patients who believe that changing one's behavior can be done by increasing their intention through a motivational phase to form their intention into action [9].

The research conducted by Kusnanto, Dwi Kurnia, and Prasetya (2015) states that there is an effect from the implementation of HAPA on T2DM diet compliance [11]. Intention can control the patient when it comes to regulating their diet. However, intention must be supplemented by other variables that are more proximal so then they can turn the intention into action. Intention is a vital part of individual self-regulation so it can be interpreted that self-regulation affects intention [12]. Self-regulation is the process of a system used for maintaining the stability of a person's functions and their ability to adapt to changes. Self-regulation has a role in maintaining an action or behavior [13]. Based on the above problem, it is necessary to conduct research in order to determine the relationship between self-regulation and intention with the compliance to the T2DM client's diet over 5 Surabaya City Health Centers.

II. METHODS

- **Study design**

The research design used was a descriptive correlational research with a cross-sectional approach. This is a type of research study that emphasizes the measurement time or the observation of the independent and dependent variable data one at a time simultaneously. There is no follow up [14].

- **Population and Sample**

The population in this study was 1080 T2DM clients spread across 5 Public Health Centers (PHC) in Surabaya, Indonesia. The number of samples in this study totaled 108 respondents obtained using proportional random sampling with the following inclusion criteria: 1) DM patients classified as early adults through to seniors who had been diagnosed with DM for more than 1 year. The exclusion criteria for the DM patients was if they had DM complications such as coronary

artery disease, peripheral blood vessel problems, diabetic gangrene, diabetic neuropathy (disorders of the nerves) and cataracts based on historical diseases.

- **Measurements**

The demographics characteristics of the respondents were obtained using questionnaire. It was developed by the researcher and consists of questions on age, gender, marital status, profession, GDA and drugs. The variables used were both independent and dependent variables. The independent variables in this study were self-regulation and intention. The dependent variable used was T2DM diet adherence. The research measuring tool was in the form of a questionnaire. *Self-regulation*. The questionnaire used in this study was the Treatment Self Regulation Questionnaire (TSRQ) by Ryan and Conel (1999) modified by Darmansyah (2013)[16]. The self-regulation questionnaire consisted of a scale n self-regulation based on the stages of self-regulation consisting of interpretation, coping and assessment. This was measured using a rating of 1-7 with a value of 1 = very incorrect, 7 = very true. There were 15 items for the self-regulation questions. The highest score was 105 and the lowest was 15 with a bad regulation rating criteria = 15-45, enough regulation = 46-75 and good regulation = 76-105. This measurement tool has been tested for validity and reliability. It was 0.816 for two cycles which means that the gauge is reliable.

Intention. In this study, intention was measured using the intention questionnaire by Purnama (2017)[17]. The intention questionnaire was made by adjusting the section on nutritional diet management according to the needs and situations encountered by T2DM patients. There were 10 items for the questions about the intention related to planning and decision making in terms of the selection of time, place and how to manage food according to the number, type and schedule of the dining arrangements. The highest score was 40 and the lowest was 11 with the assessment criteria being 11-20 = less strong intention, 21-30 = strong enough intention and 31-40 = very strong intention. The intention questionnaire was tested by Purnama (2017) using the Person's Product Moment technique with a value of $\alpha < 0.05$, the value of r table = 0.5140, and r count > 0.5140. The Cronbach's alpha coefficient value is 0.858 and has been repeatedly tested to produce a constant value so that it can be concluded if this questionnaire is reliable to use.

Diet adherence. The measuring instruments used to measure the dependent variable of dietary compliance was the PDQ (Personal Diabetes Questionnaire) questionnaire compiled by Stetson (2011)[18]. In this study, we took one domain out of the 4 domains from the PDQ questionnaire, namely the nutrition domain. The dietary compliance questionnaire was modified by Harmiardi (2018) and consisted of 4 sub-domains, namely dietary knowledge and the individual's abilities (6 items), decisions in terms of diet selection (4 items), problems in terms of eating behavior (2 items) and obstacles (2 items). The highest score was 68 and the lowest was 18. In terms of the evaluation criteria, the level of compliance for less = 18-34, the level of compliance for sufficient = 35-51 and the level of compliance for good = 52-68. The questionnaire was tested for validity using the product-moment correlation test. This calculated the data correlation for each question with a total score that afterwards was compared to the r count > r table. All of the dietary compliance questionnaire items had a calculated value of $r > 0.444$. It can thus be concluded that all of the items in the dietary compliance questionnaire questions are valid. The reliability value of the diet compliance questionnaire was 0.825. The questionnaire had a Cronbach's alpha value > 0.05, which means that the compliance questionnaire is reliable.

- **Procedure**

The data collection process starts with the preparation stage in the form of research licensing. The next step was for the researcher to collect the research data from the 5 Surabaya city health centers at a predetermined time from May to June

2019. The method for the data collection was carried out by the researchers distributing questionnaires in the 5 health centers to the T2DM patients who routinely used the health centers in Surabaya. They also had to meet the study inclusion criteria. The researchers also conducted additional data collection by distributing questionnaires to the Prolanis (Chronic Disease Management Program) activities in the area of the community health centers and door to door.

- Analysis

The data was analyzed using the Spearman rho statistical test and the ordinal regression had a p-value ≤ 0.05 . The software used was IBM SPSS 24.

- Ethical consideration

This study passed the ethical review of the Health Research Ethics Commission of the Faculty of Nursing, Airlangga University and it received protocol approval on May 27th 2019 number 1439-KEPK

III. RESULTS

The most common age group in this study was the elderly age group. Judging from the gender distribution data, the majority of the respondents were female. Based on the data on the marital status of the research respondents, most were married. In terms of work, the majority were housewives. The majority of the respondents had random blood sugar values within the criteria for diabetes. The oral drugs that were consumed by the T2DM clients in this study were glibenclamide and metformin (Table 1).

Table 1. Characteristics and categories of the respondents (n=108)

Characteristics	n	%
Age		
Early adulthood (26-35)	2	1.9
Late adulthood (36-45)	5	4.6
Elderly (46-55)	24	22.2
Old (56-65)	40	37.0
Very old (65-up)	37	34.3
Gender		
Male	33	30.6
Female	75	69.4
Marital status		
Married	67	62.0
Single	9	8.3
Widow	32	29.6
Profession		
Civil Servant	1	0.9
Entrepreneur	13	12.0
Housewife	57	52.8
Pension	12	11.1
Does not work	8	7.4
Other	17	15.7
GDA Value Criteria		
Normal	9	8.3
Pre-diabetes	38	35.2
Diabetes	61	56.5
Drugs		
Herbal medicine	1	0.9
Glibenclamid	12	11.1
Glimepirid	10	9.3
Metformin	21	19.4
Glibenclamid& Metformin	39	36.1
Metformin & acarbose	2	1.9
Metformin & glimepirin	23	21.3

The relationship between the self-regulation variable and T2DM diet compliance was determined using the Spearman Rho Test. The results obtained show a score of $p < 0.001$ and $r = 0.612$. This means that there is a relationship between self-regulation and T2DM diet compliance with a strong correlation coefficient. The correlation coefficient is positive. This means that the relationship between self-regulation and T2DM diet compliance is in the same direction, therefore if the self-regulation gets better then so will the diet compliance. It is known that the majority of respondents, as many as 70 (64.8%) out of 108 respondents, who had good self-regulation, also had a good level of compliance. The statistical test results determined using the Spearman Rho test obtained a p value < 0.001 and $r = 0.646$. This means that there is a relationship between intention and adherence to the T2DM diet with strong correlation coefficient values. The correlation coefficient is positive which means that the intention relationship with T2DM diet compliance is unidirectional. If there is a very strong intention, then the diet compliance will also get better. This was assessed using a multivariate static test with ordinal regression. From the test results, it can be seen that self-regulation and intention are equally related to diet compliance. The self-regulation variable has a p -value of < 0.001 and the intention variable has a p -value of 0.014. Thus it can be seen that self-regulation has the strongest relationship with adherence to the T2DM diet compared to the intention variable (Table 2).

Table 2. Correlation between self-regulation and intention with diet adherence.

Variables	Diet Adherence								Total	r	p*	p**	CI 95%	
	Poor		Enough		Good		Lower Bound	Upper Bound						
	n	%	n	%	n	%							n	%
Self-regulation														
Enough Well	1	0.9	15	13.9	2	1.9	18	16.7	0,612	<0,001	<0.001	-4.012	-1.224	
	1	0.9	19	17.6	70	64.8	90	83.3						
Intention														
Strong	2	1.9	23	21.3	21	19.4	46	42.6	0.646	<0.001	0.014	-2.168	-0.249	
Very	0	0.0	11	10.2	51	47.2	62	57.4						

p^* : spearmen rho; p^{**} : ordinal regression; r : spearmen correlation; coefficient correlation: $p < 0.05$

IV. DISCUSSION

The results of the study in Table 2 regarding the relationship between self-regulation and T2DM diet compliance obtained a p -value $< \alpha$. This shows that there is a strong and direct correlation coefficient. This shows that there is a relationship between self-regulation and T2DM diet compliance. The successful implementation of the T2DM diet depends on the behavior of the DM client in terms of following the food recommendations given. Not all DM clients are able to undergo the DM diet. Client noncompliance when adhering to a diet is one of the obstacles involved in the management of DM. Disobedience arises during chronic health conditions when the cause of the symptoms varies. The program is complex and complicated when treatment requires lifestyle changes [19]. According to Almatsier (2006), T2DM patients who adhere to a regular diet can reduce the risk of both short-term and long-term complications.

Self-regulation has a very big role in the formation of actions or behavior and it also maintains the behavior of the T2DM patients including their adherence to the diet. Good self-regulation gives rise to motivating the client to heal. They will carry out good T2DM management including diet therapy. self-regulation is the ability or capacity of a person to change his behavior [13]. The client's ability to interpret the problem can cause the T2DM sufferers to create a coping (defense mechanism) against T2DM. The coping mechanism can be in the form of the client's desire to cure the disease. The existence

of defense mechanisms can cause the client to make an effort to assess the threats that cause T2DM. The existence of an assessment effort causes an increase in the self-regulation of patients with type 2 DM[16].

Darmansyah (2013) explains that self-regulation has the role of improving self-efficacy and self-care agency in relation to the glycemic control of T2DM clients through supportive educative programs[16]. Supportive education in the nursing system is an educational method that uses various methods such as teaching, guiding, supporting, and providing an environment that will make important contributions to the patient's self-care agency when improving the ability of the DM sufferers to control the disease. From the results of the research conducted by Darmansyah, Nursalam, and Suharto (2013), it was found that improving self-regulation can be done by providing education or knowledge to the T2DM clients[20].

The results of this study are in accordance with the previous study by Prabaningrum, (2016). The researcher stated that there is a positive, moderate and significant relationship between self-regulation and adherence to diet among DM clients [21]. In addition, the research by Berg, Wiebe and Suchy (2014) on children with type I DM shows that the level of compliance every day would be better if the children with type I DM and their mothers had skills in relation to implementing self-regulation as a part of DM management[22]. This shows the direct relationship between self-regulation and DM management including diet therapy.

The disobedience and hopelessness of DM patients is apparent when they are undergoing treatment due to low self-regulation. Self-regulation according to (Vansteenkiste, 2010) is divided into 2, namely autonomous self-regulation derived from the will and controlled regulation that is influenced by pressure from outside of the individual[23]. The factors that influence self-regulation include the individual, behavior and the environment. The individual factors are related to the knowledge factor. Behavioral factors consist of 3 details, namely self-observation, self-assessment and self-reaction. Negative self-observation and self-assessment will result in a negative self-reaction. Environmental factors are related to one's social influence and experience [24].

The results of the research conducted by Sholihatul Maghfirah (2016) state that the respondents who are highly self-regulated receive support from both their families and the health workers. The respondents who self-regulate have only family support. Self-regulation is caused by interpersonal or intrapsychic pressure [26], [27] Thus self-regulation, besides being influenced by the internal factors of the individuals, is also influenced by external factors that cause a person to experience pressure. This results in self-regulation.

The results of the study in Table 2 on the relationship between intention and adherence to the T2DM diet were tested using the Spearman rank correlation test. The test found that $p < \alpha$, meaning that there is a relationship between intention and the dietary compliance of the T2DM clients in the Surabaya city health center. The correlation coefficient values indicate that the relationship between intention and T2DM diet adherence has a strong correlation coefficient. The correlation coefficient is positive which means that the relationship between intention and T2DM diet compliance is in the same direction. If there is intention, then the level of dietary compliance will be better as well.

In this study, the majority of T2DM clients had the intention to carry out sticking to a diet, thus the results obtained on the level of compliance of the respondents in this study show that the majority have a good level of compliance. However, some of the respondents still only have a sufficient level of compliance. This is because some of the respondents only have a sufficient level of intention. According to Kusnanto, Dwi Kurnia and Prasetia (2015), T2DM clients often fail to follow

the recommended diet due to a lack of motivation, memory, and a poor intention to adhere to the DM diet. HAPA (Health Action Process Approach) is a conceptual approach for patients who believe that changing a person's behavior can be done by increasing the intensity (intention) in the motivational phase to form an intention to conduct an action. HAPA has advantages compared to other theories because HAPA not only explains the process of increasing motivation for the formation of intentions but it also explains how to maintain the healthy behaviors that have been formed [10].

The results of this study are supported by a research study conducted in Iran by Rohani (2016) about the development and psychometric theory of the Health Action Process Approach (HAPA) for measuring a healthy diet on DM clients. The researchers state that one component of HAPA, namely intention, has a high level of correlation that is significant in relation to the DM client's diet [28]. Another study conducted by Namadian (2016) when examining the various components of HAPA theory found that it indicated there to be a relationship between intention and DM client behavior[29]. The results of the research by Todd (2014) suggests that the intention of HAPA partially contributes to the relationship when predicting the clients' with T2DM [31].

This study is different from the results of the research conducted by Radtke, Kaklamanou and Scholz (2014) who stated that there is no significant relationship between behavior when undergoing a diet with intention. Intention is associated with the perception of high-risk[32]. The results of this study indicate that there are T2DM clients who have the intention to have a level of compliance that is good. Intention is instrumental in supporting the T2DM clients when they are carrying out their diet. This is supported by a statement by Hagger and Luszczynska (2014) which states that to comply with the recommendations on behavior, one must form a firm intention [33]. Research by Fai and Anderson (2017) found that the results of the analysis with multiple regression showed that intention can influence adherent behavior[34].

Concerning DM management compliance, the intention to comply with the DM management is shown in the individual's motivation to display compliant behavior. This indicates how much the individual wants to perform a behavior. Intention is a direct factor of behavior so it can be stated that the behavior of certain individuals will be consistent with their intentions towards the behavior itself. If there is an intention to behave in a certain way, then someone will do the behavior [35]. This is supported by the research conducted by Ferreira and Pereira (2017) which states that intention and adherence in T2DM patients has a relationship[36].

DM diet behavior is determined by several internal factors such as the desire or strong intention to heal from within as well as external factors such as the family support factor and support from the health workers. This is as well as referring to the environment, culture, information and knowledge possessed by someone related to their health. All of these sources are considered to be capital for someone to use to behave in a healthy manner.

V. CONCLUSION

This is evidenced by the DM clients who have good self-regulation and a good level of compliance. Intention and DM diet adherence have a relationship with each other. This is evidenced by the T2DM patients who have the intention to carry out their diet well and those who have a good level of adherence. Self-regulation becomes a factor or variable that has a dominant relationship with diet adherence. This is because the intention cannot stand alone when manifesting an action. There must be a more assertive variable bringing it into action. These variables are known as self-regulation variables. Self-regulation also plays a role in maintaining compliant behavior or the actions when maintaining a diet.

CONFLICT OF INTEREST

No conflicts of interest have been declared.

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