Developing Early Detection Questionnaire for Diabetes Mellitus Disease Type 2 Based on the Diet

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ABSTRACT
Diabetes Mellitus disease is one of the Non- Transmissible Diseases (NTD) with rising amount of sufferer. The lifestyle in food consumption or diet, the lifestyle in selecting the place to eat, and the type of food consumed are some of the triggers of diabetes mellitus. This development research aims at creating a product that is an early detection questionnaire for diabetes mellitus type 2 disease based on the diet. The method applied in this study is development research method by Sugiyono and had been adjusted to the researcher's need. The analysis technique used in this research is qualitative and quantitative analysis technique that is conducted in accordance with development procedure. The average result of validity coefficient from each item was 0.67, reliability coefficient 0.855, the assessment from material expert was 80.68%. Besides, a try out was administered to 8 people with the result of 89.06%. Meanwhile, the product usage try out was distributed to 30 people and acquired the percentage of 92.5%. Based on the expert assessment and try out on the society, it can be concluded that the questionnaire of early detection is very appropriate to be used as the instrument to early detect diabetes mellitus type 2 diseases.

Keywords: *Early detection questionnaire, Diabetes mellitus type 2, Diet.*

1. INTRODUCTION

Diabetes mellitus is a disease caused by the high concentration of glucose within the blood due to chronic metabolic disorder as the pancreas is unable to produce enough insulin or the body is unable to make use the insulin produced in pancreas effectively [1]. There are four types of diabetes mellitus, those are diabetes mellitus type 1, diabetes mellitus type 2, gestational diabetes, and other types of diabetes [2]. The most common diabetes cases found in the society is the type 2 diabetes. About 90-95% of diabetes sufferer type 2 diabetes. The type of diabetes commonly suffered by those above 40, but it may also attack those above 20 [3]. Data of Sample Registration Survey in 2014 reported that diabetes placed as the third deadliest disease in Indonesia [4]. Indonesia experience the increase of diabetes mellitus prevalence based on the doctor diagnosis on society aged ≥15 years old which was initially 0.7% in 2007 and became 1.5% in 2013 [5]. Futhermore, the percentage was elevated to 2.0% in 2018 [6].

The risk of diabetes mellitus that mostly lead to death can be decreased by minimizing the risk factor to occur. One of the most dominant risk factor is obesity or weight above the normal standard. This is affected by the lifestyle in selecting the place to eat and type of food to eat and it is the trigger of diabetes mellitus [7]. Improper diet such as high carbohydrate intake causes 80-85% of the diabetes mellitus type 2 sufferers have above the normal standard weight [8]. Diet planning is essential since it may influence the blood sugar level, and excessive glucose intake may disturb the function of insulin [3]. A good diet planning, such as decreasing glucose intake and do regular physical activity for at least 30 minutes each day, may minimize the possibility of diabetes mellitus to occur [9]. Dieting habit is commonly influenced by various aspects such as social, cultural, economy, agriculture, nutrition, health, politics, or beliefs. Specifically, those issues are also related to the capacity of production, food availability, effectiveness of distribution, structure and amount of citizen, household purchasing power, and also the society awareness on nutrition and environment sanitation [10]. Other that due to the risk factor, the increase of prevalence on diabetes mellitus occurrence is also caused by the society's lack of information that they are prone to diabetes mellitus. This lack of information is because diabetes mellitus mostly occur without any symptoms for several years [3].

Those risk factors contribute to the increasing number of diabetes mellitus sufferer each year. The most common diabetes mellitus case found among the society in Indonesia is diabetes mellitus type 2 that is strongly correlated with wrong diet and lifestyle [3]. For Malang City Region, based on the data acquired from the Department of Health Malang in regards to the achievement of Minimum Service Standard (MSS) for Non-Communicable Diseases on January-June 2018, Arjuno Health Center (*Puskesmas Arjuno*) had the highest prevalence of diabetes mellitus that was 46.55%.

The result of Minimum Service Standard (MSS) for the screening of non-communicable diseases (hypertension and diabetes mellitus screening) among the society aged 15-59 in January-June 2018 is about 17.56%, this value is far behind the MSS target of 100%. The high number of diabetes mellitus sufferer is also influenced by the lack of facilities provided in Arjuno Health Center that caused the disease undetected. Furthermore, the screening of diabetes mellitus is so far only conducted using the blood sugar test that is relatively expensive can only be operated by the medical staffs.

2. METHOD

The design of this research implemented development research method by Sugiyono that had been adjusted to the researcher's need. The total respondents participated in this study were 38 people that consisted of 8 people in the product tryout and 30 people in the product usage tryout. The criteria of respondents were people aged 15-59 years old who visited Arjuno Health Center and willing to be respondents by signing the *Informed Consent*. There were 9 stages of research and development conducted in this study, those are (1) finding the potential problem of diabetes mellitus disease, (2) collecting the data in respect to the dieting factors that may trigger diabetes mellitus type 2, (3) creating the development design of early detection questionnaire, (4) experts validation, question item validation, and reliability test, (5) revising the design of questionnaire product, (6) product tryout, (7) product revision, (8) product usage tryout, (9) revising the product and product usage tryout. The analysis technique used is qualitative and quantitative analysis technique in accordance to the procedure of development method.

3. RESULTS

3.1 The Characteristic of Respondents

During the product tryout, the majority of the respondents were female, 7 (87.5%) of them were female, while the remaining respondent was 1 (12.5%) male. Meanwhile, at the product usage tryout, the majority of the respondents or 19 (63.3%) of them were female, and the remaining 11 (36.67%) were male.

In the product tryout, 8 of respondents (100%) were aged ≥ 46 years old, and none of them were aged 15-45 years old. On the other hand, during the product usage tryout, 12 people (40%) of the respondents were aged 15-30 years old, 8 people (22.7%) were 31-45 years old, and 10 people (33.3%) were≥46 years old.

Throughout the product tryout, the majority of respondents had educational background of Junior High School and Senior High School or the equivalent that was about 3 people (37.5%), the remaining 2 (25%) has Elementary School background. Meanwhile at the product usage tryout, 14 people (46.7%) or the majority of the respondents had educational background of Senior High School or the equivalent, * people (26.7%) graduated from Junior High School, 6 people (20%) were Elementary School, and the remaining 3 (10%) had bachelor degree.

At the product tryout, 7 (37.5%) of the respondents were unemployed while 1 (25%) of the respondents was employed. During the product usage tryout, the majority of the respondents for about 21 people (70%) were also unemployed, while the rest about 9 people (30%) were employed.

In the product tryout, majority of the respondents about 5 people (62.5%) had never been diagnosed to suffer from Diabetes Mellitus, yet the remaining 3 (37.5%) had been diagnosed to have Diabetes Mellitus. At the product usage tryout, the majority of the respondents around 26 people (86.7%) also never been diagnosed yet, only 4 respondents (13.3%) had been diagnosed by the medical staff.

3.1 Content Validation by the Material Experts

The results of question item assessment by the material experts were processed using *Aiken's* formula with the help of *software Microsoft excel 2016.* According to the content validation conducted by the material experts as seen in Table 1, all the items presented in the questionnaire are considered very valid and valid with the validity coefficient ≥ 0.4.

Table 1. Content validation results from material experts

Question	V1	V2	S1	S2	Σ S	Aiken's Coeff.	Inter-preta-tion
1	3	3	2	2	4	0.667	Valid
2	3	3	2	2	4	0.667	Valid
3	2	3	1	2	3	0.5	Valid
4	3	3	2	2	4	0.667	Valid
5	3	3	2	2	4	0.667	Valid
6	3	3	2	2	4	0.667	Valid
7	3	4	2	3	5	0.833	Very valid
8	2	3	1	2	3	0.5	Valid
9	2	3	1	2	3	0.5	Valid

Question	V1	V2	S1	S2	Σ S	Aiken's Coeff.	Inter-preta-tion
10	3	3	2	2	4	0.667	Valid
11	3	4	2	3	5	0.833	Very valid
12	3	3	2	2	4	0.667	Valid
13	3	3	2	2	4	0.667	Valid
14	3	3	2	2	4	0.667	Valid
15	3	4	2	3	5	0.83	Very valid
16	3	3	2	2	4	0.667	Valid
17	2	3	1	2	3	0.5	Valid
18	3	4	2	3	5	0.833	Very valid
19	3	3	2	2	4	0.667	Valid
20	3	4	2	3	5	0.833	Very valid
21	3	3	2	2	4	0.667	Valid
22	3	3	2	2	4	0.667	Valid
23	2	3	1	2	3	0.5	Valid
24	2	4	1	3	4	0.667	Valid
25	3	3	2	2	4	0.667	Valid

3.3 Validation of Questionnaire Product by the Material Expert

Based on Table 2, the percentage of the validation result of the questionnaire by the material expert can be concluded that the questionnaire is included in the category of very proper. The score gained is 80.68%, which means it can be used directly with no revision needed.

Table 2. Validation of questionnaire product by the material expert

No	Question	%	Interpretation
1	Compatibility of materials with the development of knowledge	75	Appropriate
2	Compatibility of language used by the user	87.5	Very appropriate
3	The questions presented have no multi-interpretation	75	Appropriate
4	The questions presented is not leading to answer only the good or bad answer only	87.5	Very appropriate
5	Number of questions presented	75	Appropriate
6	Coherence of questions	87.5	Very appropriate
7	Compatibility of font size to ensure the text easy to read	75	Appropriate
8	Type of paper used	87.5	Very appropriate
9	Clarity of questions to ensure understandability	75	Appropriate
10	Attractiveness of questionnaire presentation	87.5	Very appropriate
11	The compatibility of question as the risk factor of diabetes melitus	75	Appropriate
Total		81	Very appropriate

3.4 Validation of Question Items

Based on Table 3, the content validation result is processed using the statistic software of IBM SPSS 23, using the Pearson correlation of product moment. Based on the validation of question item, 25 items that is present on the questionnaire is considered valid with the $r_{count} > r_{table}$ (0.361), so that all the 25 items can be used as the instrument of data collecting.

Table 3. Result of question items validation

Question No.	Aiken's Coefficient	Interpretation
1	0.461	Valid
2	0.415	Valid
3	0.398	Valid
4	0.434	Valid
5	0.413	Valid
6	0.473	Valid
7	0.449	Valid
8	0.375	Valid
9	0.469	Valid
10	0.463	Valid
11	0.470	Valid
12	0.498	Valid
13	0.482	Valid
14	0.430	Valid
15	0.405	Valid
16	0.422	Valid
17	0.599	Valid
18	0.599	Valid
19	0.473	Valid
20	0.575	Valid
21	0.432	Valid
22	0.520	Valid
23	0.731	Valid
24	0.394	Valid
25	0.470	Valid

3.5 Reliability Test

The calculation of reliability using the formula of Cronbach's Alpha with the help of statistics software of IBM SPSS 23. Based on the reliability test of the entire tem of the question that is valid and is considered to have the coefficient of reliability that is very high that is 0.855.

3.6 Product Testing

The calculation of reliability using the formula of Cronbach's Alpha with the help of statistics software of IBM SPSS 23. Based on the reliability test of the entire tem of the question that is valid and is considered to have the coefficient of reliability that is very high that is 0.855.

Table 4. Product Testing

No	Question	%	Interpretation
1	Is the questionnaire of early detection of diabetes mellitus interesting?	93.75	Very appropriate
2	Are the questions presented in the early detection questionnaire of diabetes mellitus disease easy to understand?	93.75	Very appropriate
3	Are the writings presented in early detection questionnaire of diabetes mellitus disease visible?	93.75	Very appropriate
4	How is the amount of question in the early detection questionnaire of diabetes mellitus disease?	100	Very appropriate
5	Is this early detection questionnaire of diabetes mellitus disease beneficial for you?	100	Very appropriate
6	Is the indication result of this questionnaire suitable to your condition?	62.5	Appropriate
Total		89	Very appropriate

3.7 Product Usage Tryout

As seen from table 5, the result of product usage tryout administered to 30 people showed that the percentage acquired was 92.5%. This number indicated that the questionnaire of early detection has been appropriate to be used as the instrument to early detect diabetes mellitus type 2 diseases without any revision needed. The final conclusion of the assessment in the product usage tryout was no major revision necessary. Yet, the same issues occur, that was the incompatibility between the indication of the questionnaire and the respondent's actual condition. This is because the questionnaire of early detection only reviewed one aspect which was diet.

Table 5. The results of product usage tryout

No	Question	%	Interpretation
1	Is this questionnaire of early detection for diabetes mellitus interesting?	100	Very appropriate
2	Are the questions presented in this questionnaire of early detection for diabetes understand	95.83	Very appropriate
3	Are the writings presented in early detection questionnaire of diabetes mellitus disease visible?	98.33	Very appropriate
4	How is the amount of question in the early detection questionnaire of diabetes mellitus disease?	100	Very appropriate
5	Is this early detection questionnaire of diabetes mellitus disease beneficial for you?	100	Very appropriate
6	Is the indication result of this questionnaire suitable to your condition?	69.17	Appropriate
Total		93	Very appropriate

4. DISCUSSION

In the making of question items, the researcher referred to the result of previous research and the theory from experts. The questionnaire of early detection consists of 11 indicators with the explanation as follows.

4.1 Indicator Of Eating Schedule

In eating, the controlling of type, amount, and schedule to eat every day is suggested so that the level of blood sugar is stable [3]. The wrong eating schedule can affect the blood sugar setting because the insulin and the body metabolism needs the fix working schedule [3]. Generally, the proper time to eat is in the

morning before 9.00 in the morning, lunch at 12.00-13.00 in the afternoon, and dinner at 18.00-19.00 in the night. The schedule here is the good timing to eat because it is adjusted to the time of emptying stomach that is 3 to 4 hours so that the stomach is not empty for a long time especially [11].

4.2 Indicator Of Consumption Of Fruits And Vegetables

Lacking of fiber consumption (< 25 gram/day) can increase the level of blood sugar. The fiber as the benefit of preventing the carbohydrate absorption in the small intestine so that it will reduce the process of gluconeogenesis that affects the increasing work for the insulin [12].

4.3 Indicator Of Water Consumption

Water consumption (Hydrotherapy) can help the secretion process for all the toxin in the body, including the excess sugar. Drinking water will cause the sugar breakdown so that it does not cause excess sugar inside the body[13].

4.4 Indicator Of Alcohol Consumption And Smoking

Smokers have the tendency of 0.89 times higher to suffer diabetes mellitus, while the alcohol consumers have tendency of 0.40 times higher to suffer the diabetes mellitus[14].

4.5 Indicator Of Sweet Food/Drink Consumption

Consuming snacks in between eating schedule can increase the risk of diabetes mellitus. Snacks like biscuit, potato and other sweet cakes contain high carbohydrate with lacking of fiber in it. All these foods are classified in the high glycemic index food. Flour and sugar contained in it has the role to increase the level of blood sugar [8].

4.6 Indicator Of Food Consumption That Contain MSG

Food that is made with additional additives could trigger diabetes mellitus. The most common additives used among the society nowadays is vetsin (garam mosodium glutamat) that may cause cell degradation and ruin pancreas [15].

4.7 Indicator Of Coffee Consumption

Coffee consumption ≥ 1 may increase the risk of diabetes higher than 3-6 times per week [16].

4.8 Indicator Of Savory Food Consumption

The consumption of food with low salt content may decrease blood pressure that eventually minimize the possibility of diabetes mellitus [3].

4.9 Indicator Of Fatty Food Consumption

Excessive fat consumption would increase the fat content in our body that could disturb the function of insulin. The increasing content of fat will inhibit the process in absorbing glucose into tissue. Consequently, the sugar content in the blood will also increase [15].

4.10 Indicator Of Eating Portion

Indonesian diet that, mostly, prioritize carbohydrate intake, without considering the amount of energy needed may trigger diabetes mellitus if done repeatedly [17]. Therefore, a suitable eating portion is important to be kept in order to maintain our health.

4.11 Indicator of preserved food consumption

Excessive consumption of carbohydrate and fat along with heavy snacking habit, often consuming fast food (that contain fat, additive, empty calorie, and preservatives), as well as lack of fiber intake will result to diabetes mellitus [17].

5. CONCLUSION

Based on the validation result by the material expert, validation of question item, reliability test, and product tryout, it can be concluded that the questionnaire of early detection for diabetes mellitus based on the diet is appropriate to be used as the instrument to early detect diabetes mellitus disease among the society domiciled in the working area of Arjuno Health Center. Even so, this questionnaire also have some lacking such as a member of respondents who stated that the result on the interpretation doesn't match which the actual condition of the respondents. Besides the rate of sensitivity and specificity of the questionnaire of early detection is still unknown. For the upcoming researchers, it is suggested to conduct an extended research regarding other factors that is not yet analyzed in this study. Additionally, it is also suggested to conduct an extended research on the sensitivity and specificity of the questionnaire of early detection for diabetes mellitus type 2 based on the diet

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