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The Instrumentation of Standard Diet Food Portions for Diabetes Mellitus

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Abstract

The right diet is needed in the treatment of Diabetes Mellitus. The dietary standards used must be by their nutritional adequacy. This study aims to determine the effectiveness of the use of aluminum cup serving tools for standard measuring devices in the Diabetes mellitus diet. The portion measurement instrument is designed by 1P, 1 1 / 2P, and 2P standards. The study was conducted at a laboratory scale in 2018 with a quasi-experimental approach. Data analysis uses Analysis of Variance (ANOVA) with α = 5%. The results show that the average effectiveness of 1P portion accuracy is 99%, 1½ P for 101%, and 2P about 99.6%. There was no difference in effectiveness compared to using a scale and there were differences in measurements using bowls and spoons. Standard portion of 1P measuring instruments 114% effectiveness bowl and 113% spoon, standard 1½ P portion for 107% bowl and 105% spoon, and 2P standard portion for measuring the effectiveness of the portion of the bowl is 104% and 103% spoon. Using a measuring device Aluminum cup portions, both 1P, 1.5P, and 2P parts can determine the value of food and nutritional adequacy standards of patients with Diabetes Mellitus.

Introduction

Compliance of Diabetes patients toward nutritional principles and food planning is important for maintaining health status (Yuliastuti et al., 2019; García-Pérez et al., 2013). Nutritional therapy is a major component of the successful management of Diabetes mellitus. Based on the recommendations of the American Diabetes Association (ADA), medical, nutrition, and therapy requires a comprehensive approach, including doctors, dietitian, nurses, other health workers, and patients. That aims to improve the ability of each patient to achieve good metabolic control (Morris & Wylie-Rosett, 2010). For those digitizers as implementers of nutrition management, especially in hospitals, so that a healthy diet through balanced nutrition for patients is fulfilled, it is very important to set standards for food portions. The standard food portions set for people with Diabetes mellitus must comply with nutritional adequacy standards (López-gamiño et al., 2012). Therefore, a standard measurement of food portions that are accurate, fast and appropriate is needed so that the patient's nutritional adequacy is met.

Specifically for implementing a healthy diet with balanced nutrition for people with Diabetes mellitus who are either outpatient or hospitalized to fulfill their nutritional requirements, it is recommended to fulfill adequacy, such as carbohydrate needs are <130 gr/ day (Morris & Wylie-Rosett 2010), normal protein requirements, 15-20% of energy requirements (López-gamiño et al., 2012), fat requirements, about 7% of total energy needs (Mihardja et al., 2014), fiber intake is recommended as much as 20-35 gr/1000 kcals (Folorunso & Oguntibeju, 2013). In managing a healthy diet with balanced nutrition, there are recommended dietary standards in the exchange unit of the portion (P), for example for people with Diabetes mellitus with normal body weight energy requirements of 1900

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kcal/day. Diabetics with a body weight of less than 2300 kcal. Whereas sufferers with more weight need 1300 kcal/day while sufferers with vegetarian behavior need the energy of 1600 k.kal (Jain et al., 2014).

To make it easier to get food, the menu is compiled based on a list of food exchanges (P). Food needs to meet their energy needs, expressed in units of exchange (non-standard), especially for carbohydrates such as rice, for example, 1 cup of rice about 0.5 kg, then for 1.5 glasses of 0.75 kg (Oseni et al., 2017; Mulligan et al., 2014). Diabetes mellitus patients with normal body weight with energy requirements of 1900 kcal/day. Energy requirements derived from carbohydrate sources are given morning, afternoon and evening, which amounts to around 400 gr. The number of carbohydrate needs is determined using the unit of a food exchange, for example, 1p, 1 1/2P and 2P.

If in one day energy needs for patients with Diabetes mellitus with normal weight need 4P carbohydrate intake (morning 1P, afternoon 1 1/2P and afternoon 1 1/2P) with a staple food source of rice, then sharing a daily meal is to eat breakfast needs about 100 gr of rice, noon 150 grand at night 150 gr. For that to achieve and maintain a normal Western Body, a healthy diet with balanced nutrition is very important for people with diabetes. The need for rice food is good for outpatient care and hospitalization (Oseni et al., 2017; Mulligan et al., 2014). For patients with Diabetes or other diseases in hospitals, nutrition management is not difficult, if they follow the standard food portions that have been set especially for staple foods.

Several studies have shown that there was an advantage if a precise and accurate portion of the patient is determined, namely improving nutritional status, speeding up the healing process, reducing care days and being efficient for costs lost due to leftovers (Kasper et al., 2016; Drewnowski & Darmon, 2005). Nutrition Installation as an organizer of nutrition service activities in hospitals both inpatient and outpatient care needs to make accurate measuring instruments so that the patient's nutritional adequacy is fulfilled. For this reason, researchers are interested in conducting research, the Effectiveness of Measuring Tool of Aluminum Cup's Portion toward a Standard of the Food Portion on Dietary of Diabetes Mellitus in Pontianak, West Kalimantan, Indonesia.

Method

This type of research is a quasi-experimental, with times series with control design. The research was conducted in April-August 2018 and carried out at the Food Laboratory of the Department of Nutrition, Health Polytechnic of Health Ministry of Pontianak, West Kalimantan. The number of food portion measurement tools is three treatments, namely: (1) plastic tool bowl, (2) stainless steel spoon, and (3) aluminum cup's portion. The portion measuring instrument is used to determine 1P, 1½P and 2P portions, as many as 90 samples, with sampling techniques determined by simple random sampling.

Data collected by the accuracy of portion sizes is done by filling the food portion measuring instrument. Portion measuring instruments are Stainless Steel Spoon' and Plastic Bowl 'portion, commonly used in hospitals, and the Aluminum Cup port tool. Data on the size of the staple food are then weighed. To determine the accuracy of food portion sizes, it's determined by comparing the results of the weighing with measuring instruments and the standard portion of the Diabetes diet. The standard portion of P1 is 100 gr, 1½P is 150 gr and 2P is 200 gr. Data that has been collected is processed by a computer program. Processed data is presented with tables, graphs and textual. Data analysis used the ANOVA statistical test, with $\alpha = 5\%$.

Result and Discussion

Determination of the standard measure of the portion of rice for Diabetes patients was made three standards, namely 1P (100 g), 1½P (150 g) and standard 2P (200 g). Each standard is determined by measuring instrument of a digital scale, aluminum cup, plastic bowl and stainless steel spoon.

In table 1 it's known that the standard of one portion (1P) in Diabetes patients is measured using a portion of rice measure, namely digital scales, plastic bowls and stainless steel spoons. The results showed that measuring

food portions with 100 gr digital scales is almost the same as aluminum cups which are 99.3 gr. This measurement is more accurate than the plastic bowl for 114.1 gr and with a stainless steel rice spoon 112.9 g.

Table 1. Difference between Measuring Intruments of 100 Gram Rice Portion (1P) For Diabetes Mellitus Patients

	Measuring instruments (gram)			
Replications	Digital Scales	Alumunium Cups	Plastic Bowls	Stainless Steel Spoons
1	100	101	120	127
2	100	97	106	121
3	100	98	101	123
4	100	102	117	100
5	100	100	109	109
6	100	97	120	104
7	100	101	118	115
8	100	98	119	104
9	100	100	116	109
10	100	99	115	117
Total	1000	993	1141	1129
Avarege	100	99,3	114,1	112,9

Source: primary data, 2018

Statistical analysis using the Kruskal Wallis test showed that there was a significant difference between the digital scales (control) and the manual food portion measuring instrument ($p \leq 0.001$). There is no difference in the determination of rice portion measuring instruments using digital standard scales with measuring devices for aluminum cups ($p = 0.48$). There is a significant difference between the determination of food portion measuring instruments using digital scales with plastic bowls ($p \leq 0.001$) and stainless steel rice spoons ($p \leq 0.001$). There is a difference between aluminum rice cups with plastic bowls ($p \leq 0.001$) and stainless steel spoons ($p \leq 0.001$). There is no standard difference in food portions using plastic bowls with stainless steel spoons ($p = 0.79$). The standard determination of the portion of rice using a digital scale has almost the same accuracy as a measuring instrument for aluminum cups and is more appropriate than a plastic bowl and stainless steel spoon.

Table 2 Measuring Instrument of Food Portion 150 g. (1½P) For Diabetes Mellitus

	Measuring Instrument (gram)			
Replications	Digital Scales	Alumunium Cups	Plastic Bowls	Stainless- Steel Spoons
1	150	150	160	165
2	150	152	150	155
3	150	150	158	151
4	150	152	158	155
5	150	153	160	147
6	150	149	166	155
7	150	152	153	162
8	150	150	169	160
9	150	152	164	165
10	150	151	159	165
Total	1500	1511	1597	1580
Avarage	150	151,1	159,7	158

Source: primary data, 2018

In table 2 it's known that the determination of the average standard of rice food portions 150 gr (1½ P) for Diabetes patients using a digital scale of 150 gr. This result is almost the same as measuring instrument of aluminum cups for 151 gr. Measuring with aluminum cups is more accurate than using a portion measuring instrument with a plastic bowl of 159.7 gr and with 158 gr. stainless steel rice spoons. Statistical analysis using the Kruskal Wallis test showed that there was a significant difference between the determination of the standard portion of rice with a digital scale (control) and other treatments ($p \leq 0.001$). Analysis by the Mann-Whitney test, there was no significant difference in the determination of the portion of rice using digital scales with the aluminum cups portion tool ($p = 0.28$). There was a significant difference between determining food portions using digital scales with plastic bowls ($p \leq 0.001$) and stainless steel rice spoons ($p \leq 0.001$). There was a difference between an aluminum cups measuring with a plastic bowl ($p = 0.00$) and a stainless steel rice spoon ($p \leq 0.001$). There was no difference in the determination of the average standard portion of rice 150 gr between using plastic bowls and a stainless steel spoons ($p = 0.68$).

The standard determination of food portions using a measuring instrument weighing has almost the same effectiveness as an aluminum cups food portion and it's more accurate than stainless steel spoons and plastic bowls food portion measuring instrument. Determination of the portion of rice using a plastic bowl measuring instrument and a stainless steel rice spoon is ineffective or does not meet the requirements for determining the standard portion of 150 g rice for people with diabetes. In table 3 shows that the determination of the average standard portion of rice (2P) is 200 gr in patients with Diabetes Mellitus using a scale of 200 g is almost the same as measuring cylinders of aluminum rice portion of 199.2 gr, but smaller than the measuring instrument portion a plastic bowl of 207.8 gr and a stainless steel rice spoon of 206.7 gr.

Table 3. Measuring Instrument of Food Portion 200 gr. (2P) for Diabetes Mellitus Patients

	Measuring Instrument (gram)			
Replications	Digital Scales	Alumunium Cups	Plastic Bowls	Stainless Steel Spoons
1	200	200	212	206
2	200	197	200	208
3	200	198	197	219
4	200	199	216	203
5	200	200	210	200
6	200	197	202	216
7	200	198	209	192
8	200	200	212	211
9	200	201	216	205
10	200	202	204	207
Total	2000	1992	2078	2067
Avarage	200	199,2	207,8	206,7

Source: primary data, 2018

Statistical analysis using the Kruskal Wallis test showed that there was a significant difference between the standard measurements of the portion of rice with a digital scale (control) and other treatments ($p = 0.00$). The analysis with the Mann-Whitney test revealed that there was no significant difference between the determination of the portion of the rice measure using the scales with the measuring instrument of aluminum cups ($p = 0.28$). There was a significant difference between the dosing of food portions using a scale with a plastic bowl ($p \leq 0.001$) and a Stainless Steel rice spoon ($p \leq 0.001$). There is a significant difference between the aluminum portion measuring cups with plastic cups ($p \leq 0.001$) and stainless steel rice

spoons ($p \leq 0.001$). There was no difference in the standard measurement of 200 gr food portions between using a plastic bowl with a stainless steel spoon ($p = 0.74$). Measuring the standard 200 gr food portion (2P) using a digital scale measuring instrument has almost the same effectiveness as an aluminum cups food measuring instrument and is more appropriate than a plastic bowl rice measuring instrument and a stainless steel spoon. Determination of food portions using a plastic bowl measuring instrument and stainless steel rice spoon is inaccurate or does not meet the requirements for standard dosing of 200 gr food portions. for Diabetes patients.

Healing of Diabetes patient requires to adopt a healthy lifestyle. The goal of sufferers of healthy living behavior, diet or diet is to control blood sugar levels and prevent long-term complications that can be caused by diabetes. An unhealthy/inappropriate diet can have a risk of diabetes mellitus compared to a healthy diet. For this reason, to control the stability of blood sugar, among those that can be done by people with Diabetes Mellitus is to pay attention to diet (Glauber & Karnieli, 2013).

Setting the right diet is very important for people with Diabetes Mellitus. Setting a healthy or proper diet for people with diabetes, which is recommended for example contains complete nutrition, low fat and low calorie or contains enough calories (Folorunso & Oguntibeju, 2013). Regulating Diabetes diet, for example, sufferers who are too fat energy it takes around 1300 cal., carbohydrate needs (such as rice) 192 g, 45 g protein, and fat requirements 35 g. Carbohydrate Counting for Diabetes Mellitus patients with insulin therapy uses Algorithm, the optimal value of serving carbohydrates can be known, the amount of energy and dose of macronutrients needed within the tolerance limit (Jia et al., 2014; Chiesa et al., 2005). To meet the low-calorie recommendations with the optimal carbohydrate and energy values, one of them is needed the accurate portion of rice (Tascini et al., 2018). The right amount of food/rice is very much determined by the use of accurate food portions. The large portion of food that meets the recommended low calorie with the right dosage tool will be crucial for preventing long-term complications for people with diabetes (Glauber & Karnieli, 2013; Martin et al., 2005).

The right of portion measuring tool is certainly done by weighing. Accurate food scales will determine the right amount of food intake (Martin et al.,2005; Tascini et al., 2018; Ullah et al., 2016). The use of a digital scale measuring instrument can determine the portion of food with optimal accuracy. Standard food portion measuring instruments with digital scales have high accuracy (Asif, 2014). However, it is difficult to do, if patients are served a lot and require fast service time, and patients are used in the household. In addition, this tool must be done with great care. In addition, this tool is expensive and not all people with Diabetes can afford the tool. In addition, how to operate it is must be trained. For this reason, it is necessary to make a food measuring instrument that has accuracy at the level of a digital scale but is easy to use and affordable.

In addition to testing a portion measuring instrument made of aluminum cups, a portion of rice with a plastic bowl and stainless steel rice spoon is also used. The results showed that plastic bowls and stainless steel spoons measuring tool device averaged a larger portion of rice. The use of the rice measuring tool with plastic bowls and stainless steel spoons is less effective than the standard rice portion measuring instrument, which is a digital scale from aluminum cups. The effectiveness of the use of plastic bowls and stainless steel spoon measuring device from the determination of the portion of rice is not different; the accuracy is between 103% - 114%, both for 1P, 1½P, and 2P. For this reason, it is necessary to create an appropriate tool, with material that is easily available, cheap and easy to make and can be ordered or purchased quickly, for example, in making aluminum cookware. The results of the study showed that the food/rice portion measuring instrument had high effectiveness, between 99-101%. For a standard portion of 100 g of rice (1P), a portion measuring tool is made in the form of a cylinder/aluminum with aluminum with a diameter of 6 cm and a rib height of 3.6 cm, average effectiveness of the portion of rice 99%, 1½ P 101% and 2P 99.6%, when compared with the measurement of the portion of the scale of digital (control portion)

the results were not significantly different.

The aluminum cups measuring instrument has the accuracy to measure the portion of rice for people with Diabetes mellitus. While measuring a portion of rice from plastic bowls and stainless steel spoons, the result is that the amount of rice is larger than using a digital scale and aluminum cups. For standard 1P portions using a measuring tool of rice from an effectiveness plastic bowl of 114% and stainless steel spoons of 113%. The standard portion of 1½ P effectiveness of a plastic bowl was 107% and stainless steel spoons were 105%. A standard portion of 2P rice effective portion size accuracy using plastic bowls 104% and stainless steel spoons were 103%. Similar research on the accuracy of the portion of food and intake of food is determined by estimating visual and digital methods. As a result, with an accurate portion of the appliance, the estimated portion of food is the more appropriate the amount of food intake (Rolls, 2014).

The right intake of food is important for maintaining blood glucose stability in people with diabetes (Asif, 2014; Jia et al., 2014; Fang et al., 2020). For this reason, in addition to the use of digital scales, the use of portion measuring instruments has accuracy, is cheap and easy to make. The instrument was a manual portion measuring tool made of aluminum in the form of cups. Aluminum cups have a high measurement for 1P, 1½P, and 2P portion sizes, with effectiveness between 99% - 101%, compared to plastic bowls and stainless steel rice spoons. With this effectiveness, the measuring tool of aluminum cups can be considered for use to determine the size of the rice portion of Diabetes mellitus patient (Asif, 2014; Jia et al., 2014; Martin et al., 2005).

Conclution

The rice portion measuring instrument of aluminum cups has high effectiveness, between 99-101%. The average effectiveness of the portion of rice 1P is 99%, 1½ P 101% and 2P is 99.6%, compared to the measurement of the portion of digital scales (standard of food portions) the result is no difference in effectiveness for measuring rice portions for people with Diabetes Mellitus. The amount of 1P food portion uses rice measuring instrument from effectiveness plastic bowls of 114% and stainless steel spoons of 113%, the standard portion of 1½ P effectiveness of a bowl of 107% and a stainless steel spoon of 105%.

As for the standard portion of 2P rice, the effectiveness of its portion size uses a plastic bowl of 104% and stainless steel spoon for 103%. Measuring the right portion of food/ rice, it 's important to maintain blood glucose stability in people with Diabetes Mellitus. For that, in addition to the use of digital food scales, the use of aluminum design made in the form of the cup, both for 1P, 1½P and 2P portion sizes with the effectiveness of 99% - 101% can be considered to determine the size of food portions of Diabetes Mellitus patients.

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