LONGER MASTICATION CYCLES TEND TO LOWER POST-PRANDIAL BLOOD SUGAR LEVELS

(SIKLUS PENGUNYAHAN YANG LAMA MENURUNKAN KADAR GULA DARAH POST PRANDIAL)

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ABSTRACT

Diabetes Mellitus (DM) is a metabolic syndrome occurred because of the lack of insulin hormone secretion or some factors disturbing insulin hormone or both of them. The mastication cycle is one of the factors related to the increasing in blood glucose. The research aims to analyse the relation between mastication cycle and DM risk factor on Faculty of Medicine students, Universitas Islam Bandung. The methodology was an experimental study. The subjects were 18 male Faculty of Medicine, Unisba, who fulfil the inclusive and exclusive criteria. First, scanning was conducted to know DM risk by questioners. Those students were divided into three groups of mastication cycle (15,30,45 cycle). Each group consisted of six students. The result showed that the tendency of average blood sugar was lower in the group with 45 cycles of mastication, compared to 30 and 15 cycles (86.5 vs 89.5 vs 92 mg/dL). However, according to a statistical calculation, there was no significant relationship between the mastication cycle and blood glucose (P =0.413; P>0.05). The average blood insulin level of 45 times the mastication cycle was the lowest compared to 30 and 15 mastication cycles (2.44 vs 2.97 vs 3.58 µg/ml). The result was that the mastication cycle was longer than the initial insulin release to work in the cell more effectively. In conclusion, DM needs to do more cycle in mastication food to maintain glucose in the blood.

ABSTRAK

Diabetes Melitus (DM) adalah sindrom metabolik yang terjadi oleh karena kurang sekresi hormon insulin atau oleh karena adanya faktor-faktor yang mengganggu kerja hormon insulin ataupun keduanya. Faktor siklus pengunyahan dapat menjadi salah satu faktor yang berhubungan dengan peningkatan kadar glukosa darah. Tujuan Penelitian ini adalah untuk melihat hubungan antara siklus pengunyahan dengan faktor risiko DM pada Mahasiswa Fakultas Kedokteran Universitas Islam Bandung (FK Unisba). Penelitian ini merupakan penelitian deskriptif analitik dengan subjek penelitian sebanyak 18 orang mahasiswa laki-laki FK Unisba yang memenuhi kriteria inklusi dan eksklusi dengan terlebih dulu dilakukan penapisan untuk risiko DM dengan menggunakan kuesioner. Mahasiswa tersebut dibagi dalam 3 kelompok siklus pengunyahan 15, 30 dan 45 siklus masing-masing terdiri dari 6 orang. Hasil Penelitian menunjukkan adanya kecenderungan rerata gula darah yang lebih rendah pada kelompok dengan pengunyahan 45 siklus, dibandingkan dengan 30 dan 15 siklus (86,5 vs 89,5 vs 92 mg/dL) namun dari perhitungan statistika tidak ada hubungan yang bermakna antara siklus pengunyahan dengan glukosa darah (P=0,413; P>0.05). Dari hasil penelitian ini didapatkan pada siklus pengunyahan 45 kali memiliki rerata kadar insulin darah yang paling rendah dibandingkan siklus pengunyahan 30 dan 15 berturut-turut (2,44 vs 2,97 vs 3,58 µg/ml). Hal tersebut dikarenakan dengan siklus pengunyahan lebih lama waktu pengeluaran awal insulin yang bertahap sehingga dapat bekerja didalam sel lebih efektif. Kesimpulan adalah bahwa penting penderita DM untuk lebih banyak melakukan siklus dalam mengunyah makanan agar kadar glukosa darah terjaga.

Kata Kunci: *diabetes melitus; glukosa; pengunyahan*

INTRODUCTION

Diabetes mellitus (DM) is a metabolic syndrome that occurs due to low secretion of insulin hormone or factors that interfere with the work of the insulin hormone, such as receptors or both—resulting in an increase in glucose concentration in the blood (hyperglycemia). The latest WHO data estimates the number of people with DM worldwide in 2016 is 442 million people. According to a survey conducted by WHO,

Indonesia ranks 6th in the number of people with DM. In 2020 it was estimated that the number of people with DM in Indonesia is 10.8 million people, and in 2030 it will be 21.3 million people. According to data from West Java, it is the first order of 32 162 million with a DM prevalence of 5.7% (2007) to 6.9%.[1]

Generally, the risk factors for pre-diabetes that are vulnerable to adolescents are obesity and lifestyle. Attention to the lifestyle of adolescents needs to be done to prevent an increase in the number of people with pre-diabetes before reaching the diabetes phase.[2,3] The pathogenesis of Diabetes involves lifestyle and environmental factors, including physical inactivity, lack of nutritional intake, or obesity, which often arise due to excess food intake or eating too fast.[3] Several studies have shown that diet and lifestyle modifications can play an important role in the prevention of Diabetes Mellitus.[3,4] The mastication effectiveness is demonstrated by the number of or mastication movements or cycles. This movement or processes is used to break down food into small particles before ingestion.[5]

According to Waspadji[6], Diabetes is often referred to as the great imitator because this disease can affect all organs of the body and cause various kinds of complaints. Diabetes cannot be cured but can be controlled to prevent complications. People with Diabetes are not managed properly; it can lead to complications in the cerebrovascular organs, coronary heart, leg blood vessels, eyes, kidneys, nerves and metabolic syndrome. Suzuki[7] stated a relationship between mastication and an increase in blood glucose levels in the Japanese population. The results of other studies showed that a higher mastication performance could prevent diabetes mellitus.[8,9] However, no studies have been studied the relationship between the number of mastication cycles and the risk factors for Diabetes Mellitus. Insulin is a hormone produced by pancreatic beta cells and has many functions. One of the main functions of insulin is to facilitate the uptake of glucose into cells. Therefore, cells can experience functional disorders if there is a disturbance or resistance in insulin production. Insulin resistance is caused by obesity, low physical activity and genetic predisposition. It is further explained that low-fibre and low-grain/cereal/whole grains consumption patterns also contribute to type 2 diabetes. [10]

Several studies have shown a direct link between mastication and glucose metabolism. Effective mastication decreases the plasma post-prandial glucose (PP) concentrations due to the potential of early-phase insulin secretion. These findings suggest that good eating habits prevent the onset of Diabetes by increasing glucose metabolism after meals. Several studies have reported an association between diet and diabetes risk.[11.12] Therefore, the authors wanted to examine the relationship between the number of mastication cycles with the risk factors for diabetes mellitus, namely by measuring blood sugar two hours pp and insulin in students of the Faculty of Medicine, Islamic University of Bandung.

METHOD

This research is a descriptive-analytic study conducted on male students at the final level of the Faculty of Medicine, Islamic University of Bandung. The selection of respondents was carried out purposively. The respondents were all last year students of the Faculty of Medicine Unisba, met the inclusion and exclusion criteria and stated their willingness/informed consent to participate in this study. The research permit was obtained from the Medical Ethics Unit of the FK Unisba.

Inclusion criteria included those aged between 20-25 years; Has complete permanent teeth from incisors to second molars in each quadrans; having good oral and dental health, indicated by the presence of a good DMF(Decay/Missing/Filling) index; Body Mass Index (BMI): Normal; Willing to participate in the research, while the respondent will be expelled from the study if he has teeth with an odd number and shape; suffering from temporomandibular joint (TMJ) dysfunction, and have a previous history of Diabetes. The group's division was divided into three groups with 15x, 30x and 45x mastication cycles with statistical calculations obtained for each group of 6 people.

Respondents in this study were asked to chew rice 15x, 30x, 45x, selecting subjects into group A with a 15x cycle, group B with 30x and group C with 45 times. They were randomly selected. Post-prandial (PP) blood glucose levels or post-meal blood glucose levels examination was carried out with a normal reference value: 80-144 mg/dL. Insulin test with the method of checking the DMF Index (decay/Missing/Filling): Index that states the number of cavities/missing teeth/filled teeth in min two per region.

Respondents were also given several questionnaires to assess their medical history, including the history of Diabetes, history of Diabetes among siblings (yes or no). Surveyed lifestyle variables, including smoking habits (past, former, or current), drinking alcohol habits (past, former, or present), physical activity (little, moderate, or strenuous), and eating habits (slow, intermediate, or fast).

Statistical analysis using SPSS version 21 with bivariate data to distinguish the three research groups with One Way ANOVA when the data is normally distributed and with Kruskal Wallis if the data is not normally distributed.

RESULT

All respondents were 18 male students at the Faculty of Medicine, Unisba Level Four, who met the inclusion and exclusion criteria to become research subjects and followed the minimum number of samples. Students received three treatments, group A chewed 15 times, group B chewed 30 times, and group C chewed 45 times. The characteristics of the research subjects were listed in Table 1:

Table 1. Characteristics of research subjects

No	Questions	Yes (%)	No (%)
1	Previous DM history	0 (0)	18 (100)
2	Family History of DM	5 (27.78)	13 (72.22)
3	Symptoms of Diabetes		
	Polyuria	0 (0)	18 (100)
	Polydipsia	2 (11.11)	16 (88.89)
	Polyphagia	6 (33.33)	12 (66.67)
	The wound doesn't heal	0 (0)	100(0)

All respondents did not have a previous history of DM; only five people (27.78%) have a family history of DM. In comparison, the symptoms of Diabetes often ate six people (33.33%), and two people were often thirsty (11.11%). All respondents had their blood sugar checked beforehand, and the results were normal blood sugar.

The habits that lead to DM disease were listed in Table 2.

Table 2. Habits that lead to DM disease

No	Habitual	Often (%)	Rare (%)	No (%)
1	Smoke	1 (0.055)	2 (0.11)	15 (83.33)
2	Drink alcohol	0 (0)	0 (0)	0 (100)
3	Sports	5 (27.78)	13(72.22)	0 (0)
4	Sweet's diet	9 (50)	9 (50)	0 (0)
5	fatty foods diet	7 (38.89)	11(61.11)	0 (0)

Habits that have a risk towards DM, smoking habits were five people 27.78%), nine people (50%) often eat(sweet habits, and seven people eat fatty foods (38.89%).

Blood sugar level after treatment were listed in Table 3. After mastication, results of blood sugar examination showed normal blood glucose levels both in group A with a 15-mastication cycle of 92 mg/dL and in group B with a 30-mastication cycle of 89.5 mg/dL. Group C, with a mastication cycle 45 times, showed 86.5 mg/dL. The results on blood sugar showed that at 45 times the mastication cycle, the lowest blood sugar was obtained.

Table 3. Blood sugar level after treatment

Groups	Blood glucose level (mg/dL)	P value
A (15 cycle)	92	0.413
B (30 cycle)	89.5	
C (45 cycle)	86.5	

Kruskal Wallis test, p ≤0.05 significant

Relationship between the mastication cycle and insulin level were listed in Table 4.

Table 4. Relationship between mastication cycle and insulin level

Groups	Glucose blood level (mg/dL)	P value
A (15 cycles)	3.58	0.124
B (30 cycles)	2.97	
C (45 cycles)	2.44	

The relationship between the mastication cycle and the final blood glucose level was tested using Kruskal Wallis due to one abnormal group. The calculation results obtained P> 0.05, so it can be concluded that there is no significant difference between the three treatment groups. Still, it can be seen that the average blood glucose in group C was lower than the three treatment groups.

DISCUSSION

The highest result of blood insulin examination was found in the group with 15 mastication cycles, namely 3.58. followed by the mastication cycle 30 times and 45 times were 2.97 and 2.44. The results showed that the blood sugar in the mastication cycle 15 was 92 mg / dL, while in the 30-mastication cycle, it was 89.5 mg/dL. The mastication cycle with 45 times showed the lowest blood sugar was 86 mg/dL. The relationship between the mastication cycle and the final blood glucose level was tested using Kruskal Wallis because there was one abnormal group. From the calculation, obtained P> 0.05. However, it was found that the group with the highest mastication cycle showed the lowest blood insulin levels.

This study indicated that the mastication cycle with blood glucose levels had insignificant results (p = 0.413). However, it can be seen in the table that 45 times the mastication cycle had the lowest blood glucose value (86.5 mg/dL). The results follow Suzuki's research (2005), which states a relationship between mastication and an increase in blood glucose levels in the Japanese population. The results of other studies showed that a higher mastication performance could prevent Diabetes Mellitus. [5]

In the study, the measurement of blood insulin was lower at higher mastication cycles (45x); this shows that insulin works on cells so that levels in the blood are low. In a longer mastication cycle, there was an increase in the amylase enzyme needed to convert the starch in food into glucose in oral saliva. Then when it is in the small intestine, it will be digested again with amylase produced by the pancreas.

Mastication with a longer cycle causes a gradual initial release time for insulin to work in the cells more effectively. At 45 times, the mastication cycle showed lower insulin and lowered blood glucose levels because insulin was already working on cells and take glucose from the blood. These results were consistent with the research of Suzuki[7], Mandhu [14] and Sato[15]. The importance of the gradual and effective release of glucose levels in preventing hyperglycemia in the blood can lead to glucose accumulation and, in the end, cause disorders that initially take the form of metabolic syndrome and then eventually become Diabetes Mellitus.

CONCLUSION

The relationship between the mastication cycle and the risk factors for DM, namely blood sugar and insulin, was not significant. Still, it was found that the study results on a longer mastication cycle had the lowest blood glucose and insulin levels.

CONFLICT OF INTEREST

The authors reported no potential conflict of interest.

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