The Relationship of Vitamin C Intake and Nutritional Status with Stress Levels in T2DM Patients during the COVID Pandemic

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ABSTRACT

Diabetes mellitus develops when the insulin hormone's secretion or work activity is reduced, resulting in an increase in blood glucose levels. Diabetes mellitus is one of the comorbid disease associated with COVID-19. Coronavirus Disease-19 is causing concern among DM patients since it has the potential to harm their psychological health. People with diabetes may suffer stress, which might affect their blood glucose management. Increased blood glucose levels alter food intake, resulting in weight loss. During the COVID-19 pandemic, the study to know relationship vitamin C intake and nutritional status with stress levels in T2DM patients. With a total of 105 respondents, the study was done cross-sectional in three health centers: Bantul 1 Health Center, Bambanglipuro Health Center, and Pajangan Health Center. Respondents involved were T2DM patients who were members of the Chronic Disease Management Program. BMI was used to measure nutritional status, while the Semi Quantitative - Food Frequency Questionnaire (SQ-FFQ) and the Perceived Stress Scale (PSS-10) were used to determine vitamin C intake and stress levels. The Chi-Square test was used to analyze data in SPSS. This study's nutritional status (p: 0.183) and vitamin C intake (p: 0.055) have a Chi-Square value, indicating that p>0.05. The conclusion there was no relationship between nutritional status and vitamin C intake and stress levels in T2DM patients

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Kata kunci:
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Vitamin C
Stres
Diabetes melitus tipe 2

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ABSTRAK

status gizi dan asupan vitamin C (p:0.055), sehingga p>0.05. Kesimpulan menunjukkan tidak adanya hubungan status gizi dan asupan vitamin C dengan tingkat stress pada penderita DMT2.

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INTRODUCTION

The number of COVID-19 cases in June 2021 worldwide is estimated at 180,817,269 active cases, including the death of around 3,923,238, with 223 confirmed cases of this disease (World Health Organization, 2021). Based on the results of the data recap of the Covid-19 task force dated June 25, 2021, the total number of Covid-19 cases in Indonesia was 2,072,867 and 50.5% of the total had a history of comorbid hypertension and was followed by DM 36.7% and heart disease 17.5%. Based on death data from Covid-19 patients, a history of DM is a comorbid disease with the highest percentage of death at 9.6%, followed by hypertension 9.3% and followed by heart disease at 5.4% (Satgas Penanganan COVID 19, 2021).

Diabetes mellitus develops when the hormone insulin’s secretion or work activity is reduced, leading in an increase in blood glucose levels. Insulin is a hormone generated by the pancreas that transports glucose from the bloodstream to the body’s cells, where it is used as an energy source (JDF, 2019). Insulin secretion has a major effect on Type 2 Diabetes Mellitus (T2DM), which is accompanied by insulin resistance (PERKENI, 2019). Diabetes Mellitus Type 2 is one of the disorders that is comorbid with COVID-19. Severe Acute Respiratory Syndrome (SARS) is a life-threatening respiratory condition. Coronavirus has been shown to attach to Angiotensin Converting Enzyme 2 (ACE2) in the pancreas, damaging it and causing rapid hyperglycemia, both of which lead to high fatality rates (Yang, Lin, Ji, & Guo, 2010).

A pandemic that lasts for a long period can cause a person to become stressed. The study of Grabia et al (2020) found that at the start of the COVID-19 pandemic, there was a surge in psychiatric problems, with high stress categories increasing from 4% to 29% and extremely high stress categories increasing from 0% to 32%. Coronavirus-19 Disease and Diabetes Mellitus (DM), which result in poorer psychosocial health, were of particular concern to people with T2DM.

During territorial constraints, psychological variables have a significant impact on eating patterns. Food cravings in T2DM patients might be triggered by a variety of mental health problems such as stress, social isolation, or a lack of physical activity (Naja & Hamadeh, 2020; Watson et al., 2018). Stress that isn’t managed can lead to leptin resistance and an increase in food consumption (Sugiyanto, 2017). Overeating and obesity can result from uncontrolled food intake. Psychological factors (including stress), physical exercise, and eating behavior are all complicated elements that might be connected (Nurrahmawati & Fatmaningrum, 2018). Persons with diabetes were twice as vulnerable to stress as people without DM (Utami, Jamaludin, & Agus, 2016). People with T2DM may suffer stress, which might affect their glucose management. When you’re stressed, your body produces more cortisol, a hormone that can counteract the effects of insulin and cause high blood glucose levels (Strandberg, Graue, Wentzel-Larsen, Peyro, & Rokne, 2014).

One of the most common endocrine illnesses, T2DM, is linked to a high level of oxidative stress. In T2DM patients, anxiety, stress, and sadness were prevalent neuropsychiatric symptoms. To help lower glucose levels, hyperglycemia generates an increase in oxidative stress, which necessitates reducing the requirement for antioxidants (Mazloom, Ekramzadeh, & Hejazi, 2013). Antioxidants work by removing free radicals or blocking other oxidation events to lessen or stop chain reactions (Azab, Adwas, & Elsayed, 2019). Vitamin C is one of the antioxidants. In persons with T2DM, vitamin C can help reduce free radicals in the body and manage blood sugar levels. In persons with T2DM, consuming vitamin C-rich foods can boost immunity and reduce COVID-19 illness.

METHODS

Study Design

A cross-sectional study

Sampling

The sample technique employed in this investigation was multi-stage random sampling. Stratified random sampling with multiple stages. The first step is chosen three health center with random from a total of 27 health facilities in Bantul Regency (Bantul Health Center, Bambanglipuro Health Center, and Pajangan Health Center). The research sample size was obtained using the Kothari formula for estimating the number of samples, with total sample size of 105 respondents (Murti, 2013). The respondents were members of Chronic Disease Management Program. The second step involves using proportional random sampling to sample T2DM patients each health center. A total of 40 respondents were gathered from Bantul Health Center, 35 respondents from Bambanglipuro Health Center, and 30 respondents from Pajangan Health Center for this study.

Instrument

The information gathered is primary information. By recording the food consumed in the previous month, the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) can be used to determine vitamin C intake. The BMI is used to assess nutritional health, whereas the Perceived Stress Scale (PSS)-10 is used to assess stress levels. The Perceived Stress Scale-10 is a ten-item self-report tool that claims to measure “how unpredictable, unmanageable, and overcrowded respondents’ lives are.” Each PSS-10 point is scored on a 5-point Likert scale, from 0 (never) to 4 (always) (very often). PSS-10 has six positive points (1, 2, 3, 6, 9, and 10: positive factors) and four negative points (1, 2, 3, 6, 9, and 10: negative factors) (4, 5, 7, and 8: negative factors). During the analysis, any points that worked negatively were recoded. The total score ranges from 0 to 40, with higher scores indicating higher degrees of stress perception. Low stress is defined as a score between 0 and 13, moderate stress is defined as 14 to 26, and severe stress is defined as a

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score between 27 and 40 (Maroufizadeh, Foroudifar, Navid, Ezabadi, & Sobati, 2018).

**Procedure**

Data was gathered at three health sites in Bantul, Yogyakarta (Bantul Health Center, Bambanglipuro Health Center, and Pajangan Health Center), from May to June 2021. The health department has granted this study an ethical license and authorization. Written and verbal consent were sought prior to data collection. Patients have the right to refuse to participate in the trial at any time. A nutritionist conducted each interview. For roughly 15 to 30 minutes, an inspection and survey is conducted.

**Statistical analysis**

SPSS (IBM SPSS Statistics for Windows, Version 16). The relationship between nutritional status and vitamin C intake with stress levels was determined using the chi-square test with significance level (p<0.05).

**RESULTS AND DISCUSSION**

The characteristics of participants can be described as follows:

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>67 (63.8)</td>
</tr>
<tr>
<td>Male</td>
<td>38 (36.2)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>26-45 years old</td>
<td>6 (5.7)</td>
</tr>
<tr>
<td>46-65 years old</td>
<td>70 (66.7)</td>
</tr>
<tr>
<td>&gt;65 years old</td>
<td>29 (27.6)</td>
</tr>
<tr>
<td><strong>Fasting Blood Glucose Level</strong></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>47 (44.8)</td>
</tr>
<tr>
<td>Not Normal</td>
<td>58 (55.2)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>105 (100)</td>
</tr>
</tbody>
</table>

Table 1 reveals that women the majority of the responders (63.8%) and 46-65 years old group (66.7%). Over the age of 40 years old, the risk of noncommunicable diseases and other chronic diseases increases. As a result, T2DM patients over the age of 40 were likely to be more health-conscious, eating a balanced diet, exercising regularly, and beginning to avoid high-sugar, high-salt, and high-fat meals (Yunieswati, Marliyati, & Setiawan, 2020). The fasting blood sugar levels of many T2DM participants were abnormal (55.2%). Coronavirus Disease-19 severity and mortality appear to be linked to the presence of T2DM and the degree of hyperglycemia in an individual (Holman et al., 2020).

The nutritional condition in Table 2 shows the majority of them are either normal (48.6%) or have a BMI of 18.5–22.9 kg/m². In contrast to Ruiz-Roso et al., (2020)’s study, the majority of persons with T2DM were obese (63%). The optimal management of T2DM, particularly during the Covid-19 pandemic, is emphasized through the management of modifiable factors, particularly living a healthy lifestyle that includes efforts to achieve and maintain normal nutritional status to prevent obesity, apply a balanced diet based on nutrition principles, and engage in regular physical activity according to age (Rohani & Ardenny, 2019).

**Table 2. Nutritional Status, Vitamin C Intake, and Stress Level**

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nutritional Status</strong></td>
<td></td>
</tr>
<tr>
<td>a. Underweight</td>
<td>44 (41.9)</td>
</tr>
<tr>
<td>b. Normal</td>
<td>51 (48.6)</td>
</tr>
<tr>
<td>c. Overweight</td>
<td>8 (7.6)</td>
</tr>
<tr>
<td>d. Obesities I</td>
<td>2 (1.9)</td>
</tr>
<tr>
<td><strong>Vitamin C Intake</strong></td>
<td></td>
</tr>
<tr>
<td>a. Deficient</td>
<td>46 (43.8)</td>
</tr>
<tr>
<td>b. Adequate</td>
<td>38 (36.2)</td>
</tr>
<tr>
<td>c. Surplus</td>
<td>21 (20.0)</td>
</tr>
<tr>
<td><strong>Stress Level</strong></td>
<td></td>
</tr>
<tr>
<td>a. Low</td>
<td>46 (43.8)</td>
</tr>
<tr>
<td>b. Medium</td>
<td>35 (33.8)</td>
</tr>
<tr>
<td>c. High</td>
<td>24 (22.4)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>105</td>
</tr>
</tbody>
</table>

Vitamin C intake in T2DM patients was divided into three categories: less (43.8%), good (36.2%), and more (20%). Fruits high in vitamin C, such as oranges, papaya, bananas, apples, pears, and guava, provide a good source of vitamin C and other nutrients to T2DM sufferers. According to the SQ-FQ data, the typical fruit consumption was 3-5 times per week. Orange jember, papaya, and kapok banana are the most popular fruits. Oranges (49mg/100gr), papaya (78mg/100gr), and kapok bananas (9mg/100gr) all have high vitamin C levels (Persagi, 2017). Vitamin C requirements for men aged 19 to 80 years old are 90 mg per day and 75 mg per day for women aged 19 to 80 years old (Kemenkes RI, 2019).

Type two diabetes mellitus patients have low stress levels (43.8%), moderate stress (33.8%), and high stress (22.9%). According to a study Ruissen et al., (2021), T2DM suffered up to 35.1% stress throughout the area quarantine. Quarantine has been linked to higher levels of mental discomfort and anxiety in previous studies (Brooks et al., 2020; Hossain, Sultana, & Purohit, 2020). Excessive stress can disrupt diabetes self-management and glucose control by causing changes in everyday behavior (Falunbach et al., 2012).

Table 3. reveals that 14 people with a low T2DM intake have a high stress level (13.3%). In T2DM, which has a low stress level of 26 people, the nutritional state reveals normal nutritional status (24.8%). The association between stress and nutritional status was not established in this study. This occurs because emotional overeating as a coping mechanism for stress is insufficient to influence food intake, hence it is unrelated to nutritional status (Sukianto, Marjan, & Fauziyah, 2020). Relationship with no tension other things that were more connected to nutritional status, such as energy, carbohydrate, and protein intake, cause nutritional status. Other studies have found that stress has no bearing on one’s nutritional health (Nicholas, 2016).

There was no correlation between nutritional status and vitamin C intake with stress level (p>0.05). On the intake of vitamin C, 23 persons had a low stress level and a good intake of T2DM (21.9%). Interestingly, ascorbic acid has been shown in multiple clinical investigations to reduce stress hormone levels and subjective impressions of stressful situations. For example, ascorbic acid (3 g/day for 5 days) can block the increase in cortisol levels caused by exogenous Adrenocorticotropic Hormone (ACTH) (Moritz, Schmitz, Rodrigues, Dafre, & Cunha, 2020).
The emotional strain faced by responders with T2DM is a concern. Because of the huge number of concomitant COVID-19 mortality cases, someone with T2DM may experience strong emotions during this pandemic. This is becoming more prevalent in the population, particularly in rural regions. So many people, especially during the COVID-19 epidemic, have emotional difficulty dealing with their condition (Shinan-Altm & Levkovich, 2022). Furthermore, unfavorable opinions about health personnel are affected by the media during the COVID-19 epidemic. Health personnel must utilize comprehensive personal protection equipment when treating COVID-19. When a person with T2DM is receiving treatment at a health institution, this produces anxiety and fear, as well as psychological issues (Manik, Natalia, & Theresia, 2021). A person with mental difficulties' interpersonal relationships would be affected as well. Withdrawal, social isolation, and a lack of self-activities are all symptoms. A person with mental difficulties has an impact on many parts of their life, including medication adherence, which leads to illness recurrence (Febrianita, Alfianto, & Muntaha, 2021).

In Alfianto, Ulfa, Kurniyanti, & Wicaksono (2021)'s research, they discuss the description of stress in people with DMT2 in rural areas. The average result of the respondent's stress level is moderate. During the COVID-19 pandemic, the issue that becomes a priority is mental health. The cortisol hormone caused by negative feelings of anxiety or stress can cause physical health problems, especially problems with non-communicable diseases such as the heart. The cortisol hormone caused by anxiety problems is influenced by a person's negative thoughts due to the COVID-19 pandemic. This feeling arises from information about COVID-19 in the mass media or social media, death, illness, to mental health problems due to COVID-19. Village people on average have a less understanding of a disease. Lack of access to information about the COVID-19 pandemic has made rural communities ignore health protocols. But on the other hand, the community is very concerned about the problems of the COVID-19 pandemic, such as the stigma against people who are exposed to COVID-19, the stigma on health workers by assuming that if they visit and check with the puskemas or health services, they will be infected. This reduces the number of visits to health services for self-examination. The decrease can be from non-communicable disease services such as checking for diabetes, hypertension, aeric acid and cholesterol. So that the cause of mental health problems in someone with a non-communicable disease or such as DM is a stigma factor (negative thoughts) that can cause anxiety and stress in a person and have an impact on psychosocial problems in someone with DM.

It was not related in this study because T2DM respondents were members of Chronic Disease Management Program members who received routine treatment at the Health Center, implying that T2DM patients received treatment and education directly from the on-duty doctor. Several prolanis operations, including as counseling and Posbindu PTM, were halted during the COVID-19 pandemic. According to prior study, T2DM patients who have routine health checks, monitor their drugs and nutrition, and participate in activities can help T2DM patients adjust to their surroundings so that they don't feel stressed while undergoing therapy (Wahyu Lestariina, 2018).

**LIMITATION OF THE STUDY**

Researchers did not examine the stress coping of T2DM patients. Methods or problem-solving strategies (coping) used by diabetics are also strongly related to the problem of stress in diabetes. The use of SQ-FFQ also has drawbacks because T2DM patients have to remember food habits in the past month, so many patients experience forgetfulness.

**CONCLUSIONS AND SUGGESTIONS**

Nutritional status and vitamin C did not have a significant relationship with stress levels in T2DM patients. Further research is needed to determine the factors that influence stress levels in T2DM patients during the COVID-19 pandemic.

**ETHICAL CONSIDERATIONS**

The Research Ethics Committee of the Faculty of Medicine, Universitas Sebelas Maret (No: 34/UN27.06.6.1/KEP/EC/2021).

**Funding Statement**

No funding was received for conducting this study

**Conflict of Interest Statement**

None declared

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