Research Article

Effect of Mediterranean Diet Composition on Metabolic Syndrome Marker Parameters Based on NCEP-ATP III Criteria

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Abstract.
Metabolic syndrome refers to a cluster of metabolic abnormalities in the body, including central obesity, elevated blood pressure, high glucose, and triglyceride levels, as well as low HDL levels. The Mediterranean diet, known for its specific composition, is believed to mitigate metabolic syndrome. This study aims to assess the impact of adhering to the Mediterranean diet on individuals with metabolic syndrome. It employs an observational analytic approach, utilizing a prospective cohort of 30 participants who followed the Mediterranean diet regimen as part of their treatment at a clinic in Bandung City. Systematic Random Sampling was used to select participants, and blood pressure was measured at the beginning (T1) and end (T2) of the study. Data on dietary intake were collected using the Relative Mediterranean Diet (rMED) scale via a Food Frequency Questionnaire (FFQ). Statistical analyses, including ANOVA and Tukey's post-hoc test, were conducted to compare dietary compositions across adherence groups and to assess the impact of the Mediterranean diet on metabolic syndrome components. The findings revealed that participants, with an average age of 57.94 years and 69.44% female, experienced significant improvements in certain metabolic syndrome components, such as waist circumference (fruit and nut intake), triglycerides (vegetable intake), HDL (meat intake), and blood glucose (dairy product intake). However, no significant effects were observed for legumes, seeds, fish, and olive oil components on MetS.

Keywords: components, Mediterranean diet, MetS, NCEP-ATP III

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1. Introduction

Metabolic syndrome (MetS) is a collection of interconnected symptoms and risk factors that increase the risk of developing cardiovascular disease and type 2 diabetes mellitus (T2DM) [1]. A person experiences MetS if ≥ 3 symptoms are found which include obesity, high triglycerides, low levels of HDL-cholesterol, increased blood pressure, and increased blood sugar levels [2]. Data from the Framingham Offspring Study, in 2005 SM affected 20-25% of cases in the world with the prevalence of respondents aged 26-83 years being 29.4% in men and 23.1% in women [3]. According to the National Basic Health Research (RISKESDAS), the prevalence of MetS in Indonesia has risen from 14.8% in 2013 to 21.8% in 2018 [2,4]. As outlined by the National Cholesterol Education Program Adult Treatment Panel (NCEP-ATP) III, metabolic syndrome symptoms align with three of the five criteria. These criteria include: 1) waist circumference > 90 cm for men and > 80 cm for women, 2) HDL value < 40 mg/dL, 3) triglyceride value ≥ 150 mg/dL, 4) blood pressure ≥ 130/85 mmHg, and 5) fasting blood glucose ≥ 110 mg/dL [5,6].

According to the American Heart Association (AHA), the Mediterranean Diet is one of the recommended dietary therapies for SM therapy [7-9] The Mediterranean Diet, originating from the Mediterranean region, emphasizes the consumption of plant-based foods like cereals, fruits, vegetables, legumes, nuts, and whole grains, along with olive oil as the primary source of additional fat. It includes moderate intake of fish, seafood, and dairy, while limiting the consumption of red meat and other meat products [10-12].

The Mediterranean diet is well-known, especially in Europe, but its benefits are still not widely experienced by the Indonesian population. This study seeks to elucidate the impact of Mediterranean diet composition on the parameter markers of metabolic syndrome as defined by the NCEP-ATP III criteria.

2. Methods

The research method used is observational analytic with the principle of the prospective cohort in 30 research sample, with man 26,67% and woman 73,33% an average age of 58 years and exhibiting symptoms of metabolic syndrome meeting three out of the five criteria outlined by the NCEP-ATP III. The population in this study were MetS patients who had undergone the Mediterranean diet and followed prolanis at the Bandung city clinic. The sample selection used the Systematic Random Sampling method for

research subjects, blood pressure was checked in the first month (T1) and the last month of the study (T2). Information regarding the consumption of individual components was gathered using the relative Mediterranean Diet (rMED) assessed through the Food Frequency Questionnaire (FFQ). ANOVA test and Tukey's post-hoc test were employed to assess disparities in Mediterranean and MetS diet composition among adherence groups, as well as to evaluate proportion comparisons among rMED adherence groups. Linear regression analysis was utilized to examine the mean and standard deviation ($M \pm SD$) of each Mediterranean diet component consumption, aiming to ascertain the influence of Mediterranean diet composition on MetS.

3. Results

The objective of this study was to investigate the impact of the Mediterranean diet composition on the parameters of metabolic syndrome, as defined by the NCEP-ATP III criteria. From the research results obtained as many as 30 metabolic syndromes that have met the criteria.

MetS individuals adhering to the Mediterranean diet had an average age of 58.12 years, with a median of 59 years and a standard deviation of 8.48 years. The youngest participant in this study was 40 years old, while the oldest was 73 years old. Age can increase the risk of Mets. Increasing age causes changes in body composition including an increase in fat mass to central obesity in MetS patients. Aging can also occur from several mechanisms resulting from the symptoms of MetS with inflammation, oxidative stress, and endothelial dysfunction [13-18].

The majority of metabolic syndrome patients who underwent the Mediterranean diet were female, namely 22 people (73.33%), while there were 8 male patients (26.67%). The rise in MetS incidents is believed to be linked to lifestyle changes influenced by globalization. There's a shift towards modern living, where traditional dietary habits are being replaced by the consumption of instant and Westernized foods. Based on research by Srilaning et al. in 2018 showed women were four times more at risk than men with the results of a sample of women who experienced MetS, namely 26.6%, while men were 18.3%, or women almost 1.5 times compared to men [3].

The statistical analysis indicates a significant correlation between adherence to the Mediterranean diet and the consumption of fruit, nuts, vegetables, legumes, whole

grains, fish, olive oil, and dairy products. However, there is no significant association between adherence to the Mediterranean diet and the consumption of meat.

The multiple comparison test in this study was tested using Tukey's Post Hoc test if the components were significantly significant, whereas if the food components were not significant, then the data was not subject to a Post Hoc test on these components.

Diagram illustrating the mechanisms underlying the impact of bioactive compounds found in the components of the Mediterranean diet. Dietary fiber plays a role in reducing LDL cholesterol levels, synthesizing cholesterol, enhancing insulin sensitivity, and lowering hyperglycemia. Additionally, polyphenols present in fruits and vegetables can enhance antioxidative capabilities, enhance endothelial function, and exhibit anti-inflammatory effects [19-21]. The insignificant content of biologically active compounds in Mediterranean diet components such as legumes and nuts which contain dietary fiber, vitamins, minerals, antioxidants, lignans, and phytosterols, is lost during processing into daily food. This study illustrates that the association between legume consumption and health outcomes is multifaceted and can vary across different populations or circumstances [22-25].

The effect of the Mediterranean diet food components on waist circumference, HDL, triglycerides, blood pressure, and fasting blood glucose is presented in Table 1.

Table 1: The effect of the total rMED score and Mediterranean food components on waist circumference, HDL, triglycerides, blood pressure, and fasting blood glucose.

	p-value					
	Waist circumference	**HDL**	**Triglycerides**	**Systolic Blood Pressure**	**Diastolic Blood Pressure**	**Fasting Blood Glucose**
Fruits and Nuts	0,042	0,333	0,156	0,729	0,147	0,886
Vegetables	0,690	0,650	0,019	0,428	0,415	0,396
Legumes	0,466	0,052	0,134	0,886	0,905	0,339
Whole grains	0,316	0,754	0,449	0,960	0,689	0,386
Fish	0,404	0,063	0,537	0,704	0,552	0,089
Olive oil	0,203	0,781	0,762	0,790	0,513	0,702
Meat	0,217	0,008	0,193	0,868	0,616	0,204
Dairy products	0,496	0,337	0,780	0,906	0,071	0,027

According to the study findings, MetS patients following the Mediterranean diet had an average age of 57.94 years, with 69.44% being female. Significant effects were

observed, with fruit and nut components impacting waist circumference, vegetable components affecting triglyceride levels, and meat components influencing HDL levels. dairy products on blood glucose. There is no significant effect between the components of legumes, seeds, fish, and olive oil on MetS.

4. Discussion

Research on the Effect of the Composition of the Mediterranean Diet on the Metabolic Syndrome Marking Parameters based on the NCEP-ATP III criteria shows several influences on the components of the metabolic syndrome. From these data the researchers suggest that the composition of the Mediterranean diet can be applied as a food requirement in everyday life. In addition, further research is needed with a longer period of monitoring the Mediterranean diet to determine the long-term benefits of the Mediterranean diet. Further research is needed regarding the effect of the Mediterranean diet in people who have genetic risk factors for metabolic syndrome to see the benefits of the Mediterranean diet as an eating pattern that can prevent metabolic syndrome. Further research is also needed to examine other factors that influence the control of the 5 components of metabolic syndrome with the Mediterranean diet, such as differences in each group's level of physical activity so that they can find out the therapeutic options given to patients with metabolic syndrome.

5. Conclusion

MetS patients following the Mediterranean diet had a mean age of 58.12 years. The majority of these patients were female, comprising 73.33% of the sample, and most had low dietary adherence, accounting for 36.67%. Significant effects were observed, with fruit and nut components impacting waist circumference, vegetable components affecting triglyceride levels, meat components influencing HDL levels, and dairy product components affecting blood glucose. However, there were no significant effects observed between the components of legumes, seeds, fish, and olive oil on MetS.

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