Food Consumption Behavior and their Association with Metabolic Syndrome: A cross-Sectional Study of Adult in Gorontalo Province, Indonesia

by Herlina Jusuf

Food Consumption Behavior and their Association with Metabolic Syndrome: A cross-Sectional Study of Adult in Gorontalo Province, Indonesia

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ABSTRACT

The objective of this study was to examine the behavioral associations of Gorontalo people in consuming foods with the incidence of metabolic syndrome. This research is expected to contribute as data source for endeavor to prevent morbidity and mortality of cardiovascular system disease. The approach of the study was an observational analytic study with cross sectional design. The population in this study was all non-infectious patients treated in the path of internal policlinic and heart policlinic located three Hospitals in Gorontalo Province, Indonesia, namely Regional Hospital of City Gorontalo – Rumah Sakit Umum Daerah (RSUD) Prof. Aloe Saboe, Regional Hospital of District Gorontalo (RSUD) MM Dunda Limboto Gorontalo and Regional Hospital of Bone Bolango (RSUD) Toto Kabila Bone Bolango, Gorontalo to obtain sample of 360 respondents. The sampling method employed non-probability sampling technique by accidental/convenience sampling. These samples were then subjected to multiple tests to establish the appropriate metabolic syndrome of criteria in the National Cholesterol Education Program (NCEP) Adult Treatment Panel-III (ATP-III) NCEP-ATP III. After that the sample was then given some questions about habitual behavior in consuming food.

All research procedures were granted ethical permission from the Medical Ethics Committee of Universitas Hasanuddin, Makassar, Indonesia.

The result of the study showed that female (109 respondents) were more prone to metabolic syndrome than men, and age range of 46-60 years (151 respondents) were more risky to metabolic syndrome compared to the age range 25 - 45 years. There is a significant relationship between food consumption in the fatty foods (p value = 0.001, OR = 2.023), baked foods (p value = 0.000, OR = 2.638), salted food (p value = 0.016, OR = 3.094) and Gourmet powder (p value = 0.000, OR = 2.911) with metabolic syndrome.

Keywords: Food, Consumption habit, Consuming, Behavior, Adult, Metabolic, Syndrome

INTRODUCTION

Metabolic syndrome is a complex metabolic disorder caused by factors such as obesity, blood pressure increase, insulin resistance, and dyslipidemia; this syndrome could lead to cardiovascular diseases such as coronary heart disease, the number one among deadliest diseases. Metabolic syndrome was once called syndrome X in 1988 by Reaven; who later changed the name to metabolic syndrome X in 1999 [1]. World Health Organisation (WHO) referred the disease as metabolic syndrome, meeting at least three of five criteria in NCEP-ATP III (the National Cholesterol Education Program-Adult Treatment Panel III), particularly abdominal obesity (obesity with waist circumference >80 cm for women, and >90 cm for man), triglyceride rate increase, and HDL cholesterol decrease [2].

The prevalence of metabolic syndrome differs in each region, and is higher in developing countries compared to developed ones. The 2014 survey displayed that the prevalence of metabolic syndrome cases in Europe ranged from 11.6 - 26.3% [3]. In Japan, the disease's prevalence as quantified by NCEP-ATP III criteria was 16.5%; using the same criteria, the prevalence of metabolic syndrome in Indonesia resulted in much higher percentage, 28.4% [4, 5]. Metabolic syndrome cases are highly related with lack consumption of essential nutrients, for instance vitamin C and E, Zinc, sodium, potassium, calcium, and magnesium; these nutrients are commonly acquired in fruits and vegetables, therefore, less intake will result in increasing risk of metabolic syndrome [6]. The Data of Indonesian Basic Health Research (Riskesdas) in 2013 highlighted that 93.5% of population of > 10 years old tended to have less fruits and vegetables intake. Moreover, the national sugary food intake (≥ once a day) was 53.1%; while the intake of food containing high fat or cholesterol contents, and fried food (≥ once a day) was 40.7%. The research also highlighted that 77.3% Indonesians consumed MSG (monosodium glutamate) ≥ once a day [7].

The consumption pattern that was low in fiber, but high in fat, cholesterol, sugar, and sodium; worsened by sedentary life style contributed to higher risk of obesity, metabolic syndrome, as well as other degenerative diseases [5, 8, 9]. The prevalence is more likely to increase, leading to higher quantity of population suffering from cardiovascular diseases and impacting one's quality of life [10, 11]. Other studies indicated that 21.7% patients of arterial disorder with metabolic syndrome also suffered from cardiovascular diseases that led to death [12]. Further, the result of 2013 Family Health Survey indicated that cardiovascular disease ranked first (49.9%) as the deadliest degenerative diseases in Indonesia [7]. The findings also suggested that the metabolic syndrome and its risk factors are to be treated seriously to prevent increasing risks of degenerative diseases.

Recent trends in metabolic syndrome cases are highly related to lifestyle shifts as a result of globalization. The community's turn to modern lifestyle also brought changes in high intake of instant and western food. A nine-years long cohort study involving 9514 subjects found out approximately 40% of new cases of metabolic syndrome due to increasing consumption of fast food, meats, and fried food [13]. In the meantime, other studies showed that consumption of products that are based of low-fat milk, fish, and cereals prevented metabolic syndrome diseases [14].

556

The etiology of metabolic syndrome is still unknown. A hypothesis argued that insulin resistance is the primary cause of the disease. In addition to that, the risk factors of metabolic syndrome involve aspects in life that are linked with early development of the disease, namely eating pattern, alcohol intake, cigarette intake, physical activities, socio-economic factors, genetic factors, as well as stress [15]. Among the mentioned factors, eating pattern contributes the most to the metabolic syndrome cases; however, it is still unknown that which kind of eating pattern that precisely leads to metabolic syndrome. The identified gap serves as this present study's rationale as the researcher intends to elaborate the aforementioned problems. This study's objectives are to identify and analyze the correlation between metabolic syndrome and eating habit of Gorontalo's community in consuming sugary foods, fatty foods, spicy foods, grilled foods, and foods that are high in MSG contents.

METHODS

The analytical survey research relied on cross-sectional method and involved variables i.e., metabolic syndrome as the dependent variable; as well as sugary food, fatty food, spicy food, grilled food, and high-MSG food as the independent variables. This study was conducted in three public hospitals, namely Aloei Saboe Hospital, MM Dunda Hospital in Limboto, and Toto Hospital in Kabila. The population comprised non-infectious diseases healthy-looking outpatients from 25-60 years old that underwent treatments in internal organs clinic and cardiology clinic. Based on the criteria, the research generated 360 respondents by accidental sampling technique.

The samples, which are the outpatients in the three hospitals, was chosen randomly, or by accident, during the initial observation. The selected criteria involved 1) patient with non-infectious disease, 2) was 25-60 years old during observation, and 3) was willing to be respondent. The study exclusion criteria were respondents consuming alcohol or they have not consumed any alcohol in the last 12 months, were excluded from the analyses and patients are not willing to become respondents in this study.

The data were directly collected from the respondents. The observation was conducted to diagnose indications of metabolic syndrome based on the NCEP-ATP III criteria [16]: waist circumference data were collected using standard techniques and standardized tools recommended by the International Diabetes Federation (IDF) to assess specific abdominal obesity for ethnic Asians with abdominal circles that exceed 80 cm in women and 90 cm in men [17]. Measure blood sugar was using fasting blood sugar. Respondents who presented three or more of the five

criteria established for metabolic syndrome, namely central obesity (waist circumference 90 cm in men and women 80 cm in women), hypertriglyceridemia (> 150 mg / dL), low HDL cholesterol (<40 mg / dL in men and <50 mg / dL in women), hypertension (≥130 / 85 mm Hg) and hyperglycemia (fasting plasma glucosa> 110 mg / dL).. HDL cholesterol levels, fasting blood sugar levels, and fasting triglyceride levels are measured by conducting the respondent's blood screening. The data of blood pressure were acquired by digital sphygmomanometer. Initially, the respondents were rested for 10 minutes in a sitting position and the Sphygmomanometer was placed at the height of the heart. Blood pressure measurements were carried out three times with a 5 minute break.

The instant blood sugar levels were measured by blood testing procedure that referred to the Standard Operating Procedure. Blood pressure was determined under standardized conditions with validated. About 2-3 cc of blood were acquired from each respondent to be further checked in the hospitals' laboratory. Waist circumference data were collected using standard techniques and standardized tools. HDL cholesterol levels, fasting blood sugar levels, and fasting triglyceride levels are measured by conducting the respondent's blood screening.

The respondents' consumption habit within the last 30 days was quantified by Food Frequency Questionnaire. Sugary foods are foods that are included in the food group that contains high sugar levels beyond the intake of daily needs. Fatty foods are foods that contain high total fat that exceeds the intake of daily needs. Spicy food is food that has a spicy flavor and has a lot of chili. Baked foods are foods that are processed by means of roasted. Foods with seasoning are foods that contain a lot of monosodium glutamate salt. Salty foods are foods that contain more than one and a half tablespoons of salt per day or more than 2000 mg / day. The consumption behavior of respondents is categorized into two, i.e. they often consume and rarely consume. Consumption behavior is categorized frequently if the respondent consumes ≥ 3 times a week, and consumption behavior is categorized rarely if the respondent consumes ≤ 2 times a week [17]

The data were further analyzed by Chi square test using SPSS 21 software. All research procedures were granted ethical permission from the Medical Ethics Committee of Universitas Hasanuddin, Makassar, Indonesia.

RESEARCH FINDINGS

The present study confirmed the findings about food consumption behavior and their association with metabolic syndrome of adult in Gorontalo province, Indonesia, as follows:

Table 1: Characteristics of Respondents

Characteristics	n	%
Gender		
Male	148	41.1
Female	212	58.9
Age	84	23.3
25 – 45 years	276	76.7
46 – 60 years		
Profession		
Civil servants	45	12.5
Entrepreneurs	49	13.6
Labors/Temporary workers	15	4.2
Farmers	69	19.2
Housewives	152	42.2
Retirement	30	8.3

The table 1 shows that numbers of male respondents were more than female respondents. However, female respondents suffering from high metabolic syndrome were larger in number. Based on the respondents' age, the ratio of 46-60 years old respondents suffering from metabolic syndrome is highest among those of other age groups. The classification of age group variable referred to that of the Ministry of Health, especially early mature age, late mature age, and early elder age. In addition to that, housewives were more likely to suffer from metabolic syndrome compared to those of other professions.

Table 2: Analysis of the relationship between habitual behavior in consuming food and the incidence of metabolic syndrome

	Metabolic syndrome		Non-metabolic syndrome			
	n	%	n	%	P	OR
Sweets						
Frequently	164	87.7	155	89.6	0.467	0.782
Seldom	23	12.3	18	10.4		
Fatty foods						
Frequently	128	68.4	89	51.4	0.001	2.023
Seldom	59	31.6	84	48.6		
Spicy Foods						
Frequently	164	87.2	156	90.7	0.362	0.731
Seldom	24	12.8	16	9.3		
Grilled Foods						
Frequently	153	81.3	107	62.2	0.000	2.638
Seldom	35	18.7	65	37.3		
Gourmet powder						
Frequently	162	86.1	117	68.0	0.000	2.911
Seldom	26	13.9	55	32.0		
Salty Foods						
Frequently	181	96.8	156	90.7	0.016	3.094
Seldom	7	3.2	16	9.3		

The Table 2 indicates that sugary food consumption habit (p = 0.467) as well as spicy food consumption habit (p = 0.362) do not have significant correlation to metabolic syndrome cases. However, other food consumption habits, i.e., fatty food, grilled food, high-MSG food, and salty food possess significant risk to the cases.

DISCUSSION

Based on the research findings, people age 46 to 60 are those who suffer from metabolic syndrome compared to people with other age groups. It is shown that females are more likely to suffer such a syndrome rather than males. This is in line with the research by WHO in France that the prevalence of metabolic syndrome in people age 55 to 64 is higher than other groups of age, with the percentage of males and females accounted for 23% and 12%, respectively. However, the prevalence of this disease in males (34%) is higher than women (21%). The situation is because people ages 46 to 60 years are in their pre-elderly stage, namely a stage where physiological changes occur, specifically in blood vessels. Blood vessels begin to lose their elasticity and harden, while at the same time, the blood viscosity is increased and the blood is thickened. These situations lead to high blood pressure. In other words, such declines in

blood vessels increase the risks of hypertension and atherosclerosis.

High prevalence of metabolic syndrome in females rather than males is due to the fact that they have reached menopause. Menopause is a contributing factor in metabolic syndrome. Women who have reached menopause suffer from estrogen and progesterone deficiency; these hormones function to maintain the elasticity of the blood vessels and viscosity, increasing blood pressure and the resistance of blood vessels. On top of that, females tend to store fat under the abdominal skin compared to males; and consequently, females are prone to central obesity. A study has indicated that more females (26.6%) suffer from metabolic syndrome rather than males (18.3%). The chance of females from suffering the syndrome is 1.6 higher than males [18].

Dietary habits categorized *frequently* are the ones with the frequency ≥ 3x/week while the *rarely* category refers to the ones with the frequency ≤ 2x/week. Variable of sugary food is not significant since the population in Gorontalo rarely consume this type of food. Sugar cravings are never satisfied, and, as a result, people who consume sugary food never stop eating. This condition is a cause of obesity and insulin resistance. Consuming sugary food continuously triggers type 2 diabetes mellitus. This research echoes the result seen in the study [19] on Korean females. It is shown that those with western lifestyles tend to incorporate sugary food in their diet; this situation positively correlates with the prevalence of metabolic syndromes, for instance obesity and high triglycerides level. Another research has revealed that high consumption of sugary food increases the risks of cardiovascular disease [20].

Consuming fatty food more than three times a week is two times more likely to suffer from metabolic syndrome compared to those who consume such type of food once a week. The majority of people in Gorontalo consume fatty food on a daily basis, considering that the local culinary, such as *Kuah Bugis* (local traditional herb soup), of this province is mostly high-fat dishes. The digestion processes break the fatty food into fatty acid and glycerol. Once the needs of energy are satisfied, fat is stored under the skin and around abdominal areas. Over consuming fatty food is a cause of obesity [21].

Central obesity refers to an excess accumulation of fat in the abdominal area that creates omentum or a sheet of fatty tissue that stretches over the abdomen. The accumulation of excessive fat in omentum will be stored under the skin. Accumulated fat in the omentum is also found surrounding the heart. The impact of the excessive fat accumulation in this part is significant, given the function of the heart to metabolize food to energy. The inability of the heart to metabolize food to energy results in the accumulation of fat to the food storage system of the human body. Failure to address the issue can increase the level of blood sugar [22]. The result of this research is in line with a study of metabolic syndrome in teens in Australia; the study [23] indicates that teens often consuming fatty food are prone to suffer from such a syndrome.

By consuming salt more than 1.5 tablespoons per day or more than 2000 mg correlates significantly with the metabolic syndrome prevalence. People with this diet are three times more likely to suffer from metabolic syndrome compared to those who rarely add salt in their food. High consumption of salt causes sodium to enter endothelial cells of arteries, and consequently, it attracts chloride ions (CI), forming Na Cl (sodium chloride). This new compound has the osmotic power, by which it draws water to endothelial cells, resulting in cell swelling and high blood pressure (hypertension) [24]. Such a notion echoes the result seen in reference [25] in Finland; the study has shown that high consumption of salty food is a strong predictor of metabolic syndrome.

Frequently adding chemically produced food seasonings to the daily diet is also a significant factor in the issue of metabolic syndrome. Adding more than one tablespoon of such food seasonings increases the risk of the syndrome by 2.9 times. Consuming food with MSG can cause the degradation of neuronal membranes, allowing calcium ions to enter cells due to the permeability against sodium ion, calcium ion, and water. Calcium ion entering the cells increases the intracellular calcium ion, which is the preliminary phase of cell death, including nerve cells, by which it can harm the pancreas gland. Disorders in the pancreas gland lead to a deficit in the production of insulin, and, to worsen, the gland is no longer capable of producing insulin, causing a person to suffer from diabetes [26]. This is in line with the result seen in reference [27] that in Thailand, those who consume food with chemically-produced seasonings are prone to metabolic syndrome.

Baked food consumption significantly correlates with metabolic syndrome prevalence. Consuming grilled food more than three times a week increases the risk of the syndrome by 2.6 times. Most people in Gorontalo consume grilled food, such as tuna fish satay, *Ayam Bakar Iloni* (grilled chicken with traditional sauce), and other grilled food marinated with lots of oil. The residue of the grilling process results in the contamination of free radicals in the food, and, as a result, consuming the contaminated food damages the membrane of the cells of the body, specifically the pancreas. Damaged pancreas means that the person is incapable of producing insulin, causing diabetes mellitus type 2 [28]. People in Gorontalo often add greasy chili sauce to grilled food. A study has indicated that over-consumption of oil is impactful on people's metabolism and it has a glycemic effect, which is harmful to one's health [29], [30], [31].

CONCLUSION

The percentage of patients with metabolic syndrome (52.2 %) is greater than those without metabolic syndrome (47.8%). Metabolic syndrome prevalence in Gorontalo correlates with the diet of the people who often consume fatty or salty food with the addition of MSG. The way the food is processed, i.e., grill and fry, is also the factor contributing to the metabolic syndrome prevalence. On the other hand, the habit of consuming spicy food does not significantly correlate with the issue of metabolic syndrome.

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