Identification of Somatotype Characteristics and Diet Inflammatory Index (DII) Profiles in Female Adolescents Obese with Different Sub Types of Metabolic

Salma Assyifa¹, Fillah Fithra Dieny¹,²*, Aryu Candra¹, Enny Probosari¹, A. Fahmy Arif Tsani¹,²

¹Department of Nutrition Science, Faculty of Medicine, Universitas Diponegoro
²Center of Nutrition Research (CENURE), Faculty of Medicine, Universitas Diponegoro

*Corresponding author:
Fillah Fithra Dieny
Jalan Prof. H. Soedarto SH, Tembalang, Semarang 50275
Phone numbers: +6285640204747
E-mail address: fillahdieny@gmail.com

Abstract

Background: Obesity and metabolic syndromes are clusters of abnormalities known to attack various ages, including adolescent, and are prevalence in developing countries, such as Indonesia. Based on the criteria of metabolic syndrome, obesity has two different subtypes, namely metabolically health obese (MHO) and metabolically obese (MOO). The association between obesity and metabolic syndrome is observed through Somatotype and DII. Aims: This study aims to analyze the characteristics of somatotype and DII in Female Adolescents Obese with Different Metabolic Subtypes. Setting and Design: This research was included in the scope of community nutrition which is observational with a cross-sectional design. Methods and Material: There were 72 subjects’ ages of 18 – 21 years and selected using the random sampling method. Statistical analysis used: The statistical analysis of this study used a Mann Whitney test for analyzing data and used a Kolmogorov-Smirnov for normality data test. Result: The results showed that, out of the 72 subjects (female adolescent obese), 52.7% were MHO and 47.2% were MOO. The characteristics of the Somatotype showed that 79.1% were endomorphic–mesomorph, 15.2% were mesomorph–endomorphy, and 5.5% were mesomorphic–endomorph. The characteristics of DII showed that, 55.5% were anti–inflammation, and 44.4% were pro–inflammation. The results of bivariate analysis showed that, there was no differences somatotype; endomorph, mesomorph, ectomorph between MHO and MOO (p-value = 0,901; 0,735; 0,167) and there no differences DII profiles; anti-inflammation, pro-inflammation between MHO and MOO (p-value = 0,901; 0,791). Conclusions: There were no differences in the characteristics of somatotype and DII in female adolescents obese with different sub types of metabolic.

Keyword: Metabolic Syndrome, Diet Inflammatory Index, Metabolically Obese.
Key Messages:

As a paramedic, we should pay more attention to our health and environment, especially to keep our food intake and activity in order to avoid obesity and metabolic syndrome.

How to cite this article: Assyifa S, Dieny FF, et al (2021): Identification of somatotype characteristics and diet inflammatory index (DII) profiles in female adolescents obese with different sub types of metabolic, Ann Trop Med & Public Health; 22(S01): SP24109. DOI: http://doi.org/10.36295/ASRO.2021.24109

Introduction

The incidence of obesity and metabolic syndromes are nutritional problems, prevalence in developing countries, such as Indonesia. Overweight or obesity is not only a problem of excess nutrition; it is also a chronic illness in the long term causing various non-communicable diseases, such as diabetes mellitus, cardiovascular infection, stroke, and cancer. They are preceded by the emergence of a syndrome, namely metabolic and marked by an increase in body mass index (BMI), hypertension, hyperglycemia, and dyslipidemia. Obesity and metabolic syndrome affect all ages, including adolescents. Furthermore, its prevalence in adolescents has increased by 11%, according to a survey of national health and nutritional status in the United States (National Health and Nutrition Examination Survey III / NHANES III) from 1988 - 1994 and 1999 - 2000. Meanwhile, the study of Riskesdas (2013) showed that there was an increase (5.7%) in overweight, i.e., from 1.4% in 2007 to 7.3% in 2013, and obesity (1.6%) for 16-18 years old. In Central Java, the prevalence of obesity in adolescents over 15 years of age was 17% (21.7% for women and 11.5% for men).

According to the World Health Organization (WHO) in 2014, obesity is defined as an abnormal condition characterized by an increase in excess body fat, accumulated in the subcutaneous tissue and infiltrated into organs. There is a link between obesity and the incidence of metabolic syndrome, which is defined as a complex disorder resulting from increased body mass index. The data from the Association of Indonesian Obesity Studies (HISOB) showed that the prevalence of metabolic syndrome was 13.13%. Based on a report from the National Health and Nutrition Examination Survey III (NHANES III), there was an increase in the prevalence of adolescent metabolic syndrome based on the criteria of NCEP-ATP III (National Cholesterol Education Program - Adult Treatment Panel III), from 1988-1994, and also from 1999-2000 (4.2% to 6.4%). The National Health and Nutrition Examination Survey III (NHANES III), from the 1988-1994 survey showed that metabolic syndrome occurred in 4.2% of adolescents aged 12-19 years, while 28.7% of them suffer from it. Obesity is known to be a risk factor for the development of metabolic disorders. Also, these abnormalities are associated with the characteristics or signs of the syndrome. However, not all overweight people have the signs of metabolic syndrome, therefore, the identification of different subtypes in obesity is initiated. Based on body mass
index (BMI) and signs of metabolic syndrome, obesity is categorized into two groups, namely Metabolically Health Obese (MHO) and Metabolically Obese Obese (MOO).\(^{12}\) It is known that MHO patient has BMI> 25 kg/m\(^2\), however, with no signs of metabolic syndrome, while those with MOO has BMI> 25 kg/m\(^2\) with various symptoms.\(^{13}\) The difference between MHO and MOO lies in the difference in visceral and mass fat, insulin sensitivity, High Density Lipoprotein (HDL), fasting blood sugar, and triglycerides.\(^{14}\)

Furthermore, the mechanism underlying the presence of metabolic disorders in individuals are poorly understood. Based on the journal Somatotype, the ability to store fat in the subcutaneous adipose tissue, rather than the visceral causes the phenomenon of differences in body metabolic subtypes. This implies a certain difference in body types (somatotype) between individuals with a healthy metabolism and obesity at the same nutritional status.\(^{15}\) Somatotype is defined as a body type or classification of human shape. According to Health-Carter, body shape is classified into three main types, namely endomorph, mesomorph, and ectomorph. The endomorph type tends to be obese, with high fat content in the abdomen, chest, short hands, and waist. The mesomorph type tends to be a square body, with a slim waist, broad shoulders with massive trapezius and deltoid muscles. While ectomorph types tend to be slim, with weak, small body and bones, and thin muscles.\(^{17}\) The research conducted in Serbia resulted in differences in body types (somatotype) between metabolically healthy women (showing no signs of metabolic syndrome) and obese with normal weight and obesity. The significant differences in body types (somatotype) were observed in the group of normal-weight women, namely metabolically healthy women with lower endomorphs and mesomorphs. However, with higher ectomorph values compared to metabolically obese women of normal weight. The MHO women had lower endomorph and mesomorph scores, and higher ectomorph scores than 'at risk' obese women, however, the differences were not statistically significant. The ectomorph value was found to be higher in MHO individuals, which is related to the linearity of the body. Meanwhile, the endomorph and mesomorph values were higher in Metabolically Obese Obese (MOO) individuals. It is concluded that, besides fat mass, metabolic profile is predicted by the structure of lean body mass, particularly by linearity.\(^{15}\)

One of the methods that have been developed to determine the quality of diet is by observing the diet profile based on inflammation, namely the Diet Inflammatory Index (DII). This is assessed by calculating the DII score obtained from filling out the SQ-FFQ form.\(^{19-24}\) The relationship between inflammation and dietary is still being studied, therefore, the adequate intake of vegetables and fruit reduce hs-CRP and show a DII score which is included in anti-inflammatory. The Levels of inflammatory markers (hs - CRP, TNF-a, IL-6, MCP-1), and DII scores were the highest in individuals with MOO, followed by the MHO. Based on this, the level of inflammatory markers is higher in MOO individuals with Metabolic Syndrome than those with MHO, without the syndrome.\(^{19}\) Based on the above background, the somatotype characteristics and dietary inflammatory index (DII) profiles in female adolescents obese with different metabolic subtypes are identified and analyzed.
Subject and Methods

Design, location, time

This research was included in the scope of community nutrition which is observational with a cross-sectional design from June - August 2019 in the Nutrition Department, Faculty of Medicine, Universitas Diponegoro, Semarang. The subjects were students of the University and were included in the obesity category. The implementation of this research had received approval from the Medical / Health Research Bioethics Commission, Faculty of Medicine, Sultan Agung Islamic University Semarang No.183 / VI / 2020 / Bioethics Commission.

Subjects and sampling

The subjects were selected through initial screening process for obese students aged 18-21 years, across the 10 faculties of Universitas Diponegoro, Semarang. The screening results were based on the number of students in the 2017 and 2018 batches, and they underwent initial anthropometric measurements in the form of weight, height, and waist circumference. There were 1260 obese female students that were adjusted to the inclusions criteria and selected using a random sampling method. The included subjects were obtained using the formula for observational research in one population and resulted in 72 samples. The inclusions criteria that were set in the subjects selection were female, aged 18-21 years, with a waist circumference of more than 80 cm, not sick, did not take certain drugs, such as steroids and hormone, did not smoke, did not consume alcohol, not pregnant, and willing to take part in the research by filling in the form Informed Consent. Meanwhile, the exclusions criteria included being absence during data collection, resignation before the study was completed, and death.

Data collected

The independent variables used were the body type or somatotype, and the Diet Inflammatory Index (DII) profiles. The dependent variable was the criteria for the types of metabolic body obesity, namely Metabolically Healthy but Obese (MHO) and MOO. The data taken included the identity and anthropometrics in the form of measurements of height, weight, fat percentage, the thickness of under-skin fold including subscapular, supra iliac, triceps, humerus and femur width, upper arm and calf girth, blood pressure, biochemicals on the HDL levels, triglycerides, fasting blood sugar, and food intake, by filling in the SQ-FFQ form. The retrieval of anthropometrics data, such as body weight was measured using a scale with an accuracy of 0.1 kg. The Body height was measured using a microtoise with an accuracy of 0.1 cm. The Body fat measurements were measured using a skinfold calliper. The bone width was measured using a sliding calliper. The Measurement of the circumference of the upper arm and calf girth was measured using the tape with a maximum size of 150 cm. The biochemicals data, such as blood fasting sugar, HDL, and triglycerides were carried out with blood samples in the laboratory using enzymatic colorimetric methods. The blood pressure was measured through a digital aneroid tensimeter. Food intake data was obtained through a subject interview with the SQ-FFQ form.
The results of data collection were divided into three, namely the conversion of food intake from filling in the SQ-FFQ form, which was used to calculate and determine the DII profile, the Somatotype measurement, and the anthropometric (weight and height used for determining the obesity category based on BMI, blood pressure data, and biochemicals, such as MHO and MOO). The Conversion of food intake data obtained from filling in the SQ-FFQ form with the application of nutrisurvey and nutrisoft, then multiply by the DII parameter score for the respective nutrient. After this, the cut-off was seen as either pro-inflammatory or anti-inflammatory (DII Profile) based on a minus or positive value, which indicated the subject's DII category. The minus and positive values indicated an anti-inflammatory and pro-inflammatory DII category. The formula for calculating the DII profile was as follows:

The Total of DII score = Σ (nutrients x DII inflammation score)

An example of the conversion of the SQ-FFQ form to nutrisurvey:
Energy = 2000 kcal, Carbohydrates = 250 gr, then:
DII score = (E x 0.180) + (Carbohydrates x 0.097) + etc.
The total of DII score = Σ (2000 X 0.180) + (250 x 0.097) + etc.

The somatotypes data, which was obtained from the measurements, was calculated according to the established mathematical formula and fell in the somatotype category (as shown in the 13 categories of somatotypes). The somatotype calculation formula according to the Health-Carter was as follows:

\[
\text{Endomorphs} = -0.7182 + 0.1451X - 0.00068X^2 + 0.0000014X^3
\]
\[
\text{Mesomorph} = [(0.858 x HB) + (0.601 x FB) + (0.188 x CAG) + 0.161 x CCG] - (H x 0.131) + 4.50
\]
\[
\text{Ectomorph} = HWR x 0.732 - 28.58 \text{ (if HWR ≥ 40.75)}
\]
\[
= HWR x 0.463 - 17.63 \text{ (if 40.75 > HWR > 38.25)}
\]
\[
= 0.1 \text{ (if HWR ≤ 38.25)}
\]

Description:
\[
X = \text{Addition of TLBK Tricep, subscapular, suprailiac skinfold} \times 170.18 / \text{TB}
\]
\[
\text{Humerus Board (HB), and Femur Board (FB)}
\]
\[
\text{CAG} = \text{(upper arm girth – Triceps skinfold / 10)}
\]
\[
\text{CCG} = \text{(Calf girth – calf skinfold / 10)}
\]
\[
\text{HWR} = \text{body height / cube root of body weight}
\]

Data Analysis
The blood pressure data, fat percentage, BMI derived from the height and weight, as well as the blood samples in the form of HDL, fasting sugar and triglycerides, were used in determining the metabolic types of obesity, namely Metabolically Healthy Obese (MHO) and MOO. After this, the Diet Inflammatory Index (DII) and the somatotypes data were analyzed using univariate and bivariate analysis. The univariate data analysis was used to describe the characteristics of each variable, the frequency distribution based on somatotype and DII category, and the normality test.
The normality test used the Kolmogorov Smirnov assessment. The bivariate analysis determined the differences of each dependent variable, namely the body’s metabolic types, either MHO or MOO, with the independent factors, namely the somatotype body types and DII profiles. The bivariate analysis used a numerical data for the somatotype and DII results. The differences analysis that used is Mann Whitney test.

Results

The Characteristics of subjects

The characteristics table of the subjects in the general category showed the age range of 18-21 years. Based on the anthropometrics data, the weight showed a range of 52 - 103.6 kg, with a median of 69.35 kg and a mean of 72.29 kg. The height data showed a range of 100.5 - 169.1 cm, with a median of 156.60 cm, and a mean of 154.4 cm. The BMI data showed that a range of 25.02 - 61.00 kg/m² with a median of 28.85 kg/m² and a mean of 30.81 kg/m². This showed that the subjects were categorized as obese I and II according to the Asia Pacific BMI classification, with a maximum value for obesity II (61.00 kg/m²). The fat percentage data showed susceptibility of 34.4 - 55.5 with a median of 42.3, and a mean of 42.41. The fat percentage in the subjects indicated obesity with a value that was above normal, (more than 30%). In addition, the waist circumference data showed 80.50 - 114.00 cm with a median of 88 cm and a mean of 89.28 cm. This also showed that the average subjects had a waist circumference value that was above normal, which was more than 80 cm for women.

Table 1. The Characteristics of subjects

<table>
<thead>
<tr>
<th>Variable</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Median</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anthropometrics Data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>52</td>
<td>103.60</td>
<td>69.35</td>
<td>72.29</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>100.5</td>
<td>169.1</td>
<td>156.60</td>
<td>154.4</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>25.02</td>
<td>61.00</td>
<td>28.85</td>
<td>30.81</td>
</tr>
<tr>
<td>Percent of Fat (%)</td>
<td>34.4</td>
<td>55.5</td>
<td>42.3</td>
<td>42.41</td>
</tr>
<tr>
<td>Waist Circumference (cm)</td>
<td>80.50</td>
<td>114.00</td>
<td>88</td>
<td>89.28</td>
</tr>
<tr>
<td>Upper Arm Girth (cm)</td>
<td>27.1</td>
<td>59.9</td>
<td>31.9</td>
<td>32.93</td>
</tr>
<tr>
<td>Calf Girth (cm)</td>
<td>31.20</td>
<td>46.50</td>
<td>39</td>
<td>39.43</td>
</tr>
<tr>
<td>Humerus Width (cm)</td>
<td>6.28</td>
<td>10.85</td>
<td>8.29</td>
<td>8.34</td>
</tr>
<tr>
<td>Femur Width (cm)</td>
<td>6.24</td>
<td>13.02</td>
<td>10.34</td>
<td>10.40</td>
</tr>
<tr>
<td>Triceps Skinfold (mm)</td>
<td>18.95</td>
<td>97.70</td>
<td>26.80</td>
<td>28.11</td>
</tr>
<tr>
<td>Calf Skinfold (mm)</td>
<td>16.10</td>
<td>35.10</td>
<td>24.05</td>
<td>24.53</td>
</tr>
<tr>
<td>Subscapular Skinfold (mm)</td>
<td>13.00</td>
<td>39.00</td>
<td>24.12</td>
<td>24.88</td>
</tr>
<tr>
<td>Suprailiac Skinfold (mm)</td>
<td>14.00</td>
<td>37.90</td>
<td>23.30</td>
<td>23.88</td>
</tr>
<tr>
<td><strong>Biochemicals Data</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Density Lipoprotein</td>
<td>20.00</td>
<td>74.00</td>
<td>47.50</td>
<td>49.43</td>
</tr>
<tr>
<td>Triglycerides (mg/dL)</td>
<td>47.00</td>
<td>519.00</td>
<td>103.50</td>
<td>113.44</td>
</tr>
<tr>
<td>Blood Fasting Sugar (mg/dL)</td>
<td>68.00</td>
<td>121.00</td>
<td>88</td>
<td>89.13</td>
</tr>
</tbody>
</table>
The results showed that 52.8% of the subjects had the metabolic type of MHO and 47.2% had the MOO. In the frequency distribution table, those with metabolic body type MHO were categorized into 3, namely 84.2% Endomorphic - Mesomorph, 2.6% Mesomorph - Endomorph, and 13.2% Mesomorphic - Endomorph. Also, based on the DII profiles, MHO subjects had an anti-inflammatory type of 52.6%, and 47.4% pro-inflammatory. Then the subjects with the MOO metabolic body type were categorized into three types, namely 73.5% Endomorphic - Mesomorph, 8.8% Mesomorph - Endomorph, and 17.6% Mesomorphic - Endomorph. Also, based on the DII profiles, MHO subjects had an anti-inflammatory type of 58.8%, and 41.2% pro-inflammatory. This showed that those with both MHO and MOO were known to have the most of the Endomorphic - Mesomorph and an anti-inflammatory type.

Table 2. Profile of Somatotypes and Dietary Inflammatory Index based on Metabolic Types

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>MHO</th>
<th>MOO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td><strong>Somatotype</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endomorphic - Mesomorph</td>
<td>32</td>
<td>84.2</td>
</tr>
<tr>
<td>Mesomorph - Endomorph</td>
<td>1</td>
<td>2.6</td>
</tr>
<tr>
<td>Mesomorphic – Endomorph</td>
<td>5</td>
<td>13.2</td>
</tr>
<tr>
<td><strong>Dietary Inflammatory Index</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anti-Inflammatory</td>
<td>20</td>
<td>52.6</td>
</tr>
<tr>
<td>Pro-Inflammatory</td>
<td>18</td>
<td>47.4</td>
</tr>
</tbody>
</table>

Differences between Metabolic Types of Obesity and Somatotype

Based on the results of the bivariate analysis, table 3 showed that the test for differences in the metabolic obesity, body types (somatotype), and p-value (Asymp. Sig. (2 tailed), produced endomorphs of 0.901, mesomorph of 0.735, and ectomorph of 0.167. In addition, the median and mean standard deviation showed insignificant differences, namely the endomorph body type of 7.42 and 7.42+±1.03 for MHO and 7.43 and 7.50+±1.08 for MOO, while the mesomorph indicated 9.2 and 9.5 + -2.3 for MHO and 9.2 and 9.1 + -1.8 for MOO, and the ectomorph showed 0.1 and 0.28 + -0.28 for MHO and 0.1 and 0.21 + -0.23 for MOO. From these results, it was stated that there were no significant differences between the metabolic obesity (MHO and MOO) and body types (endomorph, mesomorph, ectomorph) in female adolescents obese.

Table 3. The Differences between Metabolic Types of Obesity and Body Types (Somatotype)

<table>
<thead>
<tr>
<th>Metabolic Types of Obesity</th>
<th>Body Types (Somatotype)</th>
<th>n</th>
<th>median</th>
<th>mean+s.d</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHO</td>
<td>Endomorph</td>
<td>38</td>
<td>7.42</td>
<td>7.42+1.03</td>
<td>0.901</td>
</tr>
<tr>
<td>MOO</td>
<td>Endomorph</td>
<td>34</td>
<td>7.43</td>
<td>7.50+1.08</td>
<td>0.735</td>
</tr>
<tr>
<td>MHO</td>
<td>Mesomorph</td>
<td>38</td>
<td>9.2</td>
<td>9.5+2.3</td>
<td>0.167</td>
</tr>
<tr>
<td>MOO</td>
<td>Mesomorph</td>
<td>34</td>
<td>9.2</td>
<td>9.1+1.8</td>
<td></td>
</tr>
<tr>
<td>MHO</td>
<td>Ectomorph</td>
<td>38</td>
<td>0.1</td>
<td>0.28+0.28</td>
<td></td>
</tr>
<tr>
<td>MOO</td>
<td>Ectomorph</td>
<td>34</td>
<td>0.1</td>
<td>0.21+0.23</td>
<td></td>
</tr>
</tbody>
</table>
Analysis of the Differences between Metabolic Types of Obesity and Diet Inflammatory Index (DII) Profiles

Based on the results of the bivariate analysis, table 4 showed that the test for differences in the metabolic types of obesity MHO and MOO with the DII profiles, (p-value produced Anti-Inflammatory score of 0.901, and 0.791 Pro-Inflammatory). In addition, the median and average standard deviation results showed insignificant differences, namely the Anti-Inflammatory results of -471.94 and -738.63 + -750.81 for MHO and -532.23 and -621.21 + -447.43 for MOO. The Pro-Inflammatory indicated 404.12 and 404.12 for MHO and 388.61 and 434.07 + -175.69 for MOO. From these results, there were no significant differences between the metabolic types of obesity (MHO and MOO) with Diet Inflammatory Index (DII) profiles in female adolescents obese.

Table 4. The Differences between Metabolic Types of Obesity and Diet Inflammatory Index Profiles

<table>
<thead>
<tr>
<th>Metabolic Types of Obesity</th>
<th>DII</th>
<th>n</th>
<th>median</th>
<th>mean±sb</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHO</td>
<td>Anti-Inflammatory</td>
<td>38</td>
<td>-471.94</td>
<td>(-738.63±750.81)</td>
<td>0.901</td>
</tr>
<tr>
<td>MOO</td>
<td></td>
<td>34</td>
<td>-532.23</td>
<td>(-621.21±447.43)</td>
<td></td>
</tr>
<tr>
<td>MHO</td>
<td>Pro-Inflammatory</td>
<td>38</td>
<td>404.12</td>
<td>441.68±171.55</td>
<td>0.791</td>
</tr>
<tr>
<td>MOO</td>
<td></td>
<td>34</td>
<td>388.61</td>
<td>434.07±175.69</td>
<td></td>
</tr>
</tbody>
</table>

Discussion

The study began with the screening of 1260 obese female students at Diponegoro University, Semarang, and 72 subjects that met the inclusions criteria were selected for further data collection. These included the identity, anthropometrics in the form of height, weight, fat percentage, thickness of under-skin fold including subscapular, supra iliac, triceps, and calf, humerus and femur width, upper arm and calf girth, blood pressure, biochemical on the HDL levels, Triglycerides, blood fasting sugar, and food intake data. They were obtained by filling in the SQ-FFQ form. The Anthropometrics, such as fat percentage, body weight and height were used in determining the subject's BMI, blood pressure, while the biochemical data, such as HDL, blood fasting sugar, and triglycerides were used in assessing whether the subject was classified as obese with the MHO or MOO. While other anthropometrics data, such as Thickness of the Under-Skin Fold, calf and upper arm girth, femur width, and humerus width were used in determining the subject's body types. The food intake data obtained through interviews using the SQ-FFQ form was used in ascertaining the subject's Diet Inflammatory Index Profiles.

Then, out of 72 subjects, 38 subjects were MHO, and 34 subjects were MOO. Based on the results of the somatotypes, it was known that 57 subjects were endomorphic – mesomorph, 11 subjects were mesomorph - endomorphy, and as many as four subjects had mesomorphic – endomorph. The results of the food intake interview using the SQ-FFQ form showed that 32 subjects were pro-inflammatory, and 40 subjects were anti-inflammatory. When further elaborated, in the data on the metabolic types of obesity, 38 subjects were classified as MHO, 18 were pro-
inflammatory, and 20 subjects were anti-inflammatory. Meanwhile, 34 subjects were classified as MOO, 14 subjects were pro-inflammatory, and 20 subjects were anti-inflammatory.

After obtaining data on the metabolic types of obesity (MHO and MOO), somatotypes (endomorph, mesomorph, and ectomorph), and the subject's DII profiles, they were analyzed by univariate and bivariate test. The univariate analysis was used to determine the characteristics of each variable, the frequency distribution based on somatotype and DII categorical data, and the normality test. The normality assessment used the Kolmogorov Smirnov test (subjects more than 50). The bivariate analysis determines the differences of each dependent variable, namely the body's metabolic types, either MHO or MOO, with the independent factors, namely the somatotype and DII profiles. The bivariate analysis used numerical data for the somatotype and DII results. Therefore, when the data was normally distributed, it used a parametric test, while Mann Whitney assessment was utilized for the normal.

The results of the univariate analysis showed that the characteristics of the subjects in the general category indicated the age range of 18-21 years. Based on anthropometrics, the weight data showed a range of 52 - 103.6 kg, with a median of 69.35 kg, and a mean of 72.29 kg. The data for height showed a range of 100.5 - 169.1 cm, with a median of 156.60 cm, and a mean of 154.4 cm. The BMI data showed a range of 25.02 - 61.00 kg/m$^2$, with a median of 28.85 kg/m$^2$ and a mean of 30.81 kg/m$^2$. This BMI data showed that the subjects were categorized as obese I and II according to the Asia Pacific BMI classification, with a maximum value for obesity II (61.00 kg/m$^2$). The fat percentage data showed the susceptibility of 34.4 - 55.5, with a median of 42.3, and a mean of 42.41. This indicated obesity with a value that was above normal, (more than 30%). In addition, the waist circumference data showed 80.50 - 114.00 cm with a median of 88 cm and a mean of 89.28 cm. This also showed that the average subjects had a waist circumference value that was above normal, which is more than 80 cm for women.

The results also showed that 52.8% of the subjects had metabolic type of MHO, while 47.2% had MOO. In the frequency distribution table, those with MHO had body types percentage divided into three types, namely 84.2% Endomorphic - Mesomorph, 2.6% Mesomorph - Endomorph, and 13.2% Mesomorphic - Endomorph. Also, based on the DII profiles, MHO subjects had an anti-inflammatory type of 52.6%, and a pro-inflammatory of 47.4%. Then those with the MOO had body types percentage divided into 3, namely 73.5% Endomorphic - Mesomorph, 8.8% Mesomorph - Endomorph, and 17.6% Mesomorphic - Endomorph. Also, based on the DII profiles, MHO subjects had an anti-inflammatory type of 58.8%, and pro-inflammatory of 41.2%. This showed that those with both MHO and MOO metabolic body were known to have most of the Endomorphic - Mesomorph and an anti-inflammatory type.

Based on the results of the bivariate analysis, table 3 showed that the differences in the metabolic obesity and body types (somatotype), p-value (Asymp. Sig. (2 tailed), obtained an endomorphs of 0.901, mesomorph of 0.735, and ectomorph of 0.167. In addition, the median and mean standard deviation showed insignificant differences, namely the endomorph body type showed the results of 7.42 and 7.42+1.03 for MHO and 7.43 and 7.50 +1.08 for MOO, the
mesomorph indicated 9.2 and 9.5 \(+/-2.3\) for MHO and 9.2 and 9.1 \(+/-1.8\) for MOO, and the ectomorph showed 01 and 0.28 \(+/-0.28\) for MHO and 0.1 and 0.21 \(+/-0.23\) for MOO. From these results, there were no significant differences between the metabolic types of obesity (MHO and MOO) with body types (endomorph, mesomorph, ectomorph) in female adolescents obese. These corresponded with the study conducted in Serbia, where there was no significant variation in metabolically healthy obese women. It happened because the endomorph and mesomorph values in both metabolic types of obesity (MHO, and MOO), showed a dominant result compared to the ectomorph value at the same nutritional level. There were no differences in the somatotype of the two metabolic obesity, which tended to have higher endomorph and mesomorph than ectomorph values.\(^{15}\) It was also related to the trend that women with a pear-shaped body type easily store fat in the subcutaneous tissue than in the visceral, therefore, the endomorphic tends to be higher than the ectomorphic value that is often found in men.\(^{32}\)

Based on the results of the bivariate analysis, table 4 showed that the test for differences in the metabolic types of obesity MHO and MOO with the DII profiles, p-value (Asymp. Sig. (2 tailed), obtained an Anti-Inflammatory score of 0.901, and the Pro-Inflammatory score of 0.791. In addition, the median and average standard deviation showed insignificant differences, namely the Anti-Inflammatory results of -471.94 and -738.63 \(+/-750.81\) for MHO and -532.23 and -621.21 \(+/-447.43\) for MOO, the Pro-Inflammatory indicated 404.12 and 404.12 for MHO and 388.61 and 434.07 \(+/-175.69\) for MOO. From these results, there were no significant differences between the metabolic types of obesity (MHO and MOO) with Diet Inflammatory Index (DII) profiles in female adolescents obese. The absence of a significant difference occurred because, at the same nutritional level of obesity, the type of diet or food intake possessed by Indonesian adolescents did not differ much. There was a tendency for adolescents currently having a western type of diet with high-calorie and fat, high sugar and Natrium, low fiber and micronutrients, to depend on foods with high energy density, calorie-dense, and fast food in large portions.\(^{30,33}\) This was evidenced by the research conducted on adolescents in Yogyakarta, where there was a relationship between diet and obesity incidence. On the average, adolescents tend to frequently consume fast food at 3x/week, therefore, increasing obesity incidence among adolescents.\(^{34}\) Furthermore, this was inversely proportional to countries that adopted a healthy diet, such as the Italian Mediterranean feed, which recommends the consumption of grains, vegetables, fruit, fish, coconut oil, and reducing the intake of red meat and products high in calories or fat. The results showed that those feeding on Mediterranean diet had a DII score showing anti-inflammatory at the same nutritional level.\(^{25,33}\) Also, the consumption of high-calorie and low-fiber foods caused more fat deposits. Moreover, it was known that women had higher obesity incidence than men, due to high fat storage under the skin than in the stomach.\(^{30}\)
Acknowledgement

Thank you to Universitas Diponegoro and subjects throughout the faculty involved. This research is founded by PDUPT Research Grant in 2019, The Ministry of Research, Technology, and Education, Indonesia.

References

15. BlüherM.The distinction of metabolically healthy from unhealthy obese individuals.CurrOpinLipidol.2
010;21:38-43,


