The Association of Adiponectin

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Submission date: 14-Oct-2023 01:27PM (UTC+0800)
Submission ID: 2195334837
File name: The_Association_of_Adiponectin.pdf (780.93K)
Word count: 3193
Character count: 17142

Article Type: Research Article

The Association of Adiponectin Serum Level and Body Mass Index among Javanese Obese Adolescents

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Abstract

Introduction : The adiponectin level should decrease in obese people, however, many previous studies' results about its role in obesity still remain controversies. The present study aimed to evaluate the profile of adiponectin serum level among obese adolescents in Javanese population and its correlation with body mass index (BMI)

Methods : A cross-sectional study involving obese adolescents aged 13-18 years old from some schools was conducted from May to September 2020. The subject were determined by using a total population sampling method that met inclusion and exclusion criteria. Anthropometries were measured to count BMI and determine obesity according to CDC 2000. The adiponectin serum level was examined by *ELISA* from blood samples. Data were analyzed using Mann-Whitney Test and Spearmann correlation, with a significance value at $p < 0.05$.

Results: There were 240 obese adolescents involved (52.1% boys) in the present study. There were significant differences in the mean of body-weight and body-height according to gender ($p<0.05$), however, there was no significant difference in BMI based on genders. The median of adiponectin serum level was 13.9 (1.5-46.6) µg/ml, which had no correlation with BMI (*p=0.98; r=0.002)*.

Conclusion: The adiponectin serum level had no significant correlation to body mass index. More studies are suggested to find out several factors that might influence the adiponectin serum level in Javanese population.

Keywords : *Adiponectin, Body Mass Index, Obese Adolescents, Javanese*

Introduction

Adiponectin is an endocrine factor that is synthesized and released from adipose tissue, especially in subcutaneous and visceral fat.[1] Several studies have shown that adiponectin serum level has negative correlation with body fat mass.[2,3] However, others still show controversial results.[4,5]

In obesity, there are adipocytes hypertrophy. This condition, accompanied with high fat diet, might cause DNA methylation. DNA methylation is the addition of methyl group to the atom carbon number 5 from cytosine ring or atom nitrogen number 6 of adenine. Furthermore, it will decrease the adiponectin expression. The same methylation might be happened in adiponectin receptor (AdipoR1 and AdipoR2), thus, it will prevent

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the adiponectin to bind its receptor.[6]

The adiponectin increases insulin sensitivity and glucose uptake, decreases gluconeogenesis, decreases triglyceride production and lipogenesis on the liver and skeletal muscle.[7]

Adiponectin and insulin resistance in obese adolescents will increase glycolysis, gluconeogenesis, hyperlipidemia, and endothelial dysfunction. The process, at last, results in metabolic syndrome.[8] The obesity management and decreasing body weight hopefully will increase adiponectin serum level. [9]

Therefore, it is essential to see the profile of adiponectin serum level in obese adolescent. In conjunction with its association to metabolic syndrome from previous studies, the obese children with lower adiponectin serum level will be more susceptible to develop metabolic syndrome.[10]

The correlation of adiponectin serum level and BMI might differ according to race, age, and gender. To the best of the researchers' knowledge, the study of adiponectin serum level among obese adolescents in Javanese population, Indonesia, is still limited.

Materials and Methods

Cross-sectional research was conducted on obese adolescents from 12 junior and senior high schools in Surabaya and Sidoarjo city, East Java, Indonesia, from May to September 2020. The subjects were determined using a total population sampling method that met the inclusion and exclusion criteria. The inclusion criteria were adolescents aged 13-18 years old with obesity problems. Moreover, both students and their parents voluntarily participated in the study. Adolescents with a history of corticosteroid consumption for more than two to six months before the study was carried out or the subjects got sick were excluded.

Obesity was established based on the CDC 2000 criteria, which was body mass index (BMI) for age and gender above the 95th percentile. Body weight was measured using a digital weight scale (Seca, Germany No ref. 224 1714009) with a precision of 0.1 kg. The subjects were standing with barefoot and using thin clothes during bodyweight measurement. Height measurement was performed using stadiometers (Seca, Germany No ref. 224 1714009), with an accuracy of 0.1 cm. During height measurement, the subjects were standing with barefoot without using hat. The stadiometer was used to measure the height from heel to vertex. The results were presented as 'meter'. BMI was calculated by the following formula:

$$BMI = \frac{Body\ weight\ (kg)}{Body\ height\ (m)^2}$$

The subjects had been fasting for 12 hours before the blood samples were taken. The adiponectin serum level was examined using 5 ml venous blood. The blood samples were centrifuged until the serum were achieved and saved in -70^{0}C for further analysis. The analysis of adiponectin serum level used ELISA (*Enzyme Linked Immuno-Sorbent Assay)* of DBS (*Diagnostic Biochem Canada CAN-APN-5000)* kit and presented as µg/ml.

Bodyweight, body height, and adiponectin were described as ± mean (*M*) and standard deviation (*SD*). The correlational analysis between adiponectin serum level with gender and age group was carried out using *Mann-Whitney test.* The correlation between BMI and adiponectin serum level was analyzed using *spearman rho,* $p<0.05$ considered as significant. All statistical analysis were conducted using SPSS 21.0.

This study had got permission from the ethics committee of The Faculty of Medicine, Airlangga University No. 115/EC/KEPK/ FKUA/2020. Before the subject recruitment, the researchers had explained to the subjects and their parents about the general research information and the consent.

Results

There were 240 obese adolescents involved in this study, consisting of 125 (52.1%) boys and 115 (47.9%) girls. Based on age group, there were two groups namely those less than 15 years old and those 15 years old or older. 44.6% subjects were less than 15 years old.

Table 1. Characteristic of the subjects.

Characteristics	Gender	Mean ± SD	p
Weight	Boys	87,4 ± 14,6	0,00
	Girls	81,4 ± 11,7	
Height	Boys	164,1 ± 7,9	0,00
	Girls	156,9 ± 8,1	
BMI	Boys	32,4 ± 4,2	0,54
	Girls	32,9 ± 4,7	

The median of adiponectin serum level from all subjects was 13.9 (1.5-46.6) µg/ml and the mean amounted of 15.7 µg/ml±7.6. Table 2 shows that the mean of adiponectin serum level among boy adolescents was lower than girls and it was not statistically significant. Furthermore, from the classified age, the mean of adiponectin serum level in less than 15 years old group was slightly lower than the others. Figure 1 confirms that there was no correlation between adiponectin serum level with body mass index (*p=0.98; r=0.002)* from this study.

Table 2. The adiponectin serum level according to gender and age groups.

		Mean of Adiponectin Serum Levels±SD	p
Gender	Boy	14,8 ± 6.8	0,09
	Girl	16.7 ± 8.4	
Age Group	< 15 years old	15.3 ± 7.3	0,59
	≥≥ 15 years old	15.9 ± 7.9	

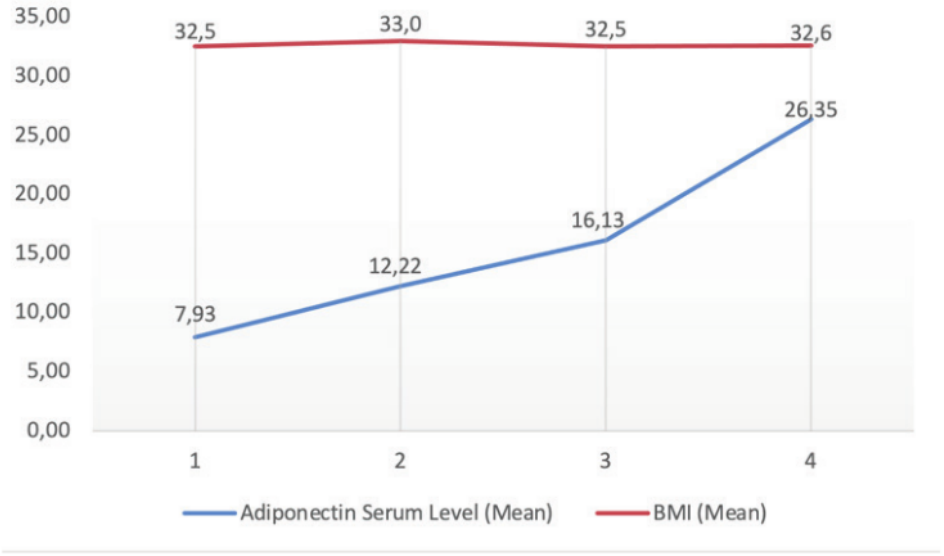

Figure 1. The average of body mass index (BMI) based on adiponectin serum level (in quartiles)

Discussion

The decrease of adiponectin serum level in obesity is caused by the failure of transcription regulation with unclear mechanism. Generally, the adiponectin expression is ruled by transcription and translation process. In obesity, adipocyte hypertrophy and inflammation disturb the process. The *DNA-metyltransferase-1* (DNMT1) expression is increasing and causes hyper methylation on adiponectin promoter. As a result, it can inhibit adiponectin production.[11]

This study gave the result of median adiponectin serum level of 13.9 (1.5-46.6) µg/ml and the mean of 15.7 µg/ml±7.6 from all subjects. This value was higher than previous studies conducted by Asayama *et al,* who stated 6.4 µg/ml±0.6, Lanas *et al* with 9.9 µg/ml±3.2, and Widjaja *et al* with 7.84 µg/ml±3.8.

Several factors might influence adiponectin serum level such as gender, obesity, physical activity, dietary pattern, and genetic.[13,14] Ethnicity is one of the independent factor that might influence adiponectin level. The adiponectin serum level was significantly different between Iranian, Indian, and European although they were living in Australia. The Europeans had the highest mean of adiponectin serum level of 16.8 (14-20.2) µg/ml).[15]

Similar to the result of the present study in adiponectin serum level according to gender, several previous studies also showed that it was lower in boys than girls.[13,16,17] The insignificant difference of our result was the same as Woo *et al*, and might be happened due to our samples only included obese adolescents.[18]

Meshkini *et al* found the adiponectin serum level was initially lower in boys. However, after it was corrected with age, BMI, and fat mass, and waist circumference, there were no differences between both genders. Based on that result, the adiponectin serum level might be influenced by percentage of fat mass and pubertal state. The percentage of fat body mass in girls is increasing during puberty. On the contrary, it is constant in boys.[19]

Estrogen might increase subcutaneous fat, on the other hand, testosterone is more influencing the visceral fat. Cnop *et al* observed that visceral fat had association with lower adiponectin level.[20,21]

The adiponectin level in this study was not significantly different according to age classification.

In contrast, other studies could describe the decrease of adiponectin level during puberty. Thus, the older adolescent would have lower adiponectin serum level.[22] Otherwise, on adults, Obata *et al* found the positive correlation between adiponectin and age, either in healthy or patient with type 2 diabetes mellitus.

In this study, there was no significant correlation between serum adiponectin and body mass index. Awede *et al* found the same result in west African without diabetes. In male subjects, the lower adiponectin level was in subjects with normal BMI and obesity. On the other hand, on female group , subjects with overweight had the highest adiponectin level but subjects with obesity had the lowest adiponectin serum level. [23] Study in Indian population also portrayed the same result.[24]. Our result was in contrast with other studies that stated the BMI had negative correlation with adiponectin serum level.[22,25,26]

The racial distinction might play an important role. Mente *et al* found negative correlation between BMI and adiponectin serum level on subjects from Chinese, European, and Aborigin population, whereas the same correlation did not find in South Asian population.[27] Khoo *et al,* also found different rate of negative correlation between BMI and adiponectin serum level in the Chinese, Malay, and Indian population that lived in Singapore. The most significant decrease of adiponectin serum level based on BMI happened in Chinese population.[28]

The insignificant correlation from this study might be caused by the difference of fat mass distribution, dietary patterns, and genetic factor among our subjects with other studies. The limitation of this study was only involved obese adolescents. Moreover, the physical activity and dietary patterns have not assessed in this study yet. Further studies should include normal and overweight adolescents, evaluation of physical activity and dietary patterns.

Conclusion

The concern to adiponectin serum level in obese adolescent is increasing due to its impact on insulin resistance and developing metabolic syndrome. Results of the decrease of adiponectin level related to obesity is still controversy. The adiponectin serum level in this study had a wide range, with no significant correlation to body mass index.

Our average result of adiponectin serum level among obese adolescents was higher than other previous studies. It also did not have significant correlation with age and gender. More studies are needed to find out several factors that might influence the adiponectin serum level in Javanese population such as physical activity, dietary patterns, and genetic.

Acknowledgements: Authors are grateful to the 12 high schools in Surabaya and Sidoarjo who volunteered to become the research respondents. Moreover, they would thank all headmasters and counselling teachers who gathered our respondents and their parents with us before and during the data collection

Ethical Clearance - This study had got permission from the ethics committee of The Faculty of Medicine, Airlangga University No. 115/EC/KEPK/ FKUA/2020. Before the subject recruitment, the explanation was done to the subjects and their parents about the general research information for getting their consent.

Source of Funding – Self

Conflict of Interest – Nil

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