

## Some factors related to lipid profile in obese children at junior high schools in Manado

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### Abstract

**Background** Factors related to lipid profile in obese children are calorie intake, fast food consuming habit, gender, physical activity, television (TV) watching, sleep duration, and visceral fat distribution.

**Objective** To determine factors related to lipid profile in obese children at junior high school.

**Methods** We studied obese children aged 11-<15 years from November 2004 to February 2005 at junior high school in Manado city. One hundred and seven junior high school children aged 11-<15 years were enrolled in this study, excluding children with acute disease, having hypothyroidism, diabetes mellitus, chronic renal disease, liver disease, and using corticosteroid. The risk factors considered were calorie intake, fast food consuming habit, gender, physical activity, TV watching, sleep duration, and waist circumference. The outcome measures were total cholesterol, LDL, HDL, non-HDL cholesterol, and triglyceride. Data was analyzed using  $\chi^2$ , *fisher exact test*, Spearman's rho and multiple linear regression analysis with stepwise procedure.

**Results** The prevalence of increased total cholesterol was 28%, LDL 44%, triglyceride 16.8%, low HDL cholesterol 6.5%, and non-HDL was 23.3%. There were statistically significant relationship between gender, calorie intake, fast food consuming habit, physical activity, TV watching, sleep duration, and total cholesterol. There were also statistically significant relationship between calorie intake, habit of consuming fast food, physical activity, TV watching, sleep duration, and LDL cholesterol. Fast food consuming habit and TV watching also had statistically significant relationship with HDL cholesterol. There were statistically significant relationship between calorie intake, physical activity, TV watching, and sleep duration with non-HDL cholesterol.

**Conclusion** Duration of TV watching, sleep duration, less physical activity and waist circumference  $\geq 98$  percentile are correlated with hyperlipidemia in obese children. [Paediatr Indones 2007;47:166-171].

**Keywords:** *Obese children, risk factors, lipid profile, television*

Obesity is a major nutritional problem. It is often found in developed countries and tends to be more apparent than that in the developing countries. Several years ago, cases of obesity in children started to appear in Indonesia, especially in the metropolitan. However, the data of obesity problem in children is still very limited.<sup>1</sup>

Obesity in children will persist until they reach adolescent period, only 4% will be normal in adult life, 60% become moderate obesity, and 84% become severe obesity. It may become risk factors of diseases such as hypertension, cardiovascular disease, diabetes mellitus, and hyperlipoproteinemia.<sup>2-4</sup>

The clinical cardiovascular manifestation in obesity is correlated with the changing of serum lipid profile. It began in childhood period and most of them were asymptomatic.<sup>5,6</sup> The abnormality of fat and lipoprotein in obese patient generally are the increase of Low Density Lipoprotein (LDL) cholesterol, hypertriglyceridemia, and decrease of High Density Lipoprotein (HDL) cholesterol.<sup>7</sup>

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Some factors related to lipid profile in obese children i.e. calorie intake<sup>8</sup>, sex<sup>9</sup>, TV watch<sup>10</sup>, sleep duration<sup>11</sup>, physical activity<sup>12</sup>, and visceral fat distribution.<sup>13</sup> This study was aimed to determine factors related to lipid profile in obese children at junior high school.

## Methods

This was an observational descriptive analytical correlation form using a cross sectional study design. This study took place at junior high schools in sub-districts of Wanea, Sario, and Malalayang, Manado, from November 2004 to February 2005. Samples were chosen by two stage cluster random sampling. In this study, there were 140 obese children aged 11- <15 years old, but only 116 children gave back the questionnaire and got permission from parents. During the study period, there were only 107 children who met the study criteria and were able to be statistically analysed.

The inclusion criteria were junior high school children aged 11- <15 years old whose parents agreed to enroll in this study. We excluded children with acute disease, having hypothyroidism, diabetes mellitus, chronic renal disease, liver disease, and those who were on corticosteroid treatment.

Obesity was defined as body mass index  $\geq 95$  percentile based on CDC 2000 chart. Lipid profile was described as **acceptable total cholesterol level** <170 mg/dL, **borderline** 170-199 mg/dL, **high** >200 mg/dL; **acceptable LDL cholesterol level** was <110 mg/dL, **borderline** 110-129 mg/dL, **high** >130 mg/dL.<sup>14</sup> **Normal triglyceride level** in male and female was <138 mg/dL and **high** >138 mg/dL.<sup>15</sup> **Low HDL level** was <35 mg/dL, **normal** was 35-84 mg/dL, and **high** HDL level was >84 mg/dL.<sup>16</sup> Non-HDL cholesterol level = total cholesterol – HDL cholesterol level with cut off point = 30 mg/dL + cut off point of LDL cholesterol level.<sup>17</sup>

Calorie intake was determined based on 24-hour food recall method.<sup>18</sup> Fast food consuming habit was defined as the habit of children in consuming fast food such as hamburger, fried chicken, and pizza, with criteria as follows: **frequently** was once in a week, **sometimes** was once in >1 week-3 months, and **rarely** was once in  $\geq 3$  months.<sup>19</sup>

Physical activity was categorized as the kind of sports and activities done by the children. Physical ac-

tivity was divided into: less, adequate and over. **Less**: no sports at all in a week or only mild activities (fishing, billiard, walking in 20 minutes, jogging) to less than 3 times a week in the last 3 weeks. **Adequate**: 3-5 times in a week or moderate sports (karate, judo, walking > 20 minutes, running 12 minutes/1.5km) to heavy sports (badminton, basket ball, football, aerobics, table tennis, swimming, running 10 minutes/1.5 km) with a frequency <3 times in a week in the last 3 weeks with a duration of activities >20 minutes. **Over**: moderate to heavy sports with a frequency of 4-5 times a week in the last 3 weeks with a duration of >20 minutes.<sup>11</sup>

Duration of TV watching was defined as hours spent by children watching television. It was divided into **less**: <2 hours/day, **moderate**: 2-4 hours/day, **over**: >4 hours/day.<sup>10</sup> Duration of sleep was defined as the duration of sleep per day consisted of duration of night sleep and nap with criteria **less**: <8 hours, **normal** 8-10 hours, **more**: >10 hours.<sup>20</sup> Food recall method was applied using the domestic measurement units (plates, glasses, spoons) and based on meal noted since the last day (24-hour recall) within 3 consecutive days. Waist circumference for central obesity was >98 percentile according to the age and sex. The statistic was analyzed by multiple linear regressions with stepwise procedure for relationship of some factors to lipid profile.

## Results

Boys tended to have higher cholesterol level compared to girls (35.1% vs 20%) (**data not included**). Obese children with high calorie intake had high total, LDL-, and non-HDL cholesterol level (**data not included**). Obese children who frequently consumed fast food had high total and LDL cholesterol level (**data not included**). Obese children with less activity had high total, LDL-, and non-HDL cholesterol level (**data not included**). Obese children who watched TV =4 hours daily had high total, LDL-, non-HDL cholesterol and triglyceride level, but low HDL cholesterol level (**data not included**). Obese children who slept >10 hours daily had high total, LDL-, non-HDL, cholesterol and triglyceride level (**data not included**).

Duration of TV watch and sleep and waist circumference simultaneously had significant relationship with total and LDL cholesterol level (**Table 2**).

Gender, waist circumference, duration of sleep and TV watch, habit of consuming fast food, physical activity and calorie intake did not have significant relationship with HDL cholesterol level (Table 3).

Significant relationship had been shown in the duration of TV watch with triglyceride level, as well as in the duration of TV watch, duration of sleep, and physical activity with non HDL cholesterol level (Table 4).

## Discussion

Lipid profile in obese patients generally abnormal as shown by increased LDL cholesterol, hypertriglyceridemia, and decreased HDL cholesterol.<sup>7</sup> Hyperlipidemia in obese children is one of the risk factors for the development of cardiovascular disease in the future. In this study, obese children with increased total cholesterol were 28%, increased LDL cholesterol was 44%, increased triglyceride was 16.8%, decreased HDL cholesterol was 6.5%, and increased non-HDL cholesterol 23.3%. Hidayati et al<sup>21</sup> found that obese children with increased total

cholesterol were 88.1%, and with increased triglyceride was 10%. The Bogalusa Heart Study found that gender and waist circumference were responsible for 7.7% of variant of non-HDL cholesterol.<sup>22</sup>

Increased calorie intake acts as synergetic factor in obesity that affects the lipid and serum lipoprotein level.<sup>19</sup> This study's result indicated that there was a relationship between calorie intake and total cholesterol, LDL and non-HDL level in obese children.

Medical Research Council in London studied the relationship between the fast food consuming habits with cholesterol level. They reported that frequent fast food consumption would have a great effect on the prevalence of obesity and hyperlipidemia.<sup>23</sup> Our study indicated that there were relationship between fast food consuming habit with total cholesterol, LDL, and HDL in obese children. Research in England (2003) indicated that 26% of obese children who consumed fast food had high LDL cholesterol.<sup>24</sup>

Android fat pattern in male which is defined as distribution of fat mostly in the upper body region, related to poor metabolic predictor, while gynoid fat pattern in female is relatively large fat in hip and thigh region and is related to lower risk of metabolism

**Table 1.** Subject's characteristics

No	Subdistrict	Junior High School	Students	Obese	Subject
1.	Wanea	SMP Negeri 4	1035	37	27
		SMP Negeri 7	875	20	15
		SMP Kristen Diakonia	40	1	1
		SMP Kristen Hati Kudus	235	7	7
		SMP Kristen Zaitun	78	-	-
2.	Sario	SMP Kristen El Shaddai	33	-	-
		SMP Kristen Advent II	215	7	7
3.	Malalayang	SMP Negeri 8	1010	21	14
		SMP Khatolik Rafael	539	30	23
		SMP Khatolik Theresia	404	12	9
		SMP Immanuel Bahu	105	5	4
T o t a l			4569	140	107

**Table 2.** Result of regression analysis of total & LDL cholesterol

Total	Coefficients	T	P
Constant	51.41	2.12	0.36
TV viewing (X <sub>5</sub> )	10.85	4.46	0.000
Duration of sleeping (X <sub>6</sub> )	5.74	2.85	0.005
Waist circumference (X <sub>7</sub> )	33.72	2.35	0.02
LDL			
Constant	10.12	0.46	0.64
TV viewing (X <sub>5</sub> )	8.08	3.69	0.000
Duration of sleeping (X <sub>6</sub> )	5.76	3.18	0.002
Waist circumference (X <sub>7</sub> )	30.19	2.34	0.021

**Table 3.** Regression analysis of HDL cholesterol

	Coefficients	T	P
Constant	43.93	4.08	0.00
Sex (X <sub>1</sub> )	-2.95	-1.86	0.067
Waist circumference (X <sub>7</sub> )	2.10	-0.50	0.62
Duration of sleeping (X <sub>6</sub> )	-0.014	-0.23	0.81
TV viewing (X <sub>5</sub> )	1.30	1.84	0.07
Consume fast food (X <sub>3</sub> )	-0.83	-0.48	0.63
Physical activity (X <sub>4</sub> )	0.80	0.46	0.65
Calorie intake (X <sub>2</sub> )	-0.017	-0.32	0.75

**Table 4.** Regression analysis of triglyceride & non HDL cholesterol

	Coefficients	T	P
Triglyceride			
Constant	63.41	4.84	0.000
TV viewing (X <sub>5</sub> )	8.92	2.89	0.005
Non HDL			
Constant	72.40	3.40	0.001
TV viewing(X <sub>5</sub> )	8.50	3.49	0.001
Duration of sleeping(X <sub>6</sub> )	5.00	2.51	0.01
Physical activity(X <sub>7</sub> )	-14.29	-2.44	0.02

disorder.<sup>16</sup> Our study showed that there was a relationship between sex and total cholesterol. Lewis *et al*<sup>25</sup> found that female triglyceride transportation level was higher than that of male, it might be caused by high lipase lipoprotein activity in adipose tissue.

In general, obese individual is less active than individual with normal body weight. Low physical activity can increase lipoprotein. Physical activity is related to sport activity. Rhythmic exercise will burn calorie, stimulate metabolism of lipid, decrease body fat, and increase vascular health.<sup>9</sup> Our study indicated that there was a relationship among physical activity with total cholesterol, LDL, and HDL level. This was similar to that reported by Craig *et al*<sup>11</sup> and Franklin *et al*.<sup>12</sup>

Long duration of watching television will decrease physical activity, decrease energy expenditure and lead to obesity and hypercholesterolemia.<sup>11</sup> Our study showed that there were relationship between TV watch and total cholesterol, LDL, HDL, triglyceride and non-HDL cholesterol level. Wong *et al*<sup>26</sup> found that watching TV =2 hours per day was correlated to the prevalence of hypercholesterolemia and watching TV >4 hours per day was the greatest predictor of hypercholesterolemia compared to other factors such as positive family history or non-genetic predictor like diet and nutritional status.

Excessive sleeping will lead to decrease physical activity and is resulted in obesity and hypercholes-

terolemia.<sup>20</sup> Obese children who slept more than 10 hours a day had high level of total cholesterol, LDL, triglyceride and non-HDL cholesterol. This finding was similar to that of their study<sup>27</sup>.

Fat distribution in obese children is related to lipid and serum lipoprotein level. Waist circumference can be used to predict the quantity of inner fat tissue which has direct relationship with fat-free mass. It is an important variable because it is related to intra-abdominal fat and metabolic complication, and lipid profile.<sup>28</sup> This study indicated that there was no relationship between waist circumferences and total cholesterol, LDL, HDL, triglyceride, and non-HDL cholesterol level. Freedman *et al*<sup>29</sup> found that body fat distribution on central region or abdomen was related to triglyceride, LDL, and HDL level. Bermingham *et al*<sup>30</sup> found the small result with the one reported in our study. Study on fat distribution among children and adolescents is not that simple because there are significant changes in waist circumference, skin-fold thickness, and lipoprotein level during growth and development.<sup>29</sup> Furthermore, the amount of intra-abdominal fat, which may have primary role in adverse health outcomes, is small before adulthood. Children and adolescents, compared to adults, generally have relatively low quantity of intra-abdominal fat. It can be expected that only in more severe cases, the absolute amount

of visceral adipose tissue will have an impact on lipid metabolism.<sup>6</sup> However, the additional regression model showed that the duration of television watch and sleep, and waist circumference can be associated with total cholesterol and LDL cholesterol. We realized that cross sectional study design without control group was the limitation of our study.

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