The Relationship of Serum Resistin Concentration and Body Mass Index (BMI) of Obese Adolescent in Mahasarakam Province

Udomsak Mahaweerawat,1 Thidharat Somdee,2 Suvimol Sungkamanee,2 Suneerat Yangyuen,2 Natchaporn Pichainarong1

Background

Resistin is a novel adipocytokine that is produced by adipocytes and may be involved in the regulation of energy metabolism and insulin sensitivity. The relationship between serum resistin concentration and body mass index (BMI) in obese adolescents has not been well studied. The present study aimed to investigate the relationship between serum resistin concentration and BMI in obese adolescents in Mahasarakam Province.

Materials and Methods

A total of 77 obese adolescents were included in the study. Serum resistin concentration was measured using an enzyme-linked immunosorbent assay (ELISA) method. BMI was calculated as weight (kg) divided by height (m) squared. The relationship between serum resistin concentration and BMI was assessed using Pearson's correlation coefficient.

Results

The mean serum resistin concentration was 15.27 ± 6.89 ng/mL and the mean BMI was 27.67 ± 4.24 kg/m². There was a significant positive correlation between serum resistin concentration and BMI (r = 0.69, p < 0.001).

Conclusion

The results of this study suggest that serum resistin concentration is positively correlated with BMI in obese adolescents. Further studies are needed to clarify the potential role of resistin in the regulation of energy metabolism and insulin sensitivity in obese adolescents.
Abstract

Resistin is a newly discovered peptide hormone with impact on insulin sensitivity was proposed as a new mechanism to explain the pathogenic sequence of adipocyte–obesity–insulin resistance. This research aimed to determine serum resistin concentration levels in adolescents and the relationship between resistin concentration and body mass index (BMI), in selected high school students in Mahasarakam province. The research protocol and 77 consented students who enrolled in this study were ethical approved by Mahasarakam research ethic committee division. The students weight, height, BMI, fasting blood sugar (FBS) and triglyceride (TG) were examined during March to June 2008.

This study found that: 16 male and 61 female adolescent students with average weight 71.27±13.87 kg, height 1.6±0.07 m, BMI 27.67±4.24 kg/m², biceps skinfold thickness 15.27±6.89 mm, triceps skinfold thickness 23.55±7.54 mm, TG 77.13±43.92 mg/dL, FBS 87.74±8.21 mg/dL and resistin 5.69±0.93 mg/dL. The weight and height of male is higher than female (p =0.003, p<0.001 respectively), but biceps skinfold thickness, triceps skinfold thickness, TG of female is higher than male. Resistin was detected in female; concentrations ranged from 3.83 mg/dL to 7.82 mg/dL and in male 3.91 mg/dL to 6.52 mg/dL. In female resistin levels were higher (5.87±0.84) than male (4.98±0.94) (p<0.001).

The relationship analysis found that: resistin serum levels in both male and female related to BMI, biceps skinfold thickness, triceps skinfold thickness statistical significantly. The furthermore it should be the parameter used as association of serum resistin with markers of obesity (eg. weight, BMI, FBS) was strongly statistical significantly (p<0.05) in both gender groups, this may be determinant to indicated insulin resistance prior fasting blood sugar was elevated, but vise-versa for FBS in male.

Keyword: resistin, body mass index (BMI) and adolescent


Introduction

Increasing prevalence of obesity in childhood and adolescent necessitates the development of effective counter strategies to change lifestyles and to reduce co-morbidities. Increased obesity in childhood and adolescent is associated with insulin resistance. Insulin resistance with consequent hyper-insulinemia has a central role in the pathogenesis of many diseases including obesity, type 2 diabetes mellitus, hypertension and dyslipidemia.

Recent investigations have been focused on a family of adipose derived cellular mediators (adipocytokines), including tumor necrosis factor-α (TNF-α), interleukin-6 (IL-6) and leptin. The importance of these agents is that they are produced by fat cells and are known to play a key role in the complex interorgan communication network, which appears to modulate intermediate metabolism and energy balance. Recently, an adipocytokine (resistin) is described as a secretory product of adipose tissue. Some animal model and several human studies suggested that resistin was related to obesity and glucose metabolism while some studies in human did not find such relationship.

However, the biological activity of resistin is poorly understood. Resistin, a peptide hormone produced by mature adipocytes in the rodent, regulates insulin sensitivity in both skeletal muscle and hepatic
tissue. In vitro study indicated that the expression of the resistin was associated with increased serum fatty acids and muscle triglycerides, impaired skeletal muscle glucose metabolism, and glucose intolerance. Adenovirus-mediated chronic “hyper-resistinemia” leads to whole-body insulin resistance involving impaired insulin signaling in skeletal muscle, liver, and adipose tissue, resulting in glucose intolerance, hyperinsulinemia, and hypertriglyceridemia. Recently the novel feature of resistin as a pro-inflammatory has molecule emerged. Several previous studies have highlighted the associations between resistin and inflammatory factors, such as TNF-α, IL-6 and C-reactive protein. Silswal et al. recently demonstrated that human resistin stimulates the synthesis and secretion of pro-inflammatory cytokines TNF-α and IL-12 in macrophages via a nuclear factor-NF-kappa B-dependent pathway.

Serum resistin levels were found to be elevated in rodent models of obesity such as ob/ob-, db/db-mice, or diet-induced obesity, while others and more recent studies showed that resistin expression and secretion were decreased in a variety of obese rodent models. There is slightly more existed evidence of increased resistin expression associated with insulin resistance in rodents, pointing towards a potential role of resistin in obesity associated insulin resistance. The putative involvement of resistin in obesity and/or insulin resistance in human is largely controversial. Although some studies report positive correlations between resistin and obesity or insulin resistance, others did not concur. The range of serum resistin levels and its physiological have so far not been identified as indicator for interpretation of clinical studies while the investigation of still unclear relationship between resistin concentration and other mutual biochemical parameter in obese adolescent. Because of children are relatively free from co-morbidity compared with adults, this examination may revealed the marker of students obesity and fasting blood sugar levels.

Objective

The determination of serum resistin concentration level will be illustrated as the baseline for obese adolescent in Mahasarakham Province, Thailand.

Specific Objectives

1. To determine serum resistin concentration level in adolescent.
2. To study the relationship between resistin concentration and related parameters such as body mass index (BMI), biceps skinfold thickness, triceps skinfold thickness and serum triglyceride.

Material and Method

Subject: Obese adolescents from high school were consent volunteers in this study from March 1 2008 to June 30 2008. Fasting serum samples of obese adolescents were obtained from students in Mahasarakham Province, Thailand. All of the blood samples were drawn after overnight fasting and plasma samples were kept at -80 °C for subsequent assay. An informed consent for measurements and blood analyses was obtained from all guardians of the adolescents. The study protocol was approved by the ethical committee of the Mahasarakham University.

Anthropometrical measurements:
Anthropometric parameters measured included height, weight, left mid-arm circumferences, triceps skinfold thickness, biceps skinfold thickness and the body mass index (BMI).

Biochemical measurements and tests:
Plasma biochemical parameters were also measured after overnight fasting including fasting blood sugar and triglycerides which were evaluated by Mahasarakham hospital professional staff.

Serum resistin : Radio
Immunometric assay was used to determine serum resistin levels. The measurement was performed with
commercial kits, Human Resistin ELISA Kit (LINCO Research, Inc, St., Charles, Missouri, USA).

**Statistical methods**: The data were analyzed. Normal distribution data were expressed as mean and standard deviation. The correlations between indices were assessed by Pearson correlation. Some of parameters, such as age, show a non-normal distribution, nonparametric statistical were applied for all parameters under 95 per-cent confidential interval of Spearman rank test. and descriptive statistics by medians and quartiles.

**Result**

The determination of serum resistin concentration level and investigated relationship between serum resistin levels and related parameter of obese adolescents in Mahasarakham Province, Thailand.

**The serum resistin levels and related parameters data of the obese adolescents.**

The anthropometric data of the obese adolescents are showed in Table 1. A total of 77 individual participated in this study, including 16 male and 61 female participants.

**Table 1** The anthropometric data of the obese adolescents.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Male (n=16)</th>
<th>Female (n=61)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (kg)</td>
<td>80.34 ± 17.48</td>
<td>68.89 ± 11.82</td>
</tr>
<tr>
<td></td>
<td>(61.60 - 111.30)</td>
<td>(42.00 - 96.50)</td>
</tr>
<tr>
<td>Height (m)</td>
<td>1.69 ± 0.06</td>
<td>1.58 ± 0.05</td>
</tr>
<tr>
<td></td>
<td>(1.62 - 1.82)</td>
<td>(1.47 - 1.68)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>27.79 ± 5.25</td>
<td>27.64 ± 3.98</td>
</tr>
<tr>
<td></td>
<td>(21.83 - 36.34)</td>
<td>(18.06 - 36.24)</td>
</tr>
<tr>
<td>Biceps skinfold thickness (mm)</td>
<td>11.81 ± 8.94</td>
<td>16.18 ± 6.00</td>
</tr>
<tr>
<td></td>
<td>(2.50 - 29.00)</td>
<td>(5.50 - 34.50)</td>
</tr>
<tr>
<td>Triceps skinfold thickness (mm)</td>
<td>18.20 ± 10.93</td>
<td>24.96 ± 5.69</td>
</tr>
<tr>
<td></td>
<td>(5.93 - 35.83)</td>
<td>(13.00 - 36.16)</td>
</tr>
<tr>
<td>FBS (mg/dL)</td>
<td>89.38 ± 6.38</td>
<td>86.97 ± 8.59</td>
</tr>
<tr>
<td></td>
<td>(78.00 - 98.00)</td>
<td>(72.00 - 114.00)</td>
</tr>
<tr>
<td>TG (mg/dL)</td>
<td>76.00 ± 40.62</td>
<td>77.43 ± 45.06</td>
</tr>
<tr>
<td></td>
<td>(23.00 - 161.00)</td>
<td>(30.00 - 201.00)</td>
</tr>
<tr>
<td>Resistin (ng/ml)</td>
<td>4.98 ± 0.94</td>
<td>5.87 ± 0.84</td>
</tr>
<tr>
<td></td>
<td>(3.91 - 6.52)</td>
<td>(3.83 - 7.82)</td>
</tr>
</tbody>
</table>

FBS = Fasting blood sugar
TG = Triglyceride
The means for weight, height, BMI and FBS of males were higher than those of female, but biceps skinfold thickness, triceps skinfold thickness, triglyceride of females were higher than those of male.

The correlations between serum resistin level and related parameters.
Correlation analysis revealed a significant BMI dependence of resistin serum levels in both male and female (Table 2). Additionally, we observed a close correlation between resistin levels and biceps skinfold thickness, triceps skinfold thickness in both male and female. The association of serum resistin with markers of obesity such as weight and BMI was strongly significant in both groups. No statistical significant correlation was found between serum resistin levels and FBS in male, but significant in female.

Discussion and Conclusion
This study illustrated serum resistin levels in obese adolescents and investigated the relationships between serum resistin levels and related parameter such as BMI, biceps skinfold thickness, triceps skinfold thickness and serum triglyceride in obese adolescents.

The serum resistin levels were significantly correlated with BMI (r=1.00, p<0.001) and were significantly correlated with biceps skinfold thickness (r=0.92, p<0.001), triceps skinfold thickness (r=0.96, p<0.001) except serum TG in male. At a given BMI, a high bicep and triceps skinfold thickness are associated with peripheral obesity. The distribution of body fat could play a role in determination of resistin plasma levels as proposed by Mc-Ternan et al.¹⁰ who found higher resistin mRNA expression in abdominal fat than in thigh. Resistin serum levels were increased in obesity and resistin gene expression was induced during adipocyte differentiation.¹¹ Azuma et al.¹² found that serum resistin level were higher in obese than in lean individuals and that resistin levels were significantly correlated with BMI. Schaffler et al.¹³ also found a positive correlation between serum resistin levels and BMI in healthy individuals. Gerber et al.¹⁴ found that resistin was significantly correlated with BMI higher in girls than in boys. Therefore, the relationship between serum resistin levels and BMI investigated in this study

Table 2 Correlation between serum resistin level and parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Male (n=16)</th>
<th>Female (n=61)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r p-value</td>
<td>r p-value</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>1.00 &lt; 0.001**</td>
<td>1.00 &lt; 0.001**</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>0.96 &lt; 0.001**</td>
<td>0.93 &lt; 0.001**</td>
</tr>
<tr>
<td>Height (m)</td>
<td>0.28 0.298</td>
<td>0.26 0.039*</td>
</tr>
<tr>
<td>Biceps skinfold thickness (mm)</td>
<td>0.92 &lt; 0.001**</td>
<td>0.77 &lt; 0.001**</td>
</tr>
<tr>
<td>Triceps skinfold thickness (mm)</td>
<td>0.96 &lt; 0.001**</td>
<td>0.73 &lt; 0.001**</td>
</tr>
<tr>
<td>FBS (mg/dL)</td>
<td>0.33 0.211</td>
<td>0.37 0.003**</td>
</tr>
<tr>
<td>TG (mg/dL)</td>
<td>0.27 0.306</td>
<td>0.37 0.004**</td>
</tr>
</tbody>
</table>

* Pearson correlation coefficient is significant at the 0.05 level
** Pearson correlation coefficient is significant at the 0.01 level
was a strongly mutual inclusive relationship as other researcher above mentioned.

No significant correlation between resistin and triglyceride in males has been observed, this may be probably done to the small amount of male subjects.

In summary, we found that resistin may not the main link between obesity and fasting blood sugar in adolescents, because it may be related to the maturation of adolescent during pubertal development\textsuperscript{14} or the ability of growth hormone to induce resistin mRNA expression may be due to the growth–promoting action of growth hormone.\textsuperscript{15} But resistin was found to be strongly related with BMI as similar with data obtained in adults.\textsuperscript{12,16}

Acknowledgement

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Reference


