Assessment of Adiponectin and Resistin Indexes Compared to FBG and Useful as Diagnostic Biomarkers in Insulin Resistance and Type 2 Diabetes

Salah Omar, Hassan Higazi, Asaad Mohammed Ahmed Babker, Sara Mohammed Ali Mohammed, Abd Elgadir Eltoum

Department of Medical Laboratory Sciences, College of Health Sciences, Gulf Medical University, Ajman, United Arab Emirates

Abstract

BACKGROUND: The world prevalence of diabetes among adults will be 6.4%, affecting 285 million adults, in year 2010, and will increase to 7.7% and 439 million adults by year 2030. Insulin resistance is a prerequisite root factor for development of Type 2 diabetes mellitus (T2DM). Adiponectin and resistin are adipokines which modulate insulin action, energy, glucose, and lipid homeostasis. Meta-analyses showed that hypoadiponectinemia and hyperresistinemia are strongly associated with increased risk of insulin resistance T2DM.

AIM: We aimed to assess adiponectin and resistin indexes compared to FBG as diagnostic biomarkers in insulin resistance and type 2 diabetes.

MATERIALS AND METHODS: In this case–control study, a total 204 Sudanese males and females were recruited to participate in this study (102 diabetic and 102 non-diabetic) and venous blood samples were collected. Serum levels of blood glucose were measured using the particle-enhanced immunoturbidimetric assay method Cobas C-311®. While adiponectin and resistin estimated by enzyme-linked immunosorbent assay Kits.

RESULTS: In this results shows a significant difference between the means fasting blood glucose (FBG), adiponectin, and resistin of diabetic patient and non-diabetic patient. FBG (mean ± SD) (164.5 ± 16.7) diabetic versus (95.7 ± 13.6) nondiabetic, had p = 0.041, resistin (mean ± SD) (18.2 ± 2.7) diabetic versus (18.2 ± 2.7) nondiabetic, had p = 0.025. In this study, observed from this results strong negative correlation between the levels of serum adiponectin and FBG, adiponectin, and resistin (p = 0.013 and r = −7.9) (p = 0.019 and r = −6.6). But in other side showed moderate positive correlation between the levels of serum resistin and FBG (p = 0.015 and r = 6.0).

CONCLUSION: Increase of resistin and FBG and reduced of adiponectin in diabetic patient can be useful as diagnostic biomarkers.

Introduction

The world prevalence of diabetes among adults will be 6.4%, affecting 285 million adults, in year 2010, and will increase to 7.7% and 439 million adults by year 2030 [1]. Insulin resistance is a prerequisite root factor for development of Type 2 diabetes mellitus (T2DM) [2]. T2DM itself is occur with by increased risk for cardiovascular disease which is distress by the concomitant risk factors of the multiple sclerosis (MS) [2]. Adiponectin [3] and resistin [4] hormones are thought to link T2DM and MS with cardiovascular risk. Adipose tissue is no longer considered an inactive organ, which only stores lipids and serves as an energy reservoir. These chemical messengers, known as “adipokines” or “adipokines,” include tumor necrosis factor α (TNF-α), adiponectin, leptin, resistin, and visfatin [5]. Adiponectin is an adipocyte-secreted polypeptide hormone with molecular weight 30 kDa (244 amino acids) which modulates a number of metabolic processes, and regulates insulin sensitivity and energy homeostasis, as well as glucose and lipid metabolism [6]. The hormone plays a principal role in the suppression of the metabolic derangements that may result in insulin resistance, T2DM, MS, and cardiovascular disease [4], [7], [8]. Adiponectin is a protective protein with antiadipocytic, anti-inflammatory, and anti-atherogenic effects [5]. Reduced plasma adiponectin levels have been reported in obese individuals, particularly in those with visceral obesity, and have been negatively correlated with insulin resistance. Furthermore, decreased adiponectin levels found to be associated with a higher incidence of T2DM [9].

Resistin is a macrophage-derived signaling polypeptide hormone with molecular weight 12.5 kDa and its length is 108 amino acids in humans [10]. In contrast with adiponectin, resistin has low circulating levels [10]. However, the blood circulating levels of resistin have been shown to be up regulated in subjects with insulin resistance, T2DM, MS, and cardiovascular disease [6],[11].The concurrence of hypoadiponectinemia [5],[8],[9] and hyperresistinemia [6],[10] in subjects with insulin resistance, T2DM, and MS risk is well-established. A significant inverse correlation between adiponectin and resistin levels has
also been reported in the literatures [12], [13]. Taking these studies together, it may be speculated that adiponectin and resistin share a common regulatory mechanism to mediate the body metabolism (e.g., energy, glucose, and lipid homeostasis). Thus, a novel adiponectin-resistin (AR) index was proposed by taking into account both adiponectin and resistin levels to provide a better indicator of the metabolic homeostasis and metabolic disorders [14], [15].

**Materials and Methods**

In this case–control study, a total 204 Sudanese males and females were recruited to participate in this study (102 diabetic and 102 non-diabetic), this study conducted in Khartoum state. Venous blood samples were collected from the antecubital vein of patients into vacuum tubes containing EDTA or a serum separator gel. After sampling, the tubes were immediately centrifuged at 1.5× g for 10 min. Aliquots of serum were stored at −20°C.

**Estimation of fasting blood glucose (FBG)**

Serum levels of blood glucose were measured using the particle-enhanced immunoturbidimetric assay method Cobas C-311®. Human glucose agglutinates with latex particles coated with monoclonal anti-glucose antibodies, and then, the precipitate was determined turbidimetrically.

**Estimation adiponectin and resistin**

For adiponectin and resistin used ELISA Kits – (ab222508)/(ab222403) is a single-wash 90 min sandwich ELISA designed for the quantitative measurement of adiponectin and resistin in plasma. Simple step ELISA® technology employs capture antibodies conjugated to an affinity tag that is recognized by the monoclonal antibody used to coat our Simple step ELISA® plates.

**Statistical analysis**

Finally, the result analyzed by SPSS version 24. The mean and SD were obtained and "t" test used for comparison. Linear regression was also used for correlation. P-value was obtained to assess the significance of the results (p < 0.05 was considered to be significant).

**Results**

In this study, the results show strong negative correlation between the levels of serum adiponectin versus FBG and resistin. (Adiponectin versus FBG: p = 0.013, r = −7.9). (Adiponectin versus resistin: p = 0.019 and r = −6.6) (Figures 1 and 2). But in other side shows moderate positive correlation between the levels of serum resistin and FBG (p = 0.015 and r = 6.0) (Figure 3). Also, our results show negative relationship between the mean of serum adiponectin, resistin compare with the history of patient/years (Figure 4).
In these results shows a significant difference between the means fasting blood glucose (FBG), adiponectin, and resistin of diabetic patient and non-diabetic patient. FBG (mean ± SD) (164.5 ± 16.7) diabetic versus (95.7 ± 13.6) nondiabetic, P = 0.041, adiponectin (mean ± SD) (5.9 ± 1.6) diabetic versus (10.1 ± 1.3) nondiabetic, P = 0.037, resistin (mean ± SD) (18.2 ± 2.7) diabetic versus (12.2 ± 1.1) nondiabetic, P = 0.023, Table 2.

## Discussion

Insulin resistance is a pre-requisite root factor for development of T2DM [2]. T2DM itself is occur with by increased risk for cardiovascular disease which is distress by the concomitant risk factors of the MS [2]. Adiponectin [3] and resistin [4] hormones are thought to link T2DM and MS with cardiovascular risk. Adipose tissue is no longer considered an inactive organ, which only stores lipids and serves as an energy reservoir. These chemical messengers, known as “adipocytokines” or “adipokines,” include TNF-α, adiponectin, leptin, resistin, and visfatin [5]. Resistin strongly affects insulin and promotes elevated blood glucose, adipocyte proliferation, and obesity [6], [7], Shanker et al. reported that adiponectin is negatively correlated with body lipid content and can correct glucose and lipid disorders, reduce inflammation and insulin sensitivity, and inhibit the development of AS [11], [12], [13]. We found that serum levels of resistin, significantly higher in patients with T2DM compared with healthy subjects. In contrast, adiponectin levels were significantly decreased in the diabetic groups compared with the non-diabetic group. The present study showed a negative correlation between the levels of serum adiponectin compare to resistin and FBG. Several studies have pointed to a negative relationship between serum adiponectin versus resistin and FBG by Zhang et al. and Oakhill et al., addition other researcher found that the adiponectin derived index correlated best with the euglycemic hyperinsulinemic clamp derived sensitivity index as compared to fasting glucose/insulin ratio [12]. According to this, result observed positive correlation between the levels of serum resistin and FBG. Serum resistin was also positively correlated with FBG, while adiponectin was negatively correlated with these same parameters.

## Table 1: Overall patient characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>(Diabetic)</th>
<th>(Non-diabetic)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>51 ± 6.6</td>
<td>49.6 ± 6.2</td>
<td>0.61</td>
</tr>
<tr>
<td>Range</td>
<td>37–61</td>
<td>40–62</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>82.5 ± 9.1</td>
<td>81.4 ± 9.3</td>
<td>0.38</td>
</tr>
<tr>
<td>Range</td>
<td>64–89</td>
<td>82–97</td>
<td></td>
</tr>
<tr>
<td>History of disease/years</td>
<td>13.6 ± 3.5</td>
<td>13.8 ± 3.5</td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>8–20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FBG: Fasting blood glucose.

Serum resistin was positively correlated with FBG, but adiponectin negatively correlated with resistin and FBG. In conclusion, serum resistin and adiponectin levels are correlated with the occurrence of T2DM and microvasculopathy complications[13], [15]. T2DM patients had low serum adiponectin level and high serum resistin level. The condition of hypoadiponectinemia and hyperresistinemia tends to concurrent in patients with T2DM. Given the opposite effects of adiponectin and resistin on the insulin sensitivity, it seems that relative proportion of adiponectin-to-resistin potentially.

## Table 2: Comparison of the means of blood parameters between diabetics and non-diabetics

<table>
<thead>
<tr>
<th>Variable</th>
<th>(Diabetics)</th>
<th>(Non-diabetics)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adiponectin</td>
<td>5.9 ± 1.6</td>
<td>10.1 ± 1.3</td>
<td>0.037</td>
</tr>
<tr>
<td>Range</td>
<td>2.1–13.1</td>
<td>3.8–15</td>
<td></td>
</tr>
<tr>
<td>Resistin</td>
<td>18.2 ± 2.7</td>
<td>12.2 ± 1.1</td>
<td>0.023</td>
</tr>
<tr>
<td>Range</td>
<td>14.4–27</td>
<td>10–17.8</td>
<td></td>
</tr>
<tr>
<td>FBG</td>
<td>164.5 ± 16.7</td>
<td>95.7 ± 13.6</td>
<td>0.018</td>
</tr>
<tr>
<td>Range</td>
<td>130–265</td>
<td>70–115</td>
<td></td>
</tr>
</tbody>
</table>

Figures:

- Figure 3: A scatter plot shows moderate positive correlation between the levels of serum resistin and fasting blood glucose (p = 0.015 and r = 6.0)
- Figure 4: Negative relationship between the levels of serum adiponectin and resistin compare with the history of patient/years
Conclusion

Increase of resistin and FBG and reduced of adiponectin in diabetic patient compare to non-diabetic patient can be useful as diagnostic biomarkers.

Acknowledgments

The authors are grateful to the faculty’s staff in College of Health Sciences, Gulf Medical University, Ajman, UAE, whom participate in this study.

References


