



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

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Abstract

Edited by: Ksenija Bogoeva-Kostovska
Citation: Omar S, Higazi H, Babker AMA, Mohammed SMA, Eltoum AE. Assessment of Adiponectin and Resistin Indexes Compared to FBG and Useful as Diagnostic Biomarkers in Insulin Resistance, Type 2 Diabetes. Open Access Maced J Med Sci. 2022 Apr 07; 10(B):853-856. <https://doi.org/10.3889/oamjms.2022.9297>
Keywords: Adiponectin and Resistin; Insulin resistance; Type 2 diabetes
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Received: 08-Mar-2022
Revised: 21-Mar-2022
Accepted: 28-Mar-2022
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Funding: This study completely funded by the researchers
Competing Interests: The authors have declared that no competing interests exist
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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 \pm SD) (164.5 ± 16.7) diabetic versus (95.7 ± 13.6) nondiabetic, had $p = 0.041$, adiponectin (mean \pm SD) (5.9 ± 1.6) diabetic versus (10.1 ± 1.3) nondiabetic, had $p = 0.037$, resistin (mean \pm SD) (18.2 ± 2.7) diabetic versus (12.2 ± 1.1) nondiabetic, had $p = 0.023$. 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 compare to non-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 “adipocytokines” 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 antidiabetic, 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 $1.5 \times g$ 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 use 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).

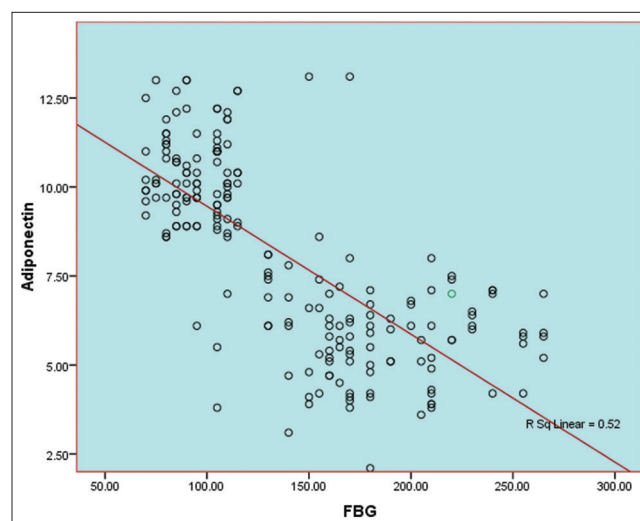


Figure 1: A scatter plot shows strong negative correlation between the levels of serum adiponectin and fasting blood glucose ($p = 0.013$ and $r = -7.9$)

204 Sudanese males and females were recruited to participate in this study (102 diabetic and 102 non-diabetic). The (mean \pm SD) of age in the diabetic patients was (51 ± 6.6) (range 37–61) years, while it was (49.6 ± 6.2) (range 40–62) years in non-diabetic patients, ($P=0.61$) and also (mean \pm SD) of the weight in the diabetic patients was 82.5 ± 9.1 (range 64–99) Kg, while it was 81.4 ± 9.3 (range 62–97) Kg in the non-diabetic patients, ($P=0.38$). The differences in the ages and weights between two groups was not statistically significant, Table 1.

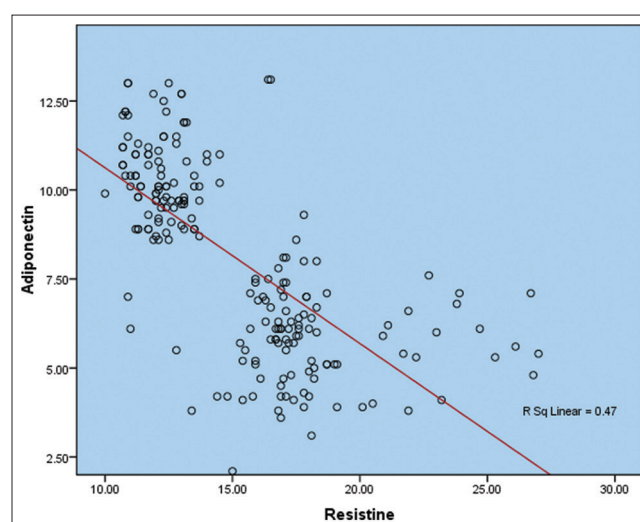


Figure 2: A scatter plot shows strong negative correlation between the levels of serum resistin and adiponectin ($p = 0.019$ and $r = -6.6$)

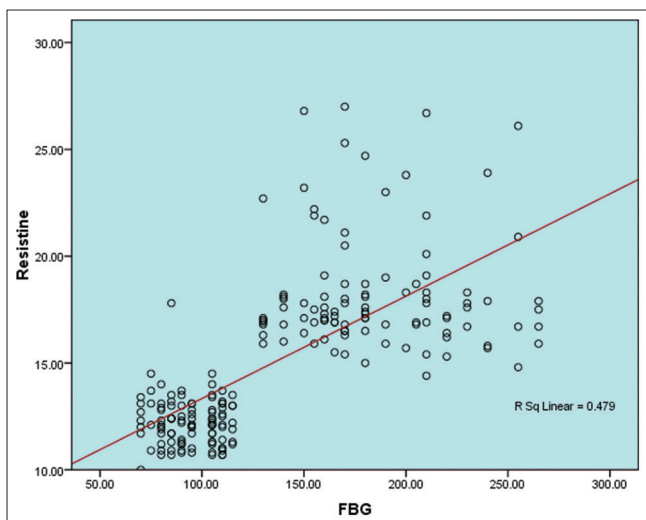


Figure 3: A scatter plot shows moderate positive correlation between the levels of serum resistin and fasting blood glucose ($p = 0.015$ and $r = 6.0$)

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 \pm SD) (164.5 ± 16.7) diabetic versus (95.7 ± 13.6) nondiabetic, $P = 0.041$, adiponectin (mean \pm SD) (5.9 ± 1.6) diabetic versus (10.1 ± 1.3) nondiabetic, $P = 0.037$, resistin (mean \pm 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

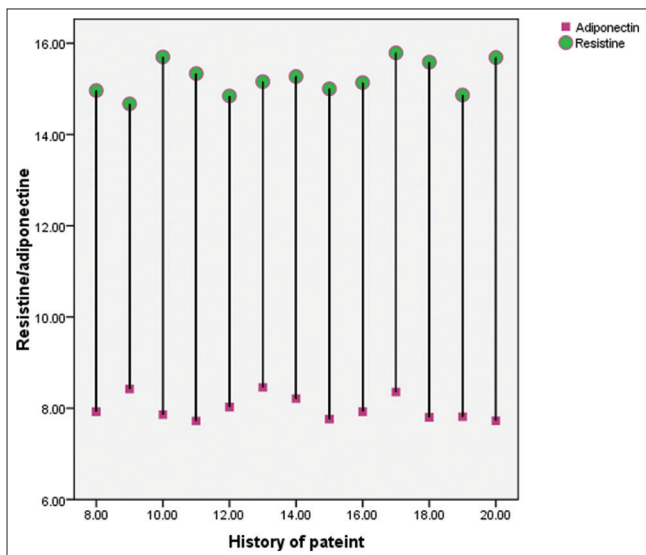


Figure 4: Negative relationship between the levels of serum adiponectin and resistin compare with the history of patient/years

Table 1: Overall patient characteristics

Variable	(Diabetic) (mean \pm SD) (n = 102)	(Non-diabetics) (mean \pm SD) (n = 102)	p-value
Age	51 \pm 6.6	49.6 \pm 6.2	0.61
Range	37–61	40–62	
Weight	82.5 \pm 9.1	81.4 \pm 9.3	0.38
Range	64–99	62–97	
History of disease/years	13.6 \pm 3.5		
Range	8–20		

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

Variable	(Diabetics) (mean \pm SD) (n = 102)	(Non-diabetic) (mean \pm SD) (n = 102)	p-value
Adiponectin	5.9 \pm 1.6	10.1 \pm 1.3	0.037
Range	2.1–13.1	3.8–15	
Resistin	18.2 \pm 2.7	12.2 \pm 1.1	0.023
Range	14.4–27	10–17.8	
FBG	164.5 \pm 16.7	95.7 \pm 13.6	0.041
Range	130–265	70–115	

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.

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.

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