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RESEARCH PAPER

Serum adiponectin is not related with insulin resistance and fasting glucose in asthma patient

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Abstract

Research evidence shows that obesity is associated with asthma and its severity. The specific mechanisms responsible for these observations are not obvious. The study objective was to determine whether the serum adiponectin concentration was associated with asthma and insulin resistance in asthma patients. Methods: For this purpose, we measured fasting serum adiponectin, insulin and glucose in 44 mild to moderate asthma with a mean body mass index (BMI) of 31.3 +/- 4.14 kg/m2. A spirometry test was performed in order to asthma diagnosis and its severity. Insulin resistance was calculated by fasting glucose and insulin. Pearson correlations were used to establish the relationship between adiponectin concentration with insulin resistance and spirometry indexes. Results: Serum adiponectin concentration was positively related to FEV1/FVC as a marker of asthma diagnosis. Additionally, although fasting serum adiponectin tended to be negatively correlated with insulin resistance and glucose, this did not reach statistical significance (P<0.086). Based on this data, it was concluded that although adiponectin is not related with insulin resistance in asthma patients, but its measuring may be a predictor of asthma severity in patients..

Key words: Asthma, Insulin resistance, Adiponectin, spirometry.

Introduction

Although there are extensive evidence regarding the direct relationship between obesity and asthma in childhood and adulthood, but exact mechanisms by which obesity affects the airways function have still remained unknown. Obesity is likely to influence asthma development and prevalence by genetics, hormonal and neural factors or mechanical effects (Boulet, 2008). Research Sources state that obesity or overweight in asthma patients is associated with increase of asthma severity and weight loss in these patients is associated with decrease of asthma severity (Castro-Rodríguez, 2007). Studies suggest that after adjustment for tobacco use and physical activity, obese or overweight subjects are far more Susceptible to asthma than subjects with normal weight (Nystad *et al.,* 2004). Breathing pattern Change in obese subjects changes flexibility of smooth muscles of air routes and airways function. Increase of secretion of some adipokines and inflammatory mediators like IL-6, TNF-α, ataxin and leptin and reduction of anti-inflammatory adipokines in obese patients are effective in prevalence or increase of asthma clinical symptoms and airways inflammation (Boulet, 2008). Research evidence suggests that obese subjects have lower levels of adiponectin than those with normal weight. Adiponectin is an anti-inflammatory and antigenic peptide hormone with 30 kDa molecular weight which is mainly secreted from adipose tissue and is abundant in blood cycle (Hadaegh *et al.,* 2006; Genuth *et al.,* 2003), but despite the increase in adipose tissue, the its levels reduce in obese subjects or obesity related diseases (Hotta *et al.,* 2001; Engeli *et al.,* 2003).

This hypothesis is consistently raised that decrease of serum adiponectin concentration in obese humans is effective in the development of asthma (Shore *et al.,* 2006). Results also indicate low levels of adiponectin in asthma patients (Shore *et al.,* 2006). On the other hand, recent findings point out that high concentration of adiponectin could be an effective factor in prevention from asthma prevalence in humans (Sood *et al.,* 2008). Interaction of insulin resistance with some other inflammatory cytokines such as leptin has been repeatedly studied in asthma patients and other obesity related diseases (Klok *et al.,* 2007; Gurkan *et al.,* 2004). Scientific resources indicate increase of insulin resistance in obese patients (Stefanyk *et al.,* 2010). Some other sources also suggest that the adiponectin levels in obese patients are lower than those with normal weight (Sowers *et al.,* 2008).

These findings also support a reverse interaction between serum adiponectin levels and insulin resistance in obese subjects. So that reduction of systemic adiponectin levels in obese patients has always been associated with increase of insulin resistance (Meilleur *et al.,* 2010).

Some studies also indicate the interaction pattern of adiponectin and insulin resistance in some obesity related diseases such as type 2 diabetes (Boulet, 2008; Hadaegh *et al.,* 2006). But few studies have studied interaction between serum adiponectin and insulin resistance in asthma patients. Hence, this question is always raised that whether changes in serum adiponectin levels in asthma patients affects also insulin resistance or whether reduction of adiponectin levels in these patients is independent of changes in insulin resistance in these individuals. Hence, the present study is conducted with the purpose of determining the relationship of baseline levels of serum adiponectin of asthma patients between insulin resistance and its related components such as fasting glucose.

Material and Methods

In the present study, the relationship between serum adiponectin and insulin resistance in 44 men with mild to moderate asthma was compared. Studied asthma patients are consisting of obese or overweight adult males (BMI ≥ 26) with mean age of 41 years (40±7) who participated in an available way in this study. Minimum age of getting affected by asthma is 5 years old. A medical history to retrieve information about health status, current medications, and history of viral or toxic hepatitis; a physical examination including height, weight, waist circumference and blood pressure; a fasting blood draw for the determination of glucose, insulin, adiponectin, lipid profile performed in studied patients. Subjects included individuals with no cardiovascular diseases, gastrointestinal diseases, kidney and liver disorders or diabetes. Participants were included if they had not been involved in regular physical activity/diet in the previous 6 months. After the nature of the study was explained in detail, informed consent was obtained from all participants. First, spirometry tests were performed in order to asthma diagnosis as well as to determine the asthma severity. Patients were asked to avoid having tea or coffee as well as other airways dilator food for at least 3 hours prior to spirometry test. Information about age, height and weight of individuals was recorded in the location of running spirometry test.

Anthropometrical indices were measured and recorded by Project executors. So that Height was measured while standing and wearing no shoes in a way that shoulders are tangent with wall from behind. Weight was measured with minimal clothing and no shoes by made in Taiwan digital Height meter Scale with maximum error of 100 grams. The formula of dividing body weight (kilograms) by squared height (square meters) was used to calculate body mass index. Average of twice systolic and diastolic blood pressure of each person was considered as the real blood pressure. Then, A venous blood sample was collected from all the subjects who came after a 12-h overnight fast between the hours of 8 to 9 am. These blood samplings used for measuring of fasting serum adiponectin, glucose, insulin, total cholesterol, triglyceride, High Density Lipoprotein cholesterol, low density Lipoprotein cholesterol. All subjects were asked to avoid any sport or heavy physical activity for two days before blood sampling. Glucose was determined by the oxidase method (Pars Azmoon kit, Tehran). Total cholesterol, HDL cholesterol and triglycerides were measured using the colorimetric enzymatic method (Pars Azmoon kit, Tehran). Serum adiponectin was determined by ELISA method, using a Biovendor-Laboratorial kit made by Biovendor Company, Czech. The Intra- assay coefficient of variation and sensitivity of the method were 3.9% and 5-50 ng/mL, respectively. Serum insulin was determined by ELISA method (Demedite, German). The Intra-assay coefficient of variation and sensitivity of the method were 2.6% and 2.88 µg/L, respectively. Insulin resistance index was calculated using fasting insulin and glucose levels in each subject (Marita *et al.,* 2005).

Statistical analysis: All values are represented as mean ± SD. Data were analyzed by computer using SPSS software version 15.0. Pearson correlations were used to establish the relationship between adiponectin with the other variables in studied patients.

Results

The present study was conducted in order to determine the relationship of serum adiponectin levels of with insulin resistance in patents with mild to moderate asthma. Clinical and biochemical data as well as anthropometrical characteristics of patients has been summarized in Table 1. Spirometry tests results showed that about 70 percent of patients have moderate asthma and the rest have mild asthma. Findings

from the statistical analysis also showed that serum adiponectin levels will be also reduced parallel to reduction of FEV1/FVC ratio, which is of the main determinants of asthma diagnosis, and somehow implies the direct relationship between these two variables (p = 0.003). In other words, the findings of spirometry tests and biochemical analysis of serum adiponectin showed that serum adiponectin levels will be reduced proportionate to increase of the severity of asthma in studied patients. But regarding determination of the relationship between adiponectin and insulin resistance, findings from correlation analysis showed that although reduction in serum adiponectin levels is associated with increase in insulin resistance, this relationship is not statistically significant (p = 0.211). In other words, insulin resistance and serum adiponectin are not good predictive for one another in asthma patients. The relationship between adiponectin and fasting glucose was reverse but non-significant which implicated the lack of significant effect of any one of them on the other one (p = 0.198).

Table 1. The descriptive anthropometric and biochemical features of studied patients

Variable	Mean	Standard deviation	Range
Age (years)	40	7	35-50
Weight (kg)	94.7	11	81-112
Height (cm)	174	6	170-176
Body mass index (kg/m^2)	31.3	4.14	28-36
Systolic blood pressure (mmHg)	126	8	116-137
Diastolic blood pressure (mmHg)	86	5	79-91
FVC	86.4	7.4	79-93
FEV1/FVC	68.52	3.14	65-73
Cholesterol (mg / dl)	168	32	133-189
Triglyceride (mg / dl)	161	38	122-193
Low density lipoprotein (mg / dl)	124	21	118-143
high density lipoprotein (mg / dl)	44	6	39-49
Insulin resistance index	3.17	0.63	4.11 – 1.55
Glucose (mg / dl)	107	14	95-116
Insulin (µIU/ml)	12	4	14- 8
Adiponectin (µg/ml)	6.21	2.7	4.8-7.11

Discussion

Asthma prevalence over past 20 years has been growing. Obesity has been recognized as a risk factor of asthma prevalence and increase of its severity and also affects lung function. Research evidence show that obese girls between 6 to 11 years old have an almost fivefold coefficient of expansion of asthma symptoms

compared with their peer girls with normal weight (Castro-Rodríguez *et al.,* 2001). Increase of insulin resistance as well as reduction of blood adiponectin levels have been repeatedly observed in obese subjects and its related diseases (Meilleur *et al.,* 2010; Nayak *et al.,* 2010). Some studies also indicate the reverse interaction of these two factors in obese subjects and its related diseases such as metabolic syndrome or type 2diabetes (Takashi *et al.,* 2006). Increase of insulin resistance in asthma patients has been observed in some studies (Al-Shawwa *et al.,* 2007). But whether there is any cause and effect relationship between serum adiponectin levels or plasma and insulin resistance in asthma patients has not been fully studied yet.
The findings of this study showed that although fasting serum adiponectin in asthma patients is reduced parallel to reduction of respiratory volumes determining asthma, such as FEV1/FVC ratio, there is no significant relationship between serum adiponectin levels and insulin resistance in these patients. Most studies on other obesity related diseases such as type 2 diabetes have supported a reverse relationship between adiponectin and insulin resistance (Pischon, 2004; Ouchi, 2003). But few studies have simultaneously evaluated the interaction pattern of these two variables in a group of asthmatic patients. This study showed that adiponectin reduction is associated with increase of insulin resistance in each one of the asthma patients, but this relationship is not statistically significant. The findings also showed that fasting glucose which is related closely with insulin resistance, although has a reverse linear relationship with adiponectin, but this relationship is not statistically significant and neither can this variable be serum adiponectin predictor in asthma patients.

In addition to these findings, this study showed that the decrease in serum adiponectin is associated with a decrease in FEV1/FVC. In other words, the more serum adiponectin levels are reduced, the more respiratory volumes determining airways function will be reduced. Low adiponectin levels have been also observed in asthma patients in some other studies (Shore *et al.,* 2006; Sood *et al.,* 2008). The findings support this phenomenon that reduction of adiponectin levels in asthma patients leads to increase of smooth muscles proliferation within airways and causes airways narrowness (Shore *et al.,* 2006). So that, some studies state that increase of adiponectin inhibits smooth muscles proliferation of airways, which in turn prevents airways narrowing in these patients (Benjamin *et al.,* 2009). Lack of significant

correlation between insulin resistance and FEV1/FVC was one of the other findings of the study. Altogether, despite observing the significant correlation between blood adiponectin levels and insulin resistance in obese subjects and other obesity related diseases in other studies, findings of the present study does not support the correlation between them in asthma patients. However, given the observation of positive relationship of adiponectin with FEV1/FVC in this study, it can be said that reduction of adiponectin levels in these patients is associated with increase of asthma severity. However, this point should not forget that asthma patients participating in our study are of mild to moderate type. It is possible that the pattern of the relationship between adiponectin and insulin resistance in asthma patients with higher severity (severe asthma) is different from our study patients which requires new studies in this area. It is also possible that in asthma patients, either variables of adiponectin or insulin resistance can affect the other one indirectly through other biochemical factors.

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References

Al-Shawwa BA, Al-Huniti NH, DeMattia L, Gershan W.2007. Asthma and insulin resistance in morbidly obese children and adolescents. J Asthma **44(6),** 469-73.

Benjamin D. Yoshihisa O, Patricio L, Meiqian W, Barry P, Sandall MJ. 2009. Adiponectin Deficiency Increases Allergic Airway Inflammation and Pulmonary Vascular Remodeling. Am J Respir Cell Mol Biol 41, 397–406.

Boulet LP. 2008. Influence of obesity on the prevalence and clinical features of asthma. Clin Invest Med **31(6),** 386-90.

Castro-Rodríguez JA, Holberg CJ, Morgan WJ, Wright AL, Martinez FD. 2001. Increased incidence of asthmalike symptoms in girls who become overweight or obese during the school years. Am J Respir Crit Care Med 163, 1344-9.

Castro-Rodríguez JA. 2007. Relationship between obesity and asthma Arch Bronconeumol **43(3),** 171-5.

Engeli S, Feldpausch M, Gorzelniak K, Hartwig F, Heintze U, Janke J. 2003. Association between adiponectin and mediators of inflammation in obese women. Diabetes 52, 942-7.

Genuth S, Alberti KG, Bennett P, Buse J, Defronzo R, Kahn R. 2003. Follow-up report on the diagnosis of diabetes mellitus. Diabetes Care 26, 3160-3167.

Gurkan F, Atamer Y, Ece A, Kocyigit Y, Tuzun H, Mete N. 2004. Leptin and asthma in overweight children at 12 years of age. Pediatr Allergy Immunol **15(6),** 523-30.

Hadaegh F, Harati H, Ghanbarian A, Azizi F. 2006. Association of total cholesterol versus other serum lipid parameters with the short-term prediction of cardiovascular outcomes: Tehran Lipid and Glucose Study. Eur J Cardiovasc Prev Rehabil 13, 571-577.

Hotta K, Funahashi T, Bodkin NL, Ortmeyer HK, Arita Y, Hansen BC. 2001. Circulating concentrations of the adipocyte protein adiponectin are decreased in parallel with reduced insulin sensitivity during the progression to type 2 diabetes in rhesus monkeys. Diabetes 50, 1126-33.

Klok MD, Jakobsdottir S, Drent ML. 2007. The role of leptin and ghrelin in the regulation of food intake and body weight in humans: a review. Obes Rev **8(1),** 21-34.

Marita AR, Sarkar JA, Rane S. 2005. Type 2 diabetes in non-obese Indian subjects is associated with reduced leptin levels: Study from Mumbai, Western India. Molecular and Cellular Biochemistry 275, 143–151.

Meilleur KG, Doumatey A, Huang H, Charles B, Chen G, Zhou J. 2010. Circulating adiponectin is associated with obesity and serum lipids in West Africans. J Clin Endocrinol Metab **95(7),** 3517-21.

Nayak BS, Ramsingh D, Gooding S, Legall G, Bissram S, Mohammed A. 2010. Plasma adiponectin levels are related to obesity, inflammation, blood lipids and insulin in type 2 diabetic and non-diabetic Trinidadians. Prim Care Diabetes [Epub ahead of print].

Nystad W, Meyer HE, Nafstad P, Tverdal A, Engeland A. 2004. Body mass index in relation to adult asthma among 135,000 Norwegian men and women. Am J Epidemiol **160(10),** 969-76.

Ouchi N. 2003. Association of hypoadiponectinemia with impaired vasoreactivity. Hypertension 42, 231–234.

Pischon T. 2004. Plasma adiponectin levels and risk of myocardial infarction in men. JAMA 291, 1730–1737.

Shore SA, Terry RD, Flynt L. 2006. Adiponectin attenuates allergen-induced airway inflammation and hyperresponsiveness in mice. J Allergy Clin Immunol 118, 389–95.

Sood A, Cui X, Qualls C, Beckett WS, Gross MD, Steffes MW. 2008. Association between Asthma and Serum Adiponectin Concentration in Women. Association between Asthma and Serum Adiponectin Concentration in Women. Thorax [Epub ahead of print].

Sowers JR. 2008. Endocrine functions of adipose tissue: focus on adiponectin. Clin Cornerstone **9(1),** 32-8.

Stefanyk LE, Dyck DJ. 2010. The interaction between adipokines, diet and exercise on muscle insulin sensitivity. Curr Opin Clin Nutr Metab Care **13(3),** 255-9.

Takashi K, Toshimasa Y, Naoto K, Kazuo H, Kohjiro U, Kazuyuki T. 2006. Adiponectin and adiponectin receptors in insulin resistance, diabetes, and the metabolic syndrome. J. Clin. Invest 116, 1784–1792.