ORIGINAL RESEARCH PAPER

Biochemistry

ADIPONECTIN: A NOVEL MARKER ON URBAN EPIDEMIC- OBESITY

KEY WORDS:

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ABSTRACT

Introduction: Obesity is the new lifestyle disorder that is increasing in incidence and prevalence. The effects on the overall health due to obesity, is a cause for concern to all. With the finding of adipokines, the role of adipose tissue as an endocrine organ is very interesting in finding the link between obesity and its complications.
Aim and objective: To assess the variations in adiponectin levels in obese and normal BMI controls.
Material and Methods: 30 healthy controls and 60 obese individuals were compared for BMI (calculation) and Adiponectin levels. Adiponectin levels were analysed by ELISA using serum sample.
Observation: Adiponectin levels were significantly lower in study group as compared to the control group. ($p<0.0001$)
Conclusion: Derangements in the adipokine levels due to change in metabolic state of adipose tissue is the probable cause for the complications resulting from obesity.

INTRODUCTION-

The rapid development in technology has led to sudden changes in lifestyle and a marked increase in incidence of non-communicable diseases like diabetes and obesity and their complications all over the world.[1] Overweight and obesity are defined as abnormal or excessive fat accumulation that presents a risk to health. [2] A body mass index (BMI) over 25 is considered overweight, and over 30 is obese.[3] as per, WHO report 2021. This issue has grown to epidemic proportions, with over 4 million people dying each year as a result of being overweight or obese. From 1975 to 2016, the prevalence of overweight or obese children and adolescents aged 5–19 years increased more than four-fold from 4% to 18% globally. Obesity is one side of the double burden of malnutrition.[3]

Overweight and obesity are major risk factors for a number of chronic and non-communicable diseases, including cardiovascular disease, type 2 diabetes, obstructive sleep apnoea, certain types of cancer, osteoarthritis and asthma.[2] An estimated 35.8 million (2.3%) of global DALYs (disability-adjusted life years) are caused by overweight or obesity.[2] The risk of these noncommunicable diseases increases even when a person is only slightly overweight and grows more serious as the body mass index (BMI) climbs.[2]

The alarming rise in the prevalence of obesity and its related health disorders has aroused the interest of researchers in exploring adipose tissue metabolism.[4] Of late almost 600 adipose tissue derived hormones and proteins collectively called Adipokines have been identified. Proteins secreted from white adipose tissue are leptin, angiotensin, adipsin, acylation-stimulating protein, retinol-binding protein, tumour necrosis factor- , interleukin-6, plasminogen activator inhibitor-1, tissue factor, resistin, metallothionein, fasting-induced adipose factor (FIAF), adiponectin and many more.[5] They play a significant role in lipid metabolism, vascular haemostasis, complement system or as inflammatory cytokines.[4]

When adipose tissue inflammation and dysfunction have developed, adipokine secretion is significantly changed towards a pro inflammatory, and diabetogenic pattern. Adiponectin is a novel adipocyte-specific protein, that is specifically and abundantly expressed in adipose tissue [6]. Plasma adiponectin levels in humans range from 0.5 to 30 µg/ml, which is about 1000-fold higher than the concentrations of most other hormones such as leptin, insulin etc[7,8] Adiponectin modulates a number of metabolic processes, including glucose regulation and fatty acid catabolism.[8] Anti-diabetic drug, Thiazolidienediones increase adiponectin gene expression,[9] as its gene has been reported to be linked to type 2 diabetes. It also promotes weight loss and improves insulin resistance and glucose tolerance. [7,9] In human studies, low adiponectin plasma concentrations are clearly correlated with insulin resistance and the risk of developing type 2 diabetes independent of body fat mass.[9] It also exhibit anti-inflammatory and anti-atherogenic properties.[10] The Adiponectin gene appears to be a promising candidate as a susceptibility gene for type 2 diabetes.[11]

Considering the role of adiponectin in pathogenesis of obesity, the aim of our study is to evaluate the Adiponectin levels in non-obeseand obese patients.

MATERIAL AND METHODS-

This is prospective, case control study conducted in Department of Biochemistry, MGM Medical College, Navi Mumbai. The aim of study is to estimate serum adiponectin levels in obese and healthy (non-obese) individuals. Ethical clearance was taken from scientific and ethical committee of the institution. The study was conducted as per ICH-GCP guidelines for human research. Written and informed consent was obtained from the patients before enrolment of subjects in this study.

Total 60 obese individuals, who were attending MGM OPD, between the age group of 25 -60 years and 30 healthy individuals after age and gender match were enrolled. Individuals with BMI more than 30 were considered as Obese. Individuals with metabolic syndrome were considered in study but not considered as a criterion for data analysis. Patients beyond study age, who are on Thiazolidienediones, known / suspected pregnancy, Cancer, with history of CVD, Asthma were excluded.

Samples have been collected as per routine sample collection protocol and Serum was separated for estimation of Adiponectin. All samples were stored at -70°C till analysis. Demographic data, clinical history and Anthropometric measurements i.e., height (cms), weight (Kgs) was recorded for each subject. Body mass index (BMI) was calculatedas

weight (kg) divided by height (m) square. Serum Adiponectin was estimated by ELISA method using commercially available Avibion Human Adiponectin (Acrp 30) ELISA kit.

RESULT-

Data reported were statistically analysed by R-software which is freely available online.

In our study, Control group (n=30) comprised of 20 males and 10 females whereas in study group (n=60) 38 female and 22 male patients were included. As BMI was considered as a criteria for obese and non-obese, It was calculated as weight (kg) divided by height (m) square.

Table I: Mean and SD of BMI (Kg/m^2) in control and study group.

	Control	Study Group	p value
BMI (Kg/m^2)	22.9 ± 1.91	32.4 ± 2.8	<0.0001*
**: Significant at 1% level of significance*			

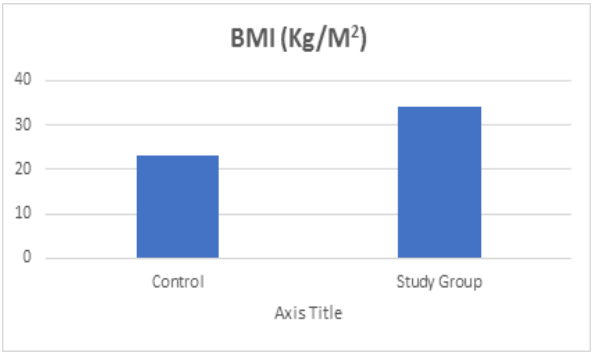
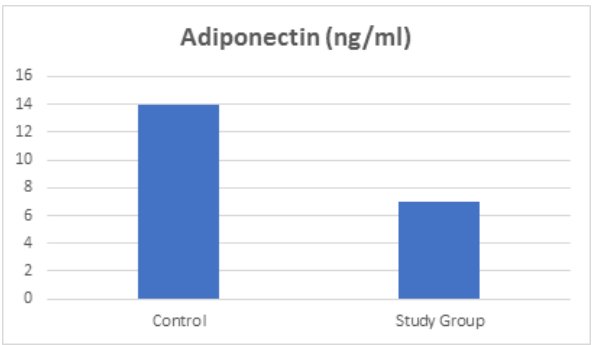


Figure I : Mean and SD of BMI (Kg/m2) in control and study group.

Table II: Mean and SD of Serum Adiponectin levels in Control and study group.

	Control	Study Group	p value
Adiponectin levels(ng/ml)	13.39 ± 1.02	5.6 ± 1.48	<0.0001*
**: Significant at 1% level of significance*			



FigureII: Mean and SD of Serum Adiponectin levels in Control and study group.

DISCUSSION

Overweight and obesity are a state of abnormal or excessive fat accumulation that may impair health.[2] The worldwide prevalence of obesity has nearly doubled between 1980 and 2008. In the WHO regions for Africa, Eastern Mediterranean and South East Asia, women had roughly doubled the obesity prevalence of men. The prevalence of overweight in high income and upper middle-income countries is more as compared to that of low and lower middle- income countries. In developing countries with emerging economies (classified by the World Bank as lower- and middle-income countries) the rate of increase of childhood overweight and obesity has been more than 30% higher than that of developed countries. Overweight and obesity are linked to more deaths worldwide than underweight.[12]

Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. Risks of coronary heart disease, ischemic stroke and type 2 diabetes mellitus increase steadily with increasing body mass index (BMI), a measure of weight relative to height. Raised body mass index also increases the risk of cancer of the breast, colon, prostate, endometrium, kidney and gall bladder.[2,12]The reason for the deep interest in adipose tissue-derived hormones lies in the growing incidence of obesity.

In this study, we hypothesized adiponectin to be a novel marker, playing an important role in the pathogenesis of obesity and hence estimated adiponectin levels in obese and non-obese individuals. For this total 90 people were enrolled between the age group of 25 to 60 years. Out of 90, 30 individuals were considered in control group whereas 60 in the study group. Gender-wise distribution is already mentioned in result.

BMI (kg/m^2) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults. It is calculated as a person's weight in kilograms divided by the square of his height in meters (kg/m^2). [12]According to the WHO definition,BMI greater than or equal to 25 is overweight and greater than or equal to 30 is obesity. In our study, individuals in control group have BMI with mean of 22.9 ± 1.91kg/m^{2}and of study group is 32.4 ± 2.8 kg/m^2, with $p \leq 0.0001$,as mentioned in table I(represented in graph I). BMI provides the most useful population-level measure of overweight and obesity as it is the same for both sexes and for all ages of adults. However, it should be considered a rough guide because it may not correspond to the same degree of fatness in different individuals. [2,12]A BMI between 25 - 30 should be viewed as medically significant and worthy of therapeutic intervention, especially in the presence of risk factors that are influenced by adiposity, such as hypertension and glucose intolerance.[1,2]

Obesity is a pro-inflammatory state, usually presenting with low-grade chronic inflammation associated with increased levels of pro-inflammatory cytokines, that are positively correlated to the BMI. [14] Obesity frequently leads to a dysregulation of adipokine secretion.Severely impaired adipokines expression in genetic and acquired obesity has been reported.[13]Adiponectin is exclusively secreted from adipose tissue (and also from the placenta in pregnancy) into the bloodstream and is very abundant in plasma relative to many hormones.[6] Levels of the hormone are inversely correlated with body fat percentage in adults.[15].This stand true for our study, level of serum adiponectin in control group is 13.39 ± 1.02 ng/ml and in study group (in obese individuals), level is on lower side with mean of 5.6 ± 1.48 ng/ml, (Table II, figure II).This result is statistically quite significant with p value of <0.0001.

Our findings in study group were consistent with the clinical studies done by Aritaet al. 1999[16], Hotta et al. 2001[17], Yang et al.2001[18] which also showed a decrease of adiponectin levels in obese humans relative to lean subjects. Arita, et al[16]. also observed and concluded that low levels were particularly more reflected in those with visceral obesity.

Hotta et al. 2000[17], Yang et al. 2001[18] found decreased adiponectin levels in obese individuals. They further observed an improvement in adiponectin levels after an intervention lead to weight loss. Thus, leanness is accompanied by increased adiponectin levels. A study by Delporte *et al.* (2002)[19] showed that malnourished anorexia nervosa patients with extremely decreased body fat content had markedly higher adiponectin levels relative to age- and

gender-matched controls. In contrast to the expression of adipokines such as tumor necrosis factors (TNF-a) and MCP-1, which cause insulin resistance, adiponectin expression is reduced in obese, insulin-resistant rodent models (Hu et al., 1996).[20]Weyer, et al.[20] showed that decreased circulating levels of adiponectin were more closely related to the degree of insulin resistance and hyperinsulinemia than to the degree of adiposity and glucose intolerance in humans.

The fact that obesity is the state of adiponectin deficiency makes this hormone a very tempting target for possible therapeutic interventions focusing on the possibility that adiponectin treatment may improve obesity-related insulin resistance and atherosclerosis.[4] Accordingto study of Lindsay et al., 2002, Adiponectin has been shown to be significantly related to the development of type 2 diabetes.[4] This concept we are evaluating in our study. That co-relation and data is under process and will be published soon.

CONCLUSION-

A strong relationship between levels of adiponectin and Obesity is observed, which explain heterogeneous nature of obesity and its associated complications. Potentially, dysregulation of these parameters may account for the increased risk of obesity. Adiponectin levels not only act as an early biomarker of adipocyte dysfunction but also can serve as therapeutic measure to prevent or in treatment of obesity.

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