

**STUDY OF SERUM ADIPONECTIN LEVELS IN TYPE 2 DIABETIC INDIVIDUALS & ITS CORRELATION WITH BMI AND WAIST HIP RATIO**Arshiya Begum<sup>1</sup>, Chitraa<sup>2</sup>, K. Nirmala Devi<sup>3</sup>**HOW TO CITE THIS ARTICLE:**

Arshiya Begum, Chitraa, K. Nirmala Devi. "Study of Serum Adiponectin Levels in Type 2 Diabetic Individuals & its Correlation with BMI and Waist HIP Ratio". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 05, January 15; Page: 826-834, DOI: 10.14260/jemds/2015/119

**ABSTRACT:** Adipose tissue is not simply an inert storage depot for lipids but an important endocrine organ. It secretes many hormones called Adipocytokines which include Adiponectin, which increase insulin sensitivity, has anti-inflammatory and anti atherogenic properties. **OBJECTIVES:** To study serum Adiponectin levels in type II DM individuals and compare the results with healthy controls and also to study the effect of BMI and WHR on serum Adiponectin levels. **MATERIALS AND METHOD:** The study was carried out in seventy seven subjects who included 6 healthy male controls and 6 healthy female controls, 30 diabetic males and 35 diabetic female individuals. The healthy controls both male and female of age around 40 to 50 years (+5 years) were selected with no history of diabetes or hypertension. The study group were selected of the same age as the control group from the Outpatient Department, Diabetology unit, of our Medical College. Individuals Height, Weight and Waist Hip Ratio were measured and BMI was calculated with the formula - Weight in Kg/ Height in m<sup>2</sup>. Estimation of serum Adiponectin with Human Adiponectin/Acrp 30 Immunoassay by Solid-phase ELISA which employs -Quantitative Sandwich Enzyme Immunoassay Technique. Plasma Glucose by GOD/POD method. **RESULTS:** The result shows that 1. Males have low levels of Adiponectin when compared to females which is not statistically significant and could be due to androgens like testosterone which inhibits the secretion of Adiponectin from adipocytes. 2. Comparison of serum Adiponectin levels in type 2 DM subjects and healthy controls shows statistically significant decrease in Serum Adiponectin levels (P Value < 0.05) in type II DM subjects. 3. Negative correlation between serum Adiponectin and WHR and BMI but it is not statistically significant. **CONCLUSION:** Serum Adiponectin levels are decreased in Type II DM individuals. Adiponectin may be considered as one of the significant novel markers in future for detection of Diabetes and also administration of Adiponectin and regulation of its pathway represents a promising target for management of obesity, hyperlipidemia, insulin resistance, Type II DM and vascular inflammation.

**KEYWORDS:** Adiponectin, Type II DM, BMI, WHR.

**ABBREVIATION:** BMI- Body Mass Index, WHR – Waist Hip Ratio.

**INTRODUCTION:** Adipose tissue is not simply an inert storage depot for lipids but an important endocrine organ that plays a key role in integration of endocrine, metabolic and inflammatory signals for control of energy homeostasis. The Adipocytes secrete many hormones called Adipocytokines which include<sup>(1)</sup>:

1. Leptin.
2. Resistin.
3. Acylation Stimulating Protein.
4. Adiponectin.

## ORIGINAL ARTICLE

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Studies have shown that Adiponectin plays an important part in increasing insulin sensitivity and it has anti-atherogenic and anti-inflammatory properties. Low Adiponectin levels are seen in individuals with Type 2 DM who have insulin resistance, obesity, CAD, dyslipidemia indicating that this novel protein may be an important marker of the Metabolic syndrome.<sup>(1)</sup>

### OBJECTIVES:

- a) To assess the level of Serum Adiponectin in male and female controls and to correlate with study group (NIDDM individuals)
- b) To assess the levels of Serum Adiponectin in Obese individuals.

**METHODOLOGY:** The study was carried out in seventy seven subjects who included 6 healthy male controls and 6 healthy female controls, 30 diabetic males and 35 diabetic female individuals.

The healthy control both male and female of age around 40 to 50 years (+5 years) was selected with no history of diabetes or hypertension.

The study group was selected of the same age as the control group from the Outpatient Department, diabetology unit of our Medical College.

5ml of fasting venous blood was drawn and used to measure the parameters like adiponectin, Glucose. 2hrs Postprandial Glucose was also measured.

Individuals Height, Weight and Waist Hip Ratio were measured and BMI was calculated with the formula - Weight in Kg/ Height in m<sup>2</sup>.

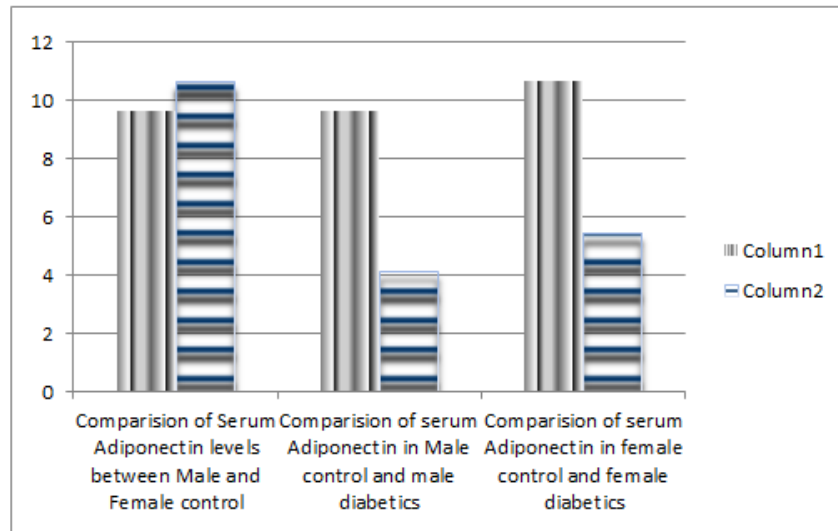
Estimation of serum Adiponectin with Human Adiponectin/Acrp 30 Immunoassay by Solid-phase ELISA which employed -Quantitative sandwich enzyme immunoassay technique,<sup>(2)</sup> Plasma Glucose by GOD/POD method.

### OBSERVATIONS AND RESULT:

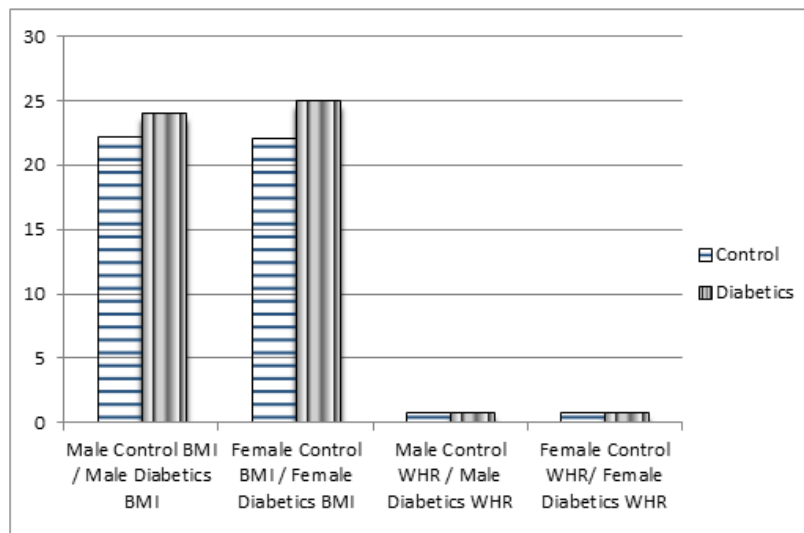
#### The result of the study shows that:

1. Comparison of Serum Adiponectin levels in Type 2 DM subjects and healthy controls show Statistically significant decrease in serum Adiponectin level in Type II DM (P value < 0.05). See Table (1)
  - a. Male controls 9.6+ 1.46 µg / ml and male diabetics 4.14 + 3.10 µg/ml (P value < 0.05.)  
Female controls 10.63 +1.64µg/ml and female diabetics 5.47+ 2.64 µg /ml (P value < 0.05.)
  - b. Males have low levels of Adiponectin when compared to females which is not statistically significant (P value > 0.05.).
  - c. Male control 9.6+ 1.46 µg / ml. Female control 10.63+1.64µg/ml. This can be explained by the fact that androgens like testosterone inhibit the secretion of adiponectin from 3T3L1 adipocytes.<sup>(27,28,29)</sup>

## ORIGINAL ARTICLE



2. In this study comparison between serum Adiponectin levels in male Diabetic individuals and BMI, WHR (Waist Hip Ratio) shows negative correlation. The negative correlation between BMI in males is highly statistically significant. (P -.516, <0.01), WHR correlation value 0.018 (not significant). See Table2.
3. In female diabetics correlation between serum Adiponectin levels and BMI, WHR show a negative correlation between BMI and Adiponectin levels correlation value is -.090(not significant). Studies show there is a negative correlation between WHR and Adiponectin levels in Female diabetics but it is not significant. WHR correlation value is P -.317(not significant)



**DISCUSSION:** The adipocytes secrete a variety of bioactive proteins into the circulation called adipocytokines which include:

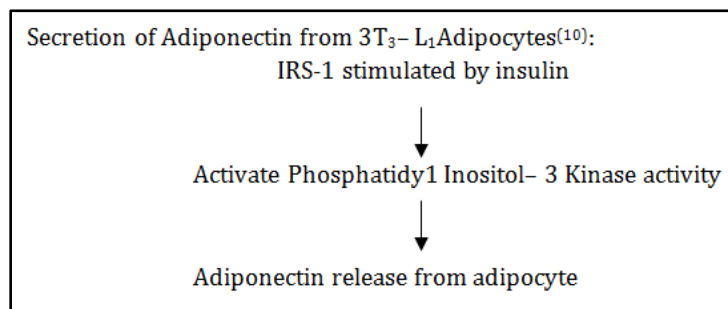
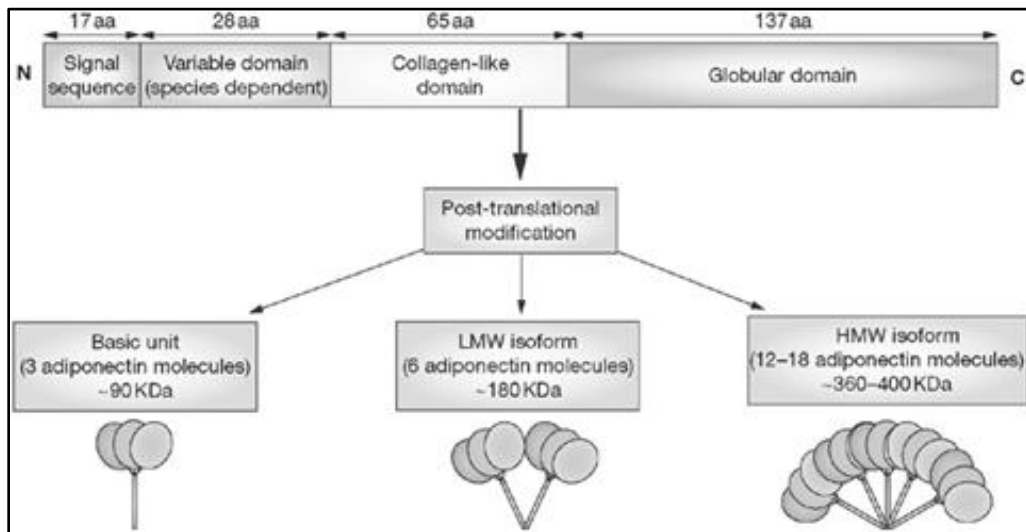
1. Leptin.
2. TNF -  $\alpha$ .
3. Plasminogen Activator Inhibitor Type I.
4. Adipsin.

## ORIGINAL ARTICLE

5. Resistin.
6. Acylation Stimulating Protein.
7. Adiponectin.

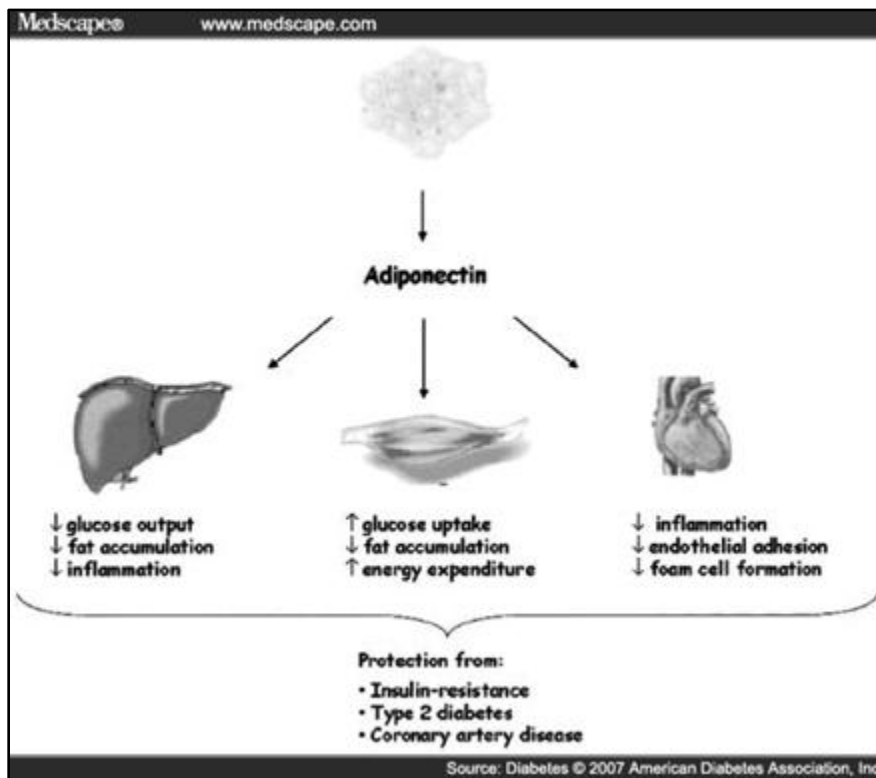
Adiponectin was identified in 1995<sup>(3)</sup> through human CDNA project targeting on adipose tissue by schrerer et al.<sup>(4)</sup> It also named as Adipocyte complement related protein of 30 kd (Acrp 30) Adipo Q, Gelatin Binding protein of 28kd (GBP 28).<sup>(5)</sup> It is a hydrophilic protein 244 amino acids.<sup>(6),(7),(8)</sup> It is the gene product of adipose tissue, most abundant gene transcript 1 (apM1gene).

It is a collagen like protein with a stretch of 22 collagen (Gly-X-Y) that is exclusively synthesized in White adipose tissue during adipocyte differentiation and circulates at a relatively high ( $\mu\text{g} / \text{ml}$ ) concentration in the serum.<sup>(1)</sup> The crystal structure of Adiponectin reveals an unexpected homology to TNF family of cytokines.<sup>(9)</sup> Adiponectin has Trimer, Hexamer and Multimer forms. It has 4 domains.



Half-life of Adiponectin is 5 – 6 hours and kidney seems to play important role in its biodegradation and elimination.

**Site of Action:** Adiponectin acts on peripheral tissues like liver, skeletal muscle and vascular tissue to exert its effects. (Fig 3.4)



#### MECHANISM OF ACTION:

- 1. It increases 5' AMP kinase Activity:** Which leads to suppression of Gluconeogenesis, promotion of glucose uptake in skeletal muscles, inhibit fatty acid and sterol synthesis, increase fatty acid oxidation and inhibit lipolysis.<sup>(11)</sup>
- 2. Enhance insulin stimulated receptor Tyrosine Phosphorylation<sup>(11),(12)</sup>:** Increase basal glucose uptake and also increase whole body insulin sensitivity.
- 3. Peroxisome proliferator activator regulator gamma (PPAR  $\gamma$ ) Mediation:** It enhances the promoter activity of adiponectin and increase the transcription of adiponectin in adipose tissue. PPAR $\gamma$  also increase the number of mature adipocytes which respond to enhancing effects of insulin on glucose disposal<sup>(13,14,15)</sup> and thus increase glucose tolerance and insulin sensitivity
- 4. Liver receptor homolog-1(LRH-1) Mediated:** LRHRE is seen on the adiponectin promoter<sup>(16)</sup> and functions as a competence factor by enhancing transactivation of PPAR/RXR in Adiponectin promoter.
- 5. Increase Fatty acid oxidation:** Peripheral application of Adiponectin attenuated body weight gain and decreased visceral adiposity by increasing the expression of Uncoupler protein 1, 2, 3.

#### METABOLIC ROLE OF ADIPONECTIN:

##### I. Insulin sensitivity / Carbohydrate Metabolism:

1. A strong correlation between Adiponectin and systemic insulin sensitivity has been well established both in vivo and in vitro in humans.<sup>(1)</sup>
2. The plasma Adiponectin concentration is decreased in insulin resistant states such as obesity and type II DM.<sup>(17,18,19,20,21)</sup>

3. In Obesity there is an increase in TNF- $\alpha$  level which leads to insulin resistance.<sup>(21)</sup> Increased levels of TNF - $\alpha$  decreased expression of Adiponectin mRNA in adipose tissue by suppressing the promoter region of Adiponectin.<sup>(22)</sup>

## II. Adiponectin and Lipid Metabolism:

1. Decreased Adiponectin levels are associated with increased in small dense LDL, Apo B, TGL.
2. Adiponectin levels correlates positively with HDL Cholesterol.<sup>(23,24)</sup>
3. Adiponectin decreases the plasma Free Fatty Acid levels and increases  $\beta$  oxidation of fatty acids.

## III. Adiponectin as an Anti-inflammatory Agent:

1. Studies have proved that chronic inflammation plays a role in the pathogenesis of Type II DM, Obesity and Insulin Resistance.<sup>(25)</sup>
2. Adiponectin inhibits the expression of TNF- $\alpha$ , Soluble Intra Cellular Adhesion molecule (SICAM),<sup>(26)</sup> Soluble Vascular Adhesion Molecule (SVCAM-1) and SE -selectin acting via Nuclear Factor -  $\kappa$  $\beta$  signalling pathway which is crucial to inflammatory response.<sup>(27)</sup>

## IV. Adiponectin As an Anti- Atherosclerotic Agent:

1. Experiments have shown that Adiponectin has potential Anti-atherogenic properties.<sup>(28,29)</sup>
2. Adiponectin inhibits foam cell formation from macrophages, suppress proliferation and migration of vascular smooth muscle cells by decreasing the effect of various growth factors.

## V. Obesity, BMI, WHR and Adiponectin:

1. Studies conducted by Masaki et al shows a negative correlation between Adiponectin, WHR and BMI.<sup>(30)</sup> There is a strong negative relationship between Adiponectin and visceral fat than that of subcutaneous fat because Adiponectin is produced by the visceral fat. This paradoxical decrease in obesity is because less adiponectin is produced by the TGL filled visceral adipocytes which are less insulin sensitive.<sup>(31)</sup>

Variable	Control Male	Diabetic Male	P Value	Control Female	Diabetic Female	P Value
Number	6	30		6	35	
Serum Adiponectin level $\mu$ g /ml	9.6 + 1.46	4.14+3.10	<0.05	10.63+1.64	5.47+2.64	<0.05
FPG mg/dl	82.50 + 6.89	150.70 + 48.03	<0.05	83.33 + 9.30	149.70 + 43.48	<0.05
PP mg/dl	113.80+ 6.83	199.40 + 38.22	<0.05	109.83+ 4.02	211.45 + 46.00	<0.05
BMI	22.21 + 2.61	24.08 + 4.14	>0.05	22.10 + 1.95	25.10 + 4.19	>0.05
WHR	0.833 + 0.076	0.89 + 0.071	>0.05	0.89 + 0.071	0.82 + 0.43	>0.05

Table 1: Shows P value on comparison with Diabetics and Healthy controls

## ORIGINAL ARTICLE

Correlation between Adiponectin levels and	Correlation Value	Significance
BMI in Male Diabetics	-.516**	Significant at 0.01
WHR in Male Diabetics	0.018	Not Significant
BMI in Female Diabetics	-.090	Not Significant
WHR in Female Diabetics	-.317	Not Significant

Table 2: Shows the Correlation value between Diabetic and healthy controls

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Date of Submission: 23/12/2014.  
Date of Peer Review: 24/12/2014.  
Date of Acceptance: 05/01/2015.  
Date of Publishing: 14/01/2015.