Serum adiponectin and BMI among Type 2 Diabetes Mellitus in Manipur

Muhammed Najir Ahamad Bilhuda[1], L. Suresh Roy[2]
Post-Graduate Trainee[1], Professor[2], Department of Physiology
Regional Institute of Medical Sciences, Imphal, Manipur.

Abstract
Background: *Diabetes Mellitus (DM) is a syndrome characterized by chronic hyperglycemia and disturbances of carbohydrate, fat and protein metabolism associated with absolute or relative deficiency of insulin secretion and /or insulin action. Adiponectin, a protein secreted by adipocytes acts as a hormone with anti-inflammatory and insulin sensitizing properties and regulates glucose and lipid metabolism. Number of studies have explored the role of adiponectin in insulin sensitivity and insulin resistance in Type 2 DM among the various population across the world. However, limited data are available to compare the levels of serum adiponectin and body mass index (BMI) among diabetic patients in Manipur.*
Objective: *To compare the levels of serum adiponectin and BMI among diabetic patients in Manipur.*
Material and Methods: *A case control study was conducted in the department of Physiology, Regional Institute Of Medical Sciences (RIMS), Imphal, Manipur. Serum adiponectin was measured along with BMI among diabetic patients and control group and data collected was analyzed using SPSS version 21(IBM).*
Result: *Adoponectin level was found to be significantly decreased among diabetic patients than control group (7.0 ± 3.5 µg/ml vs 13.4 ± 7.1 µg/ml). With increase in BMI above normal, the decrease in adiponectin level was significant when diabetic patients and control group were compared.*
Conclusion: *Serum adiponectin level decreased among diabetic patients than controls and its concentration was found to be correlated with BMI > 22.9 among both groups.*
Keywords*: Type 2 DM, Hyperglycemia, Insulin, Adiponectin, Adipocytes, BMI.*

I. Introduction

Diabetes Mellitus (DM) is a syndrome characterized by chronic hyperglycemia and disturbances of carbohydrate, fat and protein metabolism associated with absolute or relative deficiency of insulin secretion and /or insulin action. Diabetes mellitus may be suspected clinically by the presence of symptoms such as thirst, polyuria, pruritus, otherwise unexplained weight loss or one of many complications associated with or attributable to the disease.[1]

The World Health Organization estimates that about 347 million people worldwide have diabetes with a global average prevalence of approximately 10%.[2] India is witnessing an epidemic of DM and is referred to as the diabetes capital of the world. It is estimated that by 2025, there was nearly 70 million people with diabetes in India, meaning, every 5th diabetic in the world would be an Indian.[3]

On the other hand, obesity is a major public health problem worldwide, with significant social and psychological dimensions that have afflicted increasingly younger individuals and different socioeconomic groups. It is one of the most important determinants of many chronic non-communicable diseases (NCD) that significantly affect the mortality rate of many countries, including developing countries.[4]

Adiponectin, one of the recently described secretory proteins has important metabolic and anti-inflammatory actions suggesting a protective role in diabetes development.[5] It is a highly abundant protein secreted exclusively by adipocytes that regulates glucose and lipid metabolism.[6,7] It also acts as a hormone with anti-inflammatory and insulin sensitizing properties.[8,9] Adiponectin has been found to influence the body's response to insulin thereby modulates insulin action and resistance.[10] Adiponectin level is lowered in patients with impaired glucose tolerance or type 2 diabetes mellitus. However, in contrast, there were reports also that adiponectin levels do not significantly differ between T2DM patients and healthy subjects. Expression of adiponectin gene and fasting plasma adiponectin levels were found similar in both diabetic and non-diabetic subjects. The adiponectin gene expression was shown independent of the degree of obesity and insulin sensitivity.[11]

Inspite of increasing number of diabetes and rapid growth progress of science and technologies in its management and treatment, there has not been much studies on adiponectin and its correlation with BMI among

---

diabetics. It might through some light among diabetics because of its potential epidemiological and clinical implications. The present study was aimed at assessing the serum adiponectin levels and its correlation with BMI in a cross section of population of Manipur who were suffering from type 2 diabetes mellitus.

II.   Aim of the study

To compare the levels of serum adiponectin and BMI among diabetic patients and controls.

III.   Materials and Methods

3.1. Study Design and Setting
The case- control study was carried in the department of Physiology, RIMS, Imphal on 44 diabetic cases and 44 controls irrespective of sex, socio-economic status and ethnicity.

3.2. Study Period
The study was carried out in two years from September 2018 to August 2020.

3.3. Sample Size
39 diabetic patients and 49 control subjects belonging to both sexes.

3.4. Study Population
Case group consisting of patients who met the American Diabetes Association (ADA) criteria[12] of type 2 diabetes mellitus and attended the out-patient department of Medicine, RIMS, Imphal irrespective of sex, socio-economic status and ethnicity.

Control group consisting of normal healthy individuals of comparable age and sex who were free from diabetes and any systemic diseases irrespective of sex, socio-economic status and ethnicity.

The subjects of the case and control groups were further divided into three groups based on BMI (Normal group: BMI $\leq$ 22.9, Overweight group: BMI 23.0 – 24.9 and Obese group: BMI $\geq$ 25).[13]

3.4.1. Inclusion Criteria
1.   Subjects belonging to both sex and age $\geq$ 18 years.
2.   Subjects were selected on the basis of American Diabetes Association (ADA) criteria :-
a. A fasting plasma glucose of >126 mg/dl (after no caloric intake for at least 8 hours) or
b. A casual plasma glucose >200 mg/dl (taken at any time of day without regard to last meal) with classic diabetes symptoms: increased urination, increased thirst and unexplained weight loss or
c. An oral glucose tolerance test (OGTT) (75 gram dose) of >200 mg/dl for the two hour sample. Oral glucose tolerance testing is not necessary if patient has a fasting plasma glucose level of >126 mg/dl. The Committee states that the fasting plasma glucose is the preferred test and recommends moving toward its universal use for testing and diagnosis.

3.4.2. Exclusion Criteria
1. Subjects with complaints of chronic cough, sputum or breathlessness
2. Subjects having Cardio-Respiratory illness or any other major diseases
3. Subjects with history of smoking and alcoholism
4. Subjects with any physical disabilities that may affect lung function such as
kyphoscoliosis, Pectus Excavatum, Pectus Carinatum etc
5. Subjects suffering from Type 1 Diabetes Mellitus
6. Subjects suffering from Metabolic syndrome
7. Subjects unwilling to participate

3.5. Study variables
Adiponectin was estimated by Mediagnost ELISA using Adiponectin E09 kit, Germany. BMI was recorded by assessing the height and weight of all the subjects using stadiometer and weighing machine.

3.6. Ethics Approval
All the subjects were informed about the nature of the study and those who agreed to participate were asked to sign the informed consent form. Privacy and confidentiality were maintained during data collection by using unique codes. All the informations collected for the study were utilized only for the study purpose and were not disclosed to anyone. The approval of the Research Ethics Board, RIMS, Imphal was taken.

3.7 Statistical Analysis
Data entry was done using SPSS 21.0 version (IBM Inc. Armonk, NY, USA). Descriptive statistics like mean, standard deviation etc. were calculated. Correlation between adiponectin and BMI was calculated by using Chi-square test and a p-value of <0.05 was taken as significant.

IV.   Results and Observations

The present study was conducted on 88 subjects out of which 39 were Type 2 Diabetes mellitus patients who met the American Diabetes Association (ADA) criteria belonging to both sex and attended the out-patient department of Medicine RIMS, Imphal and another 49 were normal healthy subjects belonging to both sex. The study was carried out during the period of 2 years (September, 2018 to August, 2020).

Table 1 shows that serum adiponectin level in diabetic cases among different BMI group were significantly lower as compared to control. Adiponectin level among diabetic cases in BMI group of ≤ 22.9 was (7.66 ± 1.17 µg/ml) which was lower than the control (14.69 ± 8.30 µg/ml) but statistically insignificant. Among overweight groups (BMI 23- 24.9), adiponectin level among diabetic cases (7.77 ± 4.59 µg/ml) was found to be significantly lower than control (12.18 ± 4.91 µg/ml). Among obese groups (BMI ≥ 25), adiponectin level among diabetic cases (6.54 ± 3.17 µg/ml) was also significantly lower than the control group (12.11 ± 6.33 µg/ml).

Table 1: Comparison of serum adiponectin level (µg/ml) with BMI among cases and controls

BMI	Cases (n=39)	Controls (n=49)	p- value
≤ 22.9	7.66 ± 1.17	14.69 ± 8.30	0.168
23- 24.9	7.77 ± 4.59	12.18 ± 4.91	0.033
≥ 25	6.54 ± 3.17	12.11 ± 6.33	0.011

Table 2 shows that among control group, serum adiponectin level (13.4 ± 7.1 µg/ml was significantly higher than diabetic cases (7.0±3.5 µg/ml).

Table 2: Comparison of serum adiponectin level (µg/ml) stratified by cases and controls

Cases (n= 39)	Controls (n= 49)	p- value
7.0 ± 3.5	13.4±7.1	0.000

V.   Discussion

The study was conducted to compare serum adiponectin and BMI among type 2 diabetes mellitus patients and normal individuals. It was found that serum adiponectin levels decreased among the diabetic group than control group among different BMI groups. Since adiponectin is stimulated by insulin and inhibited by TNF-α, insulin resistance and enhanced TNF-α expression may contribute to this effect. TNF-α produced by white adipose tissue is markedly upregulated in obesity and contributes to insulin resistance by interfering with insulin receptor signaling.[14] TNF-α also suppresses adiponectin expression in white adipose tissue.[15]

In the present study, the mean adiponectin level of diabetic cases were significantly lower than the controls. The adiponectin level of diabetic cases was 7.0±3.5 µg/ml whereas of controls was 13.4±7.1 µg/ml. Adiponectin increases insulin sensitivity by inhibiting hepatic glucose production and increases glucose uptake in muscles and the findings of our study was found to be in accordance with Looker HC et al.[16]

Obesity is a strong factor for the development of diabetes and it has been observed that obese or overweight are at increased risk of development of diabetes. Our study also shows a significant correlation of adiponectin with BMI. Adiponectin was found to be significantly correlated with BMI when it was above normal.

VI.   Limitation of the study

The present study was done among less sample size and moreover details regarding diet, physical exercise and duration of oral hypoglycemic drugs intake was not considered which might have influenced our findings. Prospective and population based studies on a large-scale may be needed to confirm the association.

VII.   Conclusion

This study shows that serum adiponectin level is significantly decreased among type 2 diabetes mellitus patients as compared to controls **.** The serum adiponectin level showed significant correlation with BMI above normal. Thus it can be concluded that serum adiponectin estimation may be a useful biomarker for diagnosis of type 2 diabetes mellitus and it may be a useful adjunct in the treatment of type 2 diabetes mellitus.

References

[1].   Bennet PH. Definition, diagnosis and classification of diabetes mellitus and impaired glucose tolerance. In: Kahn CR, Weir GC, Williams L, Philadelphia L, editors. Joslin's Diabetes Mellitus 13th ed. India: BI Publications Pvt Ltd;1995.p.193-200.

[2].   Danaei G, Finucane MM, Lu Y, Singh GM, Cowan MJ, Paciorek CJ, et al. National, regional, and global trends in fasting plasma glucose and diabetes prevalence since 1980: systematic analysis of health examination surveys and epidemiological studies with 370 country-years and 2·7 million participants. Lancet 2011;378(9785):31-40.

[3].   Shashank RJ, Das AK, Vijay VJ, Mohan V. Challenges in diabetes care in India: sheer numbers, lack of awareness and inadequate control. J Assoc Physicians India 2008;56(6):443-50.

[4].   Costa MC, Brito LL, Barbosa PJB, Ines L. Adiponectin and low cardiometabolic risk in obese women. Arq Bras Endocrinol Metab 2011;2(004-2730):55.

[5].   Pajvani UB, Scherer PE. Adiponectin: systemic contributor to insulin sensitivity. Curr Diab Rep 2003;3(3):207-13.

[6].   Viengchareun S, Zennaro MC, Pascual-Le Tallec L, Lombes M. Brown adipocytes are novel sites of expression and regulation of adiponectin and resistin. FEBS Lett 2002;532(3):345-50.

[7].   Diez JJ, Iglesias P. The role of the novel adipocyte-derived hormone adiponectin in human disease. Eur J Endocrinol 2003;148(3):293-300.

[8].   Kadowaki T, Yamauchi T, Kubota N, Hara K, Ueki K, Tobe K. Adiponectin and adiponectin receptors in insulin resistance, diabetes and the metabolic syndrome. J Clin Invest 2006;116(7):1784-92.

[9].   Herder C, Carstensen M, Ouwens DM. Anti-inflammatory cytokines and risk of type 2 diabetes. Diabetes Obes Metab 2013;15 Suppl 3:39-50.

[10].   Weyer C, Funahashi T, Tanaka S, Hotta K, Matsuzawa Y, Pratley RE, et al. Hypoadiponectinemia in obesity and type 2 diabetes: close association with insulin resistance and hyperinsulinemia. J Clin Endocrinol Metab 2001;86(5):1930-5.

[11].   Yang WS, Lee WJ, Funahashi T, Tanaka S, Matsuzawa Y, Chao CL, et al. Weight reduction increases plasma levels of an adipose derived anti-inflammatory protein, adiponectin. J Clin Endocrinol Metab 2001;86(8):3815-19.

[12].   American Diabetes Association. Classification and Diagnosis of Diabetes. Diabetes Care [serial online] 2015;38(Suppl 1):8-16. Available from: http://care.diabetesjournals.org/content/38/supplement_1/S8. Accessed July 28,2018.

[13].   Misra A, Chowbey P, Makkar BM, Vikram NK, Wasir JS, Chadha D, et al. Consensus statement for diagnosis of obesity, abdominal obesity and the metabolic syndrome for Asian Indians and recommendations for physical activity, medical and surgical management. J Assoc Physicians India 2009;57(2):163-70.

[14].   Hotamisligil GS, Speiegelman BM. Tumor necrosis factor-alpha: a key component of the obesity-diabetes link. Diabetes 1994;43(11):1271-8.

[15].   Maeda N, Takahashi M, Funahashi T. PPAR gamma Ligands Increase Expression and Plasma Concentrations of Adiponectin, an Adipose-Derived Protein. Diabetes 2001;50(9):2094-9.

[16].   Looker HC, Krakoff J, Funahashi T, Matsuzawa Y, Tanaka S, Nelson RG, et al. Adiponectin concentrations are influenced by renal function and diabetes duration in Pima Indians with type 2 diabetes. J Clin Endocrinol Metab 2004;89(8):4010-7.