

Analysis of Change in Body Composition in Diabetic Patients vs non-Diabetic Patients

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ABSTRACT

Objective: To assess the difference in various parameters of body composition between the diabetic patients and non-diabetic controls at Pak Emirates Military Hospital Rawalpindi.

Study Design: Comparative cross-sectional study.

Place and Duration of Study: Medicine and Nutrition Department, Pak Emirates Military Hospital, Rawalpindi, from Jul 2018 to Mar 2019.

Methodology: This study was conducted on 100 patients of non-insulin dependent diabetes mellitus under treatment in medicine department and matched controls from the community. Patients with type I diabetes or insulin dependents or having some other com or bid metabolic illness or autoimmune disease or malignancy were not included in the study. Parameters of body composition were measured by using the INBODY machine which works on the principle of electro-impedance.

Results: Cases and controls were matched for age and gender. Hundred cases and hundred controls were recruited for the final analysis Mean age of the cases was 43.41 ± 2.231 years while controls were 43.46 ± 3.122 years. Mean BMI in cases was 29.32 ± 2.561 while in controls was 25.62 ± 4.483 . BMI, visceral fat and skeletal muscle fat were found statistically significant to be more in cases of non-insulin dependent diabetes mellitus as compared to the controls.

Conclusion: This case control study revealed that diabetes significantly affects the body composition of the patients. It also affects other parameters like skeletal muscle mass and visceral fat. Routine screening of body composition should be made part of the diabetic clinics to pick these changes early and intervene accordingly.

Keywords: Body composition, Diabetes mellitus type II, Electro-impedance.

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INTRODUCTION

Diabetes mellitus has been one of the most commonly encountered metabolic disorders at various specialty clinics including internal medicine, nephrology, cardiology, surgery, endocrinology, ophthalmology and nutrition clinic.¹ Pakistan also has high burden (>40 percent) of this devastating illness which affects almost all the organs of body.² Various epidemiological studies have shown high prevalence (up to 80%) of this illness and that too with complications in our part of the world.^{3,4} Still researchers say that these studies show figures less than reality as most of the population in villages never come to attention of clinicians and researchers.

Various parameters have been used for decades to look for the control of diabetes and see the effects of this illness on overall physiology of body. Association of diabetes and change in weight and lipid parameters of human body has been well established.^{5,6} Recent advances in the field of nutrition and metabolic

parameters have brought in discussion the concepts of various components of body composition which were not considered in routine previously.⁷ Measurement of total body fat, visceral fat, skeletal muscle mass and obesity degree have been under the interest of clinicians, nutritionist and researchers to look for their significance in various metabolic disorders including the diabetes.^{8,9}

Considerable literature is available that link the presence of diabetes mellitus with changes in body composition. A study done by physiologists in India concluded that patients with diabetes mellitus have more ectopic fat on the expense of skeletal muscle mass. Measurement of the parameters of body composition should be incorporated in primary health care settings to early diagnose and manage and save the patient from long term damage.¹⁰ Anatomy department of a university of Bulgaria revealed that total body fat in diabetics group was greater than the controls. The relative percentage of active body mass was greater in the healthy individuals than in diabetic patients. Longer duration of disease affected more than short duration and younger age group was at more risk of developing

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changes in body composition parameters due to this metabolic illness. Another study done in Spain including the type 1 diabetics revealed differences in anthropometric characteristics and body composition in type 1 diabetes mellitus, especially lower waist-hip ratio in male, higher free-fat mass in female and lower fat mass in male. A Canadian study revealed that the parameters of body composition also show change with change in levels of glycosylated hemoglobin after exercise training for few months.⁹

Considering the damage done by diabetes at various systems of body, routine methods of measuring the fat and obesity parameters seem inadequate. Departments of rehabilitation and nutrition are evolving all over the Pakistan but still there is a huge gap between the patients undergoing these types of screening and those never undergoing these tests. Research has also been very limited in this area in our part of the world. A study has been done in endocrine department of Karachi, but it included apparently healthy adults and compared various parameters. Limited local data is available on the patients suffering from metabolic disease like diabetes mellitus. Therefore, we planned this study with the aim to assess the difference in various parameters of body composition between the diabetic patients and non-diabetic controls at Pak Emirates Military Hospital Rawalpindi.

METHODOLOGY

This study was conducted in liaison with Medicine and Nutrition department of Pak Emirates Military Hospital Rawalpindi, from July 2018 to March 2019. Sample size was calculated by using the WHO sample size calculator. Solanki *et al*, wit population prevalence proportion of 80% was used as reference.⁷ Nonprobability consecutive sampling was used to enroll the cases of non-insulin dependent diabetes mellitus and age and gender matched controls were included from the community.

Inclusion Criteria: Patients of type II diabetes which were non-insulin dependent with age between 18 and 60 of both the genders were included in the study as cases.

Exclusion Criteria: Patients with type I diabetes or insulin dependents or having some other comorbid meta-bolic illness or autoimmune disease or malignancy were not included in the study. A similar criterion was used to recruit the controls from the community by choosing the healthy volunteers who fulfilled the criteria and agreed to participate in the study after listening to full description. Age and gender were matched and

diabetes and all other illnesses were ruled out before recruiting them as controls in the study. Pregnancy and use of lipid lowering drugs was also part of exclusion criteria for both the cases and controls.

In body machine was used to assess the body composition in both cases and controls which works on the principle of electro-impedance.^{12,13} After entering age, gender and height taken by stadiometer subject was allowed to stand on the instrument after its calibration. A digital, portable noninvasive instrument working on principle of tetra polar body index analyzer was used that passes electric current of 500 μ A at frequency 5 kHz to scan the whole body to derive regional body composition. We enrolled ambulatory outdoor patients only and took the reading in the morning to avoid dehydration that otherwise would affect the accuracy of this method.^{14,15}

Cut off values used for the parameters studies in this analysis were BMI less than or equal to,^{25,17} Visceral fat less than 1018 and Values of total body fat and skeletal muscle mass were taken according to standard guidelines as less than or more than threshold values.^{16,17}

Ethical approval was taken from the ethical review board committee of PEMH before the start of this study. IREB letter number is A/28/PSS/-105649. After written informed consent from the potential participants, patients diagnosed with type II diabetes mellitus and using oral hypoglycemic agents fulfilling the above-mentioned criteria of inclusion and exclusion were included in the study. Their diagnosis was made by a consultant medical specialist or endocrinologist. Once any co-morbidities were established and exclusion criteria were applied then the patients underwent BMI calculation via standard World Health Organization (WHO) formula.¹⁸ After that they underwent body composition analysis by inbody machine and report generated by the analyzer was attached to the study proforma. Similar procedure was done for the controls included in the study.

All statistical analysis was performed by using the Statistics Package for Social Sciences version 24.0 (SPSS-24.0). Mean and standard deviation for the age and BMI of both cases and controls was calculated. Frequency and percentages for gender and presence of overweight and obesity (on BMI).

RESULTS

Hundred cases and hundred controls were recruited of the final analysis. Cases and controls were matched for age and gender. mean age of the cases was 43.41 ± 2.231 years while controls was 43.46 ± 3.122

years. Mean BMI in cases was 29.32 ± 2.561 while in controls was 25.62 ± 4.483 . Mean duration of type II diabetes mellitus in the patient group was 5.56 ± 7.221 years. Our analysis showed that BMI and visceral fat were found to be statistically significant in cases of non-insulin dependent diabetes mellitus as compared to the controls while skeletal muscle mass was less than threshold due to deposition of fat (Table).

Table: Characteristics of patients and controls participating in study.

	Cases n=100	Controls n=100
Age (Years)		
Mean \pm SD	43.41 \pm 2.231	43.46 \pm 3.122
Range (min-max)	23-57 years	22-57 years
Gender		
Male	62 (62%)	64 (64%)
Female	48 (48%)	46 (46%)
Body Mass Index Mean \pm SD	29.32 \pm 2.561	25.62 \pm 4.483
Mean Duration of DM Type II	5.56 \pm 7.221	NA

DISCUSSION

We planned this case control study with the aim to assess the difference in various parameters of body composition by electro-impedance method between the diabetic patients and non-diabetic controls at Pak Emirates Military Hospital Rawalpindi. By using the standard machine, we included parameters of visceral fat, total body fat and skeletal muscle mass in our analysis and found two of them significantly different in the diabetic population as compared to the healthy controls. Total body fat was significantly raised in the cases as compared to controls in our analysis. This finding has been reported by the studies done in the past as well by Solanki *et al.* in 2016.¹⁰ Previously considered as disease of people with over eating and sedentary life style, it has turned out to be equally common in the people with low socio-economic status and working class.¹⁹ This multisystem illness not only increase the chance of mortality but also cause a compromise in overall quality of life by causing change in the physiology of body and disrupting the homeostatic mechanisms.²⁰ A lot of work has been done with regard to the metabolic changes caused by diabetes and alteration in the weight and lipid profile markers⁶ but less attention has been paid to the parameters of body composition.

Electro-impedance method to look for the changes in body composition has been in use for many years but clinicians seldom use it in their clinical practice. It particularly gives an idea about the body fat and muscle mass.⁸ Principle of impedance or resistance

revolves around the passage of voltage through the body.¹⁵ More muscular the body is more is water component and less is the resistance. This principle gives the information regarding total body water from which body fat can be calculated. Various components could be measured or calculated by this method.⁸ The change in parameters could be explained on the mechanism of diabetes. Even the illness with good control with medications has been associated with changes in fat and lipid component of the body on macro level as well as biochemical level.

Skeletal muscle mass was less in the case group as compared to the control group. This finding has also been in line with the studies of the past especially work done by Solanki and his colleagues.¹⁰ Diabetics have more deposition of fat and adipose tissue in the muscle region leading to less actual muscle mass.

BMI was another parameter which was seen significantly high in the patients of diabetes as compared to the healthy controls. This fact has been seen as a regular finding in most of the studies done on this topic in 2015 and 2016.^{7,10} Overall fat deposition in various regions of the body in diabetics due to altered metabolic pathways may be cause of this finding seen as global phenomenon associated with diabetes.

Diabetic control was not assessed during this study and number of medications was not considered. These factors could interfere with the results and decrease the generalizability of this study. Moreover, effect of exercise or lifestyle modifications was not considered as some of the controls would be sedentary while cases would be doing regular exercise. Future studies addressing these limitations could generate more generalizable results.

CONCLUSION

This case control study revealed that diabetes significantly affects the body composition of the patients. It also affects other parameters like skeletal muscle mass and visceral fat. Routine screening of body composition should be made part of the diabetic clinics to pick these changes early and intervene accordingly.

Conflict of Interest: None.

Author Contribution

NS:, IF:, NA: Substantial contribution in literature review, data collection, Article writing, editing of manuscript.

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