DOI: https://doi.org/10.54393/pjhs.v4i01.486

PAKISTAN JOURNAL OF HEALTH SCIENCES

https://thejas.com.pk/index.php/pjhs

Volume 4, Issue 1 (January 2023)

Original Article

Prevalence of Impaired Glucose Tolerance/prediabetes in Local Adult Obese Population Presenting to a Tertiary Care Hospital

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ARTICLE INFO

Key Words:
Impaired Glucose Tolerance, Obesity, Prevalence

How to Cite:
Khan Hadi, N. ., Salman Aamir, M. ., Ghaffar, T. ., Khan, S. ., Islam, S. ul ., Khan, S. ., ., N., & Ali, M. . (2023). Prevalence of Impaired Glucose Tolerance/ Prediabetes in Local Adult Obese Population Presenting to A Tertiary Care Hospital: IGT in Local Adult Obese Population . Pakistan Journal of Health Sciences, 4(01). https://doi.org/10.54393/pjhs.v4i01.486

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Received Date: 4th Jan, 2023
Acceptance Date: 18th Jan, 2023
Published Date: 31st Jan, 2023

ABSTRACT

Obesity is affecting all countries across the globe and becoming an epidemic. It is a major factor contributing to metabolic disorders, diabetes and cardiovascular diseases (CVD). In Pakistan, CVD has highest mortalities which is closely related to obesity and diabetes. **Objective:** To determine the frequency of impaired glucose tolerance (IGT) in local adult obese population. A cross sectional, descriptive study was designed department of Medicine, Hayatabad Medical Complex, Peshawar. **Methods:** A total of 136 patients with BMI of more than 25kg/m2 in Medical OPD with age between 18-60 years were included. Weight and height were measured for obesity and BMI calculation. All patients were subjected to 75gm oral glucose tolerance test after 08 hours overnight fast. Venous blood was withdrawn before and after the oral glucose solution and IGT were considered positive if the blood glucose level is between 140- 199mg/dl at 2-hour post oral glucose solution. **Results:** 136 patients were analyzed in which 42(31%) patients were having age between 18-40 years, 94(69%) patients were having age between 41-60 years. Mean age was 53 years with SD ± 10.44. Forty-nine (36%) patients were male and 87(64%) patients were female. Moreover 24(20%) patients had IGT while 112(80%) patients had normal glucose tolerance. **Conclusion:** Impaired glucose tolerance was found in 20% of adult obese population. The exponential rise from obesity 1 patients having 8% and obesity 3 patients having 57% IGT shows significantly increased risk.

INTRODUCTION

Obesity (defined by body mass index BMI) is affecting all countries across the globe and becoming an epidemic. It is affecting 30% of the united stated population alone and almost similar results for most countries [1]. Obesity is a major factor contributing to metabolic disorders, diabetes and cardiovascular diseases. In Pakistan, Cardiovascular diseases is one of the major NCD's with highest mortalities, which is closely related to obesity and diabetes [2]. National diabetes survey conducted in Pakistan in 2017 was largest survey to see diabetes and prediabetes prevalence utilizing oral glucose tolerance test found higher prevalence of impaired glucose tolerance/prediabetes in Pakistan. Prevalence of pre-diabetes was 14.4%, more in urban areas (15.5%) than rural areas (13.9%). The prevalence of obesity using Asian cut-offs was exponentially high with overweight, 76.2% and obesity in 62.1% respectively [3]. Along with other factors, obesity was found a strong risk factor for diabetes and prediabetes. A study conducted in Pakistan and India also showed high prevalence of obesity in school going children in Pakistan as well [4]. Another large study conducted in same year using HbA1c as cutoff showed 16.98% prevalence of diabetes. Prediabetes was present 10.91% of subjects. The odds of having diabetes while having obesity was 1.54

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signifying the importance of dysglycemia in obesity [5]. The concept of modifiable and non-modifiable risk factors modifiable risk factors common in all cardiovascular diseases include diabetes mellitus, hypertension, dyslipidemia, overweight/obesity. This is further augmented by smoking, alcohol, dietary issues and lack of physical activity [6]. For our population in Asia these factors effect outcomes at lesser BMI cutoffs than European populations [7]. This potentiate the issues as this part of the world is more prone to the adverse outcomes then. So, WHO and international bodies are using cut off value of BMI for definition of overweight (23 to 24.9 Kg/m2) and obesity greater than 25 Kg/m2 in Asian population and same goes for the waist circumference as well? WHO 2008 figures for overweight and obesity are 35% and 12% respectively [7, 8]. Impaired glucose tolerance (IGT) is also considered pre-diabetes which signifies its importance. It is defined as "two hours' glucose level of 140 to 199 mg/dl (7.8-11 mmol/L) on the 75-gram oral glucose tolerance test. [9]. Impaired glucose levels are also called as prediabetes because its above normal but not reaching diagnostic limit established for diabetes. Impaired glucose tolerance or prediabetes is characterized by subtle increase in sugar levels and resistance to insulin and is a precursor of diabetes mellitus and a risk factor for coronary artery disease, stroke and peripheral vascular disease [10]. The progression from prediabetes to diabetes is set in, by altering the glucose processing and storage, worsening with time and leading to frank diabetes [11]. High incidence of impaired glucose tolerance in obese population has been reported, signifying the relation between obesity and insulin resistance, impaired glucose tolerance, pancreatic β-cells dysfunction and change in abdominal fat distribution [12]. The term diabesity refers to the same phenomenon where obesity increases chances of diabetes exponentially [13]. The present study was planned to ascertain the prevalence of IGT in obese adult people. After an extensive literature review, it was found that very little data exists about the IGT among adult obese population in our location. Moreover, the results of this study can be used as basis for other health care professionals to build on with furthermore extensive studies.

METHODS

This cross-sectional study was conducted over 06 months period in Department of Medicine, Hayatabad Medical Complex, Peshawar. Sample Size calculated was 136 using 9.3% proportion of IGT among obese subjects 12 with 95% confidence level and 5.4% margin of error using World Health Organization (WHO) sample size calculator. Non-probability consecutive sampling technique was used for sample size calculation. Patients with BMI more than 25kg/m2 of either gender with age between 18 to 60 years were included in the study. Those already having diabetes mellitus, liver or renal failure, on medications likes salicylates, anticonvulsants and oral contraceptives were excluded from the study. After approvals from intuitional research board, the study was conducted. All the obese subjects fulfilling the inclusion criteria were enrolled in the study. The motive was thoroughly explained to the patient and an informed consent was taken. Complete history taken and clinical examination was offered to all patients to exclude confounders. Weight and height were measured for the confirmation of obesity. All the patients were advised to re visit the hospital after an 8 hour overnight fast. All patients were subjected to 75gm oral glucose solution. Venous blood was withdrawn before and after the oral glucose solution and IGT was considered positive if the blood glucose level was between 140-199mg/dl at 2 hour post oral glucose solution. Data were saved and then analyzed using SPSS version 23.0. Mean ± SD were calculated for age, weight, height, BMI, blood glucose level before and 2 hours after test (quantitative variables). Frequencies and percentages were calculated for gender, education level, occupation, residence, family history of DM, IGT (categorical variables). IGT was stratified among age, gender, education level, occupation, residence, family history of DM to see the effect modifications by applying chi square test and keeping p-value of ≤ 0.05 as significant. Results were presented in tables and graphs.

RESULTS

In the current study, age distribution among 136 patients was analyzed as 42(31%) patients were in age range 18-40 years, 94(69%) patients were in age range 41-60 years with mean age of 53 years with SD ± 10.44. Out of total patients, 49(36%) patients were male and 87(64%) patients were female. Mean age was 53 years with SD ± 10.44 (Table 1).

Variables	n=136
Gender	
Male	49 (36%)
Female	87 (74%)
Mean age in Years	53 ± 10.44
18-40	42 (31%)
41-60	94 (69%)
Mean BMI	33 ± 3.94 kg/m
Obesity I BMI (30-40)	295 (70%)
Obesity II (40.1-50)	27 (20%)
Obesity III (>50)	14 (10%)

Table 1: Characterizes of the sample

Education level among patients was analyzed as 39(29%) patients were educated while 97(71%) patients were uneducated. Status of occupation among patients was analyzed as 15(11%) patients were laborer, 44(32%) patients were office worker, 53(39%) patients were housewife, 24(18%) patients were businessmen. Status of family history of DM among patients was analyzed as 80(59%)

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patients had positive family history of DM, while 56(41%) patients had Negative family history of DM. Status of residence among patients was analyzed as 99(73%) patients were from rural areas while 37(27%) patients were from urban areas. Status of Body Mass Index among 136 patients was analyzed. Mean BMI was 33 kg/m2 with SD ± 3.94 and further classified according to BMI classes (Table 2). Frequency of impaired glucose tolerance among 136 patients was analyzed as 24(20%) patients had impaired glucose tolerance while 112(80%) patients didn't have impaired glucose tolerance. p values for IGT with respect to age, gender and family history for diabetes are 0.96,0.93,0.84 respectively (Table 2).

Variables	n=136	p-value
Presence of IGT		
Yes	24 (20%)	
No	112 (80%)	
Presence of IGT in age groups n=24		
18-40	10 (42%)	0.96
41-60	14 (58%)	
Presence of IGT in Gender n=24		
Male	10	0.93
Female	14	
Presence of IGT in family Hx for Diabetes Mellitus n=24		
Positive	11	0.84
Negative	13	

Table 2: Impaired Glucose Tolerance IGT Comparison and Stratification

The presence of IGT in different groups of patients in accordance with BMI classification are tabulated in table 3.

Normal OGTT	112 (80%)
Impaired OGTT	24 (20%)
Presence of IGT in Obesity I (n=95)	
Normal OGTT	87 (92%)
Impaired OGTT	08 (08%)
Presence of IGT in Obesity II (n=27)	
Normal OGTT	19 (70%)
Impaired OGTT	08 (30%)
Presence of IGT in Obesity III (n=14)	
Normal OGTT	06(43%)
Impaired OGTT	08 (57%)

Table 3: Presence of Impaired Glucose tolerance in different classes of obesity

DISCUSSION

Obesity is becoming an epidemic in the current world across all subcontinents and countries. The increasing prevalence of obesity and concomitant rise in diabetes is interlinked and alarming issue for the world1. Obesity not only increases risk of prediabetes and diabetes but linked to many cardiovascular, musculoskeletal, gastrointestinal diseases, pulmonary, hematologic diseases and even some malignancies. In Pakistan, non-communicable diseases linked to high risk of mortality are closely related to obesity and dysglycemia [2]. Central obesity is more atherogenic and harbors cytokines and inflammatory markers involved in chronic diseases manifestations [14]. Various factors are involved in the explanation of discrepancy between Asians and Europeans risk of metabolic complications with similar BMI, Asian population having more fat content when compared to Europeans having same weight and body proportions [6]. They have earlier manifestations at lower BMI and that is the reason for lower cutoffs for this part of world by WHO and international obesity task force. For Asians, definition of overweight is BMI range 23 to 24.9 Kg/m2 and obesity when BMI is greater than 25 Kg/m 2.7 We used similar parameters in our study for the diagnosis of obesity. Impaired glucose tolerance/prediabetes was found in significant numbers in our studied population. 45(33%) patients had impaired glucose tolerance while 91(67%) patients didn't meet impaired glucose tolerance criteria. Ghergherechi and Tabrizi conducted a study in 68 obese children in which Impaired glucose tolerance and insulin resistance was present in 14.7% and 31.8%, respectively [15]. There was no case of overt diabetes mellitus. The higher prevalence in our study might be due to adult population in our study as compared to children. The prevalence increases with progressive years and origin of disease from childhood rather from pregnancy. Gestational diabetes in pregnancy not only increases macrosomia and birth complications chances at birth but long-term risk in borne children for obesity, type 2 diabetes and cardiovascular diseases [16]. A study conducted by Ahmad *et al.*, in Lahore had almost similar aims and outcomes where 2.5 % patients in obesity 1 had impaired glucose tolerance and in obesity 2, 10% patients had impaired glucose tolerance. in which a positive result of the patient was labeled as IGT [17]. The patients mean age was 46.3 ± 13.4 years. Out of 20% patients with impaired glucose tolerance, 8% were in class 1 obesity, 30% were in class 2 obesity and in class 3 obesity, IGT was present in 57 % of cases. This signifies that the risk of having impaired glucose tolerance increases as obesity progresses further and the risk is exponential. There is also a belief that insulin resistance/ diabetes predisposes to obesity as well contrary to popular belief with some valid reasons mentioned in review by Melone and Hansen [18]. An observational study carried out by Saaristo *et al.*, conducted similar study in Finnish population and investigated this association based on BMI as well as central obesity by measuring waist circumference [19]. Obesity was highly prevalent and impaired glucose tolerance was found in 42 % of male patients and 33% of female patients. The definition of impaired glucose tolerance included those with impaired fasting, random and even patients with diabetes previously unknown. Our study showed that in 24 patients with impaired glucose tolerance, 10 out of 49 patients were male while 14 out 59 patients were female. Generally, there is concept of less

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susceptibility in females for having diabetes than males due to effect of sex steroids(estrogen)though there may be other plausible mechanisms yet unknown[20].

CONCLUSIONS

Our study concludes that impaired glucose tolerance was 20 % in local adult obese population. These are potential diabetic patients in next few years. This demands nationwide campaign and projects regarding awareness of obesity and ways and lifestyle changes to mitigate the risk of diabetes.

Conflicts of Interest

The authors declare no conflict of interest

Source of Funding

The authors received no financial support for the research, authorship and/or publication of this article

REFERENCES

[1] Flegal KM, Carroll MD, Kit BK, Ogden CL. Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. JAMA. 2012 Feb; 307(5): 491-7. doi: 10.1001/jama.2012.39.

[2] World Health Organization (WHO). Global status report on noncommunicable diseases 2014. 2014. [Lastcited:11th Jan2023].Availableat:https://apps.who.int/iris/bitstream/handle/10665/148114/WHO?sequence=6.

[3] Basit A, Fawwad A, Qureshi H, Shera AS. Prevalence of diabetes, pre-diabetes and associated risk factors: second National Diabetes Survey of Pakistan (NDSP), 2016–2017. BMJ Open. 2018 Aug; 8(8): e020961. doi: 10.1136/bmjopen-2017-020961.

[4] Misra A, Basit A, Vikram NK, Sharma R. High prevalence of obesity and associated risk factors in urban children in India and Pakistan highlights immediate need to initiate primary prevention program for diabetes and coronary heart disease in schools. Diabetes Research and Clinical Practice. 2006 Jan; 71(1): 101-2. doi: 10.1016/j.diabres.2005.06.006.

[5] Aamir AH, Ul-Haq Z, Mahar SA, Qureshi FM, Ahmad I, Jawa A, *et al*. Diabetes Prevalence Survey of Pakistan (DPS-PAK): prevalence of type 2 diabetes mellitus and prediabetes using HbA1c: a population-based survey from Pakistan. BMJ Open. 2019 Feb; 9(2): e025300. doi: 10.1136/bmjopen-2018-025300.

[6] World Health Organization. Western Pacific Region, International Association for the Study of Obesity. The Asia-Pacific Perspective. Redefining obesity and its treatment. 2000. [Last cited: 2nd Jun 2021]. Available at: www.diabetes.com.au/pdf/obesity_report.

[7] Bahadur S, Yousaf M, Ayaz HM, Sohail Z. Self-reporting of obesity, overweight and health risks among 1st year MBBS students of Rehman medical college, Peshawar. Khyber Medical University Journal. 2013 Jun; 5(2): 98-102.

[8] Samir N, Mahmud S, Khuwaja AK. Prevalence of physical inactivity and barriers to physical activity among obese attendants at a community health-care center in Karachi, Pakistan. BMC Research Notes. 2011 Dec; 4(1): 1-7. doi: 10.1186/1756-0500-4-174.

[9] Hennild DE, Bjerregaard-Andersen M, Joaquím LC, Christensen K, Sodemann M, Beck-Nielsen H, *et al*. Prevalence of impaired glucose tolerance and other types of dysglycaemia among young twins and singletons in Guinea-Bissau. BMC Endocrine Disorders. 2016 Dec; 16(1): 1-0. doi: 10.1186/s12902-016-0126-6.

[10] Derosa G, Cicero AF, D'Angelo A, Borghi C, Maffioli P. Effects of n-3 pufas on fasting plasma glucose and insulin resistance in patients with impaired fasting glucose or impaired glucose tolerance. Biofactors. 2016 May; 42(3): 316-22.

[11] Oh TJ, Min SH, Ahn CH, Kim EK, Kwak SH, Jung HS, *et al*. Response: Normal Glucose Tolerance with a High 1-Hour Postload Plasma Glucose Level Exhibits Decreased -Cell Function Similar to Impaired Glucose Tolerance. Diabetes & Metabolism Journal. 2015 Jun; 39(3): 270-1. doi: 10.4093/dmj.2015. 39.3. 270.

[12] Morandi A, Maschio M, Marigliano M, Miraglia Del Giudice E, Moro B, Peverelli P, *et al*. Screening for impaired glucose tolerance in obese children and adolescents: a validation and implementation study. Pediatric Obesity. 2014 Feb; 9(1): 17-25. doi: 10.1111/j.2047-6310.2012.00136. x.

[13] Kalra S. Diabesity. Journal of Pakistan Medical Association. 2013 Apr; 63(4): 532-4.

[14] Pi-Sunyer FX. The obesity epidemic: pathophysiology and consequences of obesity. Obesity Research. 2002 Dec; 10(S12): 97S-104S. doi: 10.1038/oby.2002.202.

[15] Ghergherechi R and Tabrizi A. Prevalence of impaired glucose tolerance and insulin resistance among obese children and adolescents. Therapeutics and Clinical Risk Managment. 2010 Jul; 6: 345-9. doi: 10.2147/tcrm.s12033.

[16] Sartayeva A, Danyarova L, Begalina D, Nurgalieva Z, Baikadamova L, Adilova G. Gestational Diabetes: Prevalence and Risks for The Mother and Child. Georgian Medical News. 2022 Jul: 328: 47-52.

[17] Ahmad MS, Iqtadar S, Mumtaz SU, Niaz Z, Waheed I, Abaidullah S. Frequency of impaired glucose

DOI: https://doi.org/10.54393/pjhs.v4i01.486

tolerance in obese patients. Annals of King Edward Medical University. 2017 Oct; 23(4): 546-9. doi: 10.21649/akemu.v23i4.2202.

[18] Malone JI and Hansen BC. Does obesity cause type 2 diabetes mellitus (T2DM)? Or is it the opposite? Pediatric Diabetes. 2019 Feb; 20(1): 5-9. doi: 10.1111/pedi.12787.

[19] Saaristo TE, Barengo NC, Korpi-Hyövälti E, Oksa H, Puolijoki H, Saltevo JT, *et al.* High prevalence of obesity, central obesity and abnormal glucose tolerance in the middle-aged Finnish population. BMC Public Health. 2008 Dec; 8(1): 1-8. doi: 10.1186/1471-2458-8-423.

[20] Tramunt B, Smati S, Grandgeorge N, Lenfant F, Arnal JF, Montagner A, *et al.* Sex differences in metabolic regulation and diabetes susceptibility. Diabetologia. 2020 Mar; 63(3): 453-61. doi: 10.1007/s00125-019-05040-3.