Pre-Diabetes State: Anthropometric and Haematological Parameters

Neeta Kumari[1], Dr. B.K. Binawara[2][§], Deepak Kumar Verma[3], Jyoti Dwivedi[4]

[1]Ph.D scholar, Department of Physiology, S.P Medical College, Rajasthan University of Health, Jaipur (Rajasthan) India
[2]Professor, Department of Physiology, S.P Medical College, Rajasthan University of Health, Jaipur (Rajasthan) India
[3]Assistant Professor, Department of Physiology, S.P Medical College, Rajasthan University of Health, Jaipur (Raj) India
[4]M.Sc students, Department of Physiology, S.P Medical College, Rajasthan University of Health, Jaipur (Rajasthan) India

Abstract—Diabetic is a well known public health problem of today. There are many risk factors of it, which can be identified in pre-diabetic state. So the present study was conducted with the aim to know the status of anthropometric and haematological parameters in pre-diabetic states. For this hospital based study pre-diabetic subjects were identified from first degree relatives of type 2 DM Patients, enrolled in diabetic research centre P.B.M. hospital Bikaner. Relevant investigations were done. Data thus collected on semi-structured questionnaire and analysed using content analysis. Data analysis revealed that although mean Body Mass Index (BMI) was within normal range but Waist circumference (WC), West Hip (W/H) Ratio, Systolic blood pressure were higher than the normal range accepted for that parameter. But mean value of all the studied haematological parameter were within the normal range accepted for that parameter. So it can be conclude that anthropology of an individual may be associated with the pre-diabetic state. Hypertension was found in 25.35% of pre-diabetics. Further researches are necessary to find out this possible association of anthropologic parameter and pre-diabetic state.

Keywords: Pre-diabetes, Anthropometric Parameters, Haematological Parameters, Hypertension.

I. INTRODUCTION

Diabetes mellitus (DM) is a public health problem worldwide causing a substantial increase in morbidity and mortality. The prevalence of type 2 diabetes is increasing worldwide and exhibits a challenge on the health care system as well as on the public health and socioeconomic development of all nations.[1]

The causes of type 2 diabetes are multifactorial and result from a combination of environmental and genetic risk factors.[2] The implementation of preventive measures in populations and the identification of high risk groups, which mostly benefit from such activities, is the key point for the early prevention of type 2 diabetes and its complications. Since many years, a number of potential risk factors for type 2 diabetes have been identified. In this context, one's attention was particularly turned on lifestyle risk factors, inflammatory parameters, metabolic abnormalities, and genetic risk factors, many of which have been found to be independently associated with type 2 diabetes.[3]

Among those risk factors, routinely measured haematological parameters, such as White Blood Cell (WBC) count and hematocrit (HCT) level were associated with insulin resistance and incident type 2 diabetes.[4-8] Hematocrit is positively correlated with hyperinsulinemia and risk factors associated with insulin resistance, e.g. high blood pressure, elevated serum triglycerides, low HDL cholesterol, and central obesity and could therefore be related to insulin resistance. Furthermore, hematocrit is a major determinant of blood viscosity. Increased blood viscosity also contributes to the development of insulin

resistance.[5- 9] In addition, chronic inflammation is involved in the pathogenesis of type 2 diabetes and evidence from epidemiological studies suggests an association between total WBC or leukocyte count, a non-specific marker of inflammation, and diabetes risk.[10]

However, only a few prior studies investigated, whether selected haematological parameters such as WBC count, Mean Platelet Volume or red cell count are related to pre-diabetic states.[11-12]

So this study was conducted to know the status of anthropometric and haematological parameters in pre-diabetic states.

II.   METHODOLOGY

This hospital based descriptive study was conducted at Department of Physiology of SP Medical College & Hospital in collaboration with diabetic research centre P.B.M. hospital, Bikaner (Rajasthan) India in year 2019-2020.

Before collecting the data this study was approved by the Institutional Ethical Committee at the Sardar Patel Medical College and Associated Group of P.B.M. Hospitals, Bikaner, Rajasthan, India, approved the study. The Developmental Research Committee at the Rajasthan University of Health Sciences, Jaipur, India, was also approved the study. For taking the written informed consent, all participants read and signed a study consent form approved by the Ethics Committee.

For the study purpose, 142 pre-diabetic subjects were identified from first degree relatives of type 2 DM Patients, enrolled in diabetic research centre P.B.M. hospital Bikaner. Pre-diabetics (Impaired fasting glucose) subjects was identified on the basis of fasting blood glucose 100 to 125 mg/dl and HbA1C (5.7% TO 6.4%) as per American Diabetic Association (ADA) 2011 guidelines.[13] Subjects aged 20-74 years and giving written informed consent were included in the study. Subjects taking lipid lowering drugs, dugs to control blood sugar, hormonal therapy, and hormonal contraceptives were excluded from the study. Subjects having known endocrinal, renal, cardiovascular disorders were also excluded from this study.

All the consented study subjects were given a screening performa for identifying the subjects included for the study as per inclusion and exclusion criteria. Those who were eligible for included in the study were administrated a semi-structured interview schedule to obtain relevant information from the study participants.

Haematological parameters testing were done of all participants and results were obtained and recorded in MS Excel 2010.

Data thus collected were classified, analyse to get inferences with the help of statistical software Primer (Version 6).

III.   RESULTS

Out of 142 subjects. maximum Pre- Diabetic Subjects were found in 30-34 years (48; 33.80%), followed by 35-39 years (29;20.42%) and minimum in 55-59 years age group (1;0.70%). These Pre-diabetic subjects were having male predominance 91(64.08%) males versus 51(35.92%) were female. (Figure 1 & 2)
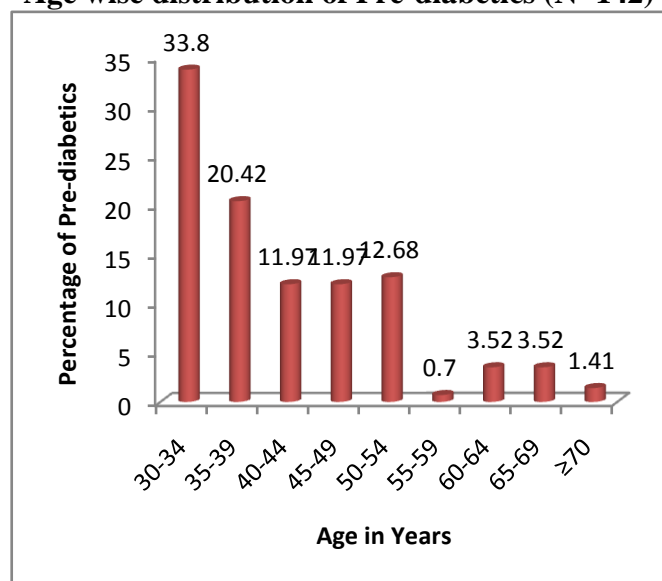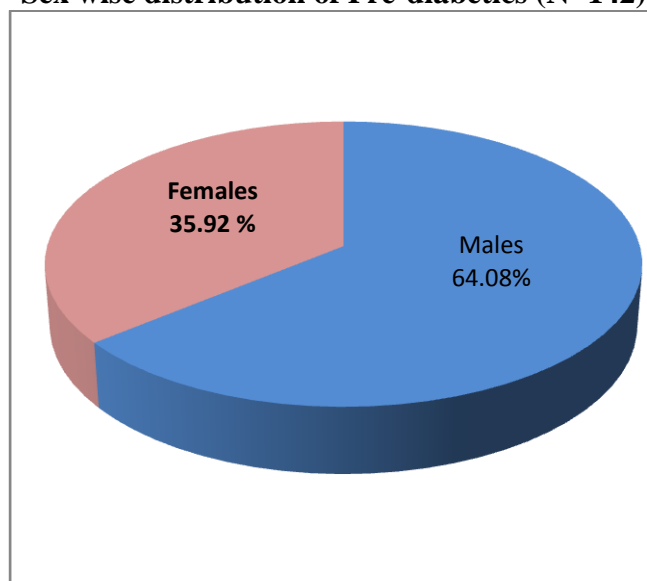
Figure 1
Age wise distribution of Pre-diabetics (N=142)

Figure 2
Sex wise distribution of Pre-diabetics (N=142)

Table 1 shows characteristics of studied pre-diabetics subjects. Mean value of the entire studied anthropometric variable were higher than the normal rage accepted for that variable, except BMI which was within the normal range.

TABLE 1
CHARACTERISTICS IN PRE- DIABETIC SUBJECTS (N=142)

S. No.	Parameters	Mean ± SD	Range	Relation of mean to normal range
1	BMI (kg/m^2)	25.18±4.76	17.2-41.7	Within
2	WC (cm)	92.33±13.20	60.96-139.7	Higher
3	W/H Ratio	0.9195±0.09	0.697-1.652	Higher
4	SBP (mmhg)	130.06±14.38	86-164	Higher
5	DBP(mmhg)	82.26±7.09	70-100	Higher
6	HbA1C (%)	6.03±0.27	5.4-6.4	Higher
7	FBS (mg/dL)	116.92±6.14	100-125	Higher

Table no.2 show that mean value of all haematological parameters in studied pre-diabetic subjects were within the normal rage accepted for that variable.

TABLE 2
HEMATOLOGICAL PARAMETERS IN PRE- DIABETIC SUBJECTS (N=142)

S. No.	Parameters	Mean ± SD	Range	Relation of mean to normal range
1	RBC (10^{12}/L)	4.80±0.59	3.75-8.28	Within
2	WBC (10^9/L)	8.72±2.02	4.6-15.5	Within
3	HB (g/L)	13.19±1.68	8.4-16.2	Within
4	MCV (fl)	84.04±11.90	55-108	Within
5	MCH (pg)	27.66±3.59	14.3-39.1	Within
6	Platelet (10^9/L)	269.38±80.41	105-503	Within

It was also revealed in this study that out of total 142 pre-diabetics, 79 (55.64%) were pre-hypertensive and 36 (25.35%) were with hypertension. (Table 3)

TABLE 3
HYPERTENSIVE STATUS IN STUDY POPULATION (N=142)

S. No.	Hypertensive status	Number	Percentage
1	Normotensive	27	19.01
2	Pre-Hypertensive	79	55.64
3	Hypertensive	36	25.35
	Total	142	

IV. DISCUSSION

In the present study, total 142 pre-diabetic subjects were studied having mean HbA1C 6.03±0.27 % with mean fasting blood sugar 116.92±6.14 mg/dl.

It was also observed that mean anthropometric parameters like BMI, WC and W/H ratio were found 25.18±4.76 Kg, 92.33±13.20cm and 0.9195±0.09 respectively, where WC and W/H ratio were found higher than the normal rage accepted for these, only BMI was found within the normal range.

Fleming et al. reported anthropometric parameter as an independent risk factor for development of diabetes.[14] Pandey et al.[15] found the cut-off values of BMI for predicting pre-diabetes ≥22.8 kg/m^2 in boys and ≥20.5 kg/m^2 in girls and the cut-offs for waist circumference for predicting pre-diabetes ≥82.5 cm for boys and ≥80.3 cm for girls. BMI and waist circumference estimation can be done for early detection of pre-diabetes in adolescents for further diagnostic evaluation and management. Pratyush DD et al.[16] found waist circumference cut-offs for males was 90 cm with a sensitivity and specificity of 71% and 96%, respectively, and for females was 85 cm with a sensitivity and specificity of 86% and 93%, respectively, having a positive association with metabolic syndrome. WHO Expert consultation[17] reported cut-off of BMI for moderate risk varies from 22 kg/m^2 to 25 kg/m^2, whereas that for high risk ranges from 26 kg/m^2 to 31 kg/m^2 in different Asian populations.

It was also found that mean value of all haematological pparameters like RBC, WBC, HB, MCV, MCH and Platelets in studied pre-diabetic subjects were within the normal rage, which are 4.80±0.59 10^{12}/L, 8.72±2.02 10^9/L, 13.19±1.68 g/L, 84.04±11.90fl, 27.66±3.59pg and 269.38±80.41 10^9/L respectively. Almost similar was observed with other studies.[15,18]

In this present study pre-hypertension was found in 55.64% and hypertension in25.35% of pre-diabetics. Park et al.[19] and Demetria H et al.[20] both reported higher proportion of hypertension in pre-diabetics in their study i.e. 48.7% and 58.14% respectively. Francis BH et al.[21] observed that 36.3% of patients with pre-diabetes and hypertension and 27.1% of patients with pre-diabetes alone developed diabetes and Geva, M et al.[22] found that FPG in the pre-diabetes range, albeit not glycated hemoglobin, is independently and significantly associated with future development of HTN. So it is very important to evaluate for blood pressure in pre-diabetics.

Here in present study as waist circumference and waist hip ratio is higher than normal range, so anthropometric parameters can be used as screening for pre-diabetes. Earlier the diagnosis the better is the management.

V.   CONCLUSION

It can be concluded from this present study that although hematological parameters were within normal range but anthropometric parameter were higher in pre-diabetics than the normal range. Prevelance of hypertension was 25.35% in these pre-diabetics in this present study. As there were no comparison group in this study, so to find out the association of various hematological and anthropometric parameters future researches are proposed with appropriate sample size and better study designs.

CONFLICT OF INTEREST

None declared till now.

REFERENCES

[1] Nwose EU, Richards RS, Digban K, Bwititi PT, Ennis G, Yee KC, Oguoma VM, Liberato S. Cardiovascular risk assessment in prediabetes and undiagnosed diabetes mellitus study: international collaboration research overview. North Am J Med Sci. 2013;5:625–30.

[2] Oguoma VM, Nwose EU, Richards RS. Prevalence of cardio-metabolic syndrome in Nigeria: a systematic review. Public Health. 2015;129:413–23.

[3] Oguoma VM, Nwose EU, Bwititi PT. Cardiovascular disease risk prevention: preliminary survey of baseline knowledge, attitude and practices of a nigerian rural community. North Am J Med Sci. 2014;6:466–71.

[4] Ikem I, Sumpio BE. Cardiovascular disease: the new epidemic in sub- Saharan Africa. Vascular. 2011;19:301–7.

[5] Uchenna DI, Ambakederemo TE, Jesuorobo DE. Awareness of heart disease prevention among patients attending a specialist clinic in Southern Nigeria. Int J Prev Treat. 2012;1:40–3.

[6] Frood A. Funding: global alliance for chronic diseases tackles diabetes. Lancet. 1014;2013:382.

[7] Nwose EU, Oguoma VM, Bwititi PT, Richards RS. Metabolic syndrome and prediabetes in ndokwa community of Nigeria: preliminary study. North Am J Med Sci. 2015;7:53–8.

[8] Oguoma VM, Nwose EU, Skinner TC, Digban KA, Onyia IC, Richards RS. Prevalence of cardiovascular disease risk factors among a Nigerian adult population: relationship with income level and accessibility to CVD risks screening. BMC Public Health. 2015;15:397.

[9] Oguoma VM, Nwose EU, Skinner TC, Richards RS, Digban KA, Onyia IC. Association of physical activity with metabolic syndrome in a predominantly rural Nigerian population. Diabetes Metab Syndr. 2016;10:13–8.

[10] Oguoma VM, Nwose EU, Ulasi II, Akintunde AA, Chukwukelu EE, Bwititi PT, Richards RS, Skinner TC. Cardiovascular disease risk factors in a Nigerian population with impaired fasting blood glucose level and diabetes mellitus. BMC Public Health. 2017;17:36.

[11] Wang-Sattler R, Yu Z, Herder C, Messias AC, Floegel A, He Y, Heim K, Campillos M, Holzapfel C, Thorand B, et al. Novel biomarkers for prediabetes identified by metabolomics. Mol Syst Biol. 2012;8:615.

[12] O'Connor A, Wellenius G. Rural-urban disparities in the prevalence of diabetes and coronary heart disease. Public Health. 2012;126:813–20.

[13] Diagnosis and Classification of Diabetes Mellitus. American Diabetes Association. Diabetes Care 2011 Jan; 37(Supplement 1): S81-S90.

[14] Fleming, S. E., Boyd, A., Ballejos, M., Kynast-Gales, S. A., Malemute, C. L., Armstrong Shultz, J., & Vandermause, R. K. (2013). Goal setting with type 2 diabetes: A Hermeneutic analysis of the experience of diabetes educators. *Diabetes Educator*, *39*, 811–819.

[15] Pandey, U., Midha, T., Rao, Y. K., Katiyar, P., Wal, P., Kaur, S., & Martolia, D. S. (2017). Anthropometric indicators as predictor of pre-diabetes in Indian adolescents. *Indian heart journal*, *69*(4), 474–479.

https://doi.org/10.1016/j.ihj.2017.06.006.

[16] Pratyush D.D., Tiwari S., Singh S., Singh S.K. Waist circumference cutoff and its importance for diagnosis of metabolic syndrome in Asian Indians: a preliminary study. Ind J Endocrinol Metab. 2012;16(1):112–115.

[17] WHO Expert consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004; 363:157–163.

[18] Ziaee, A., Ghorbani, A., Kalbasi, S., Hejrati, A., & Moradi, S. (2017). Association of hematological indices with prediabetes: A cross-sectional study. *Electronic physician*, *9*(9), 5206–5211. https://doi.org/10.19082/5206.

[19] Park, Chang; Park, Sung; Park, Eun; Choi, Ja; Lee, Sun; Choi, Chul; Na, Jino; Kim, Jin; Rha, Seung; Seo, Hong; Oh, Dong PS 06-16 Prevalence and clinical features of prediabetes in patients with hypertension, Journal of Hypertension: September 2016 - Volume 34 - Issue - p e171.

[20] Demetria Hubbard, Lisandro D. Colantonio, Rikki M. Tanner, April P. Carson, Swati Sakhuja, Byron C. Jaeger, Robert M. Carey, Laura P. Cohen, Daichi Shimbo, Mark Butler, Alain G. Bertoni, Aisha T. Langford, John N. Booth, Jolaade Kalinowski, Paul Muntner. Prediabetes and Risk for Cardiovascular Disease by Hypertension Status in Black Adults: The Jackson Heart Study. Diabetes Care 2019 Oct; dc191074.

[21] Francis BH, Song X, Andrews LM, et al. Progression to type 2 diabetes, healthcare utilization, and cost among pre-diabetic patients with or without comorbid hypertension. Curr Med Res Opin 2011;27:809–819.

[22] Geva, M., Shlomai, G., Berkovich, A., Maor, E., Leibowitz, A., Tenenbaum, A., & Grossman, E. (2019). The association between fasting plasma glucose and glycated hemoglobin in the prediabetes range and future development of hypertension. *Cardiovascular diabetology*, *18*(1), 53. https://doi.org/10.1186/s12933-019-0859-4.