

## Association of Systemic Blood Pressure, Self- Reported Physical Activity And Family History of Diabetes with Type 2 Diabetes In Urban Women Aged 40 Years Above Residing In Kolkata-A Cross Sectional Study.

\*Sonali Majumdar (Das)<sup>1</sup>; Saibendu Kumar Lahiri<sup>1</sup>

Anil Baran SinghaMahapatra<sup>3</sup> Munna Das<sup>4</sup>

<sup>1</sup>Department of Physiology, R.G.Kar Medical college, Kolkata/University of Health Sciences,India)

<sup>2</sup>Department of Community Medicine, R.G.Kar Medical College, Kolkata/ University of Health Sciences,India)

<sup>3</sup>Department of Physiology, R.G.Kar Medical College, Kolkata/ University of Health Sciences,India)

<sup>4</sup>Department of Cardiology, Narayan Hrudralaya Institute of Health, Howrah/ University of Health Sciences,India)

Corresponding Author: \*Sonali Majumdar (Das)

### Abstract:

**Background:** Recent data suggests that urban women above 40 years of age have higher prevalence of obesity and overweight compared to men. Few workers have studied the association of given parameters with diabetic status among urban Kolkata women for disease prevention and management.

**Aims and Objectives:** The present study was undertaken to analyze whether the systemic blood pressure and parameters like self- reported physical activity and family history of diabetes were associated with type 2 Diabetes among women aged above 40 years residing in Kolkata.

**Materials and Methods:** The study was conducted among the study population living in Southern fringe of Kolkata and selected by simple random sampling method. Out of 163 women, 132 were non diabetic (NDM) while 31 were diabetic women (DM). Of 132 NDM, 75 were aged 40 years and above (NDM > 40 yrs) and taken as age matched controls.

**Result:** The DM group had higher number of hypertensive (41.93%) compared to NDM (17.33%).

Family history of diabetes was similar for both DM and NDM (58.06% vs 54.44%). Self-reported physical activity was more in diabetic group compared to NDM > 40 years (58.06% vs 41.33%). Family history and physical activity showed positive correlation for DM group ( $r=0.880$ ) compared to

Age: matched controls where the correlation was negative ( $r=-0.134$ ).

**Conclusion:** Early diagnosis and treatment of hypertension as well as proper guidance regarding physical activity especially among those with positive family history will go a long way in combating diabetes among older urban women.

**Keywords:** Diabetes, Kolkata, family history, physical activity, urban, women

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## I. Introduction

### 1.1 Background

Over 371 million people worldwide have diabetes and approximately half of these are women. Age standardised prevalence of diabetes and impaired glucose tolerance however show no gender difference but when it comes to healthcare for patients with diabetes, women in India find themselves at a disadvantage compared with men. The health toll diabetes takes on women is significant, particularly in terms of diabetes-related complications such as heart disease. This results in high rates of mortality and morbidity of women with diabetes. [1] Women tend to avoid blood test which forms the cornerstone for diagnosis of the condition due to unreasonable fear regarding venepuncture. [2] Due to this reason a vast majority of the conditions lie undetected. Education regarding the prevention and management of the disease is the need of the hour. Different anthropometric, clinical indices and other parameters like family history of diabetes, leisure time physical activity have been used to assess metabolic syndrome and associated chronic diseases like type 2 diabetes. [3,4] Though similar studies have been conducted in different parts of the country but such studies are few in Eastern India especially in women.

## **1.2 Aims and Objectives**

The present study was undertaken to analyze whether the systemic blood pressure and other parameters such family history of diabetes, self- reported physical activity were associated with type 2 Diabetes among women aged above 40 years residing in Kolkata.

## **1.3 Hypothesis**

The hypothesis being tested was that the above mentioned parameters were associated with Diabetes among the study population .

## **II. Materials And Methods**

**2.1 Study type and study design:** Observational descriptive study with Cross sectional design was conducted .

**2.2 Study duration:** November 2011 to December 2016.

**2.3 Ethical permission:** The study was commenced only after getting clearance from the Institutional Ethical Committee , R.G. Kar Medical College, Kolkata, India.

**2.4 Settings and location:** Out of total 141 wards of Kolkata Municipal Corporation (KMC) ward number 126 was Selected by simple random sampling (SRS) method using random.org software. The ward has been divided into 35 part numbers by Election Commission of India, West Bengal branch of which part number 279 was chosen by SRS.

The part had 479 women in its roll.

## **2.5 Sample size**

$$:N=z^2 pq/L^2=3.84 \times 12 \times 88 / 5 \times 5 = 163$$

Where p is the proportion of the estimated population and q = (1-p), L representing the absolute

Precision, z=1.95[5].

## **2.6 Eligibility criteria**

Adult women willing to participate in the study were included while subjects too ill or unwilling to participate were excluded from the study [6, 7, 8].

## **2.7 Study technique**

Out of 479 , one hundred and sixty -three women were selected through SRS(with replacement) from enrolled women from current voter list 2011. The study protocol was properly explained to the consenting individuals and informed consent was taken. Of them, 132 were non- diabetic (NDM, n=132), thirty-one were diabetic (DM, n=31), on the basis of blood glucose report done within last 2 years of the time of interview [9].

## **2.6 Statistical analysis**

The data were analyzed with MS Excel sheet and appropriate statistical analysis was done with Vasserstats software, New York, USA. Student's t test and Fisher Exact test were done to compare quantitative and qualitative variables respectively. P value less than or equal to 0.05 is considered to be statistically significant.

## **2.7 Variables studied**

Height, weight, waist circumference (WC), hip girth were measured following standard protocol and using standardized instruments.[10] The parameters were measured in centimeters (cm). From the above, obesity indicators like Body Mass Index (BMI), waist circumference and Waist –Hip ratio was recorded. Systemic blood pressure was expressed as Systolic Blood Pressure/Diastolic Blood Pressure (SBP/ DBP) in millimeters of Mercury (mmHg). Arm showing higher SBP and or DBP was taken for recording blood pressure. Subjects with SBP greater than or equal to ( $\geq$ ) 140mmHg and or DBP  $\geq$  90mmHg as an average of 3 separate measurements was done in sitting position after adequate rest with or without positive treatment history were termed as hypertensive[11].

Information regarding family history of diabetes (Fam H/O) including that for parents, siblings, other first degree relatives were noted [12]. Women were asked about frequency and duration of leisure time physical activity, PA (eg, walking, gardening, joint exercises, pranayam, yoga) during the past year[13].

## **III. Results**

Number of subjects eligible for the study was 479. Number of subjects examined for eligibility was 213. Number of subjects confirmed eligible was 203. Number of participants who gave consent was 163.

Demography of the study participants were recorded with respect to age, years of education, occupation, social class, family history of diabetes and or hypertension, history of leisure time – physical activity and morbidity status.

### 3.1 Age

All the diabetic women were aged 40 years and above while among nondiabetics, 43.18% were aged between 20-40 years and 56.81% were aged above 40 years [TABLE 1].

**3.2 Obesity indicators:** The waist circumference and the waist-hip ratio were significantly higher among diabetic women DM when compared to the age matched controls. BMI was similar in both the groups [TABLE 2]. Waist circumference (WC), waist-hip ratio (W/H) are higher in NDM(>40 years) when compared to the NDM(20-40 years) but statistically non significant. However BMI was greater in the older participants ( $p=0.03$ ) [Table 3].

### 3.3 Systemic Blood Pressure

Thirteen out of 132 in non diabetic women (17.33%) were hypertensive while out of 31 diabetic women, 13 suffered from hypertension (41.93%) Using Fisher Exact test it was found to be statistically significant. The SBP, DBP and MBP were significantly higher in non diabetic participants aged greater than 40 years compared to NDM(20-40 years) [TABLE 4].

**3.4 Family history of diabetes** was similar for both diabetic, 18 out of 31 and non diabetic respondents, 72 out of 132 (58.8% vs 54.4%). [TABLE 4]

**3.5 Self-reported physical activity** was more in diabetic group, 18 out of 31 compared to NDM, 48 out of 132 (58.8% vs 36.11%). [TABLE 4]

### 3.6 Occupation And Social Class

Majority of the women both in diabetic and non-diabetic group were homemakers and belonged to the middle class according to social class. [TABLE 4]

**3.7 Spearman rank Correlation coefficient, "r",** between positive family history and leisure time physical activity was positive,  $r=0.311$  for NDM(20-40 yrs) and DM,  $r=0.880$  and NDM(>40 yrs),  $r=-0.134$  the correlation was slightly negative. [TABLE 5]

## IV. Discussion

The present study was undertaken to analyze whether the systemic blood pressure and other parameters like self-reported physical activity and family history of diabetes were associated with type 2 Diabetes among women aged 40 years and above residing in Kolkata.

### 4.1 Summary of the results

The waist circumference and the waist-hip ratio was higher for the diabetic group compared to NDM>40 yrs; they in turn had higher BMI compared to NDM(20-40 years). The DM group had higher number of hypertensives (41.93%) compared to NDM(17.33%). Family history of diabetes was similar for both DM and NDM (58.06% vs 54.44%). Self-reported physical activity was more in diabetic group compared to older non-diabetic (58.06% vs 41.33%) which was statistically significant,  $p=0.0036$ . Family history and physical activity showed positive correlation for NDM(20-40 yrs), ( $r=0.311$ ) and DM group ( $r=0.880$ ) compared to older non diabetic women where the correlation was negative ( $r=-0.134$ ).

### 4.2 Limitations of the study

#### The sample size is small.

4.3 Interpretation of results  
4.3.1 The number of hypertensives were higher for diabetics, 41.93% compared to non diabetic women, 17.33% studied, ( $p=0.0000$ ). Also the SBP, DBP and MBP were significantly higher in non diabetic participants aged greater than 40 years compared to NDM(20-40 years). It has been proposed that insulin resistance and hyperinsulinemia may play a central role both in diabetes and hypertension [15]. Several workers reported that hypertension preceded the occurrence of diabetes [16], [17]. In a large prospective cohort study, the development of diabetes was found to be more likely in people with hypertension as compared to their normotensive counterparts [18]. It can be implied that women who are hypertensive should be made aware regarding the risk of diabetes and its prevention [19].

4.3.2 The waist circumference and the waist-hip ratio was higher for the diabetic group compared to NDM>40 yrs; they in turn had higher BMI compared to NDM(20-40 years). P value was  $<0.05$  in both instances. Prevalence of obesity and overweight was more in urban women aged more than 40 years compared to their younger counterparts with or without diabetes. The findings have been corroborated by other studies. [20,22]

BMI was found to be statistically non-significant in diabetic women when compared to age matched non diabetic subjects ( $p=0.3224$ ), [10]. Evidence suggests that abdominal obesity is more significantly associated with diabetic status than general fat distribution as indicated by BMI [18], [19], [22].

**4.3.3** Self –reported physical activity was more in diabetic women, 58.8% followed by the NDM women (>40 years), 41.46% and least for the younger non-diabetic, 22.58%. But all of the diabetic and older nondiabetic women performed physical activity infrequently while all the younger women performed some form of physical activity most days of the week regularly. Our findings were at variance to other studies where it was found that diabetic women's participation in physical activity is very low, only 14 to 16% of women aged 45 to 75 years participate in recommended levels of physical activity. They stated that most diabetic patients had low levels of mobility compared with non-diabetic individuals (34% vs. 40%, respectively) which was the reason that they were unable to perform moderate physical exercise at least 30 minutes per day most of the week in a regular fashion [23]. A Norwegian study found that the number of participants reporting leisure time –physical activity decreased with increasing age, 82% in young adults, 77% in the middle aged and 64% in the older subjects respectively [13]. An Indian study found that moderate to high levels of physical activity was estimated to be 19% in urban women and 38% among rural women residing in Kerala [24].

In our study, most of the women belonged to middle class, were homemakers and had higher levels of education which was similar in both age matched NDM and DM women. As the subjects had a better socio-demographic profile and education in spite of older age thus they were more aware regarding health benefits of exercise and performed more leisure time – physical activity though irregularly. Also we included all forms of physical activity including yoga, pranayam and joint exercises which could be easily performed by women with restricted mobility so higher percentage of older women participated in PA within last 12 months from the time of interview.

Eyler et al found that poor socio-demographic profile, lower educational levels, and older age most consistently associated with lower levels of physical activity among women [25]. 4.3.4. A total of 55.05% of women had positive family history of diabetes, with 54.16% of NDM and 58.8% of DM women respectively. Our findings were different from a previous study conducted in Kolkata. A cross sectional study was conducted in Kolkata by Das et al where out of 448 individuals (257 males and 191 females participated) 291 subjects had positive family history of type 2 DM (64.95%). However breakup for the same for NDM and DM women was not given in that study [26].

Family history of type 2 diabetes is recognized as an important risk factor for the disease. Individuals with positive family history are 2 to 6 times the risk of type 2 diabetes compared to those with no family history of the disease. It can form part of comprehensive risk assessment for the individual and prevention, early detection and treatment of type 2 DM [27].

But in our study Fam H/O was similar in DM and NDM groups. 4.3.5 Though the leisure time physical activity was lower in younger NDM group (22.58%) but it was seen that non-diabetics aged 20-40 years with positive family history of diabetes were more likely to participate in leisure time- physical activity ( $r=0.335$ ) compared to their older counterpart. Infact NDM >40 years tended to show slightly negative correlation between positive family history and leisure time –physical activity ( $r=-0.125$ ). The intention to perform physical activity in women is influenced apart from mobility, by social pressures, self efficacy and attitude [28]. Also the younger non-diabetic women had more number of education years compared to the older non-diabetics ( $12.87 \pm 6.42$  compared to  $11.60 \pm 3.16$  years) though it was statistically non-significant,  $p=0.2774$  and were better socio-economically than NDM >40 years. The diabetic women also showed positive correlation with family history and leisure time –physical activity.

## **V. Conclusion**

The DM group had higher number of hypertensive (41.93%) compared to NDM (17.33%). Family history of diabetes was similar for both DM and NDM (58.06% vs 54.44%). Self-reported physical activity was more in diabetic group compared to NDM >40 years (58.06% vs 41.33%). Family history and physical activity showed positive correlation for DM group ( $r=0.880$ ) compared to age- matched controls where the correlation was negative ( $r=-0.134$ ).

Non- diabetic respondents aged above 40 years had higher systemic blood pressure, greater BMI compared to younger non diabetics. Early diagnosis and treatment of hypertension as well as proper guidance regarding physical activity especially among those with positive family history would go a long way in combating diabetes among older urban women. Small sample size is a limitation for our study. In a larger sample size, the predictive value of these parameters could be better understood.

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Tables Table1 shows Data and Frequency age distribution for the non diabetic and diabetic groups

Age Groups(years)	NDM n=132	DM, n=31
20-<25	20 (15.15%)	0
25-<30	5 (3.78%)	0
30-<35	13 (9.84%)	0
35-<40	20 (15.15%)	0
40-<45	18 (13.63%)	7 (22.58%)
45-<50	8 (6.06%)	5 (16.12%)
50-<55	24 (18.18%)	2 (6.45%)
55-<60	13 (9.84%)	7 (22.58%)
60-<65	7 (5.3%)	6 (19.35%)
65-<70	2 (1.5%)	2 (6.45%)
70-<75	2 (1.5%)	2(6.45%)

Table 2 shows relationship of different parameters among diabetic women and age matched controls Using Student's t test

	NDM(>40 years), n=75	DM, n=31	t value	p value
Age in years Mean,SD	51.41, 10.47	52.93, 11.73	t = 0.6562	p=0.5131
Education years Mean,SD	11.60, 3.16	11.31, 4.54	t = 0.3760	p=0.7077
Wt in kgs Mean,SD	57.39, 11.66	61.59, 11.9	t = 1.6769	p= 0.0966
Ht in m Mean,SD	1.52,0.061	1.55, 0.073	t = 2.1719	p=0.0321*
BMI in kg/m2 Mean,SD	24.69,4.94	25.66, 3.49	t = 0.9942	p=0.3224
WC in cm Mean,SD	91.04, 15.10	102.18, 21.74	t = 3.0194	p=0.0032*
HC in cm Mean,SD	96.42,14.31	100.56, 17.85	t = 1.257	p= 0.2113
W/H ratio Mean,SD	0.93,0.08	1.03, 0.238	t = 3.2401	p=0.0016*
SBP in mm Hg Mean,SD	125.79,16.70	130.83, 14.17	t=1.4742	p=0.1434
DBP in mmHg Mean,SD	74.79,10.66	77.81, 9.39	t=1.3719	p=0.1731
MBP in mmHg Mean,SD	91.69,11.74	95.48, 10.02	t=1.8325	p=0.0697

Table 3 shows relationship of different parameters among older and younger non diabetic women using Student's t test

	NDM(20-40 years), n=57	NDM(>40 years), n=75	T value	P value
Age in years Mean,SD	29.65,6.42	51.41, 10.47	t = 13.8317	p=0.0001*
Education years Mean,SD	12.87,6.42	11.60, 3.16	t = 1.4929	p=0.1379
Wt in kgs Mean,SD	56.68,11	57.39, 11.66	t = 0.3550	p= 0.7231
Ht in m Mean,SD	1.57,0.073	1.52,0.061	t = 4.2830	p=0.00001*
BMI in kg/m2 Mean,SD	22.94,4.21	24.69,4.94	t = 2.1942	p=0.03*
WC in cm Mean,SD	89.51,13.01	91.04, 15.10	t = 0.6116	p=0.5419
HC in cm Mean,SD	95.45,11.29	96.42,14.31	t = 0.4216	p= 0.6740
W/H ratio Mean,SD	0.93,0.1	0.93,0.08	t=0	p=1
SBP in mm Hg Mean,SD	107.30,9.77	125.79,16.70	t = 7.3727	p=0.0001*
DBP in mmHg Mean,SD	68.96,9.93	74.79,10.66	t=3.2050	p=0.0017*
MBP in mmHg Mean,SD	81.66,9.4	91.69,11.74	t = 5.2826	p= 0.0001*

Table 4 shows relationship of different qualitative variables among the study participants with their diabetic status and age using Fisher Exact test

Occupational Status	Homemakers	29	50.8	49	65.33	20	64.51	0.2091 [3.13]
	Working Women	18	31.5	26	34.66	11	35.48	
	Students	10	17.5	0	0	0	0	
Social Class[14]	High	7	12.2	24	32	9	29.03	0.0017* [17.31]
	Middle	43	75.4	31	41.33	13	41.93	
	Poor	7	12.2	20	26.66	9	29.03	
Hypertension present		0	0	13	17.33	13	41.93	0.0000002* [26.54]

H/O physical activity		13	22.80	31	41.33	18	58.06	0.0036* [11.23]
Family H/O Diabetes		35	61.4	37	49.33	18	58.06	0.3624 [2.03]
BMI>23		26	45.6	44	58.6	9	29.03	0.0183* [8]
WC>80		46	80.7	64	85.33	0	0	-
W/H>0.8		52	91.22	70	93.33	0	0	-

**Table 5** shows Correlation between positive family history for diabetes with history of physical activity

Groups	Fam H/O with PA	Correlation coefficient,r
NDM(20-40yrs),n=57	13	0.311
NDM(>40 yrs),n=75	31	-0.134
DM,n=31	18	0.880

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