

## NON-INVASIVE RISK FACTORS OF NON-COMMUNICABLE DISEASES IN PRE AND POST-MENOPAUSAL WOMEN OF VADODARA: A PILOT STUDY

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**ABSTRACT:** Non-communicable diseases have emerged as a predominant cause of deaths for women worldwide. Earlier post-menopausal women were thought to be at higher risk for chronic degenerative diseases, as protective effect of oestrogen is lost after menopause. Whereas in the last decade, alarming trends for these diseases are seen among women in their child bearing age. Hence the aim of the study was to assess non-invasive risk factors of non-communicable diseases among adult females with a focus on menopause. For this purpose, 408 females were screened and after excluding cases of peri-menopause, under-nutrition, pregnancy and hysterectomy, based on consent detailed non-invasive risk analysis was performed on 131 female subjects. The results revealed that the prevalence of self-reported history of hypertension and diabetes was around 21% and 11% respectively. About 75% of the subjects were overweight or obese according to Asia Pacific Classification. Post-menopausal women had significantly high prevalence of high body fat per cent (OR 6.52, 95%CI 1.32-62.3) and high blood pressure (OR 4.4 95%CI 2.1-9.3). Mean waist circumference, waist hip ratio, waist stature ratio, body fat and systolic blood pressure were above the normal cut-offs depicting presence of risks in both the groups. A trend of high per capita consumption of oil, salt and sugar at household level was seen. The frequency of practice of regular health check-up and awareness regarding self-breast examination was very low among the subjects. The study indicates high prevalence of non-communicable disease risks among both pre and post-menopausal women, emphasizing the need to create awareness among young female population to adapt healthy lifestyle practices.

**Keywords:** Women, Non-communicable Diseases, Menopause, Obesity, Hypertension.

### INTRODUCTION

For many decades, the term 'women's health' have been constrained to maternal and reproductive health in developing countries and many other dimensions of women's health have been overlooked. As a result of urbanization and nutrition transition, the burden of non-communicable diseases (NCDs) has shown a steep rise in both the genders. But the delusion of cardio vascular diseases (CVDs) being only men's health problem has led to underestimation of risk of these diseases for women. Around 1.2 million women aged between 20 and 59 years died due to CVD's in year 2008 worldwide. Out of these women 80 per cent were from low and middle income countries. The prevalence of breast and lung cancer is highest among all the cancers in women and around half of the cancer cases occurring among women are from developing countries (NCD Alliance, 2011). According to World Health Organization (WHO), NCDs are likely to account for 37% of the deaths in India. The estimated prevalence of four major metabolic risk factors i.e. high blood pressure (31.7%), raised glucose (10%), raised cholesterol (28.3%) and overweight/obesity (14.6%) is high among Indian females and is expected to rise in the next decade (WHO, 2011). As per definition by WHO (1996), the term menopause refers to 'the permanent cessation of menstruation and fertility resulting from the loss of ovarian follicular activity'. In this condition ovaries reduce their production of the female sex hormone-oestrogen, which is known to have protective effect against various chronic illnesses. Menopause can affect the body weight, composition and abdominal fat deposition and if obesity is prevalent among pre-menopausal women it can also alter the age of natural menopause *vice versa*. (Devis et al, 2012). Obesity is characteristically more prevalent in females and reason behind is stated as fluctuations of sex hormones at different stages of life, menopause being the predominant one. Due to the menopausal transition the gynoid type fat distribution among the females starts shifting to android type distribution. Obesity can also have an adverse effect on menopausal symptoms (Devis et al, 2012).

The Oestrogen hormone protects blood vessels by dilating the endothelium. The major effects of the decline in oestrogen levels on blood pressure are: relative increase in androgen levels, activation of renin-angiotensin system leading to high renin levels, increase in plasma endothelin levels, higher salt sensitivity, increase in insulin resistance, higher sympathetic activity and increase in weight (Mass and Franke, 2009). The two major hindering factors to reduce the incidence of cardiac events among females are inadequate recognition and poor control of hypertension (Coylewright et al, 2008). The risk of having heart diseases among females is 10 times higher than having breast cancer (WHO-NMH, 2002). Hormonal replacement therapy (HRT) has been used to prevent chronic diseases in post-menopausal women for many years but recent studies show controversial results of the impact of HRT, as it has more harms than benefits (Mass and Franke, 2009). As the prevalence of mortality due to NCDs and its risk factors is very high, developing countries like India need to focus on early prevention care as till now treatment regimen is followed only when disease has reached to its advanced stage. There is a need to educate people about the gender specific determinants of chronic diseases (WHO-NMH, 2002). The NCD alliance (2011) had recommended carrying out more women specific clinical research in the area of chronic diseases as majority of the studies till date have a focus on men. Therefore, the present study intended to assess risk factors of non-communicable disease among the adult female population of Vadodara and to compare the risk factors between pre and post-menopausal women.

## **METHODS AND MATERIALS**

For this cross-sectional study, Urban Vadodara was divided into five zones and 2 societies were randomly selected from each zone to provide a representative data. Around 408 females (30-60y) were enrolled for screening through snowball effect. Screening included anthropometric profile and menopausal status of women. Cases of under-nutrition, pregnancy, peri-menopause and hysterectomy were excluded from these subjects. Out of remaining 319 subjects, based on their consent, detailed information was collected from 131 subjects. Pre tested semi structured questionnaire was used to collect the information. Weight was taken using digital weighing scale while height, waist circumference and hip circumference were measured using non-stretchable fiberglass tape. Omron digital B.P. meter and Omron body fat analyser were used to record blood pressure and body fat respectively. International physical activity questionnaire (IPAQ) was used to assess physical activity. The subjects who did not have menstruation for more than one year, without any reproductive tract complication or pregnancy were considered as post-menopausal women. Per capita consumption of oil, sugar and salt was calculated using information of number of family members and amount of oil/sugar/salt used per month at household level. Data was analysed using Microsoft excel 2007, Epi Info version 7 and SPSS version 16. The study was approved by Institutional Ethics Committee for Human Research of Faculty of Family and Community Sciences, M.S. University, Baroda (No.: IECHR/2012/19).

## **RESULTS**

The age of the female subjects ranged from 30-60 years with mean age of 46.4±9.97 y. The background information of the subjects revealed that only 0.8% of the subjects were illiterate, 55.7% having education from primary to higher secondary level where as 43.5% were graduates or post graduates. Majority of the females were housewives (81.7%) belonging to nuclear family (62.6%). Table 1 depicts the reproductive history of the subjects. Mean age of menarche and pregnancy among females was 14.44±1.8 y and 22.9±3.1 y respectively. Around half of the females belonged to pre-menopause category. Mean age of menopause was 45.45±4.8 y. Reproductive history of the subjects showed that around 45% had more than 2 pregnancies in their life but 16.8% had more than 2 children. High prevalence of history of abortions (40.5%) was seen among the females. About 6.1% of the subjects faced still birth or death after birth of child. Merely 6% pre-menopausal women had >2 children in comparison to post-menopausal women (27.3%), showing strong preference of having just 1 or 2 children among younger population ( $p < 0.001$ ). As reported in Figure 1, 21.1% of the post-menopausal women experienced vasomotor symptoms like hot flushes and night sweats and 28.8% experienced somatic symptoms like headache, tingling of muscle, joint pain, lack of energy with varying intensity from mild to severe. Psychological symptoms were most frequently (33.3%) experienced by women. The information on family history of various non-communicable diseases showed that the highest prevalence of family history of diabetes (39.7%) and hypertension (52.5%) was seen among the subjects with lowest prevalence of family history of hyper/hypo-thyroidism (Table 2).

Similar trends were seen in the self-reported disease profile with highest prevalence of hypertension (21.4%) followed by diabetes (10.7%) among the subjects. Diabetes ( $p<0.01$ ) and hypertension ( $p<0.001$ ) were also found to be significantly higher in post-menopausal women. Prevalence of other chronic diseases like CVD, hyper-lipidemia and hypo/hyperthyroidism was also higher in post-menopausal women though not statistically significant. No case of asthma or cancer was found among the subjects. When looked at the anthropometric indices of the subjects it was found that mean weight was  $60.02\pm 10.72$  kg and height  $152.5\pm 5.99$  cm without any significant difference between pre and post-menopausal women (Table 3). Mean waist circumference (WC), waist hip ratio (WHR), waist stature ratio (WSR), body fat and systolic blood pressure (SBP) were above the normal cut-offs of risk for all the subjects and were also significantly higher in post-menopausal women. The trend showed that although the risk of NCD's is increasing with menopause, still the roots for the same are laid in early age only. Post-menopausal women had 6.5 and 4.4 times higher odds of having high body fat and blood pressure than pre-menopausal women.

**Table 1: Reproductive information of the subjects**

Parameters	Total (N=131)	Pre-menopause (n=65)	Post-menopause (n=66)	't' Stat.
	Mean±SD	Mean±SD	Mean±SD	
Age of Menarche (y)	14.44±1.8	14.37±1.82	14.5±1.76	-0.42
Age of First Pregnancy (y)	22.91±3.1	23.08±3.18	22.75±2.98	0.61
Age of menopause (y)	--	--	45.45±4.8	--
	N (%)	N (%)	N (%)	$\chi^2$ Value
>2 pregnancies	59 (45.04)	25 (38.5)	34 (51.5)	2.24
>2 children	22 (16.8)	4 (6.2)	18 (27.3)	10.37***
Abortions	53 (40.5)	27 (41.5)	26 (39.4)	0.06
Still birth or death after birth	9 (6.1)	5 (7.7)	4 (4.5)	0.13

\*\*\* $p<0.001$

**Table 2: Family History and self-reported disease profile of the subjects**

Disease	Family History	Self-reported disease history			OR (95% CI)
		Total (N=131)	Pre-menopause (n=65)	Post-menopause (n=66)	
Obesity	24 (18.4)	8 (6.4)	2 (3.1)	6 (9.1)	3.15 (0.5-32.8)
Diabetes	51 (39.7)	14 (10.7)	2 (3.1)	12 (18.2)	7.0* (1.4-66.3)
Hypertension	69 (52.5)	28 (21.4)	6 (9.2)	22 (33.3)	4.9* (1.8-13.1)
CHD	36 (27.5)	2 (1.5)	0 (0)	2 (3)	--
Hyper-lipidemia	15 (11.4)	5 (3.8)	1 (1.5)	4 (6.1)	4.1 (0.4-206.5)
Hypo/ Hyper-thyroidism	13 (10)	8 (6.1)	2 (3.1)	6 (9.1)	3.1 (0.6-16.2)
Asthma	19 (14.4)	0(0)	0 (0)	0 (0)	--
Cancer	21 (16.1)	0 (0)	0 (0)	0 (0)	--

\* $p<0.05$

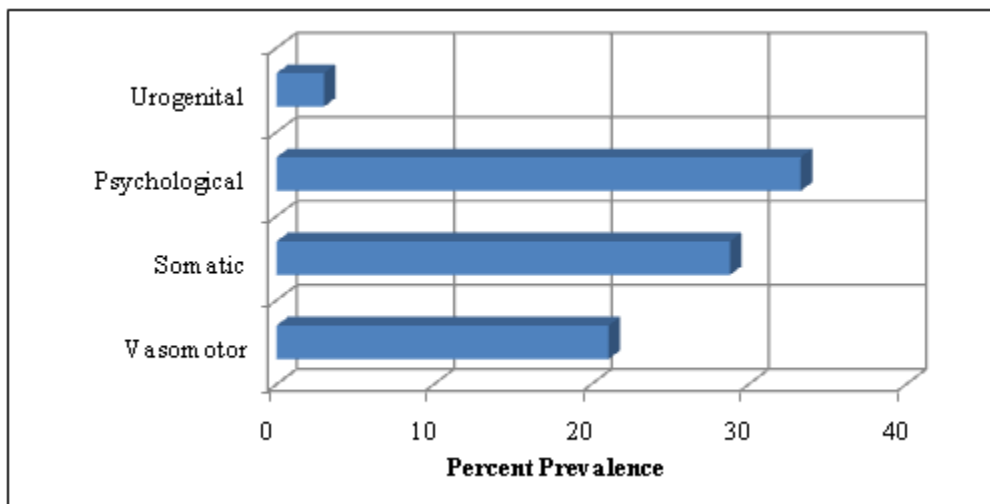
With regards to the health care practices, around 20% of the subjects reported regular health check-up with a significantly higher proportion ( $p<0.05$ ) of post-menopausal women going for regular health check-up (Table 4). The subjects were asked regarding awareness of self-breast examination and the results showed that about 32% of the subjects were aware of the practice and out of those females 90% practiced it with varying frequency from twice a month to once in 6 months. Very few subjects had undergone PAP smear (6.9%) or mammography (8.4%), majority belonging to post-menopausal group.

None of the post-menopausal women had ever received hormonal replacement therapy (HRT). Around 8.4% of the subjects reported sudden weight gain and 3% observed sudden weight loss of more than 5 kg at any point of time in their life. These results showed that the weight gain in these women was a gradual process and it could be controlled through lifestyle modifications.

**Table 3: Anthropometric and biophysical measurements of the subjects**

Parameters	Total (N=131)	Pre-menopause (n=65)	Post-menopause (n=66)	't' Stat.
	Mean±SD	Mean±SD	Mean±SD	
Weight (Kg)	60.02±10.7	59.54±11.3	60.5±10.2	-0.527
Height (cm)	152.5±5.99	153.5±6.1	151.2±5.8	1.82
Waist Circumference (cm)	93.93±10.5	91.43±10.1	96.4±10.3	-2.78**
Hip Circumference (cm)	101.26±9.9	100.01±10.1	102.5±9.7	-1.44
Waist Hip Ratio	0.93±0.07	0.92±0.07	0.94±0.06	-2.19*
Waist Stature Ratio	0.62±0.07	0.6±0.07	0.64±0.07	-3.34***
Body Mass Index (BMI)	25.82±4.45	25.3±4.66	26.3±4.2	-1.36
Body fat (%)	36.49±5.76	34.7±5.6	38.2±5.4	-3.64***
BMR	1253±179	1266±192	1240±166	0.80
Systolic Blood Pressure (mmHg)	129.4±19.0	123.14±17.2	135.6±18.8	-3.97***
Diastolic Blood Pressure (mmHg)	79.5±9.8	78.3±9.6	80.8±9.8	-1.46
	N (%)	N (%)	N (%)	OR (95% CI)
BMI >23	98 (74.8)	47 (72.3)	51(77.3)	1.3 (0.6-2.9)
WC ≥80cm	122 (93.1)	59 (90.8)	63 (95.5)	2.1 (0.4-13.7)
WHR >0.85	116 (88.5)	56 (86.2)	60 (90.9)	1.6 (0.5-4.8)
WSR >0.05	127 (96.9)	62 (95.4)	65 (98.5)	3.1 (0.2-167.6)
Body Fat >30%	118 (90.1)	54 (83.1)	64 (97)	6.5* (1.3-62.3)
Confirmed and newly diagnosed Hypertension	55 (42)	16 (24.6)	39 (59.1)	4.4* (2.1-9.3)

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001



**Figure 1: Menopausal symptoms experienced by post-menopausal women**

The life style habits of the subjects, depicted in table 5, revealed that none of the subjects consumed alcohol and only 0.8% had habit of tobacco chewing. Physical activity of the subjects showed that around 70% of the subjects were moderately physically active and only a few (6%) were having low physical activity level. The high prevalence of moderate or vigorous physical activity among the subjects was in contrast with risks assessed through anthropometric indices and one of the reasons for the same, might be, over reporting by the subjects. No significant difference was seen in the physical activity levels of pre and post-menopausal women. Nearly 78% of the subjects had normal sleep pattern. Disturbed sleep was more prevalent among post-menopausal women ( $p < 0.05$ ). Average sleeping and sitting hour among the subjects were  $7.22 \pm 1.12$  and  $4.90 \pm 1.87$  respectively, with a significantly high mean sitting hours among post-menopausal women ( $p < 0.05$ ).

Table 4: Health care practices of the subjects

Parameters	Total (N=131)	Pre-menopause (n=65)	Post-menopause (n=66)	$\chi^2$ Value
	N (%)	N (%)	N (%)	
<b>Health Check-up</b>				
No Regular Health Check-up	105 (80.2)	57 (87.7)	48 (72.7)	4.6*
Frequency of check-up >6 months	13 (50)	4 (50)	9 (50)	0.0
<b>Breast Cancer preventive practices</b>				
No awareness regarding breast examination	89 (67.9)	41 (63.1)	48 (72.7)	1.4
No Breast examination practice among aware subjects	4 (9.5)	4 (16.7)	0 (0)	--
Frequency of practice of BE >1 month	25 (59.6)	12 (50)	13 (72.2)	0.03
No PAP smear done	122 (93.1)	64 (98.5)	58 (87.9)	5.7*
No Memography done	120 (91.6)	62 (95.4)	58 (87.9)	2.4
No Hormonal replacement therapy (For post-menopausal women)	--	--	66 (100)	--
<b>Sudden weight gain or loss</b>				
Sudden weight gain	11 (8.4)	4 (6.2)	7 (10.6)	0.84
Sudden weight loss	4 (3.1)	2 (3.1)	2 (3.0)	0.0002

\* $p < 0.05$ 

Table 5: Life style habits of the subjects

Parameters	Total (N=131)	Pre-menopause (n=65)	Post-menopause (n=66)	$\chi^2$ Value
	N (%)	N (%)	N (%)	
Alcohol intake	0 (0)	0 (0)	0 (0)	--
Tobacco consumption	1 (0.8)	0 (0)	1 (1.5)	--
Low physical activity	8 (6.1)	2 (3.1)	6 (9.1)	2.05
Disturbed sleeping pattern	29 (22.1)	9 (13.8)	20 (30.3)	5.11*
Average sleep <7 hours	31 (23.7)	10 (15.4)	21 (31.8)	4.9*
	<b>Mean±SD</b>	<b>Mean±SD</b>	<b>Mean±SD</b>	<b>'t' Stat.</b>
Average sleep (Hours)	7.22±1.12	7.4±0.98	7.04±1.2	1.9
Sitting (Hours)	4.90±1.87	4.5±1.8	5.3±1.9	-2.5*

\* $p < 0.05$



Table 6: Dietary Practices of the subjects

Parameters	Total (N=131)	Pre-menopause (n=65)	Post-menopause (n=66)	$\chi^2$ Value
	N (%)	N (%)	N (%)	
Ovo-lactarian or non-vegetarian	24 (8.4)	17 (26.2)	7(10.3)	5.23*
Cow, Buffalo or Full fat packed milk	119 (90.8)	57 (87.7)	62 (93.9)	1.5
Use of single oil throughout year	108 (82.4)	54 (83.1)	54 (81.8)	0.04
Re-use of oil for deep frying	20 (15.3)	10 (15.4)	10 (15.15)	0.001
Per capita consumption of oil >30g/day at household level	105 (80.1)	50 (76.9)	55 (83.3)	0.84
Per capita consumption of salt >5g/day at household level	107 (81.7)	51 (78.5)	56 (84.8)	0.89
Per capita consumption of sugar >30g/day at household level	65 (49.6)	28 (43.1)	37 (56.1)	2.2
	<b>Mean±SD</b>	<b>Mean±SD</b>	<b>Mean±SD</b>	<b>'t' Stat.</b>
Per capita consumption of oil/ day (g) at household level	45.2±18.6	41.8±15.7	48.7±20.6	-2.16*
Per capita consumption of salt/ day (g) at household level	9.8±4.5	8.7±3.9	10.8±4.9	-2.7**
Per capita consumption of sugar/ day (g) at household level	32.5±17.9	28.8±13.5	36.2±20.9	-2.4*

\*p<0.05, \*\*p<0.01

The diet pattern of the subjects showed that most of the subjects were lacto-vegetarian (81.7%) with significantly higher number ( $p<0.05$ ) of non-vegetarians and ovo-lactarians among the pre-menopausal women (Table 6). Majority (90.8%) of the subjects consumed full fat milk of different varieties. Cotton seed oil was the first choice for cooking of around half of the subjects followed by groundnut oil (15.3%) and only 17.6% used combination of oil for preparing food. Around 15% of the subjects reused the oil for deep frying. The mean consumption of oil, sugar, salt was 45.2±18.6 g, 32.5±17.9 g and 9.8±4.5 g respectively showing high consumption among subjects. The intake of all three items was significantly higher in households of post-menopausal women as compared to pre-menopausal women.

## DISCUSSION

Obesity and hypertension have been identified as two major metabolic risk factors for non-communicable diseases. The prevalence of both the risk factors was very high in the present study. The results are in line with 'the five city study group' who demonstrated prevalence of obesity (BMI >25) around 43% in women of 5 cities of the India ranging from 39% in Moradabad to 46% in Mumbai (Singh et al, 2007). NFHS 3 also showed regional differences for the prevalence of obesity among women. Iyer et al (2011) reported prevalence of overweight among female population of Vadodara (20.1%) and Godhra (22.8%), which is lower than the present study (31%) showing a rising trend of weight gain among the female population. Abdominal obesity poses a high risk of developing insulin resistance and further increases risk for diabetes and CVDs. The prevalence of abdominal obesity was very high in the present study in comparison to data available from various regions of the country and the regional data (Khokhar et al, 2010; MMH et al, 2011; Iyer et al, 2011; Rao et al, 2013; Yadav et al, 2008). Waist stature ratio, the upcoming indice to assess CVD risk also showed high prevalence of risk among the subjects. As the cases of under-nutrition were removed in experimental design of the study, it might lead to slightly skewed prevalence of obesity towards higher side.

Out of 42% of the hypertensive subjects only half were aware about their hypertensive status. Various Indian studies have shown diverse prevalence of hypertension among the female population ranging from 23%-40% (MMH et al, 2011; Yadav et al, 2008; Rao et al, 2013). Only one day measurement of the blood pressure is a major limitation of the present study, as it can over/underestimate the prevalence of the hypertension. The prevalence of self-reported diabetes history (10.7%) was similar to that of study presented by Iyer et al (10%) in 2011 in Vadodara, whereas higher prevalence of diabetes was found in other studies executed at different regions of India, as they had used self-reported history and biochemical measurements both to diagnose diabetes (Rao et al, 2013, Yadav et al, 2008). This observation is suggestive of a fair proportion of the population living with undiagnosed diabetes. The inclusion of older population in these studies may also be a reason for higher prevalence of diabetes. Menopause brings a robust change in every aspect of health in a woman's life, be it psychological, physical or social health. These changes can, directly or indirectly have an impact on risks of developing chronic diseases. But in recent years there is a debate going on whether it's menopausal transition which leads to higher risk or NCD's or merely an effect of increase in age. In the present study high prevalence of risk factors for developing non-communicable diseases was seen among both pre and post-menopausal women. Khokhar et al (2010) also depicted similar trends showing a high prevalence of general and abdominal obesity in both the groups in a study conducted in Punjab. A significantly higher prevalence of NCDs and its risks were seen among post- menopausal women in terms of presence of diabetes, hypertension, high body fat content, higher mean abdominal obesity and waist stature ratio, without any adjustment for age, in the present study. The effect of menopause on prevalence of metabolic syndrome (MS) was assessed by Pandey et al (2010) on 498 urban females and found than post-menopausal women had significantly high prevalence of metabolic syndrome but the significance was lost after adjusting for age. Long term epidemiological studies with larger sample size are required to establish this fact.

Breast cancer is one of the most prevalent forms of cancer among women, still the awareness regarding detection of breast cancer was found very low among the subjects. A Delhi based study also showed inadequate awareness regarding breast examination among the women (Somdattaand Baridalyne, 2008). Poor dietary practices like high intake of salt, sugar and fat are well established as risk factors for developing obesity, hypertension, diabetes and cardio-vascular diseases (Johnson et al, 2009; Brown et al, 2009; Reddy and Katan, 2004). The study depicted high levels of per capita consumption of oil, sugar and salt at household level. Mean salt intake (9.8 g) observed in the present study was higher than reported (8.5g) by Radhika et al (2007) and recommended salt intake levels (<5g). There is dearth of data on average consumption of these dietary components at national level.

## **CONCLUSIONS**

Although menopause can have an adverse impact on cardio-metabolic risks among females, the changing life style and dietary habits have led these risks stepping into early stages of life. Therefore, there is an urgent need to formulate gender specific preventive strategies at policy level and to create awareness at individual level to reduce the burden of non-communicable diseases among women.

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