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Association of physical activity, sitting time and television watching time with obesity among middle aged and older adults in rural and peri-urban areas of Birbhum District, West Bengal, India

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Association of physical activity, sitting time and television watching time withobesity among middle aged and older adults in rural and peri-urban areas of Birbhum District, West Bengal, India

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ABSTRACT

Background: *Physical activity is well recognized as an important lifestyle behavior for the development and maintenance of individual and population health and well-being. Most studies indicate an inverse relationship between physical activity (PA) and obesity. Physical activity might reduce the risk associated with overweight and obesity. The aim of this study was to explore association of physical activity, sitting time and television (TV) watching time with overweight/obesity in rural and peri-urban population of Birbhum district, West Bengal for the development of intervention and prevention strategies for obesity in a middle-aged and elderly population.*

Methods: *A cross-sectional study was performed on 1791 (men 1387; women 404)adults with a mean age 50.43 ±7.55years in Suri-1 block of rural and peri-urban areas from March 2023 to December 2023 in the study areas of Birbhum district, West Bengal. A pretested standardized questionnaire was used for physical activity at workplace (employees [paid/unpaid]/ business).*

Results: *The prevalence of obesity was found in the least to the moderately and severe active group compared to sedentary physical activity group. TV watching time was comparatively higher for females than males in our study. Time spent watching TV and sitting behavior was positively associated with risk of obesity and overweight.*

Conclusion: *Time spent sitting while at work, TV viewing, and non-TV leisure-time sitting were not associated with incident or prevalent obesity in this study. Prior obesity was associated with the amount of time an individual spent sitting while watching TV, suggesting that the relationship between sedentary behavior and obesity may be more complex than has been suggested previously. The possibility of reciprocal or reverse causality in this association requires further research attention.*

Key Words: Physical activity, sitting time, TV watching time, obesity

INTRODUCTION

Lack of physical activity is one of the main risk factors that lead to overweight and obesity and its associated health complications. The prevalence of physical inactivity and obesity is on a rapid increase and as a consequence has resulted in major public health problems worldwide[Brundtland, 2002]. Physical activity assists in weight loss or a reduction in visceral fat, which could ultimately help in reducing blood pressure [Reaven et al, 1991].

Clarifying the relationship between sedentary behavior, physical activity (PA) and obesity is important for prioritizing prevention strategies. For example, if sedentary behavior is an independent determinant of obesity, then reducing sedentary time may be a more attainable health behavior goal in the long-term than increasing time spent in moderate-vigorous PA [Prince et al, 2014]. In a recent population-based study, prolonged sitting time was associated with higher risks of CVD and premature death in 21 low- to high-income countries, with the strongest associations observed in low- to middle-income countries [Li et al, 2022].Altogether there are 7 countries in the region namely; Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Although there are significant cultural differences between regional countries, South Asians are an inherently high-risk group for developing abdominal adiposity, diabetes, cardiovascular diseases [Eapen et al, 2009].

Independent of weight loss or changes in body mass index (BMI), there are emerging correlational data in individuals with obesity that demonstrate physical activity can be beneficial to many critical health markers [Gaesser &Angadi, 2021]. Time spent in sedentary behaviors reflects a wide range of human pursuits that involve sitting or reclining and only low levels of energy expenditure [Owen et al, 2010].

Public health actions to reduce obesity have mostly focused on individuals, encouraging them to eat healthier and to exercise more. But so far, these approaches are failing as not a single country has succeeded in reducing obesity rates in the past 30 years [Ng et al, 2014].Evidence has shown that greater rates of television viewing are directly associated with a higher risk of being overweight or obese, a higher BMI, and increased adiposity[Helajärvi et al, 2014].

While there are numerous studies from western countries on physical activity levels in their respective populations, few studies from India have looked at this important risk factor. Moreover, most of the

available data have been derived from small studies conducted in discrete regions of the country, which have used varying methodology and have been conducted over different time periods [Krishnan et al, 2008, Vaz&Bharathi, 2000, Thankappan et al, 2010].

This paper reports on the levels of physical activity (and inactivity) based on the data collected from rural and peri-urban areas of Suri-I block, Birbhum district, West Bengal among working population.

MATERIALS AND METHODS

The survey was conducted as a cross sectional study in rural and peri-urban areas of Suri-1 block, Birbhum district, West Bengal from March 2023 to December 2023. Total sample size is 1791 where physical activity was measured at workplace included employees (paid/ unpaid) and businessmen but excluded housewives and dependents. Age of the participants was confirmed on the basis of birth certificate. For those who did not have a birth certificate, the school certificate, Voter ID card or Aadhaar card was carefully considered as a secondary source.

Anthropometric Measurements

BMI was calculated as weight (kg) divided by height in metres squared (m2). Body mass index (BMI) was the outcome measure of this study and was calculated from self-reported weight and height. Participants were categorized as normal weight (BMI <25 kg/m2) and overweight or obese (BMI ≥25 kg/m2) for descriptive analyses (WHO, 2010).WHtR was calculated as waist circumference (cm) (WC) divided by height (cm). The standardvalue for WHtR was considered as 'no increased risk' (WHtR<0.5); 'increased risk' (WHtR ≥0.5. The cut-off value for WHtR was considered as 0.5. WHtR cut-off point of ≥0.50 was used to define obesity in both men and women.(NICE guideline, 2022). Similarly, WC ≥90 cm for males and ≥80 cm for females were considered 'cut-off values' (WHO guideline 2008).

Assessment of television viewing and sitting time and type of physical activity level for adults

In physical activity, sedentary activity includes land owner, service, business, postman,teacher and white collar workers. Moderate activity includes labourer, other labourer, cultivator, artisan, mason, servant maid, tailor, rickshaw –puller, etc. Heavy activity includes blacksmith, stone cutter, railway gagman, wood cutter, mine worker etc. In the formation of quintile, five groups have been created such as poor, poor middle, upper middle and upper. Quintile was calculated on the basis of type of house, type of fuel

materials used for cooking, sanitation and household assets through principal components analysis (PCA) guidelines.

The number of hours of participant's television viewing was recalled by who were asked, "Between the ages of 40 and 75 years, how many hours/day during the week did participant watch [television]?" Response categories were "No television," "1 to 2 hours/day," and "3 or more hours/day."

"How much time did you usually remain sitting for?" These questions were asked the participants working at college, office or own business but were not included for housewives. Response categories were "sitting hours less not 1 or not", "1 to 3 hours", "4 to 6 hours" and "7 hours and more".

Statistical Analysis

We conducted statistical analyses using STATA (version 12.0). All descriptive statistics are presented as means and standard deviations for continuous variables. The difference in physical activity levels and prevalence of obesity regarding sitting time, TV watching time and wealth index was tested using a Chi-squared test. Odds ratio (OR) was estimated with 95% confidence interval (CI). Statistical significance was determined at a p-value ≤ 0.05. Data entry was performed in the MS excel spreadsheet. Data analysis was carried out using STATA software.

Socio-demographic variables

The socio-demographic factors included: sex (men, women), religion (Hindu, Muslim, and Christian), caste (scheduled caste, scheduled tribe, other backward classes and other).

RESULTS

The mean and standard deviation for anthropometric and adiposity indices by socioeconomic, sitting time and physical activity are given in Table-1. The mean age of male participants was 50.80 (± 7.62) years while that of females was 49.13 (±7.12) years. Mean height and weight was found to be significantly higher in males than females. Males had a significantly higher mean value of minimum waist circumference than females, but females mean values of body mass index and weight to height ratio were found to be higher than males. Sitting time (hour/ day) was higher among females compared to males. The prevalence of obesity was found in the least to the moderately and severe active group compared to sedentary physical activity group. Again, mean values of body mass index, waist circumference and

weight to height ratio were comparatively higher for upper middle and upper socioeconomic group in our study who were working.

Table-1: Descriptive analysis (mean [SD]) of age, sitting time, body mass index, waist and weight to height of adults by country

Variables	N	Age	Sitting time (hour/ day)	Body mass index(kg/m2	Waist Circumference	Weight to height ratio
All samples	1791	50.43(7.55)	2.65(2.64)	20.73(3.56)	80.81(11.25)	0.51(.067)
Sex						
Male	1387	50.80(7.62)	2.63(2.67)	20.67(3.49)	81.39(11.02)	0.50(0.063)
Female	404	49.13(7.12)	2.70(2.52)	20.98(3.79)	78.82(11.82)	0.53(.076)
Religion						
Hindu	1351	50.42(7.65)	2.49(2.65)	20.45(3.45)	79.57(10.99)	0.50(0.065)
Muslim	435	50.51(7.22)	3.09(2.54)	21.59(3.74)	84.51(11.20)	0.52(.072)
Christian	5	44.67(3.05)	5.33(3.78)	25.42(5.97)	87.33(12.01)	0.55(0.07)
Caste						
ST	71	48.28(7.51)	0.69(0.90)	19.21(2.89)	74.12(9.28)	0.48(.064)
SC	796	50.01(7.52)	2.12(2.59)	19.95(3.27)	77.70(10.82)	0.49(0.065)
OBC	441	50.69(7.49)	3.17(2.77)	21.5(3.48)	84.52(10.89)	0.52(0.068)
Other	483	51.19(7.56)	3.33(2.43)	21.52(3.82)	83.53(10.66)	0.51(0.067)
Socioeconomic status						
Poor	250	50.05(7.81)	1.61(2.08)	19.03(3.06)	74.69(9.44)	0.48(.060)
Poor middle	301	50.53(7.78)	2.14(3.21)	19.40(3.31)	75.81(9.97)	0.49(.064)
Middle	269	50.18(7.66)	2.14(2.03)	20.32(3.33)	78.83(10.81)	0.50(.069)
Upper middle	417	50.99(7.52)	2.70(2.34)	20.73(3.36)	81.43(10.99)	0.51(.067)
Upper	554	50.23(7.26)	3.60(2.69)	22.45(3.42)	86.78(10.00)	0.53(.062)
Physical activity						
Sedentary	918	50.91(7.72)	3.52(2.60)	21.47(3.83)	83.58(11.43)	0.52(0.069)
Moderate & Severe	873	49.91(7.33)	1.73(2.36)	19.97(3.07)	77.89(10.28)	0.49(.060)

Table-2: Descriptive analysis (mean [SD]) of age, watching TV, body mass index, waist and weight to height of adults by country

Variables	N	Age	Watching TV (hour/ day)	Body mass index(kg/m2	Waist Circumference(cm)	Weight to height ratio
All samples	1240	49.88(7.24)	1.87(1.44)	21.09(3.60)	81.96(11.35)	0.51(0.067)
Sex						
Male	976	50.14(7.32)	2.14(0.47)	21.03(3.55)	82.72(11.10)	0.51(0.064)
Female	264	48.89(6.85)	2.21(0.50)	21.30(3.78)	79.16(11.83)	0.53(0.075)
Religion						
Hindu	1028	50.12(7.37)	1.94(1.52)	20.84(3.46)	80.85(11.06)	0.51(0.065)

Muslim	209	48.74(6.45)	1.53(0.91)	22.22(3.99)	87.33(11.22)	0.54(0.071)
Christian	3	44.67(3.05)	2.33(1.52)	25.42(5.97)	87.33(12.01)	0.55(0.07)
Caste						
ST	25	48.28(8.24)	1.28(0.84)	19.89(2.84)	76.68(9.42)	0.49(0.066)
SC	576	49.42(7.01)	1.81(0.97)	20.28(3.28)	78.66(11.08)	050(0.065)
OBC	252	49.65(7.10)	1.82(1.10)	21.83(3.69)	86.41(11.24)	0.53(0.068)
Other	387	50.81(7.52)	2.03(2.09)	21.87(3.76)	84.30(10.31)	0.52(0.065)
Socioeconomic status						
Poor	119	48.72(7.34)	1.46(0.89)	19.23(2.99)	74.97(9.53)	0.48(0.059)
Poor middle	172	49.45(7.03)	1.49(0.83)	19.54(3.38)	75.75(9.88)	0.48(0.063)
Middle	163	49.77(7.66)	1.99(2.41)	20.27(3.39)	78.41(10.52)	0.50(0.065)
Upper middle	302	50.49(7.23)	1.91(0.99)	20.83(3.45)	81.73(11.29)	0.51(0.068)
Upper	484	49.97(7.13)	2.03(1.49)	22.53(3.43)	87.22(9.96)	0.53(0.062)
Physical activity						
Sedentary	702	50.38(7.34)	2.00(1.71)	21.80(3.81)	84.56(11.32)	0.53(0.068)
Moderate & Severe	538	49.21(7.06)	1.69(0.97)	20.16(3.08)	78.57(10.46)	0.49(0.060)

The mean and standard deviation for anthropometric and adiposity indices by socioeconomic, watching television and physical activity are given in Table-2. The mean age of male participants was 50.14 (± 7.32) years while that of females was 48.87 (±6.85) years. Mean height and weight for male participants were 163.11(±6.90) and 56.14(±11.04) respectively while for female participants mean height and weight were 149.35(±6.01) and 47.77(±10.26) respectively. So mean height and weight was found to be significantly higher in males than females. Males had a significantly higher mean value of weight to height ratio than males. Waist circumference and weight to height ratio both were higher for Muslim population than Hindu population in our study. The prevalence of obesity was found in the least to the moderately and severe active group compared to sedentary physical activity group. TV watching time was comparatively higher for females than males in our study. Again, mean values of body mass index, waist circumference and weight to height ratio were comparatively higher for upper middle and upper socioeconomic group in our study who were working and watching TV per day.

Table-3: Multivariate analysis showing factors associated waist circumference and waist to height ratio among study population of Birbhum district, West Bengal

Variables	**Waist Circumference**			**Weight to height ratio**		
	Odd Ratio	**95% CI**	**p-value**	**Odd Ratio**	**95% CI**	**p-value**
Sex						
Male(Reference)						
Female	4.28	3.31 5.54	0.000	2.04	1.60 2.61	0.000

Watching TV (hour/day)						
No Television (Reference)						
1 to 2 hours/day	1.61	0.85 3.05	0.147	0.94	0.54 1.63	0.820
3 or more hours/day	2.04	1.03 4.01	0.040	1.02	0.56 1.85	0.955
Work Sitting time (hour/ day)						
sitting hours less not 1 or not(Reference)						
1 to 3 hours	2.05	1.52 2.78	0.000	1.77	1.38 2.26	0.000
4 to 6 hours	2.53	1.82 3.51	0.000	2.20	1.66 2.92	0.000
7 hours and more	3.41	2.20 5.28	0.000	3.57	2.28 5.58	0.000
Physical activity						
Sedentary(Reference)						
Moderate & Severe	0.37	.296 .465	0.000	0.45	0.36 0.55	0.000
Socioeconomic status						
Poor(Reference)						
Poor middle	1.44	0.90 2.29	0.128	1.27	0.89 1.81	0.188
Middle	1.52	0.90 2.55	0.114	1.54	1.03 2.29	0.036
Upper middle	2.18	1.32 3.60	0.002	2.02	1.35 3.00	0.001
Upper	5.02	3.04 8.27	0.000	5.10	3.37 7.72	0.000

Adjusted odd ratio: Religion, caste, own house, sanitary latrine

Multinomial regression models of waist circumference and weight to height ratio on related independent variables such as physical activity, watching television and sitting time and socioeconomic status are shown in Table-3.

The risk factors associated with obesity in relation to socio-economic characteristics among these communities were analyzed by multivariate logistic regression method. In Table-3, a multinomial logistic regression was used to assess the impact of different socio-economic and demographic variables on obesity. Adjusted for waist circumference for female population (odds ratio: 4.28; 95% confidence interval: 3.31 5.54), television watching 3 hours and more (odds ratio: 2.04; 95% confidence interval:1.03 4.01), sitting time 7 hours and more (odds ratio: 3.41; 95% confidence interval:2.20 5.28), moderate and severe physical activity (odds ratio: 0.37; 95% confidence interval : .299 .465), upper middle wealth index (odds ratio: 2.18; 95% confidence interval : 1.32 3.60) and upper wealth index (odds ratio: 5.02 ; 95% confidence interval : 3.04 8.27).

Adjusted for weight to height ratio for female population (oddsratio: 2.04; 95% confidence interval:1.60 2.61),sitting time 7 hours and more (odds ratio: 3.57; 95% confidence interval: 2.28 5.58), moderate and severe physical activity (odds ratio: 0.45; 95% confidence interval: 0.36 .55), upper middle wealth index (odds ratio: 2.02; 95% confidence interval: 1, 353.00), upper wealth index (odds ratio: 5.10 ; 95% confidence interval : 3.37 7.72). In most of the cases p-values are highly significant,

DISCUSSION

This study found that older adults who spent less time watching TV, a predominant leisure-time sedentary behavior, were less likely to be overweight or obese, regardless of their levels of moderate to severe physical activity. This suggests that prolonged TV viewing elevates the risk of overweight/obesity among the elderly population. Studies on physical activity in India have shown varied results and differences according to region, gender, caste and between socioeconomic classes. In the current study sedentary behavior was 51.26% and moderate and severe behavior was 48.74%.

Weight-to-weight ratio has been shown to be a good discriminator for cardiovascular disease risk (Lee et al., 2008, Ashwell &Gisbon, 2014) and was therefore additionally included. Cut-offs of ≥ 0.5 for overweight (Browning et al., 2010) and was used for both gender groups.

A substantial amount of time spent in sedentary activities is likely to contribute to obesity through reduced overall energy expenditure, mainly resulting from their impact on incidental physical activity, since it may co-exist with relatively high levels of exercise-related physical activity.

In many countries, physical inactivity levels are rising with major implications for the prevalence of non-communicable diseases (NCD) and the general health of populations worldwide[WHO,2010]. Physical inactivity increases the risk of developing abdominal adiposity, diabetes and cardiovascular disease [Qin et al, 2010].

The fact that significant associations of TV viewing time with overweight were found that light-intensity and intermittent activities during work are protective against overweight/obesity in the presence of

prolonged TV viewing time. However, in workers, some TV viewing may accompany other leisure-time sedentary behaviors, due to the greater amount of time available for them.

The cross-sectional design of this study is one limitation, and the possibility of reverse causality (ie, overweight and obesity could discourage activity and lead to prolongation of TV viewing time) should be considered. Longitudinal studies are needed to examine causality. Finally, the analyses could not include information on diet, which may confound the relationship between sedentary time and overweight risk.

Conclusion

This study suggest that increasing activity levels and decreasing the time spent in sedentary behavior such as watching television should both be considered as potential intervention strategies in obesity prevention programs. In this sample of older adults, spending less time watching TV, a predominant sedentary behavior, was associated with lower risk of being overweight or obese, independent of meeting physical activity guidelines. Further studies using prospective and/or intervention designs are warranted to confirm the presently observed effects of sedentary behavior, independent of physical activity, on the health of older adults.

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We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed. We further confirm that the order of authors listed in the manuscript has been approved by all of us.

Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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