

Risk Factors for Obesity and Overweight in Goa, India: A community based Case-Control Study

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ABSTRACT

Introduction: Obesity is a chronic disease, which is known to affect all the age groups and is prevalent in both developed and developing countries. Environmental factors like affluent life style, high energy diet, sedentary life style, discarding old family traditions with regards to eating, exercise, outdoor activity, the couch potato culture and others have led to obesity.

Furthermore, obesity is also a key risk factor in the natural history of other non-communicable diseases (NCDs).

Material and methods: A Community based case control Study was conducted in an urban community in Goa, India. 106 cases group matched to 106 controls constituted the study sample. Cases included Obese or overweight individual within the age group of 30-60 years. Cases were selected during household survey while controls were taken in the neighbourhood of the cases. A structured questionnaire was used to get information on general demographics, personal habits which included diet, smoking, drinking of alcohol. Physical activity was assessed using the WHO Global Physical Activity Questionnaire (GPAQ).

Examination and laboratory investigations were conducted. The study was approved by the Institutional Ethics Committee. Informed written consent was obtained from all the study participants. The data was analysed using SPSS software package version 22.0. Odds ratio, chi square test, t test and multiple logistic regressions were used to analyse the data.

Results: Low Physical activity, less sleep duration, mixed diet as opposed to vegetarian diet, non-vegetarian serving 2 to 4 times a week, calorie intake in excess of recommended intake, low fruit consumption were found to be the significant risk factors both in univariate and multiple logistic regression.

Conclusion: Considering the rising prevalence of obesity and the consequent complications, there is an urgent need to address these risk factors through health education, risk reduction interventions and other innovative strategies.

Keywords: Obesity, Overweight, Risk Factors, Case-Control Study, Odds Ratio

women who were more than 20 years old were reported as obese in the year 2008.³ Environmental factors like affluent life style, high energy diet, sedentary life style, discarding old family traditions with regards to eating, exercise, outdoor activity, the couch potato culture and others have led to obesity.⁴

Furthermore, as obesity is a key risk factor in the natural history of other non-communicable diseases (NCDs), the typical time sequence of emergence of chronic disease following the increased prevalence of obesity is important in public health planning. The first few complications of obesity to emerge are high blood pressure, dyslipidaemia, and impaired glucose tolerance, while heart disease and diabetes mellitus complications will arise several years later. It is only a matter of time before the same high mortality rates for such diseases will be seen in developing countries as those prevailing 30 years ago in industrialized countries with well-established market economies.¹

There is paucity of research on the risk factors for obesity and overweight in Goa, a state in western India. Goa is highly urbanised and has a more westernised culture compared to other states in India. Therefore, it was felt necessary and important to study the risk factors for obesity and overweight in Goa, to help form the preventive strategy for obesity and overweight so that the complications associated with the obesity and overweight could be prevented.

MATERIAL AND METHODS

The Community based case control Study was conducted in an urban community in the field practice area of the department of community medicine of a government medical college in Goa. The place is located 1.5 kilometres away from the medical College. The population of the area is about 15500.

Study Design: Study Period: Two years from July 2014 - October 2016

INTRODUCTION

Obesity is a chronic disease, which is known to affect all the age groups and is prevalent in both developed and developing countries. In the modern world, obesity is now substituting the infectious diseases and has become the most significant cause of morbidity and mortality.¹

In India, the non-communicable diseases risk factor survey II which was conducted in 2007-2008, in the states of Andhra Pradesh, Kerala, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttarakhand and Mizoram showed high prevalence of overweight in all age group except in age group of 15-24 years.² Furthermore in India, 1.3% of men and 2.5% of

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Sample Size: Based on the findings of the previous study⁵ the minimum sample size calculated was 100 cases and 100 controls (1:1) as per formulae and tables of Lwanga SK and Lemeshow S.⁶ However 106 cases and 106 controls were taken to compensate for possible non-response from the study subjects.

Study Participants: Cases included Obese or overweight individual within the age group of 30-60 years. Overweight was considered when body mass index (BMI) is between 23-24.9 kg/m². Obesity was considered when BMI is more than 25kg/m² and / or Waist Hip Ratio (WHR) is more than 0.85 for females and is more than 1.0 for males.¹

Controls included normal weight for height individual in the age group of 30-60 years. Weight is considered normal when BMI is between 18.5-22.9kg/m². Cases and controls were matched for age and sex in form of group matching.

Sampling Technique: Cases were selected during household survey till target sample size was met. Controls-were taken in neighbourhood of cases.

Exclusion Criteria: Pregnant women, Patients with generalised oedema, Patient on steroid treatment for long duration, were excluded.

Data collection and study instruments: The investigator interviewed both the cases and controls. The cases and controls were investigated using a predesigned proforma. Assurance was given to maintain the strict confidentiality while interview and examination was carried out in their respective houses. A structured questionnaire was used to get information on general demographics, personal habits which included diet, smoking, drinking of alcohol. Physical activity was assessed using the WHO Global Physical Activity Questionnaire (GPAQ)⁷

Examination included Measurement of blood pressure, height, weight, waist-hip circumference and blood sample was collected for laboratory investigations including fasting blood glucose level, lipid profile and complete haemogram. Height was measured using height measuring stand, weight was measured using spring balance machine regularly checked and calibrated to zero. Waist and hip circumference were measured using a measuring tape as per guidelines. The study was approved by the Institutional Ethics Committee. Informed written consent was obtained from all the study participants.

STATISTICAL ANALYSIS

The data was analysed using SPSS software package version 22.0. The statistical analysis included the Chi square test to study the association between the exposure variables and obesity and overweight with the p value of less than 0.05 being considered statistically significant. Odds ratio with 95% confidence limits was used to measure the strength of association. The student t test was used for comparing the means of continuous variables. Multiple Logistic Regressions analysis was performed to assess the independent effect of each of the risk factors.

RESULTS

One hundred and six cases group matched to equal number of controls constituted the study sample. The mean age of cases and controls for males was 45.92±8.32 years and for females it was 45.08±8.17 years. As far as sex distribution is concerned, males constituted 43.4% and females 56.6% of the study sample. The baseline demographic characteristics of the study participants are given in table 1. As far as religion wise distribution was concerned, most of the cases and controls were Christians (55.7% of cases and 43.4% of controls) followed by Hindus (40.6% of cases and 53.8% controls) and 3.8% of cases and 2.8% of controls were Muslims. The religious distribution of cases and controls were similar to distribution of population in the area. Among the study subjects majority were married (81.2% of cases and 79.2% of controls) where as 16% of cases and 18% of controls were unmarried. Highest proportion of the cases (43.4%) and controls (39.6%) were belonging to socioeconomic class II according to BG Prasad socioeconomic classification while majority of the participants were educated up to higher secondary school and above (45.3% for cases and 61.3% for controls).

Mean values of certain risk variables and parameters are detailed in table 2. Mean cholesterol, mean triglyceride, mean LDL and mean fasting blood sugar level were significantly higher among cases compared to controls. Mean HDL was significantly lower in cases compared to controls.

Association of obesity and overweight with physical activity and reported sleep duration is described in table 3. Physical activity was assessed using the WHO Global Physical Activity questionnaire. Physical activity was classified as low, moderate and high level of activity.

As far as physical activity was concerned out of 106 cases 18.9%, 21.7% and 59.4% cases were involved in high, moderate and low physical activity respectively. Among the controls 35.8%, 40.6%, and 23.6% were involved in high, moderate and low physical activity respectively, and the difference was found to be statistically significant. Those involved in low physical activity were 4.79 times more likely to be obese or overweight compared to those involved in high physical activity (OR=4.79; 95% CI: 2.35-9.76).

Among the cases, 58.5% had less than 7 hours of sleep whereas among controls 32.1% had less than 7 hours of sleep, and the difference was found to be statistically significant. Consequently, those sleeping less than seven hours were almost three times more likely to be obese than those with sleep duration more than seven hours (OR=2.98; 95%CI: 1.70-5.23).

Association between diet and obesity has been described in table 4. Among the cases 77.4% were having mixed diet whereas among controls it was 64.2%. This difference was statistically significant with p value of 0.03. Individuals having mixed diet were twice more likely to be obese or overweight compared to vegetarians (OR=2.24; 95% CI: 1.21-4.13).

Among the cases 63.2% were consuming more than

Demographic variable	Cases, n=106		Controls, n=106	
	No.	%	No.	%
Religion				
Hindu	43	40.6	57	53.8
Muslim	4	3.8	3	2.8
Christian	59	55.6	46	43.4
Educational status				
Illiterate	12	11.3	0	0
Completed primary school	23	21.7	18	16.9
Completed secondary school	23	21.7	24	22.5
Completed higher secondary school	21	19.8	31	29.2
Graduate	23	21.7	25	23.9
Post Graduate	4	3.8	8	7.5
Socio-economic status				
Class I	20	18.9	28	26.5
Class II	46	43.4	42	39.6
Class III	35	33.0	26	24.5
Class IV	5	4.7	8	7.5
Class V	0	0	2	1.9
Occupational status				
House wife	34	32.1	31	29.3
Unemployed	4	3.8	8	7.5
Unskilled	12	11.3	6	5.6
Semi-skilled	5	4.7	7	6.6
Skilled	12	11.3	14	13.2
Clerical	8	7.5	4	3.8
Shop owner	13	12.3	16	15.1

Table-1: Baseline characteristics of the cases and controls

Risk factor	Cases, n=106	Controls, n=106	t value; p value
	Mean ±SD	Mean ±SD	
Cholesterol	212.60±39.27	175.92±36.23	t=7.06; p=0.00
Triglyceride	143.56±26.56	127.89±28.92	t=4.10; p=0.000
LDL	89.93±15.24	86.16±14.01	t=1.87; p=0.000
HDL	42.25±4.66	43.30±5.84	t=-1.17; p=0.0242
FBSL	135.94±27.53	126.07±26.62	t=2.65; p=0.009
Systolic BP	133.77±10.82	131.04±8.63	t=2.03; p=0.043
Diastolic BP	81.58±5.53	80.28±5.10	t=1.78; p=0.07
BMI	25.86±2.06	21.37±0.98	t=20.18; p=0.000
WHR	0.97±0.05	0.81±0.05	t=20.17; p=0.000

Table-2: Mean values of certain risk factors among cases and controls

Risk variable	Cases, n=106	Controls, n=106	Odd's Ratio, (95% C.I)	chi square, p value
	No.	No.		
Physical activity				
High	20 (18.9)	38(35.8)	1 (reference)	$\chi^2=14.925$ p=0.000
Moderate	23 (21.7)	43(40.6)	1.02 (0.48-2.13)	
Low	63 (59.4)	25(23.6)	4.79 (2.35-9.76)	
Sleep duration				
< 7 hours	62 (58.5)	34(32.1)	2.98 (1.70-5.23)	$\chi^2=28.05$ p = 0.000
≥ 7 hours	44 (41.5)	72(67.9)	1 (reference)	

Table-3: Association between physical activity and sleep pattern with obesity and overweight

recommended calorie intake and among controls it was about 28.3% which was found to be statistically significant. Those individuals consuming more than the recommended daily calories were four times more likely to be obese compared to those consuming recommended daily calories or less

(OR=4.35; 95% CI: 2.44-7.36).

As far as consumption of fruits was concerned, those consuming fruits rarely were twenty two times more likely to be obese or overweight and those consuming fruits only once a week were four times more likely to be obese compared to

Risk Variable	Cases, n=106	Controls, n=106	Odd's Ratio, (95% C.I)	chi square, p value
	No. (%)	No. (%)		
Type of diet				
Mixed	82 (77.4)	68 (64.2)	2.24 (1.21-4.13)	$\chi^2=4.41$ p=0.03
Vegetarian	24 (22.6)	38 (35.8)	1 (reference)	
Daily Calorie Intake				
More than recommended	67 (63.2)	30 (28.3)	4.35 (2.44-7.36)	$\chi^2=26.01$ p=0.000
Equal to or less than recommended	39 (36.3)	76 (71.7)	1 (reference)	
Fruits in diet				
Daily	8 (7.5)	28 (26.4)	1 (reference)	$\chi^2=35.89$ p=0.000
2-3 times / week	24 (22.6)	40 (37.7)	2.10 (0.82-5.35)	
Once a Week	42 (39.7)	33 (31.2)	4.45 (1.8-11.05)	
Rarely	32 (30.2)	5 (4.7)	22.4 (6.57-76.41)	
Non vegetarian serving				
No	24 (22.6)	38 (35.8)	1 (reference)	$\chi^2=12.73$ p=0.026
Daily	9 (8.8)	9 (8.5)	1.58 (0.55-4.55)	
2-4 times/week	30 (28.3)	18 (17)	2.64 (1.21-5.74)	
Once a Week	29 (27.1)	22 (20.8)	2.09 (0.98-4.44)	
Once in 15 days	13 (12.3)	11 (10.4)	1.87 (0.72-4.85)	
Rarely	1 (0.9)	8 (7.5)	0.20 (0.02-1.68)	

Table-4: Association between nutrition and obesity and overweight

Risk factors	β coefficient	p value	Adjusted odds ratio
Sleep duration (less than 7 hours)	0.959	0.010	2.61
Calorie more than daily recommended	1.622	0.000	5.062
Type of diet (mixed)	2.829	0.053	16.92
Vegetarian			1 (reference)
Non vegetarian: 2-4 times/week	3.349	0.024	28.48
Non vegetarian: weekly once	3.438	0.019	31.12
No. of fruit serving			
Daily			1 (reference)
Weekly once	1.553	0.005	4.72
Rarely	3.418	0.000	30.51
Physical activity : High			1 (reference)
Physical activity : Low	1.308	0.004	3.700

Table-5: Multiple logistic regression analysis of certain risk factors by enter method

those consuming fruits daily in their diet.

As far as consumption of non-vegetarian food was concerned those who consumed non vegetarian diet daily were 1.58 times at risk of developing obesity or overweight, and those who consumed non vegetarian 2 to 4 times per week were 2.64 times at risk of developing obesity or overweight compared to non-vegetarians.

On multiple logistic regression analysis, sleep duration of less than seven hours per day, calorie intake in excess of recommended intake, mixed diet, non-vegetarian serving 2 to 4 times a week, low consumption of fruits and low physical activity were found to be the significant risk factors for obesity and overweight (table5).

DISCUSSION

The community based case-control study identified several risk factors for development of obesity and overweight. Low Physical activity, less sleep duration, mixed diet as opposed to vegetarian diet, non-vegetarian serving 2 to 4 times a week, calorie intake in excess of recommended intake, low fruit consumption were found to be the significant risk factors.

Low physical activity was found to be a significant risk factor for obesity and overweight. Those involved in low physical activity were 4.79 times more likely to be obese or overweight compared to those involved in high physical activity.

Similarly, study by Yadav K et al showed that obesity was significantly associated with low physical activity compared to moderate physical activity with p value of less than 0.01.⁸ A study by Enayatollah Bakhshi et al⁹ showed that high physical activity is inversely related to BMI with odds ratio of 0.48 and that association was statistically significant with p value of less than 0.001. Study by Ranjana Tiwari et al¹⁰ showed that majority of obese and overweight male (73.8%) and female (94%) were not involved in any exercise or involved in mild exercise compared to non-obese individuals. Sleep duration was found to be significantly associated with obesity and overweight. Those sleeping less than seven hours were almost three times more likely to be obese than those with sleep duration more than seven hours.

A study by Anuradha R et al¹¹ showed there was a statistically significant association between overweight and obesity

and sleep duration less than 7 hours with p value of 0.006. Similarly study by Patel SR et al showed an association between decreased sleep duration with weight gain with relative risk of 1.32 for sleep duration of less than 5 hours and relative risk of 1.12 for sleep duration less than 6 hours for 15 kilo gram weight gain.¹²

Intake of mixed diet was significantly associated with obesity and overweight with p value of 0.03 and odds ratio of 2.24 when compared to those having vegetarian diet.

Similarly study by Pramil Singh N et al showed that vegetarian diet was associated with lower prevalence of overweight and obesity.¹³ Study by Anuradha R et al¹¹ showed that there was no significant association between obesity and type of diet with p value of 0.343.

Those individuals consuming more than the recommended daily calories were four times more likely to be obese compared to those consuming recommended calories or less. Similarly study by Vadera BN et al⁵ showed that the total calorie intake more than recommended was significantly associated with obesity and overweight with p value of less than 0.001.

As regards fruits, those consuming fruits rarely were twenty two times more likely to be obese and those consuming fruits only once a week were four times more likely to be obese compared to those consuming fruits daily in their diet.

Similarly study by Selvi Thangaraj et al¹⁴ showed that increased frequency of consumption of fruits was significantly associated with lower proportion of obesity and overweight with p value of 0.017

Study by Anuradha R et al¹¹ showed that increased frequency of fruit intake was statistically significantly associated with lower BMI with p value of 0.005.

On multiple logistic regression analysis sleep duration less than seven hours per day, calorie intake in excess of recommended daily intake, mixed diet, non-vegetarian serving 2 to 4 times a week, low consumption of fruits and low physical activity were found to be the significant and independent risk factors for obesity and overweight.

CONCLUSIONS

Sleep duration less than seven hours a day, calorie intake in excess of recommended intake, mixed diet, non-vegetarian serving 2 to 4 times a week, low consumption of fruits and low physical activity were found to be the significant risk factors for obesity and overweight.

Considering the rising prevalence of obesity and the consequent complications, there is an urgent need to address these risk factors through health education, risk reduction interventions and other innovative strategies.

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