# Obesity and Morbidity Among Adult Moria Muslims of Laluka Village, Dibrugarh District, Assam, India

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*ABSTRACT:* Obesity is a condition in which abnormal or excessive fat accumulation in adipose tissue impairs health. It is a complex, multifactorialand largely preventable disease affectingalong with overweight over a third of the world's population today. If secular trends continue, by the year 2030, an estimated 38% of the world's adult population would be overweight and another 20% would be obese. Obesity and its repercussions constitute an important source of morbidity, impaired quality of life and its complications can have a major bearing on life expectancy. Considering these issues, the present study highlights the prevalence of obesity and morbidity among 258 adult Moria Muslim and also tries to understand the association of obesity with self-reported morbidity. The present study has observed that self-reported morbidity and obesity were persistently higher among the females as compared to the males irrespective of the types of morbidities.

## INTRODUCTION

Obesity is a condition that develops from a chronic quantitative imbalance between energy intake and energy expenditure leading in turn to an excessive accumulation of adipose tissues within the body (Bray and Bellanger, 2006). Obesity and its repercussions constitute an important source of morbidity, impaired quality of life and its complications can have a major bearing on life expectancy. The health consequences of obesity increase morbidity and mortality with significantly increase in health costs. It is also associated with non-communicable chronic diseases (NCDs) such as cardiovascular diseases, diabetes mellitus, hypertension, stroke and osteoporosis (Krebs *et al.*, 2003; Mishra, 2004). Obesity or significant overweight can contribute to many problems in women's reproductive system like prolonged or heavy periods, menstrual pain, delayed ovulation, infertility, breast cancer and ovarian cancer.

It is believed that the changes in dietary, lifestyle and lack of physical activity pattern (Prentice, 2006; Sinha and Kapoor, 2010) are the major factors for the increasing prevalence of obesity or overweight. Almost 30,000 deaths per year are currently attributed to obesity and with significant increases in its prevalence, it is projected that obesity will overtake smoking as the major avoidable cause of premature death by the year 2030 (Haslam *et al.*, 2006). It has been estimated that about 1.9 billion (39%) adults are overweight, of these over 650 million (13%) are obese (WHO, 2017). Overweight and obesity are the fifth leading risk of deaths, resulting in around 2.8 million deaths of adults globally every year. Obesity is associated with higher rates of death driven by co-morbidities such as type 2 diabetes mellitus (T2DM), dyslipidemia, hypertension, obstructive sleep apnea (OSA), certain types of cancer, steatohepatitis, gastroesophageal reflux, arthritis, polycystic ovary

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syndrome (PCOS), and infertility (Haslam and James, 2005). Around 44% of the diabetes burden, 23% of the ischaemic heart disease and between 7% and 41% of certain cancer burdens are attributable to overweight or obesity (WHO, 2009). The rising burden of obesity is a threat to both developed and developing countries (Rohilla *et al*., 2014). Although obesity was once considered to be a problem of the developed world, today the prevalence of obesity is drastically increasing in the developing countries such as India (Chopra *et al.*, 2002). Several studies in India have focussed on the associations between overweight and obesity with diabetes, hypertension and heart disease (e.g. Singh *et al.*, 2000; Venkatramana and Reddy 2002; Mishra *et al.*, 2006; Ahirwar and Mondal, 2019). In a meta-analysis study of 2.88 million individuals, obesity was observed to be associated with an increase in mortality rate, with a hazard ratio of 1.18 (95% CI, 1.12–1.25) (Flegal *et al.*, 2013).

An individual's perception is purely subjective and can be influenced by the knowledge, surrounding environment, culture, economic and social status (Rai and Agarwal, 2018). The prevalence of obesity is rapidly spurting due to sedentary lifestyle and consumption of high calorie food. According to latest National Family Health Survey, the mean body mass index or BMI is positively associated with obesity for populations of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura (IIPS and ICF, 2017). The risks for non-communicable diseases increases with increases in Body Mass Index (BMI) (WHO, 2011).

With the above issues in mind, the present study attempts to focus on the relationship between obesity and self-reported morbidity among the urban adult Moria Muslims of Dibrugarh district, Assam, India.

## MATERIALS AND METHODS

The present community based cross-sectional study was conducted among 258 adult Moria Muslims (aged 18-70 years) residing in Laluka village located in the district of Dibrugarh, Assam, India. The Moria is a group of indigenous Muslims populations living in the Brahmaputra Valley of Assam. The word '*Moria*' originated from the beating (*mara*) of hot brass metal to make utensils. They came as invaders and started their careers as braziers. But at the present, majority of them are engaged in other occupations such as business and services. This occupational diversification is the result of the coming of stainless steel, plastic and machine-made brass utensils. The Moria Muslims are homogenous as a linguistic community. Their common language is Assamese. They had their language known as *Duan*, in the past. However only a few of them can speak this language to some extent today. The numerical strength of the Moria Muslims in Dibrugarh town is 64,526 which are 4.86% out of the total population (Census of India, 2011). The highest concentration of Moria population is found in Chaulkhowa (10.55% of the total Moria population) village in Dibrugarh District of upper Brahmaputra valley.

The village Laluka was selected primarilty because it had a predominance of Moria Muslims and that it was easily accessible. A two-stage stratified random sampling method was used to identify and include the participants. In the first stage, individuals belonging to the Moria Muslim population were identified and these were also verified from the official records. In the second stage, adult Moria Mulim individuals belonging to the age group of 18–70 years were selected. The ages were verified from the official records. Then 270 Moria adults were approached to voluntarily participate in the study. Of them 12 individuals refused to take part in the study. Hence the final study sample was 258 adult Moria Muslims.

Anthropometic measurements of height and weight were collected following established methods. Height was measured to the nearest 0.10 cm using an anthropometer with the subject standing in the erect position with the head oriented in the Frankfort horizontal plane. Weight was recorded to the nearest 0.10 kg with the subject standing motionless on a portable weighing scale. Intra-observer and inter-observer technical errors of the measurements (TEM) were calculated to determine the accuracy of the anthropometric measurements using a standard procedure (Ulijaszek and Kerr, 1999). The BMI was calculated from the measurements. The WHO (2000) cut-offs have been utilized to assess obesity, based on BMI (Table 1).

*Table 1. WHO (2000) cut-offs to assess obesity based on BMI*

| Nutritional Status | Cut off points (BMI kg/m$^2$ ) | Risk of co-morbidities |
|---|---|---|
| Underweight | < 18.50 | Low (but increase risk of other clinical) |
| Normal | 18.50 – 22.99 | Average |
| Overweight:At-risk or II preobeseObese IObese | >2323.00 – 24.9925.00 – 29.99>30.00 | Increase Moderate Severe |

Data on morbidity were collected based on "self-reported illness" of the information taking into consideration the timeframe of two-weeks, three-weeks and four-weeks recall of illness before the survey. The self-reported symptoms of illness were grouped into different categories as followed by many studies (e.g. Strickland and Ulijaszek, '93; Sadana, 2000). The categories are as follows:

1. Cold/respiratory disorders (cough + runny nose + headache + fever, fever + cough, cough alone, swollen glands + cold breathing problem)
2. Cardiovascular and other problems (Heart diseases, Diabetes - Type I and Type II,hypertension, tuberculosis, Miscellaneous disorders: sores/boils, fever alone, chickenpox, malaria, typhoid, scabies, jaundice, all body pain, osteoarthritis, rheumatism, headache alone, headache and weakness, ear problem, don't know/unknown).

All the statistical analysis was done using the Statistical package for Social Sciences (SPSS). The tests inclused mean and standard deviation. To assess differences between males and females in respect to the anthropometric variables, t-test was utilized. A p value <0.05 has been considered to be statistically significant.

## RESULTS

The anthropometric characteristics (weight and height) of adult Moria Muslim males and females are shown in Table 2. The mean weight of males and females were 64.83kg ± 14.54 and 57.03kg ± 12.83 respectively. Among males, the height was 163.57cm ± 6.11 while height among females was 151.02cm ± 5.96 respectively. Using e-test, it was observed that statistical significances existed between the males and females in terms of height (t-value: 4.57) and weight (t-value; 16.61).As generally expected, males are significantly heavier and taller than the females.

*Table 2. Anthropometric characteristics of adult Moria Muslim males and females*

| Anthropometric Characters | MalesN=114 | | FemalesN=144 | | t-value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| Weight (kg) | 64.83 | 14.54 | 57.03 | 12.83 | 4.57* |
| Height (cm) | 163.57 | 6.11 | 151.02 | 5.96 | 16.61* |
| p<0.05* | | | | | |

Table 3 shows the nutritional status according to BMI categories. 7.75%, 31.78% and 60.47% belong to underweight, normal and overweight categories. It is found that 7.90% and 33.33% of males belong to the categories of underweight and normal respectively and among females, these frequencies are 7.64% and 30.56% respectively.In table 3, we have categorized the overweight into three groups (preobese, obeseI and obeseII).It is seen that 58.77% of males and 60.42% of females belonging to the category of overweight. From the table, it can be seen that most of the study population falls under the category of overweight. Among the males, 14.91%, 35.10% and 8.80% fall under the category of Preobese, Obese I and Obese II respectively. Among females, 14.60%, 32.64% and 14.60% fall under the category of Preobese, Obese I and Obese II respectively.The proportion of obese II category shows higher among the females (14.60%) than that of their males (8.80%) counterpart.

*Table 3. Nutritional status according to BMI (WHO, 2000 cut-offs)*

| Nutritional status | MalesN=114 | | FemalesN=144 | | TotalN=258 | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Underweight(<18.50kg/m$^2$) | 9 | 7.90 | 11 | 7.64 | 20 | 7.75 |
| Normal(18.50-22.99 kg/m$^2$) | 38 | 33.33 | 44 | 30.56 | 82 | 31.78 |
| Overweight (<23.00) | 17 | 14.91 | 21 | 14.60 | 38 | 14.73 |
| At-risk or Preobese | 40 | 35.10 | 47 | 32.64 | 87 | 33.72 |
| (23.00 – 24.99 kg/m$^2$) | 10 | 8.80 | 21 | 14.60 | 31 | 12.02 |
| Obese I (25.00 – 29.99 kg/m$^2$) | | | | | | |
| Obese II (>30.00 kg/m$^{2)}$ | | | | | | |

The next table (Table 4), shows the proportion of reported morbidity of adult Moria Muslim males and females. It is observed from the table that males (12.28%) have a higher proportion of cold and respiratory disorders than cardiovascular and other problems. On the other hand, 9.03% of females show the proportion of cold and respiratory disorders and 5.56% shows cardiovascular and other problems. From the table, it is also observed that the proportion of cold and respiratory disorders was higher among males than females. However, the proportion of overall morbidity is higher in females (12.50%) than males (7.89%).

*Table 4. Self-reported morbidity of adult Muslim males and females*

| Self-reported morbidity | MalesN=114 | | FemalesN=144 | | TotalN=258 | |
|---|---|---|---|---|---|---|
| | N | % | N | % | N | % |
| Cold and respiratory | 14 | 12.28 | 13 | 9.03 | 27 | 10.47 |
| disorderCardiovascular | 7 | 6.14 | 8 | 5.56 | 15 | 5.81 |
| and other problemsOverall | 9 | 7.89 | 18 | 12.50 | 27 | 10.47 |
| morbidity* | | | | | | |

*Based on those who reported atleast one type of morbidity

The prevalence of overweight (Pre-obese, Obese I and Obese II) according to self-reported morbidity is depicted in Table 5. It is observed from the table that there were no cases reported for cold and respiratory disorder in both the males and females belonging to the Pre-obese category. It is observed that 13.16% have reported for cardiovascular and other problems and 10.53% for overall morbidity in both the sexes. The percentage of reported morbidity was higher in females (28.60%) than males (17.73%). It is observed from the table that the prevalence of Obese I according to self-reported in both the sexes was associated with cold and respiratory disorders (11.50%), cardiovascular and other problems (5.75%) and overall morbidity (13.80%) respectively. The prevalence of Obese I according to self-reported morbidity was higher among males (37.50%) than their females (25.54%). It has been also observed that the prevalence of Obese II according to self-reported morbidity in both the sexes were associated with cold and respiratory disorders (3.22%), cardiovascular and other problems (6.45%) and overall morbidity (16.13%) respectively. However, no males have reported suffering from cold and respiratory disorder whereas, 4.76% of females have reported the same. It is further observed that the prevalence of reported morbidity was higher in females (19.05%) than males (10.00%). The overall incidence of Obesity II according to self-reported morbidity was however found to be higher among females than the males.

*Table 5. Prevalence of overweight (Preobese, Obese I and Obese II) with self-reported morbidity.*

| | Pre-obese | | | | | |
|---|---|---|---|---|---|---|
| Self-reported morbidity | Males N=17 | | Females N=21 | | Total N=38 | |
| | N | % | N | % | N | % |
| Not Reported Reported Cold and respiratory | 14 | 82.40 | 15 | 71.43 | 29 | 76.32 |
| disorderReported Cardiovascular and other | - | - | - | - | - | - |
| problemsReported Overall morbidity* | 21 | 11.80 | 3 | 14.30 | 5 | 13.16 |
| | 1 | 5.90 | 3 | 14.30 | 4 | 10.53 |
| | Obese I | | | | | |
| Self-reported morbidity | Males N=40 | | Females N=47 | | Total N=87 | |

*Contd....*

| | N | % | N | % | N | % |
|---|---|---|---|---|---|---|
| Not ReportedReported Cold and respiratory | 25 | 62.50 | 35 | 74.47 | 60 | 69.00 |
| disorderReported Cardiovascular and other | 6 | 15.00 | 4 | 8.51 | 10 | 11.50 |
| problemsReported Overall morbidity* | 3 | 7.50 | 2 | 4.26 | 5 | 5.75 |
| | 6 | 15.00 | 6 | 12.77 | 12 | 13.80 |
| | Obese II | | | | | |
| Self-reported morbidity | Males N=10 | | Females N=21 | | Total N=31 | |
| | N | % | N | % | N | % |
| Not ReportedReported Cold and respiratory | 8 | 80.00 | 15 | 71.43 | 23 | 74.20 |
| disorderReported Cardiovascular and other | - | - | 1 | 4.76 | 1 | 3.22 |
| problemsReported Overall morbidity* | 1 | 10.00 | 1 | 4.76 | 2 | 6.45 |
| | 1 | 10.00 | 4 | 19.05 | 5 | 16.13 |

*Based on those who reported atleast one type of morbidity

## DISCUSSION

Much of the inertia in addressing obesity and morbidity can be attributed to the prevailing and persistent framing as a matter of personal responsibility. In reality, obesity has been rooted in a complex web of genetic, physiological, psychosocial and environmental factors requiring systems-level action. Also, the complex drivers of fat-mass regulation are not widely understood by health-care professionals nor included in most medical curricula or public-health training. Addressing obesity as a chronic disease requires understanding the biological regulation of food intake and the physiological mechanisms that control the regulation of fat mass. Even modest weight loss improves glycaemia, blood pressure, lipids, mobility, and quality of life, benefits that do not require a return to so-called normal BMI (Berthoud *et al.*, 2017).

Increased energy availability in contemporary Indian population results in rapid secular increases in BMI and obesity (Popkin *et al*., 2001; Deepa *et al*., 2009; Bhardwaj *et al*., 2011). It can be observed from the present study that 60.47% of the individuals studies fell under the category of overweight (Pre-obese, Obese I and Obese II). As expected, males were significantly heavier and taller than females. It is observed that 58.77% of males and 60.81% of females belonged to the category of overweight (Pre-obese, Obese I and Obese II). The overall prevalence of obesity or overweight was observed to be higher among female which is consistent with the study of Pi-Sunyer (1994).

According to WHO (2014), obesity has been increasing in all countries. The worldwide prevalence of obesity nearly doubled between 1980 and 2014 with 39% of adults aged 18 years and older (38% of men and 40% of women) being overweight. In 2014, 11% of men and 15% of women worldwide were obese. Thus, more than half a billion adults worldwide are classed as obese. Various non-communicable diseases are the results of excess body fat accumulation which give rise to serious health consequences such as cardiovascular disease, type-2 diabetes, hypertension,osteoarthritis as reported by the population under study. Hormonal imbalance and polycystic ovary syndrome (PCOS) can also result from excess body fat (Popkin, 2012; Ranjani *et al*., 2014; Kelishadi *et al.*, 2015; Pozza and Isidori, 2018; Debnath *et al.*, 2018 ).

The term “diabesity” is used to describe the overlap between T2DM and obesity (Dixon, 2009).The long-term complications of T2DM include cardiovascular diseases (CVD), stroke, peripheral vascular diseases (PVD), retinopathy, nephropathy, neuropathy (Riobo, 2013).The prolonged exposure to obesity leads to worsening of cardiac function and larger ventricular mass (Brassard, 2007), while left atrial dilatation and systolic dysfunction may also develop (Lakhani and Fein, 2011). Obesity is considered neither as one of the WHO’s five major NCDs nor as one of the five NCD risk factors, and so it might not be systematically included in national NCD strategies based on WHO’s a framework. Failure to tackle commercial determinants of health or to include obesity in comprehensive packages of health care also contribute to the growing toll of childhood obesity which is a threat for the future generation.

Similarly, obese patients also reported being 3.5 times more likely to have hypertension, while 60%-

70% of hypertension in adults may be attributable to adiposity (Kotchen *et al*., 2008). The growing incidences of CVDs and NCDs were also reported from Kerala, Tamil Nadu, Punjab and West Bengal. The prevalence of self-reported morbidity nearly doubled from 55 to 98 per 1000 populationsindividuals within two decades i.e. 1995-2014. Assam reported the highest prevalence of infectious diseases in the first two consecutive rounds (22 and 28 per 1000 individuals respectively) from among the major states in India. However, in the last round of NSS, Assam reported a lower level of prevalence (13 per 1000 individuals) (Paul and Singh, 2017).

Self-reported morbidity substantially increased in both male and female population. However, the increase was steadily higher among females as compared to males which are consistent with the present study. Infectious disease, CVDs, NCDs, and disability increased drastically within two decades, of which, CVDs increased by seven times, disability increased by four times and both infectious diseases as well as NCDs increased by nearly three times (Paul and Singh, 2017).

In the present study, 5.87% of the Moria Muslims have reported for cardiovascular and other problems. It reveals that 10.47% reported for both cold and respiratory disorder and overall morbidity in both the sexes. Even though the present study reveals the prevalence of cold and respiratory disorders being higher among males (12.28%) than the females (9.03%). The percentage of overall reported morbidity was higher in females (28.60%) than males (17.73%) in the present study.

The results of the present study is consistent with data showing that BMI increases were associated with a risk of diabetes, the metabolic syndrome, and cardiovascular disease (Bhargava *et al.*, 2004; Wells *et al*., 2016). It might be due to the relatively higher ratio of fat to lean mass for any given level of BMI as the Indian population accumulate a higher metabolic load when their BMI increases.Thus in the present study, it has been observed that self-reported morbidity and obesity was persistently higher among the female population as compared to male population irrespective of the types of morbidities.

## CONCLUSION

Although this study provides a glance at the association between obesity and morbidity, the findings need to be taken in light of a few limitations such as sample size. In general, self-reported morbidity may be under-reported (Sundararaman and Muraleedharan, 2015) but it is also likely over-reported among the health-conscious and educated respondents. As the study is based on self-reports, potential reporting biases were possible there. Morbidity of overweight and obesity are substantial and should prompt further attention towards the need for appropriate weight management in health care among these Moria Muslims. Appropriate programmes should incorporate medical and population health training, and should include professional development in evidence-based clinical obesity management and policy.

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