Temporal trends in overweight and obesity among Nicobarese adults in Nicobar Islands, India, 1960s—1999

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KEYWORDS
Overweight; Obesity; Nicobarese; Nicobar Islands

Summary
Objective: The aim of the present study is to assess the change in the prevalence of overweight and obesity among Nicobarese adults from 1960s to 1999 using WHO recommendations for the classification of overweight and obesity.

Methods: The sample includes 774 individuals (424 men and 350 women) during 1960s and 484 individuals (259 men and 225 women) during 1999, aged 20—64 years from Nicobar Islands, India. Height (cm), weight (kg) and sitting height (cm) were measured and BMI (kg/m²) was calculated. Overweight and obesity were defined as BMI ≥ 25 kg/m² and BMI ≥ 30 kg/m², respectively.

Results: There was significant increase of height, weight and BMI among both the men and women of 20—39, and 40 and above years age groups. However, the higher magnitude of increment was observed in 20—39 years. The prevalence of overweight increased from 5.42% to 22.01% among men and from 4% to 21.78% among women, while obese individual was absent during 1960s and the prevalence of obesity increased to 2.70% in men and 8.89% in women. The magnitude of increment was higher among women compared to men.

Conclusion: The results indicate remarkable increase in the prevalence of both overweight and obesity among Nicobarese adult in Nicobar Islands.

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Introduction

The increasing trend of overweight and obesity has reached epidemic proportions not only in developed countries but also under-developed and developing...
countries in the Asia-Pacific region [1]. It is estimated that about one fifth of the world population is overweight and about 300 million people are obese [1,2]. Increased mortality among the overweight and obese is evident for several life threatening diseases including type-2 diabetes mellitus [3], cardiovascular disease (CVD), gall bladder disease, and hormonal sensitive and gastrointestinal cancers. Risks are also higher for some non-fatal conditions such as back pain, arthritis, infertility and poor psychosocial function [1,4—9].

Trends over time can be seen in almost every countries in the world (1), for example, in Samoa (1978—1991) [10] and Mauritius (1987—1992) [11] as well as Canada (1981—1996) [12], where marked increases in the prevalence of obesity have occurred, especially in rural Samoa. The cumulative incidence of overweight or obesity in men ranged from 10.8% in Chinese to 18.2% in Creoles, and in women from 16.1% to 27.5% in Chinese and Creoles, respectively. In Japan, although the little increase of obesity over time has been observed but there has been a 2—4 times increase in overweight men. The increasing trends have also been observed in China [13], Malay and also Indian women [14]. Therefore, there are regional, ethnic and cultural variations in the temporal trends for obesity and overweight [1]. The obese have an elevated risk from all cause mortality with elevated risk of 1.9 being reported among both men and women who were more than 40% of the average weight in a large scale prospective study of 750,000 individuals [15].

In India, the prevalence of overweight and obesity is found to be lower than the Asian countries mentioned above. The WHO Global database on body mass index concluded in 1998 that showed the prevalence of overweight and obesity in young adults were 4.3% and 0.3% in case of men and 4.5% and 0.5% in case of women, respectively. However, regional studies are shown higher prevalence of overweight and obesity among different ethnic group compared to national level studies, mostly living in urban area and has impaired energy intake and expenditure level. Overweight and obesity are not only constricted among non-tribal group but also among tribal group, who are practicing modern and changing life-style pattern. Sarkar found that the overweight and obesity prevalence are higher among Bhutia tribal community of Sikkim Himalaya [16]. Sahani reported similar picture among Nicobarese tribal group in Indian Island [17].

In order to understand increased level of vulnerability of population over time, the present study aims to understand the temporal change of overweight and obesity among Nicobarse adult, a tribal group in Nicobar Island, India.

Materials and methods

Study area and sample

The Nicobar Islands are located about 1200 km away from the east coast of Indian mainland and situated in the southernmost portion of the Bay of Bengal of the Indian Ocean. Its location ranges from 6° and 10°N latitude and the meridians of 89° to 94°E longitude. The archipelago is consists of 319 Islands and 22 come under the Nicobar group of whom only 12 were inhabited. The northernmost island of the Nicobar group of Island is Car Nicobar which is 75 miles South of Little Andaman Islands.

The study was conducted during 1960s among the Nicobarese tribal population at Nicobar Islands and also in the year 1999 among the similar group of population from same regions. The present study was based on cross-sectional samples of Nicobarese adults. The sample includes 774 individuals (424 men and 350 women) during 1960s and 484 individuals (259 men and 225 women) during 1999, aged 20—64 years.

The anthropometric measurements such as height (cm), sitting height (cm), and weight (kg) were measured according to the standard techniques suggested by Martin and Saller for both the time periods to keep the uniformity [18].

In the present study, body mass index (BMI) (weight/height²) has been calculated. The subjects were classified on the basis of BMI gradation [19,1].

The mean and standard deviation of anthropometric variables including height, weight, sitting height and BMI were carried out according to age group and sex. t-Test was used to understand mean difference of anthropometric traits between 1960s and 1999 data. Odd ratio has been calculated using logistic regression in understanding degree of getting overweight between two time periods. All data were analyzed using SPSS software, version 11.0; significance level is set at 5%.

Results

Table 1 shows the temporal difference of mean anthropometric characteristics among men and women. There was significant increase of mean height, weight and body mass index (BMI) in both men and women between 1960s and in the year 1999 except sitting height. The increase of height was higher among men (2.5 cm) than women (1.0 cm). In contrast, increase of weight and BMI was higher among women (6.2 kg weight; 2.5 kg/m²).
Table 1: Characteristics of the subjects.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>32.0 ± 9.8</td>
<td>37.9 ± 22.5</td>
<td>36.8 ± 10.8</td>
<td>32.7 ± 10.0</td>
<td>36.3 ± 10.8</td>
<td>37.8 ± 10.8</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>167.2 ± 5.0</td>
<td>167.2 ± 6.2</td>
<td>167.2 ± 5.7</td>
<td>167.2 ± 4.9</td>
<td>167.2 ± 5.7</td>
<td>167.2 ± 4.9</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>73.2 ± 13.8</td>
<td>73.2 ± 13.8</td>
<td>73.2 ± 13.8</td>
<td>73.2 ± 13.8</td>
<td>73.2 ± 13.8</td>
<td>73.2 ± 13.8</td>
</tr>
<tr>
<td>Sitting height (cm)</td>
<td>84.1 ± 2.7</td>
<td>84.1 ± 2.7</td>
<td>84.1 ± 2.7</td>
<td>84.1 ± 2.7</td>
<td>84.1 ± 2.7</td>
<td>84.1 ± 2.7</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>22.1 ± 1.8</td>
<td>22.1 ± 1.8</td>
<td>22.1 ± 1.8</td>
<td>22.1 ± 1.8</td>
<td>22.1 ± 1.8</td>
<td>22.1 ± 1.8</td>
</tr>
</tbody>
</table>

**Table 2** represents increased mean BMI on the basis of age group between 1960s and the year 1999. It was noted that both men and women in the age group of 20–39 years were shown higher increase of mean BMI compared to 40 and above years age groups. However, the differences of both age groups were statistically significant.

**Fig. 1** and **Table 3** demonstrate the percentage difference of BMI gradation in two time periods on the basis of sex and age groups. The prevalence of overweight increased from 5.42% to 22.01% among men and from 4% to 21.78% among women, while obese individual was absent during 1960s and the prevalence of obesity increased to 2.70% in men and 8.89% in women. The prevalence of overweight men in 1960s was only 3.51% compared to 23.81% in 1999 in the age group of 20–39 years and 1.36% was in obese (BMI ≥ 30.0 kg/m²). The prevalence of obese individuals was higher in 40–64 years age group compared to 20–39 years age group in both the sexes. Over all, the increment of the prevalence of overweight and obesity was higher in both the sexes rather than increment in the prevalence of undernutrition among Nicobarese adult.

**Table 4** shows odd ratio values and 95% confidence interval of overweight and obese combined group between two time periods. The entire odd ratio values showed that both men and women of 1999 were significantly more likely to be getting overweight and obese compared to 1960s counterparts. In case of men, the vulnerability of suffering overweight was more likely to be higher in the age group of 20–39 years age group during 1999 (Odd ratio 9.23, p < 0.01) compared to 40 and above years age group (Odd ratio 2.62, p < 0.05). However, women were shown that equal chance of suffering overweight (p < 0.01) in both age groups during 1999.
Table 2  Distribution of mean BMI by sex and age group.

<table>
<thead>
<tr>
<th>Sex and age group (years)</th>
<th>n</th>
<th>Mean BMI</th>
<th>t-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1960s</td>
<td>1999</td>
<td>1960s</td>
</tr>
<tr>
<td>Men</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20–39</td>
<td>313</td>
<td>147</td>
<td>22.0 ± 1.7</td>
</tr>
<tr>
<td>40 and above</td>
<td>111</td>
<td>112</td>
<td>22.2 ± 2.0</td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20–39</td>
<td>254</td>
<td>143</td>
<td>21.1 ± 2.1</td>
</tr>
<tr>
<td>40 and above</td>
<td>96</td>
<td>82</td>
<td>20.8 ± 2.4</td>
</tr>
<tr>
<td>Total</td>
<td>567</td>
<td>290</td>
<td>21.6 ± 1.9</td>
</tr>
<tr>
<td></td>
<td>207</td>
<td>194</td>
<td>21.5 ± 2.3</td>
</tr>
</tbody>
</table>

* p < 0.05 significance level.
** p < 0.01 significance level.

Table 3  Distribution of BMI gradation by sex and age group.

<table>
<thead>
<tr>
<th>Sex and age group (years)</th>
<th>Year of study</th>
<th>BMI (kg/m²)</th>
<th>Undernutrition (&lt;18.50)</th>
<th>Normal (18.50–24.99)</th>
<th>Overweight (25.00–29.99)</th>
<th>Obese (≥30.0)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
</tr>
<tr>
<td>Men</td>
<td>1960s</td>
<td>6</td>
<td>1.92</td>
<td>296</td>
<td>94.57</td>
<td>11</td>
</tr>
<tr>
<td>1999</td>
<td>4</td>
<td>2.72</td>
<td>106</td>
<td>72.11</td>
<td>35</td>
<td>23.81</td>
</tr>
<tr>
<td>40 and above</td>
<td>1960s</td>
<td>2</td>
<td>1.80</td>
<td>97</td>
<td>87.39</td>
<td>12</td>
</tr>
<tr>
<td>1999</td>
<td>4</td>
<td>3.57</td>
<td>81</td>
<td>72.32</td>
<td>22</td>
<td>19.64</td>
</tr>
<tr>
<td>Women</td>
<td>1960s</td>
<td>24</td>
<td>9.45</td>
<td>219</td>
<td>86.22</td>
<td>11</td>
</tr>
<tr>
<td>1999</td>
<td>9</td>
<td>6.29</td>
<td>91</td>
<td>63.64</td>
<td>31</td>
<td>21.68</td>
</tr>
<tr>
<td>40 and above</td>
<td>1960s</td>
<td>15</td>
<td>15.63</td>
<td>78</td>
<td>81.25</td>
<td>3</td>
</tr>
<tr>
<td>1999</td>
<td>10</td>
<td>12.20</td>
<td>46</td>
<td>56.10</td>
<td>18</td>
<td>21.95</td>
</tr>
<tr>
<td>Total</td>
<td>1960s</td>
<td>30</td>
<td>5.29</td>
<td>515</td>
<td>90.83</td>
<td>22</td>
</tr>
<tr>
<td>1999</td>
<td>13</td>
<td>4.48</td>
<td>197</td>
<td>67.93</td>
<td>66</td>
<td>22.76</td>
</tr>
<tr>
<td></td>
<td>1960s</td>
<td>17</td>
<td>8.21</td>
<td>175</td>
<td>84.54</td>
<td>15</td>
</tr>
<tr>
<td>1999</td>
<td>14</td>
<td>7.22</td>
<td>127</td>
<td>65.46</td>
<td>40</td>
<td>20.62</td>
</tr>
</tbody>
</table>

Discussion

The purpose of this paper was to assess changes in the prevalence of overweight and obesity of Nicobarese adults from 1960s to 1999. The results provide compelling evidence that there has been a progressive increase in the prevalence of overweight and obesity among Nicobarese. This is one of the new emerging issues in Indian population even in Indian tribal population. Similar findings have been reported for the Asian and Pacific Islander population living in Rhode Island (overweight 33.4% and obese 4.8%). Obesity prevalence rates of between 60% and 80% can be found among men and women in some islands including Samoa and Nauru. In Tonga, 60% of the adult population was suffered by obesity and recently 12% of men and nearly 18% of women were identified with type 2 diabetes mellitus, a doubling of the rate over 25 years. A further 20% were found to be at risk due to elevated blood sugar levels [20]. It may be due to sustained economic growth and increasing political stability in many countries at Asian region, thereby bringing about rapid advances in socioeconomic status for more than three decades [21]. The situations have been reflected in the form of nutrition transition [22], where high fat diets have a greater risk for obesity than high sugar and low fat diets [23]. However, traditionally diets of the Island populations have been very low in fat, and
high in complex carbohydrates, dietary fibre, and foods of plant origin as shown among the Pacific Islands and Melanesia [24]. But dietary change may have played a major contributing factor showing a higher contribution of fat and protein to total energy intake as observed among urban communities of Pacific Islands than among those practicing traditional subsistence [25,26]. Most importantly, dietary change and changes in patterns of physical activity may be associated with levels of education, occupational status, and rural residence have been invoked as being central to the emergence of obesity in this Island region as suggested by many researchers [27—29]. The Federated States of Micronesia (FSM) has received considerable attention for their alarming rates of overweight and obesity. On Kosrae, one of the four districts in the FSM, 88% of adults aged 20 or older are overweight (BMI > 25), 59% are obese (BMI > 30), and 24% are extremely obese (BMI > 35). This may be because of the long history of foreign rules and social change over the last 100 years, and suggests that a combination of dietary change influenced by foreigners, dependence on foreign aid, and the ease of global food trade contributed to poor diet and increased rates of obesity in Micronesia, where foreign dependence and global food trade exacerbates their obesity epidemic [30]. Fatness and obesity became an important public health problem among Pacific Island populations during the second part of the twentieth century, along-side great increases in population size in many of the Pacific Island nations, and migration from the Pacific Islands to urban centers, especially in the United States, France, New Zealand, and Australia. Best documented is the rise of obesity and fatness among adults in Western Samoa [31,28] the Cook Islands [32,27], the Tokelau Islands [33], Tuvalu [34], the Marquesas Islands [35], and American Samoa [28]. There are indications that people are becoming overweight and obese earlier in life; girls and young women in particular tend to gain weight during adolescence and pregnancy. The overall adult obesity rate (BMI > 30) was 60% in the 2004 survey in Tonga [36]. The increase in mean body mass index observed in Pacific Islanders in the second half of the twentieth century can in general be attributed to dietary change associated with greater food and energy intake, associated with increased consumption of fatty foods and meat, most of which are imports [37]. However, nation base data in India, the prevalence of overweight and obesity is found to be lower than the Asian countries. The WHO Global database on body mass index showed that in 1998 the prevalence of overweight and obesity in young adults were 4.3% and 0.3% in case of men and 4.5% and 0.5% in case of women, respectively [38]. But in India, Bharati et al. 2007 showed that more than 31% of women are malnourished and the percentage of overweight and obese women in urban area is about four times higher than that of rural areas. Reddy et al. suggested that in India, urban—rural difference in overweight and obesity would be due to the difference in life-style factors including physical activity and nutrition by residence [39]. Urban area of living plays a significant role in deciding the obesity status of the population, which is a threat to India in the context where urban population is increasing dramatically [40].

The present study also revealed that the magnitude of increment of obesity (not overweight) is higher among women compared to men. However,
Among this Island population, specific underlying causes behind this adverse situation may be the causal factor of high obesity. However, decreasing physical activity level and change in lifestyle, which reduces physical activity level and change in life-style, there is also drastic change in food habits and dietary intakes. The replacement of staple in consumption from rice, wheat flour, pulses, biscuits, sugar, powder milk, oil. Rice is now staple food replacing the Pandanus lerram. Distilled liquor is in frequent use. On the other hand, the primary subsistence activities were horticulture, fishing and raring of pigs and fowls. They engaged themselves in making baskets, mats, wooden iron spears and repairing canoes. At present, a sizeable number of Nicobarese adults are in white-collar jobs, besides some have opened petty shops. Comparison of activities performed by the Nicobarese and life-style based on earlier works.

References

Temporal trends in overweight and obesity


