Body size of Papua New Guineans: a comparison of the body mass index of adults in selected urban and rural areas of Papua New Guinea

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SUMMARY

This is a cross-sectional study conducted in Port Moresby and 3 rural areas of Papua New Guinea from 1999 to 2002. These areas were selected because of their specific characteristics such as modernity, geographical location and remoteness. The aim of the study was to compare the body mass index (BMI) of selected urban and rural populations. When age was standardized, in urban and periurban populations, the mean BMI increased with age to about 40 years, plateaued and then decreased in older age. The BMI was higher in Port Moresby than in the other study areas: many people in Port Moresby were overweight (40%) and obese (21%), and by gender, 26% of females and 16% of males were obese. In Manus, the prevalence of overweight and obesity was 36% and 18% respectively. In both Port Moresby and Manus, more women than men were obese. Obesity was not a problem in rural areas of Strickland and Central Province. In rural Central Province 52% of subjects had a BMI <20 kg/m². Obesity is becoming a public health problem in the urban areas. The high prevalence of overweight and obesity corresponds with the high intake of refined carbohydrates and fatty foods in urban and periurban areas. It will be necessary to carry out health awareness and education on the risk factors associated with obesity in the urban and periurban areas and promote healthy environments: healthy foods should be available and affordable, and the accessibility and safety of exercise and walking tracks must be supported by the community and government agencies.

Introduction

This study was part of a larger study of the prevalence of diabetes mellitus in the urban and rural areas of Papua New Guinea. This paper reports on the comparison of body mass index (BMI) of subjects in Port Moresby and three rural areas of Papua New Guinea (PNG). The objective of this study was to compare the body mass index of Papua New Guinean adults living in urban and rural areas.

In Papua New Guinea, overweight or obesity is not seen as a health problem and is even admired. We expect our government leaders, politicians and senior executives to look 'big' (overweight or obese) because it is viewed as a sign of good health and wealth. This view is also shared by our other Pacific neighbours and many parts of Africa (1,2).

BMI is calculated as weight in kilograms divided by height in metres squared (kg/m²). The BMI indicates the nutritional status of the community. Based on western standard BMI criteria, a value of 20.0 – 25.0 kg/m² is considered to be normal, 25.1 – 29.9 kg/m² signifies the subject is overweight and a value of 30 kg/m² or more signifies obesity (3,4).

Methodology

Study sites

This is a cross-sectional study conducted in Port Moresby, the Mt Obree area in the foothills of the Owen Stanley Ranges in Central Province, the Upper Strickland River area between Southern Highlands and West Sepik Provinces, and Balopa District in Manus Province from 1999 to 2002. The study sites were purposely selected because

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of their specific characteristics.

**Port Moresby**

Port Moresby is the most developed and urbanized centre and the capital city of Papua New Guinea. People living in Port Moresby come from all over PNG. There are many modern supermarkets easily accessible by the city residents and periurban villagers.

**Upper Strickland River area**

Upper Strickland River area is a very remote area along the Strickland River separating Southern Highlands and West Sepik Province. There are very few government services and infrastructure and no cash crops in the area but villagers living near the Strickland River have received some benefits (royalties) from the Porgera Mine.

The villages surveyed were Egal, Bulago, Aluni and Yokona in the Southern Highlands and Bimin, Kunanap, Dupan, Gawa and Sisimin in the West Sepik Province. Two villages (Egal and Bimin) are accessible by plane but the rest only by helicopter or walking.

**Mt Obree, Central Province**

Mt Obree is a very remote area without any economic activity and no cash crops. The area is situated in the southern foothills of the Owen Stanley Ranges in Central Province. It is accessible only by plane or a 3-4 days’ walk (local persons) through rugged mountainous terrain to Sogeri or Kwikila government stations, which are about 45 and 90 kilometres respectively from Port Moresby. Of the 10 villages, 9 were surveyed.

**Balopa Islands, Manus Province**

The islands of Balopa on the south coast of Manus Island were selected because of their apparent ‘remoteness’ but with some periurban characteristics. The islands are about 3-4 hours away by open motorized boat ride from Lorengau, the provincial town. They have cash crops such as coconut and cocoa and also sell marine products such as fish, shells and various types of sea cucumber. The islanders would come into town in the morning to sell their produce in the market, do their shopping and return to their village in the evening. Six villages on the islands were surveyed.

**Sampling**

The subjects were informed about the study well in advance and individuals volunteered to participate in the survey. Pregnant women and subjects aged less than 20 years old were excluded from the study.

**Data collection methods**

The weights were measured using a standard portable bathroom foot scale. The subjects were weighed without heavy clothing or shoes. The weighing scale was regularly calibrated using a 5.0 kg metal weight. In Port Moresby and Manus, the height was measured using the standard ‘pull down’ height-measuring tape. The subject would stand barefooted directly under the tape, which was pulled down to touch the top of the head. In rural Strickland and Mt Obree, height was measured using the height-measuring stand. Subjects stood against the metal stand with the measuring plate lowered to touch the top of the head; the reading was recorded to the nearest centimetre.

**Results**

**Age**

The subjects in Manus were older with a mean age of 50 and 47 years for males and females respectively. In Port Moresby, mean age was similar for males and females at 36 years. Among the females, Strickland had the lowest mean age of 34 years (Table 1).

**Weight**

Overall, the mean and median weight and interquartile range of Port Moresby subjects were 71.9 kg, 72 kg and 62-80 kg respectively. In Manus, the mean, median and interquartile range were 65.5 kg, 65 kg and 57-74 kg respectively. Subjects in the Strickland area had a mean, median and interquartile range of 51.2 kg, 50 kg and 47-56 kg respectively. Central recorded the lowest mean, median and interquartile range of 49.6 kg, 50 kg and 45-55 kg respectively.

Subjects in Port Moresby had the highest mean weight of 74 kg and 69 kg for males and females respectively whilst Central had the lowest mean weight of 53 kg and 47 kg.
TABLE 1
MEANS OF SELECTED CHARACTERISTICS BY GENDER AND STUDY SITE

<table>
<thead>
<tr>
<th>Study site</th>
<th>Port Moresby</th>
<th>Manus</th>
<th>Central</th>
<th>Strickland</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Males</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>367</td>
<td>116</td>
<td>149</td>
<td>72</td>
</tr>
<tr>
<td>Age (years)</td>
<td>35.7</td>
<td>49.9</td>
<td>37.4</td>
<td>46.8</td>
</tr>
<tr>
<td>(35.0)*</td>
<td>(46.0)*</td>
<td>(32.0)*</td>
<td>(31.0)*</td>
<td></td>
</tr>
<tr>
<td>sd=10.6</td>
<td>sd=17.1</td>
<td>sd=13.9</td>
<td>sd=15.7</td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>165.9</td>
<td>161.7</td>
<td>162.4</td>
<td>150.7</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>74.4</td>
<td>68.1</td>
<td>53.1</td>
<td>52.7</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>26.5</td>
<td>25.5</td>
<td>19.6</td>
<td>22.7</td>
</tr>
<tr>
<td>sd=4.1</td>
<td>sd=4.4</td>
<td>sd=2.1</td>
<td>sd=3.1</td>
<td></td>
</tr>
<tr>
<td><strong>Females</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>356</td>
<td>204</td>
<td>176</td>
<td>51</td>
</tr>
<tr>
<td>Age (years)</td>
<td>35.6</td>
<td>46.7</td>
<td>35.2</td>
<td>33.8</td>
</tr>
<tr>
<td>(35.0)*</td>
<td>(50.0)*</td>
<td>(32.0)*</td>
<td>(46.0)*</td>
<td></td>
</tr>
<tr>
<td>sd=9.3</td>
<td>sd=15.4</td>
<td>sd=11.9</td>
<td>sd=9.1</td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>156.5</td>
<td>152.9</td>
<td>155.9</td>
<td>145.7</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>69.4</td>
<td>63.9</td>
<td>46.6</td>
<td>49.2</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>27.8</td>
<td>26.7</td>
<td>18.7</td>
<td>22.9</td>
</tr>
<tr>
<td>sd=4.9</td>
<td>sd=5.3</td>
<td>sd=2.4</td>
<td>sd=2.9</td>
<td></td>
</tr>
</tbody>
</table>

*median age  
sd=standard deviation  
BMI=body mass index

for men and women respectively (Table 1).

Central had the lowest mean and median BMI. There was no obesity observed in rural Central. The highest BMI was recorded in Port Moresby. In rural Strickland, the mean BMI was the same for males (22.7 kg/m²) and females (22.9 kg/m²) (Table 1).

**Body mass index and gender**

In Port Moresby, obesity among males and females was 16% and 26%, and in Manus 13% and 20% respectively (Table 2).

Among the Port Moresby subjects, 5% of females and 4% of males had a BMI <20 kg/m² while in rural Central 44% of males and 59% of females had a BMI <20 kg/m² (Table 2). BMI less than 20 kg/m² is considered to be underweight by the World Health Organization (WHO) (5,6).

**Body mass index and age group**

**Men**

In Port Moresby and Manus the mean body mass index of men increased with age up to
TABLE 2

**BODY MASS INDEX OF MALES AND FEMALES BY STUDY SITE**

<table>
<thead>
<tr>
<th></th>
<th>Port Moresby n=723</th>
<th>Manus n=320</th>
<th>Central n=325</th>
<th>Strickland n=123</th>
<th>Total n=1491</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>13</td>
<td>4</td>
<td>66</td>
<td>6</td>
<td>89</td>
</tr>
<tr>
<td>20.0-25.0</td>
<td>149</td>
<td>61</td>
<td>81</td>
<td>56</td>
<td>347</td>
</tr>
<tr>
<td>25.1-29.9</td>
<td>146</td>
<td>36</td>
<td>2</td>
<td>9</td>
<td>193</td>
</tr>
<tr>
<td>30+</td>
<td>59</td>
<td>15</td>
<td>0</td>
<td>1</td>
<td>75</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>18</td>
<td>10</td>
<td>104</td>
<td>6</td>
<td>138</td>
</tr>
<tr>
<td>20.0-25.0</td>
<td>100</td>
<td>74</td>
<td>72</td>
<td>38</td>
<td>284</td>
</tr>
<tr>
<td>25.1-29.9</td>
<td>145</td>
<td>79</td>
<td>0</td>
<td>6</td>
<td>230</td>
</tr>
<tr>
<td>30+</td>
<td>93</td>
<td>41</td>
<td>0</td>
<td>1</td>
<td>135</td>
</tr>
</tbody>
</table>

about 40 years, plateaued and then decreased with age. In all study sites, BMI decreased in older age (Figure 1). The mean BMI was greater than 20 kg/m² in all age groups in Port Moresby, Manus and Strickland; in the rural Central area, except for the 25-34 year age group, it was less than 20 kg/m² (Figure 1).

Women

The body mass indexes of women in Manus and Port Moresby were very similar in all age groups. In these sites, the mean BMI of just under 25 kg/m² at 20-24 years of age increased to about 28 kg/m², then plateaued until 55-64 years of age, after which it declined to 23 kg/m². In Strickland the mean BMI of women was highest at 25 kg/m² in the 20-24 year age group and decreased with age to 19 kg/m² in the group aged 65 years and above (Figure 2). Central women had the lowest mean BMI, which was less than 20 kg/m² in all age groups and decreased to 14.5 kg/m² at the age of 65 years and above. In all study sites, BMI decreased in older age.

**Nutritional status of subjects by study site**

Based on the WHO standard of normal BMI of 20-25 kg/m² (5,6) 67% women and 56% of men in Port Moresby were overweight or obese. In Manus, 59% of women and 44% of men were overweight or obese. Overweight or obesity was not a problem in the Central or Strickland areas (Table 3).

**Prevalence of obesity by age group and study site**

In Port Moresby the prevalence of obesity was high at 29% in the age group of 35-44 years and 15% in the older age group of 55
Figure 1. Mean body mass index of males by age group and study site.

Figure 2. Mean body mass index of females by age group and study site.
years and over. In Manus, the prevalence of obesity was 22% in the 25-34 year age group and 16% in the group aged 55 years and above (Figure 3). In the Strickland, less than 4% of subjects in the 25-34 and 35-44 year age groups were obese. There was no obesity observed in rural Central (Figure 3).

Discussion

Body mass index

WHO accepts a body mass index of 20-25 kg/m$^2$ as normal, 25.1-29.9 kg/m$^2$ as overweight and 30 kg/m$^2$ or more as obese. The normal and desirable body mass index is considered to be 20-25 kg/m$^2$(5-7). In this study, 61% of the urban subjects were overweight or obese and 21% were obese.

The mean BMI was higher in urban Port Moresby and Manus subjects (males and females) than in Strickland and Central. It was surprising to see that the mean BMI of rural Manus was similar to that in Port Moresby. This is because, unlike in the other two study sites, the people in rural Manus have easy access to western-type foods, particularly refined carbohydrates and fatty foods. This is significant, even though their diet may not be the same in terms of quantity, frequency or variety as the diet of those living in Port Moresby, who have easy access to shops and supermarkets.

In rural Central Province, the majority of subjects (52%) had a BMI between 18 and 20 kg/m$^2$, and no obesity was seen. This is because the people in rural Central still live on a more traditional diet and are physically more active. According to the WHO standards, a BMI less than 20 kg/m$^2$ indicates undernutrition, but the people there look healthy and well.

When age was standardized, the mean BMI of males increased with age (except in Central) to about 40 years, plateaued in Port Moresby and Manus, and then decreased (Figure 1); in females only those in Manus and Port Moresby had BMI patterns similar to the males. In general, the BMI of both males and females decreased in older age. This finding is similar to the Kitava study done in Milne Bay where BMI decreased in older age groups (8).

Traditional diet

The people of rural Central and Strickland areas could not be more rural than they are at the present time. Their diet is very traditional, with very little western-type food.

A traditional diet is mainly vegetarian, low in fat and protein. Crops such as cassava,
sweet potato, taro, banana and yams are staple food and are supplemented by green leafy vegetables, river fish, pork and sometimes game (wildlife) meat and chicken. In rural Manus, reef fish and other seafood such as prawns and shellfish are the main source of protein supplementing their traditional diet.

Traditional Papua New Guinean foods are bulky and most Papua New Guineans from childhood are used to eating large volumes of food; when this habit is continued in the urban setting with western-type food, their fat, carbohydrate, protein and salt intake will increase significantly, leading to obesity.

Urban diet

In Port Moresby, many Papua New Guineans eat refined carbohydrates, such as rice, bread and scones, and a variety of meat products including lamb flaps. Food choice leans more towards western-type food. Fast-food outlets are always busy selling fried takeaway food, a wide variety of soft drinks and sweets, which are favoured by a lot of people. Although there are healthy alternatives such as whole-grain carbohydrates (eg, oats), these are not easily affordable.

Although traditional types of food such as sweet potato, banana, taro, yams, cassava, sago and various green vegetables can be bought from the local markets in the city, many Papua New Guineans in the urban centres like to eat western-type food. Taufa and Benjamin found that in the dining hall of a mining company, the queue for the western food was very long while the local food queue was very short and at times non-existent (9).

Overweight and obesity

Obesity is more common in males and females in urban Port Moresby and the periurban population of Manus. In the Strickland area, only one male and female were obese. No case of obesity was recorded in rural Central (Table 3) (10).

Being overweight or obese increases with age to about 55 years and then begins to decline with advancing age. The high prevalence of overweight and obesity in Port Moresby and to some extent in Manus indicates the high intake of refined carbohydrates and fatty foods in these two populations (10).

The rural populations of Strickland and Central live on a traditional diet and in geographical locations where walking and physical activity are part of their daily routine. They are more physically active than the
Implications of obesity for Papua New Guineans in urban areas

Obesity has been shown to be associated with hypertension, ischaemic heart disease and diabetes (2). The high prevalence of overweight and obesity in Port Moresby and Manus corresponds well to the high prevalence of diabetes mellitus in these two study sites. Among the diabetes patients attending the diabetes clinic in Port Moresby, the majority (65%) of patients were overweight or obese at the time of diagnosis as is illustrated by their high body mass index (11).

Even highlanders, who are non-Austronesian and not at risk of diabetes in their traditional settings, are now developing diabetes in the urban centres (10). This shows the problems that Papua New Guineans living in urban centres are facing, with an increased likelihood of getting a non-communicable disease such as diabetes mellitus or cardiovascular disease.

Obesity has long been implicated as a very important risk factor in type 2 diabetes mellitus (12,13) because it can induce resistance to the action of insulin. It can do this by reducing the number of insulin receptors on the target cells and/or decreasing the glucose transport through post-receptor changes (14,15).

Type 2 diabetes is common among populations in the Pacific and Aboriginal Australians who are more obese and physically less active (12,16,17). In the Torres Strait Islanders, obesity has been shown to be associated with diabetes mellitus type 2 (18-20).

Dietary change: a balanced healthy diet

It is not easy to change people’s eating habits. The urban and periurban communities need to be informed about the dangers of overeating and obesity. Over 90% of patients attending the diabetes clinic in Port Moresby had been living mainly on western, imported food and lacked physical activity (10).

Community awareness about a balanced healthy diet can be conducted in primary schools, higher institutions, church groups and the community. The school canteens and takeaway shops should be encouraged to sell healthy and affordable foods to school children. It is easier to educate the young school children about healthy balanced diets than adults, who have already established their eating habits.

Exercise and physical activity

Exercise and physical activity control body weight and prevent people with impaired glucose tolerance from developing diabetes mellitus (21-24) and reduce the risk of cardiovascular disease (2). The urban and periurban dwellers need to be encouraged to do some exercise such as walking and backyard gardening in order to maintain a healthy weight. In urban areas, the urban councils should build secure and safe exercise and walking tracks for its residents, especially women.

Conclusions

The BMI of urban and periurban dwellers is higher than in the remote rural areas of Papua New Guinea. There are more overweight and obese people in the urban communities and periurban villages. The lower level of normal BMI for Papua New Guineans should be 18.5 kg/m² rather than the WHO standard level of 20 kg/m².

ACKNOWLEDGEMENTS

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REFERENCES


