

# Obesity among Mongolian Adults from Urban and Rural Areas

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## ABSTRACT

Shifts in lifestyles and eating patterns have led to an increasing prevalence of chronic non-communicable diseases in the adult population in Mongolia. This article reports the prevalence of obesity, abdominal obesity and body fat among 408 Mongolian adults aged 25 years and above. The subjects included 61.2% from urban areas and 38.8% from rural areas, reflective of the 60: 40 urban rural ratio in the general population. Anthropometric measurements were taken according to standard methods. Classification of overweight/obesity was based on body mass index of WHO while abdominal obesity was based on WPRO for Asians. Men made up 47.8% (200) and women 52.2% (218) of the sample. The mean age of the subjects was 46.7±12.7 years. About one-third (32.8%) of the subjects were overweight and 10.5% obese. A higher proportion of women (13.3%) than men were obese (7.5%). The age groups of 35-54 years in men and 55-64 years in women showed the highest prevalence of overweight. Prevalence of abdominal obesity was found in 46.5% of the men and in 65.1% of the women. Women aged 55-64 years had the highest proportion (78.4%) of abdominal obesity. In terms of body fat, 20.0 % and 51.5% of the men had high and very high levels of body fat respectively, while among the women, 15.1% and 55.5% respectively had high and very high levels of body fat. Mongolian adults face serious risk of cardiovascular diseases and other aspects of ill-health brought about by obesity. Prevention and control of obesity should be targeted as an urgent public health agenda in Mongolia.

**Keywords:** Mongolian adults, obesity, rural areas, urban areas

## INTRODUCTION

Globally, in 2005 approximately 1.6 billion adults were overweight and at least 400 million adults were obese (WHO, 2006). The World Health Organization (WHO) further predicts that by 2015, approximately 2.3

billion adults will be overweight and more than 700 million will be obese, and developing countries will share a large proportion of this epidemic.

Diet is a major contributing factor for obesity. WHO (2003) pointed out that the principal cause attributable to this

pandemic is a global shift in diet towards increased intake of energy-dense foods that are high in fat and sugars. Genetic, cultural, socio-economic and environmental aspects, however, underlie this complex development. The problem of overweight and obesity in poor countries usually affects urban middle-aged adults and then increasingly spreads to semi-urban and rural areas (Prentice, 2005). Urban-rural differences in overweight become narrow when countries are experiencing rapid economic development and urbanisation (Popkin, 2001).

Mongolia is a developing country experiencing rapid economic development and rising urbanisation, with 60.2% of the population living in urban areas. The remaining 39.8% of Mongolia's population are widely spread out in rural areas, concentrated along river valleys of the forest-steppe zone. Many are nomadic or semi-nomadic herdsman who are usually spread out during the summer but gravitate back to the sub-district centres (*somon*) in the winter. The rural people live in traditional tent houses called *gers*.

Mongolians have experienced major changes in disease patterns since the 1980s from declining rates of infectious diseases to increasing deaths from non-communicable diseases. Cardiovascular diseases have been the number one cause of death in the Mongolian population since 1995 (DMS, 2005). The most recent nationwide survey reported that 31.6% of Mongolians aged 15-64 years were overweight and 41.6% had central obesity. Rural females were more obese (13.3%) than their urban counterparts (11.5%). There was a small difference in the prevalence of overweight between urban (26.1%) and rural females (25%). Moreover, rural females were more centrally obese (43.7%) compared to urban females (41%), while an opposite trend was observed among the males. However, urban males were more overweight and obese (28.9%) compared to the rural males (22.5%) (MOH, 2006).

Mongolians have a distinctive lifestyle and dietary habits characterised by a preference for high protein and fatty foods of animal origin. Such a dietary preference is probably in keeping with the country's extreme continental climate and nomadic lifestyle, whereby meat and meat products are the main sources of energy during both winter and spring, while dairy products are commonly consumed during summer and autumn. However, there have been shifts in lifestyle patterns and decreased seasonal variations in eating patterns amidst an increasing prevalence of chronic non-communicable diseases among the Mongolians.

This article reports the prevalence of overweight/obesity and central obesity among Mongolian adults from urban and rural areas, according to socio-demographic characteristics.

## METHODOLOGY

### Study design

Mongolia is divided administratively into 21 provinces called *Aimags* and seven districts and the capital city is Ulaanbator. Each *Aimag* is divided into *Soums*, which in turn are further divided into *Bags*. Out of the 21 *Aimags*, Khövsgöl *Aimag* was randomly selected, while out of its 23 *Soums*, Murun *Soum* was selected at random. In 2005, Murun *Soum* had a population of 121,700, of which approximately 54,000 were adults aged 25 years and above. Of the four *Bags* in Murun *Soum*, one *Bag* was randomly chosen for the rural sector for this study (Murun *Soum Bag*). A *Bag* consists of a group of households registered under the care of a clinic or doctor.

As for the urban sector, Bayanzurkh District was randomly chosen from the seven districts of Ulaanbator. The Bayanzurkh District has 24 *Khoroos* from which the fourth *Khoroos* was selected at random. Of the five *Bags* in the fourth *Khoroos*, two *Bags* were chosen randomly.

Based on a marginal error of 5%, confidence level of 95% and CHD prevalence of 38.3% among Mongolian adults, a sample size of 364 was obtained. The sample size was increased to 436 allowing for 20% non-response rate. Based on the urban to rural population ratio of 60: 40 in Mongolia, the estimated breakdown in number of urban and rural adults from the computed sample size of 436 was 262 and 174 respectively.

All men and women aged 25 years and over in the selected urban and rural *Bags* were eligible for the study. Lists of names of eligible adults registered with physicians in the *Bags* were obtained. Those who were not registered, sick, disabled and pregnant were excluded. The first 436 adults who gave consent to participate were included in the study. This gave a study sample comprising 265 urban and 171 rural adults. During the survey, 13 changed their minds about participating, two could not be reached and one became sick. The final number of subjects recruited was thus 420 consisting of 256 urban and 164 rural adults. Data analysis was conducted on 418 subjects because two subjects with extreme values for body weight and waist circumference were removed prior to data analysis.

The study was approved by the Ethics Committee of the Ministry of Health of Mongolia.

### Anthropometric measurements

Anthropometric measurements were collected following standardised procedures. Height was measured using the Harpenden portable stadiometer (Holtain

Ltd, Crymych, Dyfed, UK). Waist circumference was taken at the end of normal expiration at the midpoint between the lower border of the rib cage and the iliac crest using an inelastic tape measure. Body fat was measured using a bioelectrical impedance meter (Professional Body Composition Analyzer TBF 110, Tanita Co., Tokyo, Japan), from which body mass index (BMI) was computed. Classification of overweight/obesity was based on BMI. Abdominal obesity was defined as waist circumference > 102 cm for men and > 88 cm for women (WHO WPRO, 2000). Classification for total body fat is as shown in the table above.

### Statistical analysis

The survey database was created in EpiData 3.1, a Microsoft Windows-based programme. Data were entered twice using double entry verification to improve the quality of data. Exploratory data analysis was applied for detection of missing data and for handling outliers. Associations between categorical variables were tested by using contingency tables and calculation of chi square test. All statistical analyses were performed using SPSS 13 for Windows. A two-sided *p* value of <0.05 was considered significant.

## RESULTS

### Background characteristics of subjects

The sample comprised 47.8% (200) men and 52.2% (218) women. Out of these, 61.2% were from the urban Bayanzurkh district of Ulaanbator city, while 38.8% were from the rural area of Murun soum in Khövsgöl

Reference values for body fat percent

<i>Gender</i>	<i>Body fat percent</i>			
	<i>Low</i>	<i>Normal</i>	<i>High</i>	<i>Very high</i>
Male	<10.0	10.0 – 19.9	20.0 – 24.9	25<=
Female	<20.0	20.0 – 29.9	30.0 – 34.9	35<=

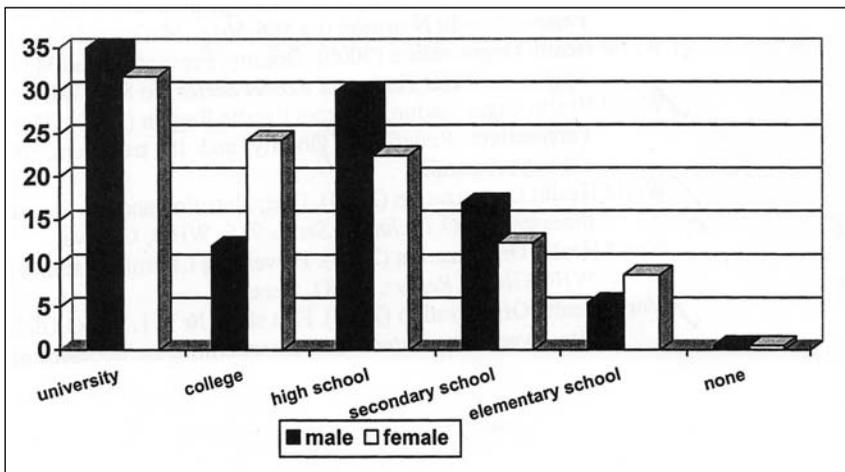
Source: Wardlaw & Kessel (2000).

**Table 1.** Distribution of study population by gender and locality

	Locality		Total n (%)
	Urban n (%)	Rural n (%)	
Male	128 (64.0)	72 (36.0)	200 (100)
Female	128 (58.7)	90 (41.3)	218 (100)
Total	256 (61.2)	162 (38.8)	418 (100)

**Table 2.** Mean age of subjects by gender and locality

	Locality (Mean ±SD)		P value
	Urban (N=256)	Rural (N=162)	
Male	49.5±14.1	45.6 ± 10.2	0.044
Female	47.0±13.5	42.9 ± 10.5	0.017
Overall	48.2±13.8	44.1 ± 10.4	0.001



**Figure 1.** Education attainment of subjects by sex

Aimag (Table 1). The average number of persons in urban and rural households was 4.7±1.8 and 4.3±1.3 respectively. Overall 21.5% of the subjects lived in their own houses, 33.3% owned state apartments and 45.2%, especially the rural subjects, resided in traditional dwellings (*Ger*).

The overall mean age of the men was 48.2±13.8 years and that for the women was

44.1±10.4 years. There was no significant difference in age between urban and rural subjects (Table 2).

More than half of the female subjects (56%) had attained college or university education compared to 47% among the males (Figure 1). The rest had attended high school or secondary school. Very few were without formal schooling.

**Table 3.** Body mass index (BMI) of subjects by sex

Characteristics	Male (N=200)	Female (N=218)	<sup>a</sup> p value
	Mean ± SD		
Weight (kg)	68.3 ±12.7	60.0 ±11.9	<.001
Height (cm)	167.1 ± 5.6	155.1 ± 5.5	<.001
BMI (kg/m <sup>2</sup> )	24.4 ± 4.0	24.9 ± 4.4	.231

<sup>a</sup>Independent – Samples T test, SD –standard deviation

**Table 4.** Body mass index classification by sex

BMI classification (WHO, 2000)	Male N=200		Female N=218		Both sexes	
	n	%	n	%	n	%
	Underweight	13	6.5	12	5.5	25
Normal	110	55	102	46.8	212	50.7
Overweight	62	31.0	75	34.4	137	32.8
Obese	15	7.5	29	13.3	44	10.5

Note: BMI – Body mass index; Pearson  $\chi^2$  (df=3) = 5.26,  $p$  = 0.15.

### Body mass index

The mean weight and height of the men was 68.3±12.7 kg and 167.1±5.6 cm respectively, while their mean BMI was 24.4±4.0 kg/m<sup>2</sup> (Table 3). As for the female subjects, their mean weight, height and BMI were 60.0±11.9 kg, 155.1±5.5 cm and 24.9±4.4 kg/m<sup>2</sup> respectively.

Based on the BMI classification of WHO (2000), 6% of the subjects were underweight, 50.7% had normal weight, while 32.8% were overweight and 10.5% obese (Table 4). Almost one-third (31%) and 7.5% of the men were overweight and obese respectively. Slightly higher proportions of the women were overweight (34.4%) and obese (13.3%) compared to the men. However, these differences between men and women were not significant.

The proportion of overweight among men increased substantially after the age of 34 years or thereabouts. The age group of

25-34 years were 19.4% overweight but the proportion nearly doubled to 35.4% for ages 35-44 years (Table 5). The level remained above 30% after that. A similar trend was found for the female subjects. The proportion of overweight women was lowest (20.4%) in the youngest age group of 25-34 years, almost doubling (39%) for age 35-44 years (Table 6). The high level continued to be seen among the oldest age groups of above 55 years (39.2%). There was a significant association between BMI status and age groups among the female subjects.

In terms of locality, the rural subjects were seen to have a higher prevalence of overweight and obesity than their urban counterparts. While 34.6% of combined sexes in rural areas were overweight and 12.3% obese, the corresponding figures for urban areas were 31.6% and 9.4% (Table 7). However, these differences between localities were not statistically significant.

**Table 5.** Prevalence of overweight and obesity among men by age groups

<i>BMI classification</i>	<i>Age years (n, %)</i>				<i>Total n (%)</i>
	<i>25-34</i>	<i>35-44</i>	<i>45-54</i>	<i>&gt; 55</i>	
Underweight	2 (5.6)	2 (4.2)	3 (6.4)	6 (8.7)	13 (6.5)
Normal	26 (72.2)	26 (54.2)	22 (46.8)	36 (52.2)	110 (55)
Overweight	7 (19.4)	17 (35.4)	16 (34.0)	22 (31.9)	62 (31.0)
Obesity	1 (2.8)	3 (6.3)	6 (12.8)	5 (7.2)	15 (7.5)
Total	36 (100)	48 (100)	47 (100)	69 (100)	200 (100)

Male N=200; Pearson  $\chi^2$  (df=9) = 8.510,  $p = 0.484$

**Table 6.** Prevalence of overweight and obese among women by age groups

<i>BMI categories</i>	<i>Age years (n, %)</i>				<i>Total n (%)</i>
	<i>25-34</i>	<i>35-44</i>	<i>45-54</i>	<i>55-64</i>	
Underweight	8 (16.3)	1 (1.7)	2 (3.4)	1 (2.7)	12 (5.5)
Normal	29 (59.2)	28 (47.5)	24 (40.7)	21 (41.2)	102 (46.8)
Overweight	10 (20.4)	23 (39.0)	22 (37.3)	20 (39.2)	75 (34.4)
Obesity	2 (4.1)	7 (11.9)	11 (18.6)	9 (17.6)	29 (13.3)
Total	49 (100)	59 (100)	59 (100)	51 (100)	218 (100)

Female N=218, Pearson  $\chi^2$  (df=9) = 24.90,  $p$  value = 0.003

**Table 7.** BMI status by urban-rural locality (Urban N=256, Rural N=162)

<i>BMI classification</i>	<i>Male (N, %)</i>		<i>Female (N, %)</i>		<i>Both Sexes</i>	
	<i>Urban</i>	<i>Rural</i>	<i>Urban</i>	<i>Rural</i>	<i>Urban</i>	<i>Rural</i>
Underweight	9 (7)	4 (5.6)	9 (7)	3 (3.3)	18 (7.0)	7 (4.3)
Normal	73 (57)	37 (51.4)	60 (46.9)	42 (46.7)	133 (52)	79 (48.8)
Overweight	39 (30.5)	23 (31.9)	42 (32.8)	33 (36.7)	81 (31.6)	56 (34.6)
Obese	7 (5.5)	8 (11.1)	17 (13.3)	12 (13.3)	24 (9.4)	20 (12.3)
Total	128 (100)	72 (100)	128 (100)	90 (100)	256 (100)	162 (100)

Pearson  $\chi^2$  (df=3) = 2.33,  $p= 0.50$  male;  $\chi^2$  (df=3) =1.54,  $p= 0.67$  female

The problem of overweight and obesity prevails in both rural and urban areas in Mongolia.

### Abdominal obesity

The mean waist circumference of the men was  $88.2 \pm 12.1$  cm, while that of the women was  $83.9 \pm 11.3$  cm. Among the men, the age

group of 45-54 years showed significantly higher waist circumference or girth than the other age groups (Table 8). The women showed significantly lowest abdominal circumference in the youngest age group of 24-34 years, compared to the other ages. Meanwhile women aged 55-64 years showed significantly higher mean waist circumference among all the age groups.

**Table 8.** Mean waist circumference by age and sex

Age groups(years)	Male (N=200)		Female (N=218)	
	N	Mean $\pm$ SD	N	Mean $\pm$ SD
25 -34	36	82.9 $\pm$ 11.1 <sup>a</sup>	49	77.4 $\pm$ 9.8 <sup>a</sup>
35-44	48	88.9 $\pm$ 12.5 <sup>a</sup>	59	83.5 $\pm$ 10.6 <sup>b</sup>
45-54	47	90.1 $\pm$ 12.8 <sup>b</sup>	59	85.6 $\pm$ 10.5 <sup>b</sup>
55-64	46	89.7 $\pm$ 11.8 <sup>a</sup>	37	89.6 $\pm$ 11.9 <sup>c</sup>
>65	23	87.9 $\pm$ 10.2 <sup>a</sup>	14	86.1 $\pm$ 11.3 <sup>b</sup>
Total	200	88.2 $\pm$ 12.1 <sup>a</sup>	218	83.9 $\pm$ 11.3

ANOVA, F (4, 195) = 2.28, p = .061 male; F (4, 213) = 7.85, p = <.001 female  
 Values with same superscripts within a column are not significantly different

**Table 9.** Prevalence of abdominal obesity by sex and age groups

Age groups (years)	Male		Female	
	N	Waist girth $\geq$ 90 cmn (%)	N	Waist girth $\geq$ 80 cmn (%)
25 -34	36	8 (22.2)	49	21 (42.9)
35-44	48	25 (52.1)	59	38 (64.4)
45-54	47	25 (53.2)	59	44 (74.6)
55-64	46	23 (50.0)	37	29 (78.4)
>65	23	12 (52.2)	14	10 (71.4)
All ages	200	93 (46.5)	218	142 (65.1)

Pearson  $\chi^2$  (df=4) = 10.50, p= 0.033 male;  $\chi^2$  (df=4) = 16.14, p= 0.003 female

The prevalence of abdominal obesity (waist circumference  $\geq$  90 cm) was 46.5% in men and 65.1% among the women (waist girth  $\geq$  80 cm) (Table 9). The percentage of men and women with abdominal obesity increased with age. In the former, the youngest group of 25-34 years had 22.2% with abdominal obesity, and this figure rose to above 50% for all the older ages. Similarly, 42.9% of women for ages 25-34 years had abdominal obesity and this level rose to 78.4% for the age group 55-64 years. For each age group, the proportion of abdominal obesity was higher among women than men. These findings indicate a significant association between sex and age groups for abdominal obesity.

Women showed a higher prevalence of abdominal obesity compared to men,

regardless of whether they were from rural or urban areas (Table 10).

### Percentage of body fat

Almost three-quarters of the subjects possessed high to very high body fat (Table 11). Results showed that 20.0 and 51.5% of the men had high and very high levels of body fat respectively. Likewise, 15.1 and 55.5% of the women showed high and very high levels of body fat respectively.

The mean percentage of body fat of the men (26.0 $\pm$ 7.9) was significantly lower than that of the women (36.4  $\pm$  9.7;  $p$ <0.000). While the men did not show significant differences between the age groups for mean body percentage fat, the women in the youngest group had significantly lowest body fat than the other age groups (Table 12).

**Table 10.** Prevalence of abdominal obesity by locality

Locality	Male		Female	
	N	Abdominal obesity n (%)	N	Abdominal obesity n (%)
Urban	128	58 (45.3)	128	85 (66.4)
Rural	72	35 (48.6)	90	57 (63.3)
Total	200	93 (46.5)	218	142 (65.1)

Pearson  $\chi^2$  (df=1) = 0.20,  $p= 0.65$  male;  $\chi^2$  (df=1) = .22,  $p= 0.64$  female

**Table 11.** Percentage of body fat risk categories by sex

Body fat classification	Male		Female	
	n	%	n	%
Low	1	0.5	6	2.8
Normal	56	28.0	58	26.6
High	40	20.0	33	15.1
Very high	103	51.5	121	55.5

**Table 12.** Mean percentage of body fat by age and sex

Age groups (years)	Male		Female	
	N	Mean $\pm$ SD	N	Mean $\pm$ SD
25-34	36	24.6 $\pm$ 8.1 <sup>a</sup>	49	32.9 $\pm$ 10.3 <sup>a</sup>
35-44	48	27.5 $\pm$ 8.7 <sup>a</sup>	59	36.6 $\pm$ 8.7 <sup>bc</sup>
45-54	47	27.5 $\pm$ 7.5 <sup>a</sup>	59	37.8 $\pm$ 10.3 <sup>b</sup>
55-64	46	25.5 $\pm$ 7.8 <sup>a</sup>	37	38.2 $\pm$ 9.0 <sup>b</sup>
>65	23	23.0 $\pm$ 6.6 <sup>a</sup>	14	36.3 $\pm$ 8.7 <sup>bc</sup>
Total	200	26.0 $\pm$ 7.9	218	36.4 $\pm$ 9.7

One way ANOVA; F (4, 195) = 1.97,  $p=0.10$  male; F (4, 213) = 2.22,  $p=0.06$

Values with same superscripts in the same column are not significantly different

## DISCUSSION

This study reported a high prevalence of obesity, abdominal obesity and body fat among Mongolian adults aged 25 years and above. Approximately half of the men and women were overweight and obese. Men and women of the middle-age groups of 35-

44 and 45-54 years showed the highest propensity for being overweight and obese compared to the other ages. The situation was aggravated by the high prevalence of abdominal obesity and percentage body fat in both men and women. Men showed high to very high levels of body fat especially those aged 35-54 years. Women were even worse-

off in having very high body fat after the age of 35 years. The presence of high body fat coincides with high abdominal obesity among the subjects - 46.5% in men and 65.1% women. Older women (55-64 years) also showed abdominal obesity (78.4%).

The study results are not unexpected as the prevalence of overweight has caught up with underweight in many developing countries (Mendez, Monteiro & Popkin, 2005). Indeed, obesity among the poor has been well documented in recent years (Monteiro, Moura & Conde, 2004; Drewnowski, 2004; Monteiro, 2006).

Another important finding is the lack of significant differences between urban and rural subjects in terms of the magnitude of overweight, obesity, abdominal obesity and high body fat. Often, the rural population in developing countries is found to have a lower prevalence of obesity than the urban counterparts. This is often attributed to the lifestyle shift of the urban population toward westernisation of the dietary intake that tends to be energy-dense coupled with a reduction in physical activity (Popkin, 2002; Popkin, Kim & Russev, 2006). However, the lack of significant difference in the obesity magnitude between urban and rural subjects in this study may be due to the fact that, regardless of locality, Mongolians tend to consume an energy-dense diet. The Mongolian 'traditional' diet as practised by the rural population is characterised by a high intake of dairy products, especially milk and natural yogurt, fats and oils, sugar confectionery and horsemeat (Otgontuya, 2009). On the other hand, the more urbanised population takes a 'transitional diet' that is high in meat, both ruminant and monogastric, and potato. In addition, the majority of the adults in both urban and rural areas were found to be not physically active (Otgontuya, 2009).

The results here concur with the country's recent survey which reported that 31.6% of Mongolians aged 15-64 years were overweight with 41.6% experiencing central obesity (MOH, 2006). As cardiovascular

disease has been the number one cause of death in the Mongolian population since 1995 (DMS, 2005), these findings indicate the serious need for urgent public health efforts to address the obesity problem among Mongolian adults. Middle-aged adults, especially women, from rural and urban areas, should be targeted in such intervention programmes.

## CONCLUSION

The adults in Mongolia face serious risks of cardiovascular diseases and other aspects of ill-health that are associated with obesity. There is a pressing need for action on the part of the public health authorities in Mongolia toward reducing the high prevalence of general obesity and abdominal obesity in the adult population in rural and urban areas.

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