

Short communication

BMI among Timorese aged ≥ 40 years

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Abstract

Objective: To determine the distribution and sociodemographic associations of BMI (kg/m^2) among adults aged ≥ 40 years living in Timor-Leste.

Design: BMI was calculated for participants of a population-based cross-sectional survey.

Setting: Urban and rural Timor-Leste.

Subjects: Adults aged ≥ 40 years living in Timor-Leste.

Results: Of those enumerated, 2014 participated (89.5%). Male gender, rural domicile, older age, illiteracy and source of household income were associated with BMI $< 18.5 \text{ kg}/\text{m}^2$ on multivariate analysis. Female gender, urban domicile and literacy were associated with BMI ≥ 25.0 and $\geq 30.0 \text{ kg}/\text{m}^2$. Adjusting for gender, age and domicile, and extrapolating to those aged ≥ 40 years across Timor-Leste, 9.9%, 36.0%, 6.6% and 0.8% had BMI < 16.0 , < 18.5 , ≥ 25.0 and $\geq 30.0 \text{ kg}/\text{m}^2$, respectively.

Conclusions: At this time, being 'underweight' or 'severely thin' is more prevalent in the Timorese adult population than being 'overweight' or 'obese'.

Keywords
BMI
Timor-Leste

The WHO has recognized the link between changing diets and lifestyle ('nutritional transition'), increasing obesity and increased risk of a range of diseases including CVD, hypertension, diabetes mellitus and hyperlipidaemia^(1,2). It has also identified that many developing countries have the double burden of this increasing overnutrition while concurrently still attempting to address undernutrition within their populations⁽¹⁾.

Timor-Leste is a relatively new nation of 1.1 million people, approximately 80% of whom currently live in rural areas and half of whom lived below the poverty line ($< \$\text{US } 0.88/\text{d}$) in 2007⁽³⁾.

Geographically positioned at the eastern end of the Indonesian archipelago near the island of New Guinea, ethnically the majority of Timorese are of Austronesian (Malayo-Polynesian) or Melanesian-Papuan origin.

The health status of the population is generally poor. There is high morbidity from infectious disease, and maternal and child health indicators, including malnutrition, are problematic⁽⁴⁾. Food security is also an issue: 29% of farmers reported insufficient maize harvest to meet their annual need in 2009⁽⁵⁾ and Timor-Leste has the worst Global Hunger Index in South-East Asia⁽⁶⁾.

To date, 'lifestyle diseases' associated with obesity have not been identified as a priority by the Ministry of Health in Timor-Leste and population-based prevalence estimates are as yet unavailable. Obtaining more information about

the body fat profile of the Timorese population will assist in understanding the current situation relating to over- and undernutrition and planning for the most appropriate allocation of resources in the future.

A Demographic and Health Survey in 2003 reported a mean BMI of $19.5 \text{ kg}/\text{m}^2$ for women aged 15–49 years and $19.7 \text{ kg}/\text{m}^2$ for men aged 15–54 years⁽⁷⁾. When measurement was repeated for the female group in the 2010 Demographic and Health Survey⁽⁴⁾, mean BMI had increased to $20.2 \text{ kg}/\text{m}^2$. Neither of these surveys reported sociodemographic risk factors for high or low BMI.

The Timor-Leste Eye Health Survey 2010 estimated the prevalence and causes of vision impairment and blindness for adults aged ≥ 40 years in Timor-Leste. The present paper reports BMI data from that survey, using the WHO classification of underweight (BMI $< 18.5 \text{ kg}/\text{m}^2$), normal weight (BMI = 18.5 – $24.9 \text{ kg}/\text{m}^2$), overweight (BMI $\geq 25.0 \text{ kg}/\text{m}^2$) and obese (BMI $\geq 30.0 \text{ kg}/\text{m}^2$) for adults⁽⁸⁾. Severe thinness (BMI $< 16.0 \text{ kg}/\text{m}^2$)⁽⁹⁾ and BMI cut-off points suggested to assist comparison with other populations⁽¹⁰⁾ are also presented.

Methods

The survey took place between August 2009 and May 2010, with a 4-month break for the monsoon season, which made some roads impassable.

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Sampling plan

The sample frame of the eye health survey included all people aged ≥ 40 years living in Timor-Leste's twelve mainland districts (173 000 people; 87.2% rural dwellers). Using an anticipated prevalence of blindness (presenting visual acuity worse than 6/60 in both eyes) of 7.5% in the target population, absolute precision of $\pm 1.5\%$ (20% relative difference), with 95% confidence, a design effect of 1.6 and a response rate of 80%, the sample size was determined to be 2250 persons. From the sample frame, fifty clusters of forty-five people were required. Across the twelve districts, the clusters were selected through probability proportionate to size sampling, using 2004 census data.

Pilot

A pilot study was undertaken (sixty participants from three clusters, representative of the population to be enumerated in the main survey) to refine and validate the questionnaire and to standardize and streamline the examination. These data were not included in the final survey analysis.

Enumeration

Using a random process, the team leader identified the first household to be targeted in each cluster. Thereafter, consecutive households were approached and eligible people enumerated by trained local fieldworkers until the forty-five participants for that cluster were enrolled.

Enumerated residents amenable to participating attended a central facility, typically a community hall, for administration of a questionnaire and examination.

Questionnaire and clinical examination

An interview-based questionnaire, developed in English, translated into Tetun (the local language) and back translated to ensure veracity, was used to collect data.

Participants were asked to provide demographic, socio-economic and health-related information. Participants' barefoot stretch stature height was measured to the nearest centimetre using a portable stadiometer. Weight, with the participant in light tropical clothing and without shoes, was measured to the nearest 0.1 kg using portable scales.

Data analysis

Data were de-identified and entered into a specifically designed database during the survey, with subsequent random checking of up to 20% of records for entry integrity. BMI was calculated for each participant. Analysis involved univariate comparisons of the prevalence of BMI < 16.0 , < 18.5 , ≥ 25.0 and ≥ 30.0 kg/m² by key socio-demographic variables, followed by multivariate logistic regression to estimate relative differences in risk between sociodemographic groups. This was performed using

PASW/SPSS Statistics 18.0 (SPSS Inc., Chicago, IL, USA). Statistical significance was accepted at $P < 0.05$.

National census data (2004) were used to adjust the sample prevalence estimates for gender, age and domicile and to extrapolate the findings to those aged ≥ 40 years across the entire country.

Ethical considerations

The Timor-Leste Ministry of Health ethics apparatus, the precursor of the subsequently formed National Research Ethics Review Committee, approved the study and its methodology. The tenets of the Declaration of Helsinki were observed.

Consent was obtained from village chiefs prior to survey commencement in each cluster and participants provided written acknowledgement of informed consent prior to enrolment. Referral to permanent health-care services was organized for any participant requiring refraction or ocular investigation or treatment.

Results

Of the 2250 eligible people enumerated, 2014 participated (89.5%). Height and/or weight measurements were not recorded for eleven people; therefore data are reported for 2003 participants.

The mean height for males (n 1039) and females (n 964) was 1.61 (SD 0.07) m and 1.50 (SD 0.07) m, respectively. Mean weight was 50.3 (SD 8.3) kg and 45.0 (SD 9.2) kg, respectively.

The mean BMI of the sample was 19.6 (SD 3.3) kg/m² (range 11.1–39.2 kg/m²; Fig. 1): 19.3 (SD 2.8) kg/m² (range 12.2–34.9 kg/m²) for males and 19.9 (SD 3.8) kg/m² (range 11.1–39.2 kg/m²) for females (Table 1).

Of males, 39.3% had BMI < 18.5 kg/m² and 9.8% had BMI < 16.0 kg/m², while 3.1% had BMI ≥ 25.0 kg/m² and

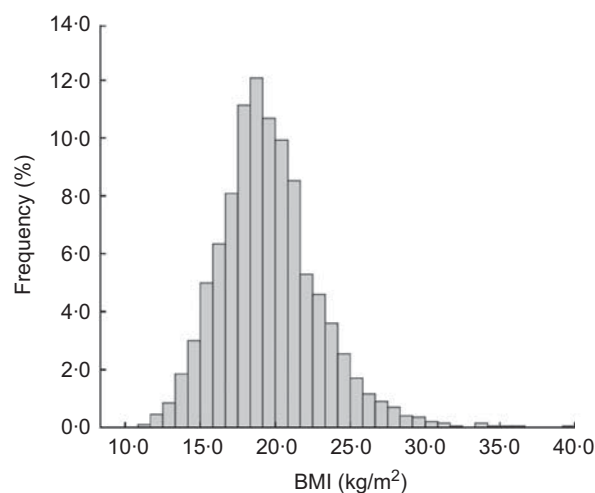


Fig. 1 Distribution of BMI (mean 19.6 (SD 3.3) kg/m²) among adults (n 2003) aged ≥ 40 years, Timor-Leste, 2010

Table 2 Association of being severely thin, underweight, overweight and obese with demographic and socio-economic characteristics of adults (*n* 2003) aged ≥40 years, Timor-Leste, 2010

Characteristic	Severely thin (BMI < 16.0 kg/m ²)						Underweight (BMI < 18.5 kg/m ²)						Overweight (BMI ≥ 25.0 kg/m ²)						Obese (BMI ≥ 30.0 kg/m ²)							
	Univariate			Multivariate			Univariate			Multivariate			Univariate			Multivariate			Univariate			Multivariate				
	<i>n</i>	OR	95% CI	<i>P</i> value	OR†	95% CI	<i>P</i> value	OR	95% CI	<i>P</i> value	OR†	95% CI	<i>P</i> value	OR	95% CI	<i>P</i> value	OR†	95% CI	<i>P</i> value	OR	95% CI	<i>P</i> value	OR†	95% CI	<i>P</i> value	
Gender	1039	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.		
Male	964	1.4	1.0, 1.8	0.029*	1.2	0.9, 1.6	0.213	1.1	0.9, 1.3	0.408	1.2	1.0, 1.5	0.036*	3.3	2.1, 5.0	<0.001***	4.8	3.0, 7.7	<0.001***	3.0	1.0, 8.9	0.068	4.5	1.3, 14.9	0.015*	
Female	280	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	
Domicile	1723	2.3	1.4, 3.9	0.001**	2.0	1.1, 3.5	0.015*	2.0	1.5, 2.7	<0.001***	1.6	1.2, 2.3	0.002**	4.3	2.9, 6.3	<0.001***	2.9	1.8, 4.5	<0.001***	9.5	3.5, 25.8	<0.001***	5.1	1.7, 15.7	0.004**	
Urban	686	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	
Rural	486	2.0	1.2, 3.1	0.005**	1.5	1.1, 1.9	0.102	1.5	1.1, 1.9	0.003**	1.2	0.9, 1.6	0.154	3.4	1.7, 7.2	<0.001***	1.2	0.5, 2.8	0.719	1.6	0.5, 5.0	0.565	1.7	0.4, 6.3	0.448	
Age (years)	541	4.4	2.9, 6.6	<0.001***	2.9	1.8, 4.5	<0.001***	2.5	2.0, 3.2	<0.001***	1.8	1.4, 2.4	<0.001***	2.3	1.4, 3.7	<0.001***	1.6	0.7, 3.6	0.293	0.8	0.2, 3.3	>0.999	0.6	0.2, 2.4	0.476	
40–49	290	5.0	3.2, 7.9	<0.001***	3.1	1.9, 5.1	<0.001***	3.4	2.6, 4.6	<0.001***	2.3	1.7, 3.2	<0.001***	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	
50–59	676	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	
60–69	1327	4.7	3.1, 7.1	<0.001***	2.7	1.7, 4.5	<0.001***	2.7	2.2, 3.3	<0.001***	1.7	1.4, 2.2	<0.001***	2.8	1.9, 4.1	<0.001***	2.3	1.4, 3.7	0.001**	8.0	2.4, 26.4	<0.001***	7.0	1.7, 29.3	0.008**	
≥70	897	3.6	1.9, 6.9	<0.001***	1.2	0.6, 2.5	0.663	3.4	2.4, 4.8	<0.001***	2.1	1.4, 3.1	<0.001***	2.6	1.6, 4.3	<0.001***	3.4	1.8, 6.3	<0.001***	8.5	1.4, 52.2	0.022*	4.8	0.5, 47.1	0.174	
Literacy	843	2.9	1.5, 5.6	0.001**	1.0	0.5, 2.0	0.902	3.8	2.6, 5.5	<0.001***	2.2	1.5, 3.3	<0.001***	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	
Literate	242	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	
Illiterate	1327	4.7	3.1, 7.1	<0.001***	2.7	1.7, 4.5	<0.001***	2.7	2.2, 3.3	<0.001***	1.7	1.4, 2.2	<0.001***	2.8	1.9, 4.1	<0.001***	2.3	1.4, 3.7	0.001**	8.0	2.4, 26.4	<0.001***	7.0	1.7, 29.3	0.008**	
Household income	897	3.6	1.9, 6.9	<0.001***	1.2	0.6, 2.5	0.663	3.4	2.4, 4.8	<0.001***	2.1	1.4, 3.1	<0.001***	2.6	1.6, 4.3	<0.001***	3.4	1.8, 6.3	<0.001***	8.5	1.4, 52.2	0.022*	4.8	0.5, 47.1	0.174	
Unemployed	843	2.9	1.5, 5.6	0.001**	1.0	0.5, 2.0	0.902	3.8	2.6, 5.5	<0.001***	2.2	1.5, 3.3	<0.001***	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	
Farming	242	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	1.0	Ref.	1.0	
Paid																										

Ref., referent category.
 P* < 0.05, *P* < 0.01, ****P* < 0.001.
 †Adjusted for all participant characteristics listed in the table.
 ‡21 unknowns.

0.4% had BMI ≥ 30.0 kg/m². For females, these figures were 37.4%, 13.0%, 9.5% and 1.2%, respectively (Table 1).

On multivariate analysis, adjusting for gender, age, domicile, literacy and main source of household income, having BMI < 18.5 kg/m² was independently and significantly associated with male gender, rural domicile, being aged 60–69 years and ≥70 years compared with 40–49 years, illiteracy and the main source of household income (Table 2). Rural domicile, being aged 60–69 years and ≥70 years compared with 40–49 years and illiteracy were predictive of having BMI < 16.0 kg/m², but gender and primary source of household income were not.

No males or females had a BMI ≥ 40.0 kg/m². Female gender, urban domicile and literacy were significantly associated with having BMI ≥ 25.0 and ≥30.0 kg/m² on multivariate analysis (Table 2). In addition, the main source of household income being unemployment compared with subsistence farming/fishing was predictive of BMI ≥ 25.0 kg/m².

Adjusting for gender, age and domicile, and extrapolating to those aged ≥40 years across Timor-Leste, 36.0 (SD 2.1) % had BMI < 18.5 kg/m² and 9.9 (SD 1.3) % had BMI < 16.0 kg/m², being approximately 66 500 and 18 000 people, respectively. Meanwhile 6.6 (SD 1.1) % had BMI ≥ 25.0 kg/m² and 0.8 (SD 0.4) % had BMI ≥ 30.0 kg/m², being approximately 10 000 and 1500 people, respectively.

Discussion

The determinants of BMI were unlikely to be associated with survey non-participation, nor with the sporadic omission of height and weight measurements that occurred for some participants. Therefore, the results in the present study are likely representative of the Timorese population aged ≥40 years.

Compared with other Malay populations, a higher proportion of Timorese are underweight⁽⁶⁾ and a lower proportion are overweight⁽¹¹⁾. The people of Timor-Leste are currently among the most underweight, least overweight populations in the world⁽¹²⁾. The WHO states that a prevalence of 20% or more of the adult population with a BMI < 18.5 kg/m² indicates a serious public health problem⁽⁹⁾. The results of the current and previous surveys^(4,7) suggest that the Timorese population remains in this category, and is close to the ‘critical’⁽⁹⁾ situation of having ≥40% of the population with a BMI < 18.5 kg/m².

The Timor-Leste Demographic and Health Surveys in 2003⁽⁷⁾ and 2010⁽⁴⁾ show that the proportion of women aged 15–49 years being underweight decreased from 37.7% to 27.2% and the proportion of women overweight rose from 3.1% to 5.1%. While the increase in overweight women needs monitoring given the dangers of obesity, the decrease in underweight women is encouraging if it reflects improvement in nutrition and food security. The association of rural domicile and older age

with undernutrition indicates these groups are most in need of attention by nutrition and food security programmes.

The current study found urban domicile was a predictor of being overweight and obese. Increasing urbanization, with its associated changes in activity and nutrition, is generally regarded as contributing to the rise of obesity in developing countries^(1,13). The Timorese population is likely to be at particular risk: rapid urbanization is predicted for Timor-Leste in the coming years, with an even rural–urban population distribution by 2040⁽¹⁴⁾. Also, the country has already improved its Human Development Index ranking, having moved up forty-two places to achieve a ‘medium’ rating in 2010⁽¹⁵⁾. Much of this was due to increased government spending from petroleum revenue, both of which are expected to continue⁽¹⁶⁾.

In most parts of the world the prevalence of overweight and obesity tends to be higher for females than for males⁽¹⁷⁾. Also, it has been found in all but the least developed countries that the proportion of the adult female population overweight now exceeds that which is underweight in both urban and rural areas⁽¹⁸⁾. The findings of the current study are consistent with both these observations.

Literacy (as a proxy for educational attainment and the likelihood of a more sedentary lifestyle) was found to be a predictor of being overweight and obese. Conversely, illiteracy was a predictor of being underweight and severely thin. Having no household member in paid employment was also predictive of being underweight, but not of severe thinness.

On multivariate analysis, paid employment (as a proxy for likely increased food choices) was not predictive of being overweight or obese. This may be because the economy in Timor-Leste is still very young and the nutrition transition is in its early stages.

BMI was chosen as the anthropometric measure in the present study due to its widespread use in surveillance internationally^(19,20). While the skill required for accurate determination of waist-to-hip ratio and waist circumference⁽²¹⁾ was considered prohibitive in the present survey, the inclusion of this measure in future would provide a more comprehensive picture of the body fat distribution in the Timorese population.

At this time, the issue of undernourishment is more prevalent in the Timorese adult population than being overweight or obese. Continued monitoring of population BMI statistics may be prudent. This would assist assessment of the effectiveness of nutrition and food security programmes currently being implemented and the planning of cost-effective preventive and early interventions for the anticipated obesity and associated diseases as urbanization and socio-economic development increase. Given that diabetes occurs at lower BMI in many Asian populations compared with elsewhere in the world⁽²²⁾, the inclusion of diabetes measurement in future surveys would permit the exploration of whether the same trend exists in the Timorese population.

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