Association between television viewing and overweight and obesity among women of reproductive age in Timor-Leste: evidence from the demographic health survey 2016

Animesh Talukder, Rajat Das Gupta, Mohammad Rashidul Hashan, Shams Shabab Haider, Ibrahim Hossain Sajal, Malabika Sarker

ABSTRACT

Objective This study aimed to assess the possible relationship between television viewing and overweight and obesity among Timorese women of reproductive age.

Methods This cross-sectional study analysed the Timor-Leste Demographic and Health Survey 2016 dataset. A weighted sample of 11 398 Timorese women aged 15–49 years was chosen using a two-stage stratified random sampling technique. Asian criteria-based body mass index (BMI) cut-offs were used to define overweight (BMI 23.0 to <27.5 kg/m²) and obesity (BMI ≥27.5 kg/m²). Frequency of TV viewing was categorised into three groups: (1) not at all, (2) less than once a week and (3) at least once a week. Multilevel ordered logistic regression was performed to identify the correlates of overweight and obesity. Both crude and adjusted odds ratios (AOR) along with a 95% CI were calculated to show the strength of association.

Results Among 11 398 respondents, 19.4% were overweight or obese (overweight: 15.7% and obese: 3.8%). Although about half of the respondents reportedly did not watch TV at all, just over two-thirds watched TV at least once a week. Women who watched TV at least once a week were found to have 1.3 times the odds of being overweight or obese compared with those who never watched TV (AOR: 1.3, 95% CI: 1.1 to 1.5; p<0.001). However, when stratified by settlement type, the statistical significance stood for the rural women only (AOR: 1.5, 95% CI: 1.1 to 1.9; p<0.001), after adjusting for the covariates.

Conclusion Watching TV at least once a week was found to be a significant correlate of overweight and obesity in rural Timorese women of reproductive age. Further studies need to be undertaken to assess physical activity, sedentary and dietary patterns to clarify the possible mechanism through which TV viewing may influence BMI in those groups.

INTRODUCTION

High body mass index (BMI) (ie, overweight and obesity) is considered the fourth leading risk factor of disability worldwide when ranked by disability-adjusted life-years. Epidemiological studies throughout the years have found associations between overweight and obesity and many notable chronic diseases, such as hypertension, cardiovascular and cerebrovascular diseases, type 2 diabetes mellitus, chronic kidney disease, a number of cancers, a group of musculoskeletal disorders and some forms of respiratory diseases. In particular, obesity is suggestive of contributing to severe forms of infection amid the COVID-19 pandemic. Among the COVID-19-affected groups that needed critical care, a higher prevalence of obesity was observed. Additionally, a significant inverse correlation was found between age and BMI among the affected individuals, suggesting younger patients’ being more likely to be obese. Moreover, obesity may...
also lead to psychosocial impairment and a significant reduction in both health-related quality of life and overall life expectancy. Furthermore, it poses drastic economic implications as well, as highlighted by a systematic review in 2011, which showed obese people enduring 30% excess medical expenses, compared with their normal weight counterparts. This condition, though currently affecting over a third of the global population, is largely preventable. Even a modest reduction of body weight was found to be associated with meaningful risk attenuation for hypertension, hyperglycaemia, dyslipidaemia and many other comorbidities. Of those who suffer the most, the women of reproductive age are of particular importance. Apart from the aforementioned complications, overweight and obesity pose an additional burden on women of reproductive age due to obstetric complications, such as gestational diabetes mellitus and pre-eclampsia, surgical and anaesthetic complications, as well as an increased chance of miscarriage; these obstetric risks are more common in low-resource settings, which have a substandard continuum of care to deal with the existing obstetric and gynaecological problems.

Globally, both developed and underdeveloped countries are experiencing an escalating prevalence of overweight and obesity. Due to demographic and epidemiological transition, obesity and overweight, once considered an archetypal high-income country problem, are becoming dramatically prevalent even in the least developed countries. Timor-Leste (also known as East Timor), despite only gaining international recognition as a sovereign nation in 2002, has continued to struggle to achieve economic solvency amid the ongoing massive rebuilding and has remained one of the least developed countries in the world thus far. Although Timor-Leste has been experiencing a massive burden of undernourishment, a looming double burden of malnutrition due to epidemiological transition cannot be ruled out. This might pose a tremendous challenge for the country’s healthcare system, especially when the country is still far off course from meeting its nutrition targets; that is evident from the fact that more than 40% of Timorese women of reproductive age are anaemic. On the contrary, almost 5% of the women of Timor-Leste are reportedly obese; however, the proportion of overweight and obesity among the women of reproductive age is not known. Therefore, it is important to know the prevalence and correlates of these conditions in this age group.

Spending time watching TV was found to be associated with excess body weight among both men and women in prospective studies. Some propositions that may elucidate this relationship are: (1) replacement of the daily recommended as well as discretionary physical activity time with TV watching time, (2) sleep deprivation and (3) promotion of unhealthy dietary choices that contribute to weight gain. Women of reproductive age were found to be sedentary to an alarming extent in a large epidemiological study. Moreover, sedentariness has been linked with idiopathic infertility of women in...
sampling and data collection procedure of the TLDHS 2016 were published previously.35

Data collection and measurements
Data were collected through a standard pretested women’s questionnaire developed by the DHS programme. The questionnaire was modified according to the local context. It was developed in English, then translated into Tetum (local language of Timor-Leste). Trained interviewers collected the data via face-to-face interviews. Tablet computers were used for the questionnaire-based survey. Anthropometric measurements were conducted using calibrated measuring boards and calibrated Seca scales.35

Study population, variables, and inclusion criteria
The target population of this study were Timorese women aged 15–49 years. Women who were either pregnant or gave birth in the 2 months prior to the survey were excluded. The primary study variables of interest for this study were high BMI (ie, overweight and obesity) and frequency of TV viewing. Asian criteria-based BMI cutoffs were used to categorise BMI in order to allocate a more accurate association between body fat percentage and BMI for the target population.39 The following categories of BMI were used: (1) normal and/or underweight (BMI: <23.0 kg/m²), (2) overweight (BMI: 23.0 kg/m² to <27.5 kg/m²) and (3) obesity (BMI≥27.5 kg/m²). The frequency of TV watching was categorised into three groups: (1) not at all, (2) less than once a week and (3) at least once a week.35 Based on the literature, the following covariates were considered: age, place of residence, municipality of residence, marital status, educational attainment, current employment status, household wealth status, parity and the number of household members. Based on the available literature, age was categorised into the following three categories: (1) 15–24 years, (2) 25–34 years and (3) 35–49 years.40 The number of household members was dichotomised, based on the median value of 6, into two categories: (1) ≤6 and (2) >6. Wealth index was calculated through principal component analysis technique based on household construction material, water source and sanitation facility, and possession of assets like bicycles, TV, etc. Household wealth status was derived after dividing this wealth index into quintiles.35 41 The study variables along with their categories are outlined in online supplemental table 1.

Data analysis
At first, the background characteristics of the respondents were determined by descriptive analysis and the findings were presented in frequency and percentage. Then, a χ² test was conducted to find the possible relationship of BMI with the frequency of TV viewing and other covariates. During the analyses, the sample weight used in the TLDHS was adjusted for. To find the possible correlates of overweight and obesity, multivariable multilevel ordered logistic regression was carried out. The multilevel regression was performed considering the hierarchical nature of the DHS data.42–44 Both crude odds ratio (COR) and adjusted odds ratio (AOR) were reported with 95% CI. Additionally, we performed multilevel ordered logistic regression analyses considering normal BMI (18.5–22.99 kg/m²) as the reference category. Moreover, linear regression analyses were conducted to assess the relationship between BMI and the frequency of watching TV. Furthermore, the association between underweight (<18.5 kg/m²) (compared with normal BMI) and frequency of watching TV was assessed. Variance inflation factor (VIF) was used to determine possible multicollinearity among the covariates. The existence of significant multicollinearity was defined by a VIF greater than 5,45 however, no significant multicollinearity was detected. All the statistical analyses were performed through Stata V.14.0 (StataCorp).

Reporting checklist
The STROBE cross-sectional checklist was utilised while writing the manuscript.

No patient involved.

Findings prevalence and distribution of BMI categories
This study analysed the data from a weighted sample of 11 998 Timorese women of reproductive age (15–49 years) to assess the possible relationship between frequency of TV viewing and being overweight or obese. The prevalences of overweight and obesity among the respondents were found to be 15.7% (95% CI: 14.7% to 16.7%) and 3.8% (95% CI: 3.3% to 4.3%), respectively, whereas the combined prevalence of both overweight and obesity was 19.4% (95% CI: 18.3% to 20.6%).

The distribution of BMI across different categories of respondents’ background characteristics is outlined in table 1. The majority of women were between 15 and 24 years of age (41.2%), hailed from rural areas (67.1%) and belonged to the municipality of Dili (25.1%). Although just over one-fifth (21.8%) of the respondents did not receive any formal education, more than half (52.0%) completed secondary education. Around two-thirds of the respondents (65.8%) were in employment at the time of the survey. In terms of wealth status, approximately, a quarter of the respondents (24.2%) belonged to the ‘richest’ quintile of the wealth index. Around half of the respondents (42.4%) were nulliparous, whereas 29.6% had a parity of more than three. Around half of the respondents (47.7%) had more than six members in their households. Although 41.2% of the respondents, reportedly, did not watch TV at all, 38.0% watched TV at least once a week.

Relationship of overweight and obesity with background characteristics
Statistically significant differences were found among the BMI of women across all the covariates, except the number of household members. Prevalence of overweight and
Table 1  Distribution of BMI across categories of background characteristics of the respondents (N=11398)

| Background characteristics | N    | %   | BMI <23 kg/m² | BMI ≥23 kg/m² ≥ BMI < 27.5 kg/m² | BMI ≥27.5 kg/m² |
|----------------------------|------|-----|---------------|-----------------------------------|-----------------|
| Age group (years)*         |      |     |               |                                   |                 |
| 15–24                      | 4694 | 41.2| 91.2          | 7.4                               | 1.4             |
| 25–34                      | 3216 | 28.2| 75.6          | 19.8                              | 4.7             |
| 35–49                      | 3488 | 30.6| 70.9          | 23.0                              | 6.1             |
| Place of residence*        |      |     |               |                                   |                 |
| Rural                      | 7649 | 67.1| 83.8          | 13.5                              | 2.6             |
| Urban                      | 3749 | 32.9| 73.9          | 20.0                              | 6.1             |
| Municipality of residence* |      |     |               |                                   |                 |
| Aileu                      | 482  | 4.2 | 86.5          | 11.0                              | 2.5             |
| Ainaro                     | 459  | 4.0 | 84.6          | 13.6                              | 1.8             |
| Baucau                     | 1161 | 10.2| 77.7          | 18.7                              | 3.6             |
| Bobonaro                   | 854  | 7.5 | 86.3          | 10.8                              | 2.9             |
| Covalima                   | 690  | 6.1 | 73.2          | 22.4                              | 4.3             |
| Dili                       | 2856 | 25.1| 74.1          | 19.7                              | 6.2             |
| Ermera                     | 1090 | 9.6 | 91.4          | 7.5                               | 1.2             |
| Lautem                     | 586  | 5.1 | 83.4          | 14.8                              | 1.8             |
| Liquiçá                    | 670  | 5.9 | 88.3          | 9.9                               | 1.8             |
| Manatuto                   | 491  | 4.3 | 75.5          | 18.3                              | 6.3             |
| Manufahi                   | 628  | 5.5 | 81.6          | 14.6                              | 3.7             |
| SAR of Oecussi             | 697  | 6.1 | 87.2          | 10.8                              | 2.0             |
| Viqueque                   | 734  | 6.4 | 75.0          | 20.5                              | 4.5             |
| Highest educational status*|      |     |               |                                   |                 |
| No formal education        | 2480 | 21.8| 84.7          | 13.2                              | 2.1             |
| Primary                    | 1749 | 15.4| 77.1          | 18.0                              | 4.9             |
| Secondary                  | 5925 | 52.0| 80.9          | 15.3                              | 3.9             |
| Higher                     | 1243 | 10.9| 75.7          | 19.3                              | 5.1             |
| Currently employed*        |      |     |               |                                   |                 |
| No                         | 7497 | 65.8| 82.4          | 14.3                              | 3.3             |
| Yes                        | 3901 | 34.2| 77.0          | 18.3                              | 4.8             |
| Household wealth status*   |      |     |               |                                   |                 |
| Poorest                    | 1880 | 16.5| 88.0          | 10.3                              | 1.7             |
| Poorer                     | 2056 | 18.0| 86.5          | 11.0                              | 2.5             |
| Middle                     | 2190 | 19.2| 82.0          | 15.9                              | 2.1             |
| Richer                     | 2512 | 22.0| 77.4          | 17.5                              | 5.1             |
| Richest                    | 2759 | 24.2| 72.9          | 20.9                              | 6.3             |
| Marital status*            |      |     |               |                                   |                 |
| Single                     | 4559 | 40.0| 91.3          | 7.2                               | 1.5             |
| Currently married          | 5873 | 51.5| 72.0          | 22.4                              | 5.6             |
| Separated/divorced/widowed | 971  | 8.5 | 82.0          | 14.7                              | 3.3             |
| Parity*                    |      |     |               |                                   |                 |
| 0                          | 4834 | 42.4| 90.5          | 7.9                               | 1.6             |
| 1                          | 1023 | 9.0 | 83.3          | 13.0                              | 3.7             |
| 2                          | 1109 | 9.7 | 74.6          | 21.4                              | 4.0             |
| 3                          | 1060 | 9.3 | 70.9          | 23.5                              | 5.7             |

Continued
Correlates of overweight and obesity

In the ordered logistic regression model, the normal and underweight category (BMI < 23 kg/m²) was held as the reference group, while the possible correlates of overweight or obesity were identified based on COR and AOR calculations (Table 2). After controlling for the covariates, age, type of settlement, municipality of residence, educational attainment, wealth and marital status, and frequency of TV viewing were all found to be the statistically significant correlates of overweight or obesity. On the contrary, household size, employment status and parity did not show any statistically significant relationship with TV viewing frequency.

The difference between urban and rural women in terms of TV viewing frequency is illustrated in Figure 1 (see online supplemental file 1). The proportion of respondents who watched TV at least once a week was significantly higher in urban areas compared with rural areas (urban: 64.1% vs rural: 39.5%, p<0.0001).

Relationship between frequency of watching TV and overweight and obesity after stratification by type of settlement

Overall, women who watched TV at least once a week had 1.3 times the odds of being overweight or obese compared with women who never watched TV (AOR: 1.3, 95% CI: 1.1 to 1.5; p<0.001). After stratification by type of settlement (urban/rural) (Table 3) and adjustment for other covariates (eg, age, municipality of residence, the status of wealth and employment, educational and marital status, parity and household size) that were found to have a statistically significant association with overweight and obesity in bivariate analyses (p<0.05), it was found that rural women who watched TV at least once a week had higher odds of being overweight or obese than those who did not watch TV at all (AOR: 1.5, 95% CI: 1.2 to 1.8; p<0.001). Conversely, no significant association between overweight and obesity and the frequency of watching TV was observed among urban women (Table 3). The logistic regression results found in the urban and rural strata, separately, are presented in online supplemental tables 2 and 3.

Similar estimates were generated while comparing the odds of overweight and obesity while keeping normal BMI as a reference category (Table 4). The detailed models are shown in online supplemental tables 4–6.

Linear regression also revealed an increase in BMI as the frequency of watching TV increases. However, stratification yielded significant result only in rural areas (Table 5). The detailed models are shown in online supplemental tables 7–9.

Watching TV at least once a week was associated with 10% lower odds of underweight compared with not watching TV at all (online supplemental table 10).

DISCUSSION

To the best of our knowledge, this is the first-ever study on Timor-Leste that analysed a nationally representative DHS dataset to investigate the association between frequency of TV watching and overweight and obesity among women of reproductive age. The data from a weighted sample of 11,938 Timorese women revealed a statistically significant association between frequency of
| Background characteristics | COR  | 95% CI Lower limit | 95% CI Upper limit | AOR  | 95% CI Lower limit | 95% CI Upper limit |
|-----------------------------|------|--------------------|--------------------|------|--------------------|--------------------|
| Age group (years)           |      |                    |                    |      |                    |                    |
| 15–24                       | Ref  |                    |                    | Ref  |                    |                    |
| 25–34                       | 3.7* | 3.2                | 4.2                | 1.9* | 1.6                | 2.3                |
| 35–49                       | 5.0* | 4.4                | 5.7                | 2.3* | 1.9                | 2.9                |
| Place of residence          |      |                    |                    |      |                    |                    |
| Rural                       | Ref  |                    |                    | Ref  |                    |                    |
| Urban                       | 1.8* | 1.6                | 2.1                | 1.4* | 1.2                | 1.6                |
| Province of residence       |      |                    |                    |      |                    |                    |
| Aileu                       | Ref  |                    |                    | Ref  |                    |                    |
| Ainaro                      | 1.3  | 0.9                | 1.8                | 1.2  | 0.9                | 1.7                |
| Baucau                      | 1.8* | 1.3                | 2.5                | 1.5‡ | 1.1                | 2.0                |
| Bobonaro                    | 1.1  | 0.8                | 1.5                | 0.9  | 0.6                | 1.2                |
| Covalima                    | 2.1* | 1.5                | 2.9                | 1.7† | 1.3                | 2.3                |
| Dili                        | 2.2* | 1.6                | 2.9                | 1.2  | 0.9                | 1.7                |
| Ermera                      | 0.7  | 0.5                | 1.0                | 0.7  | 0.5                | 1.0                |
| Lautem                      | 1.3  | 1.0                | 1.9                | 1.0  | 0.7                | 1.4                |
| Liquiçá                     | 0.9  | 0.6                | 1.2                | 0.8  | 0.6                | 1.2                |
| Manatuto                    | 2.1* | 1.5                | 2.9                | 1.6† | 1.2                | 2.2                |
| Manufahi                    | 1.5‡ | 1.1                | 2.1                | 1.3  | 0.9                | 1.7                |
| SAR of Oecussi              | 1.0  | 0.7                | 1.5                | 0.8  | 0.5                | 1.1                |
| Viqueque                    | 2.0* | 1.5                | 2.8                | 1.8* | 1.3                | 2.5                |
| Highest educational status  |      |                    |                    |      |                    |                    |
| No formal education         | Ref  |                    |                    | Ref  |                    |                    |
| Primary                     | 1.6* | 1.4                | 1.9                | 1.7* | 1.4                | 2.0                |
| Secondary                   | 1.1  | 1.0                | 1.3                | 1.5* | 1.3                | 1.8                |
| Higher                      | 1.4† | 1.2                | 1.7                | 1.4† | 1.1                | 1.8                |
| Currently employed          |      |                    |                    |      |                    |                    |
| No                         | Ref  |                    |                    | Ref  |                    |                    |
| Yes                        | 1.6* | 1.5                | 1.8                | 1.1  | 1.0                | 1.2                |
| Household Wealth index      |      |                    |                    |      |                    |                    |
| Poorest                     | Ref  |                    |                    | Ref  |                    |                    |
| Poorer                      | 1.1  | 0.9                | 1.4                | 1.1  | 0.9                | 1.4                |
| Middle                      | 1.5* | 1.2                | 1.8                | 1.3† | 1.1                | 1.6                |
| Richer                      | 2.1* | 1.7                | 2.5                | 1.6* | 1.3                | 2.0                |
| Richest                     | 2.7* | 2.2                | 3.2                | 1.9* | 1.5                | 2.4                |
| Marital status              |      |                    |                    |      |                    |                    |
| Single                      | Ref  |                    |                    | Ref  |                    |                    |
| Currently married           | 4.7* | 4.1                | 5.3                | 2.9* | 2.2                | 3.8                |
| Separated/divorced/widowed  | 2.9* | 2.3                | 3.5                | 2.2* | 1.6                | 3.0                |
| Parity                      |      |                    |                    |      |                    |                    |
| 0                           | Ref  |                    |                    | Ref  |                    |                    |
| 1                           | 1.9* | 1.5                | 2.3                | 0.6† | 0.5                | 0.8                |
| 2                           | 3.1* | 2.6                | 3.7                | 0.9  | 0.7                | 1.2                |
TV viewing and being overweight or obese. However, when stratified by the type of settlement (urban/rural), the statistical significance stood only for the Timorese women belonging to the rural stratum.

The prevalence of overweight and obesity using Asian criteria-based BMI cut-offs (BMI≥23 kg/m²) among the Timorese women of reproductive age was found to be 19.4%, which is lower than that of the neighbouring Southeast Asian countries: Vietnam, Cambodia, Malaysia, Laos, and Thailand. Given that Timor-Leste is arguably the least developed country in this region, the comparatively lower proportion of overweight or obesity is understandable. Despite going through epidemiological transitions, undernourishment is still the bigger problem among Timorese women of reproductive age. However, the methodological contrasts among studies of different Southeast Asian countries (eg, BMI cut-offs, study population, and sampling and measurement techniques) may limit direct comparison. In terms of the correlates; however, higher age groups, higher wealth status, and urban settlement were previously found to have significantly higher odds of overweight or obesity, which is consistent with the present study results.

The present study found a positive and statistically significant association between frequency of TV viewing and being overweight or obese among women of reproductive age. A number of studies over the years, conducted on people of different age groups, have established a similar positive association between the two in Western and Eastern settings. This observed positive association can be explained through at least two possible mechanisms. First, TV watching time may replace the time that could have been used for exercise or discretionary physical activities; this may result in a reduction in overall energy expenditure and subsequently lead to weight gain. Decreased energy expenditure and its consequent increase in sedentariness were found to have detrimental metabolic repercussions on adults irrespective of their meeting the recommended physical activity guidelines, posing negative implications on their BMI status. In particular, people in developing countries are reportedly shifting from an active lifestyle towards sedentariness due to greater access to mechanical appliances, TV being one of them. Being a developing country itself, Timor-Leste might not be an exception to such a shift, and Timorese women may be resorting to TV viewing as their primary form of recreation rather than engaging in physically demanding recreational or outdoor activities. Second, TV viewing time is also hypothesised to result in increased energy intake. Watching TV was found to be associated with the urge to consume more savoury snacks and high-calorie drinks. These unhealthy dietary practices, while watching TV, are hypothesised to be related to abdominal obesity in women. One of the factors that might drive this tendency is the abundance of TV programmes with commercials or advertisements.

### Table 2 Continued

| Background characteristics | COR  | 95% CI Lower limit | 95% CI Upper limit | AOR  | 95% CI Lower limit | 95% CI Upper limit |
|----------------------------|------|--------------------|--------------------|------|--------------------|--------------------|
| Number of household member |      |                    |                    |      |                    |                    |
| ≤6                         | Ref  | Ref                |                    |      |                    |                    |
| >6                         | 0.9  | 0.9                | 1.0                | 1.0  | 0.9                | 1.1                |
| Frequency of viewing television |      |                    |                    |      |                    |                    |
| Not at all                 | Ref  | Ref                |                    |      |                    |                    |
| Less than once a week      | 1.5* | 1.3                | 1.7                | 1.2* | 1.0                | 1.4                |
| At least once a week       | 1.7* | 1.5                | 1.9                | 1.3* | 1.1                | 1.5                |

Results are based on ordered logistic regression. Asterisks (*) denote level of statistical significance. *P value<0.001. †P value<0.01. ‡P value<0.05.

AOR, adjusted odds ratio; BMI, body mass index; COR, crude odds ratio.

### Figure 1

Percentage of sample (n=11398) in urban and rural areas across three categories of TV viewing frequency.

| Percentage of Respondents | Urban | Rural |
|---------------------------|-------|-------|
| Not at all                | 13.7% | 54.7% |
| Less than once a week     | 22.2% | 20.2% |
| Once a week               | 64.1% | 25.1% |
for energy-dense foods, which may determine dietary choices in other parts of the day. A content analysis study on selected Nepali and Indian TV channels found roughly 25% of broadcasted commercials to be promoting preprepared or packaged food with low nutritional value. Besides, these commercials are more likely to reach the ones spending a considerable amount of time in front of the TV and entice them through attractive communication techniques to purchase and consume obesogenic food products, which, in combination with

| Table 3 | Association between frequency of watching TV and overweight and obesity (after stratification by type of settlement) among women of reproductive age in Timor-Leste |
|----------|---------------------------------------------------|
| **Frequency of watching television** | **COR (95% CI)** | **AOR (95% CI)** |
| **Urban areas** | | |
| Not at all | Reference | Reference |
| Less than once a week | 1.3* (1.0 to 1.6) | 1.1 (0.8 to 1.4) |
| At least once a week | 1.3* (1.0 to 1.6) | 1.1 (0.8 to 1.4) |
| **Rural areas** | | |
| Not at all | Reference | Reference |
| Less than once a week | 1.3† (1.1 to 1.6) | 1.3† (1.0 to 1.5) |
| At least once a week | 1.7* (1.5 to 2.0) | 1.5* (1.2 to 1.8) |
| **Overall** | | |
| Not at all | Reference | Reference |
| Less than once a week | 1.5* (1.3 to 1.7) | 1.2‡ (1.0 to 1.4) |
| At least once a week | 1.7* (1.5 to 1.9) | 1.3* (1.1 to 1.5) |

Results are based on ordered logistic regression and adjusted for age, place of residence, municipality of residence, highest educational status, current employment and marital status, Wealth index, parity and number of household members; women having BMI <23 kg/m² were held as the reference group. Asterisks (*) denote level of statistical significance.

*P value<0.001.
†P value<0.01.
‡P value<0.05.
AOR, adjusted odds ratio; COR, crude odds ratio.

| Table 4 | Association between frequency of watching TV and overweight and obesity (after stratification by type of settlement) among women of reproductive age in Timor-Leste, compared with normal BMI |
|----------|---------------------------------------------------|
| **Frequency of watching television** | **COR (95% CI)** | **AOR (95% CI)** |
| **Urban areas** | | |
| Not at all | Reference | Reference |
| Less than once a week | 1.3‡ (1.0 to 1.6) | 1.0 (0.8 to 1.3) |
| At least once a week | 1.2‡ (1.0 to 1.5) | 1.0 (0.7 to 1.2) |
| **Rural areas** | | |
| Not at all | Reference | Reference |
| Less than once a week | 1.4† (1.2 to 1.7) | 1.2‡ (1.0 to 1.5) |
| At least once a week | 1.7* (1.4 to 2.0) | 1.4† (1.2 to 1.7) |
| **Overall** | | |
| Not at all | Reference | Reference |
| Less than once a week | 1.5* (1.3 to 1.7) | 1.2‡ (1.0 to 1.4) |
| At least once a week | 1.7* (1.5 to 1.9) | 1.3* (1.1 to 1.5) |

Results are based on ordered logistic regression and adjusted for age, place of residence, municipality of residence, highest educational status, current employment and marital status, wealth index, parity, and number of household members; women having BMI 18.5–23 kg/m² were held as the reference group. Asterisks (*) denote level of statistical significance.

*P value<0.001.
†P value<0.01.
‡P value<0.05.
AOR, adjusted odds ratio; BMI, body mass index; COR, crude odds ratio.
their sedentary behaviour, make them prone to being overweight and obese.²⁵

Nevertheless, after stratification of TV viewing status based on settlement type (urban/rural), the statistical significance of its relationship with BMI held up only in the rural stratum. Conversely, in the urban stratum, although watching TV ‘at least one a week’ gave one higher odds of being overweight or obese, it lacked statistical significance, which contrasts prior studies on this aspect.⁴⁰ This apparent contradiction may be explained from two different angles. First, the statistical significance found in the rural stratum could be because the ongoing epidemiological and demographic transitions and gradual increase in gross national income in the underdeveloped and developing countries may be resulting in gradual, yet meaningful diffusion of urban behavioural risk factors to rural areas, such as the adoption of a sedentary lifestyle, increased screen time, consumption of obesogenic food and greater reliance on the mechanised systems for routine chores and transportation.²⁷ ⁷⁰ Second, the relationship lacked statistical significance in the urban stratum possibly because of other unknown behavioural practices that might have confounded the relationship. The ability of this study to assess the relationship was constrained by the fact that frequency of TV watching was the only available measure of screen time and due to the lack of data, our study could not control for other potential confounders or mediators (eg, dietary habit, physical activity, screen time other than TV watching) of the relationship between TV viewing and overweight or obesity in urban areas.

Much as this study provides useful insights on the potential correlates of overweight and obesity and the possible mechanism of its relationship with TV viewing frequency, it also highlights the need to interpret its finding cautiously in light of potential limitations. First, the cross-sectional nature of this study prevents us from drawing causal conclusions about the hypothesised relationship between TV viewing and overweight and obesity. Nonetheless, this hypothesis was previously tested in prospective cohort studies that found temporal relationships between frequency of TV watching and incidence of overweight or obesity²⁴ ²⁵ ⁷¹ as well as in an experimental study that found moderation of the TV viewing time to have a protective association with BMI,⁷² suggesting that reverse causation would be unlikely. Second, a self-reported measurement of TV viewing frequency/duration may have led to a reporting bias. Third, due to the lack of data, some of the potentially important behavioural risk factors of BMI (eg, inactivity or sedentary status, poor dietary habit, tobacco and alcohol consumption) could not be adjusted to discern the strength of the independent relationship between TV viewing and overweight or obesity. Moreover, a more precise duration of TV viewing and the nature of the media content that Timorese women are exposed to may need to be looked at in future studies.²⁷

Notwithstanding the aforementioned limitations, this study is the first one to assess the relationship of TV viewing frequency with overweight and obesity in Timor-Leste, where the prevalence of overnutrition is on the rise due to ongoing epidemiological transition. Moreover, this study analysed a nationally representative survey dataset with a high response rate (97%), hence the findings are generalisable to a great extent. Moreover, the TLDHS 2016 utilised validated questionnaires, calibrated measurement tools and well-trained enumerators and technicians, limiting the chance of measurement error. Furthermore, this study contributes to generating representative prevalence estimates of BMI categories and their crossationally associated factors among Timorese women of reproductive age.
CONCLUSION

The ongoing epidemiological transition in Timor-Leste makes this country susceptible to a forthcoming dual burden of malnutrition. Compared with other groups, the Timorese women of reproductive age are more prone to suffer from complications of overweight and obesity due to their additional gestational and obstetric issues. This study demonstrates TV viewing frequency to be a statistically significant correlate of overweight and obesity among that age group. Therefore, intervention planners should incorporate behavioural change communication messages regarding dietary and physical activity reforms in the existing TV programmes to leverage TV viewing time, if not advice for replacing the screen time with physically demanding discretionary activities.

REFERENCES

1. Stanaway JD, Afshin A, Gakidou E, et al. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the global burden of disease study 2017. The Lancet 2018;392:1923–94.
2. Wormser D, Kappote S, Di Angelantonio E. Separate and combined associations of body-mass index and abdominal adiposity with cardiovascular disease: collaborative analysis of 58 prospective studies. The Lancet 2011;377:1085–95.
3. Singh GM, Danaei G, Farzadfar F, et al. The age-specific quantitative effects of metabolic risk factors on cardiovascular diseases and diabetes: a pooled analysis. PLoS One 2013;8:e65174.
4. Lauby-Secretan B, Scoccianti C, Loomis D, et al. Body fatness and cancer – viewpoint of the IARC Working group. New England Journal of Medicine 2016;375:794–8.
5. Jiang L, Rong J, Wang Y, et al. The relationship between body mass index and hip osteoarthritis: a systematic review and meta-analysis. Joint Bone Spine 2011;78:150–5.
6. Jiang L, Tian W, Wang Y, et al. Body mass index and susceptibility to knee osteoarthritis: a systematic review and meta-analysis. Joint Bone Spine 2012;79:291–7.
7. Guh DP, Zhang W, Bansback N, et al. The incidence of co-morbidities related to obesity and overweight: a systematic review and meta-analysis. BMC Public Health 2009;9:98.
8. Sattar N, McInnes IB, McMurray JJV. Obesity is a risk factor for severe COVID-19 infection: multiple potential mechanisms. Circulation 2020;142:4–6.
9. Simonnet A, Cherbonn M, Poissy J, et al. High prevalence of obesity in severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) requiring invasive mechanical ventilation. Obesity 2020;28:1195–9.
10. Simonnet A, Cherbonn M, Poissy J, et al. High prevalence of obesity in severe acute respiratory syndrome Coronavirus-2 (SARS-CoV-2) requiring invasive mechanical ventilation. Obesity 2020;28:1195–9.
11. Kass DA, Duggal P, Cingolani O. Obesity could shift severe COVID-19 disease to younger ages. The Lancet 2020;395:1544–5.
12. Otfe F. Obesity - a preventable disease. Ghana Med J 2005;39:98–101.
13. Williamson DA, Jack Rejeski W. Obesity and health-related quality of life. in: Handbook of obesity: epidemiology, etiology, and physiopathology, third edition. Boca Raton: CRC Press, 2014: 645–55.
14. Peeters A, Barendregt JJ, Willekens F, et al. Obesity in adulthood and its consequences for life expectancy: a life-table analysis. Ann Intern Med 2003;138:24–32.
15. Withrow D, After DA. The economic burden of obesity worldwide: a systematic review of the direct costs of obesity. Obes Rev 2011;12:131–41.
16. Ng M, Fleming T, Robinson M, et al. Global, regional, and national prevalence of overweight and obesity in adults and children during 1980-2013: a systematic analysis for the global burden of disease study 2013. Lancet 2014;384:766–81.
17. Cefalu WT, Bray GA, Home PD, et al. Advances in the science, treatment, and prevention of the disease of obesity; reflections from a diabetes care editors’ expert forum. Diabetes Care 2015;38:1567–82.
18. Kanguru L, McCaw-Binns A, Bell J, et al. The burden of obesity in women of reproductive age and in pregnancy in a middle-income setting: a population based study from Jamaica. PLoS One 2017;12:e0186677.
19. Stupin J, Arabin B. Overweight and obesity before, during and after pregnancy. Geburtshilfe Frauenheilkd 2014;74:839–45.
20. Hanson M, Gluckman P, Bustreo F. Obesity and the health of future generations. Lancet Diabetes Endocrinol 2016;4:966–7.
21. CIA. Central Intelligence Agency - The World Factbook - Timor-Leste. CIA Library, 2012:000-5–8, 2012. Available: https://www.cia.gov/the-world-factbook/countries/timor-leste/.
22. United Nations. LDCs at a glance | department of economic and social affairs. United nations department of economic and social
Affairs, 2018. Available: https://www.un.org/development/desa/dpad/least-developed-country-indices/at-a-glance.html
23 Global Nutrition Report. Timor-Leste nutrition profile - Global Nutrition Report, 2020. Available: https://globalnutritionreport.org/resources/nutrition-profiles/asia/south-eastern-asia/timor-leste/
24 FB H, TY L, Coldtiz GA. Television watching and other sedentary behaviors in relation to risk of obesity and type 2 diabetes mellitus in women. J Am Med Assoc 2003;289:1785–91.
25 Chen C-Y, Pereira MA, Kim KH, et al. Fifteen-Year prospective analysis of television viewing and sedentary lifestyle in African American and Caucasian men and women. SAGE Open 2015;5(2):152840415060048.
26 Robinson TN. Reducing children’s television viewing to prevent obesity: a randomized controlled trial. JAMA 1999;282:1561–7.
27 Tuoyire DA. Television exposure and overweight/obesity among children in Gulu, Teso. BMC Obes 2018;5.
28 Wojtala A, Kapka-Skrzypczak L, Bilinski P. Physical activity among women at reproductive age and during pregnancy (Youth Behavioural Polish Survey - YBPS and pregnancy-related assessment monitoring survey - PRAMS) - epidemiological population studies in Poland during the period 2010-2011. Annales of Agricultural and Environmental Medicine 2011;18:365–74.
29 Foucault A-M, Faure C, Julia C, et al. Sedentary behavior, physical inactivity and body composition in relation to diidioptic infertility among women and men. PLoS One 2019;14:e0210770.
30 Oddo VM, Maehara M, Rah JH. Overweight in Indonesia: an observational study of trends and risk factors among adults and children. BMJ Open 2019;9:e031198.
31 Sarma H, Saqibl N, Hasan MM, et al. Determinants of overweight or obesity among ever-married adult women in Bangladesh. BMC Obes 2016;3:13.
32 Biswas T, Uddin MJ, Mamun AA, Al MA, et al. Increasing prevalence of overweight and obesity in Bangladeshi women of reproductive age: findings from 2004 to 2014. PLoS One 2017;12:e0181080.
33 Guiness L, Paul RC, Martins JS, et al. Determinants of health care utilisation: the case of Timor-Leste. Int Health 2018;10:412–20.
34 The World Bank, World bank open data. data catalog. 2016;4. Available: https://data.worldbank.org/.
35 Ministry of Finance, Timor-Leste strategic development plan 2011–30. DILI, Timor-Leste 2011.
36 Hou X, Witter S, Zaman RU, et al. What do health workers in Timor-Leste want, know and do? findings from a national health labour market survey. Hum Resour Health 2016;14:69.
37 Hou X, Asante AD. Turning challenges into opportunities: the medium term health expenditure pressure study in Timor-Leste 2016.
38 General Directorate of Statistics. Timor-Leste demographic and health survey 2016, 2018. Available: https://dhsprogram.com/publications/publication-f3329-dhs-final-reports.cfm
39 Hu FB, Wilkerson WC. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet 2004;363:157–63.
40 Ghose B. Frequency of TV viewing and prevalence of overweight and obesity among women in Bangladesh: a cross-sectional study. BMJ Open 2017;7:014399.
41 Jolliffe IT, Cadima J. Principal component analysis: a review and recent developments. Philos Trans A Math Phys Eng Sci 2016;374:20150202.
42 Hox JJ. Multilevel analysis: techniques and applications. Second edition, Milton: Routledge, 2010.
43 Oyen H. Multilevel analysis of survey data. International Journal of Public Health 2009;54:129–30.
44 Goldstein H. Multilevel statistical models. Hoboken: John Wiley & Sons, 1987.
45 Kuliner MH, Nachtsheim CJ, Neter J. Applied linear statistical models fifth edition. New York: McGraw-Hill/Irwin, 2005. www.mhhe.com
46 von Elm E, Altman DG, Egger M, et al. Strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. J Clin Epidemiol 2008;61:503–7.
47 Trinh OT, Nghia NG, Phongsavanh P, et al. Prevalence and risk factors with overweight and obesity among Vietnamese adults: Caucasian and Asian cut-offs. Asia Pac J Clin Nutr 2009;18:226–33.
48 An Y, YI S, Fitzpatrick A, et al. Appropriate body mass index and waist circumference cutoff for overweight and central obesity among adults in Cambodia. PLoS One 2013;8:e77897.
49 Chan YY, Lim KK, Lim KH, et al. Physical activity and overweight/obesity among Malaysian adults: findings from the 2015 National health and morbidity survey (NHMS). BMC Public Health 2017;17:733.
50 Pengpid S, Yongglakham M, Kounnavong S, et al. The prevalence of overweight and obesity/obesity and its correlates among adults in Laos: a cross-sectional national population-based survey, 2013. Eat Weight Disord 2020;25:265–73.
51 Jitnarin N, Kosulwat V, Rojroongnakul N, et al. Prevalence of overweight and obesity in Thai population: results of the National Thai food consumption survey. Eat Weight Disord 2011;16:e422–9.
52 Angkurawaranan C, Jiraporncharoen W, Chenthanakaj B, et al. Urban environments and obesity in Southeast Asia: a systematic review, meta-analysis and meta-regression. PLoS One 2014;9:e115347.
53 Andersen RE, Crespo CJ, Bartlett SJ. Relationship of physical activity and television watching with body weight and level of fatness among children results from the third National health and nutrition examination survey. J Am Med Assoc 1998;279:938–42.
54 Tucker LA, Bagwell M. Television viewing and obesity in adult females. Am J Public Health 1991;81:908–11.
55 Cleland VJ, Schmidt MD, Dwyer T, et al. Television viewing and abdominal obesity in young adults: is the association mediated by food and beverage consumption during viewing time or reduced leisure-time physical activity? Am J Clin Nutr 2008;87:1148–55.
56 Braithwaite I, Stewart AW, Hancock RJ, et al. The worldwide association between television viewing and obesity in children and adolescents: cross sectional study. PLoS One 2013;8:e74263.
57 Chatzoum, Alyesh S, Khair M. Tu viewing and physical activity and television watching with fatness among children results from the third National health and nutrition examination survey. J Health Popul Nutr 2013;31:334–42.
58 Xu F, Li J, Ware RS, et al. Associations of television viewing time with excess body weight among urban and rural high-school students in regional mainland China. Public Health Nutr 2008;11:891–6.
59 Das Gupta R, Sajal IH, Hasan M, et al. Frequency of television viewing and association with overweight and obesity among women of the reproductive age group in Myanmar: results from a nationwide cross-sectional survey. BMJ Open 2019;9:24680.
60 Das GR, Haider SS, Sutradhar J. Association of frequency of television watching with overweight and obesity among women of reproductive age in India: evidence from a nationally representative study. PLoS One 2019;14.
61 Maher C, Olds TD, Esenmann JC, et al. Screen time is more strongly associated with obesity risk factors: a survey of Melbourne old Australians. Acta Paediatr 2012;101:1170–4.
62 Hamilton MT, Healy GN, Dunstan DW, et al. Too little exercise and too much sitting: inactivity physiology and the need for new recommendations on sedentary behavior. Curr Cardiovasc Risk Rep 2008;2:292–8.
63 Ng SW, Popkin BM. Time use and physical activity: a shift away from movement across the globe. Obes Rev 2012;13:659–80.
64 Salmon J, Campbell KJ, Crawford DA. Television viewing habits associated with obesity risk factors: a survey of Melbourne schoolchildren. Medical Journal of Australia 2006;184:64–7.
65 Blass E, Anderson D, Kirkorian H, et al. Television viewing increases intake of high-fat food and beverage consumption during viewing time or reduced associated than physical activity with overweight and obesity in 9- to 16-year-old Australians. Acta Paediatr 2012;101:1170–4.
66 Blasi E, Anderson D, Kirkorian H, et al. On the road to obesity: television viewing increases intake of high-density foods. Physiol Behav 2006;88:597–604.
67 Strasburger VC, Mulligan DA, Altman TR. Policy statement - Children, adolescents, obesity, and the media. Pediatrics 2011;128:201–8.
68 Neville L, Thomas M, Bauman A. Food advertising on Australian television: the extent of children’s exposure. Health Promot Int 2005;20:105–12.
69 Borzekowski DL, Robinson TN. The 30-second effect: an experiment revealing the impact of television commercials on food preferences of preschoolers. J Am Diet Assoc 2001;101:42–6.
70 Resource Centre for Primary Health Care (RECPHEC). Rapid assessment on media coverage of junk food and its content analysis on selected Nepali and Indian television channels, 2020. Available: www.recphec.org
71 Mendez MA, Monteiro CA, Popkin BM. Overweight exceeds underweight among women in most developing countries. The American Journal of Clinical Nutrition 2005;81:714–21.
72 Dietz WH, Gortmaker SL. Do we fatten our children at the television set? obesity and television viewing in children and adolescents. Pediatrics 1985;75:807–12.
73 Robinson TN. Reducing children’s television viewing to prevent obesity: A randomized controlled trial. J Am Med Assoc 1999;282:1561–7.