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BMJ Open

Frequency of Television viewing and prevalence of overweight and obesity among women of the reproductive age group in Myanmar: Results from a nationwide survey

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Complete List of Authors:	Das Gupta, Rajat; BRAC University James P Grant School of Public Health, Sajal, Ibrahim Hossain; BRAC University James P Grant School of Public Health Hasan, Mehedi; BRAC University, James P Grant School of Public Health Sutradhar, Ipsita; BRAC University, James P Grant School of Public Health Rifat Haider, Mohammad; University of South Carolina Arnold School of Public Health Sarker, Malabika; BRAC University James P Grant School of Public Health, Public Health; University of Heidelberg, Institute of Public Health
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- 1 Title: Frequency of Television viewing and prevalence of overweight and
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- 3 from a nationwide survey
- 5 Authors:
- 6 Rajat Das Gupta+*a, Ibrahim Hossain Sajal+a, Mehedi Hasan+a, Ipsita Sutradhar+a, Mohammad
- 7 Rifat Haider^b, Malabika Sarker^{a,c}
- 9 Author's address and positions:
- BRAC James P Grant School of Public Health, BRAC University, 68 Shaheed Tajuddin
- 11 Ahmed Sarani, Mohakhali, Dhaka, 1212, Bangladesh
- Department of Health Services Policy and Management, Arnold School of Public Health,
- University of South Carolina, Columbia, South Carolina, United States of America
- c Institute of Public Health, University of Heidelberg, Heidelberg, 69120, Germany
- + These authors contributed equally to this work

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- * Corresponding author:
- Rajat Das Gupta, Research Associate, BRAC James P Grant School of Public Health, BRAC
- 19 University, 68 Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka 1212, Bangladesh.
- 20 Email: rajat89.dasgupta@gmail.com



- **Objectives:** This study aimed to find out the association between frequency of television
- viewing and overweight/obesity among reproductive age women of Myanmar.
- **Design:** This was a cross-sectional study.
- **Setting:** This study used Myanmar Demographic and Health Survey (2015-16) data.
- Participants: Total 12,020 women aged 15-49 years and were not pregnant or didn't deliver a child within two months prior to the survey were included.
- Primary and secondary outcome measures: The primary outcome was overweight (23.0 to
- $<27.5 \text{ kg/m}^2$) and obesity ($\ge 27.5 \text{ kg/m}^2$), which was measured by Asian BMI cut off.
- Results: The prevalence of overweight was 26.5% and obesity was 12.2% among the study participants. The odds of being obese were 33% higher (adjusted relative risk ratio (ARRR): 1.334, 95% CI: 1.089- 1.635; *p*-value=0.006) among those who watched television at least once a week compared to those never watched television. Rural women who watched television at
- a week compared to those never watched television. Rural women who watched television at

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p-value=0.004) compared to those who did not watch television at all.

- **Conclusions:** Frequent television watching was associated with obesity among rural women of
- 43 reproductive age group in Myanmar.

Key words: Obesity, Overweight, Noncommunicable Disease, Myanmar

data mining, Al training, and similar technologies

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STRENGTHS AND LIMITATIONS OF THE STUDY

- This study utilized a nationally representative sample to investigate the relationship between the frequency of television viewing and prevalence of overweight/obesity among the women of the reproductive age group of Myanmar. So the findings of this study can be generalizable to the target population.
- The frequency of television viewing was measured in weeks, not in days/hours; the later could have given more precise information.
- In the multivariable analysis, food habit and duration of physical activity were not included because that information was not collected in MDHS.

Both developed and developing countries are facing increasing burden of overweight and obesity, posing a major public health problem.¹⁻³ The prevalence of overweight and obesity increased by 27.5% among the global adult population and 47.1% among global children between 1980 and 2013.⁴ During the same time period, globally, the prevalence of overweight and obesity rose from 29.8% to 38.0% among adult female.⁴ Although this burden is lowest in South and South East Asia, countries of this region are experiencing a rising burden of overweight and obesity.⁵ Historically, undernutrition was considered as the major nutritional problem in South and Southeast Asian countries like Bangladesh, India, Myanmar, and Nepal.⁶ However, as a consequence of economic development and rapid urbanization, currently, these countries are going through a nutritional transition which brings forth nutritional excess (overweight and obesity) as an emerging public health problem.⁷

Myanmar is a low-middle income country (LMIC) situated in the Southeast Asia region. After 50 long years of military rule, the country has recently reformed into the democratic government system.^{8 9} In 2015-16, first Myanmar Demographic and Health Survey (MDHS) was conducted using a nationally representative sample across the country.¹⁰ The survey found a high prevalence of overweight (28.1%) and obesity (13.1%) among reproductive age group women.¹¹

Overweight and obesity is an important risk factor for developing several noncommunicable diseases (NCDs) like type 2 diabetes mellitus (T2DM)¹², hypertension¹³,

cardiovascular diseases (CVDs)¹⁴, cancer¹⁵ and chronic kidney diseases (CKD).¹⁶ In addition, overweight and obese women experience complications during pregnancy (gestational diabetes mellitus (GDM), pre-eclampsia and eclampsia) more frequently than women having normal body weight.¹⁷⁻²⁰

Physical inactivity along with consumption of high-calorie food is considered as the reason for increasing trend of overweight and obesity in many studies. ²¹⁻²⁷ Physical inactivity was attributable to 13·4 million disability-adjusted life years (DALYs) lost worldwide in 2013. ²⁸ It has been found that energy expenditure is very low among people who spend leisure time watching television rather than being involved in activities like playing games, gardening etc. which ultimately increase their risk of gaining excessive body weight. ^{29 30} People who watch television more frequently also intake more energy which sometimes is attributable to their frequent exposure to the advertisements of foods and beverages broadcast at television and subsequent consumption of the foods/beverages. ³¹⁻³⁵

Across the world, many studies have shown a positive association between the increased frequency of television viewing and overweight/obesity. In USA and Australia, it has been found that people who view television more frequently are at higher risk of being overweight/obese. This association has not been explored widely in South and South Asian countries. Therefore, we conducted this study to determine the association between television

viewing and prevalence of overweight and obesity among reproductive age group women in the context of Myanmar using the MDHS 2015-16 data.

METHODS

study settings

According to the 2014 census, the total population of Myanmar was 51.5 million with population density of 76 persons per square kilometer (km²).³⁹ The country is the home to 135 ethnic groups.^{39 40} The *Gross Domestic Product* (*GDP*) of Myanmar was 6.4% and per capita, Gross National Income (GNI) was 1,455 USD in 2016-17. More than quarter (26.1%) of the population was living under the poverty line in 2014. Myanmar has the lowest life expectancy at birth (66.6 years) among the Association of Southeast Asian Nations (ASEAN) countries. High Under-five mortality rate is also high in Myanmar.^{39 41}

study design

This study analyzed the data of MDHS 2015-16, first Demographic and Health Survey of Myanmar. MDHS 2015-16 was a cross-sectional survey which used a nationally representative sample and was conducted by a joint collaboration between the Ministry of Health and Sports of Myanmar and ICF International. United States Agency for International Development (USAID) and 3MDG provided financial support to the survey. Two-stage cluster sampling technique was used for sample selection. The sample was stratified for each of the seven states and eight regions of Myanmar. The detailed method has been published previously. In MDHS, 13,260 households were selected for the final sample. The target group

of this study was women of reproductive age group (15-49 years). The permanent residents and the visitors who stayed in the selected households the night before the day of data collection were included in the questionnaire survey. Around 96% eligible women agreed to participate in the survey. Among them, 98% agreed for anthropometric measurement. However, pregnant women and women who gave birth within preceding two months of the survey were excluded. The final sample size of this study was 12,020 (Figure 1).

survey tools and data collection

A standard set of woman's questionnaire used by the DHS program was adopted according to the local context and pre-tested to collect the socio-demographic information (e.g., age, sex, household wealth index, place of residence) through face-to-face interview. A workshop was conducted involving stakeholders from the government, nongovernment organizations (NGOs) and development partners to design the questionnaire. The MDHS Technical Committee approved the final questionnaire. It was then translated into local language and back-translated into English to maintain the quality. Trained field staffs carried out the interviews and anthropometric measurements. Measuring boards specially made by Shorr Productions was used for height measurement and lightweight SECA scales with digital screens were used for measuring the weight of the respondents.

After training of the data collectors and pre-testing of the questionnaires, data were collected with tablet computers using computer-assisted field editing (CAFE) procedures. The

outcome and independent variables

The main outcome variables of this study were overweight and obesity. To define these variables. Asia specific body mass index (BMI) cut-off value was used. 42 that means we considered women having BMI <23.0 kg/m² as normal weight and underweight, women having BMI between 23.0 kg/m² and $<27.5 \text{ kg/m}^2$ as overweight and women having BMI $\ge 27.5 \text{ kg/m}^2$ as obese.

The main independent variable of interest for this study was the frequency of viewing television. Data were collected as the following categories: (1) not viewing television at all, (2) viewing television less than once a week, and (3) viewing television at least once a week. ¹⁰ The other explanatory variables had been considered based on the literature review were age group, place of residence, region of residence, education, wealth quintile, current working status and parity. The categories of the variables are mentioned in Table 1.

Table 1: List of variables considered for the study

Name of the Variables	Categories
Outcome Variables:	
Body Mass Index (BMI)	a) Normal weight and underweight (BMI < 23 kg/m ²)

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	b) Overweight (BMI 23.0 kg/m 2 - <27.5 kg/m 2)
	c) Obesity (BMI ≥27.5 kg/m²)
Dependent Variables:	
1. Age Groups	a) 15-24 years
	b) 25-34 years
	c) 35-49 years
2. Place of residence	a) Urban
	b) Rural
3. Region of residence	a) Kachin
	b) Kayah
· ·	c) Kayin
	d) Chin
	e) Sagaing
	f) Taninthayi
	g) Bago
	h) Magway
	i) Mandalay
	j) Mon
	k) Rakhine
	l) Yangon
	m) Shan
	n) Ayeyarwaddy
	o) Naypyitaw

data analysis

Weighted descriptive statistics (frequency and percentage) were used to present the sociodemographic characteristics of the respondents. Chi-square (χ^2) test was performed to see whether the groups according to the BMI status differ for the explanatory variables. To find the association between the explanatory and outcome variables multinomial logistic regression analysis was conducted. The variables showed *p*-value <0.05 in multivariable analysis were

164 considered as statistically significant. Both unadjusted and adjusted Relative Risk Ratio (RRR)

165 were reported. All the analysis was done using Stata 13.0.

ethical consideration

MDHS received ethical approval from Ethics Review Committee on Medical Research including Human Subjects in the Department of Medical Research, Ministry of Health and Sports as well as from the ICF Institutional Review Board. Written informed consent was taken from the participants. In case of minor participants, assent form was signed by the respondents and written informed consent was given by the adult guardian.

patient involvement

Patients were not involved in the study.

socio-demographic characteristics of the respondents

The socio-demographic characteristics of the respondents are presented in Table 2. Majority of the study participants were aged between 35 years and 49 years (42.3%) and were resident of the rural area (70.8%). The highest proportion of participants was from the Yangon region (15.1%), followed by Ayeyarwaddy (12.5%) and Mandalay region (12.2%) whereas lowest participation was from Kayah region (0.5%). Around half of the respondents (41.3%) were educated up to the primary level and about one-third (36.1%) received secondary level education, however, 10.2% received higher education and 12.4% received no education. More than two-third (68.1%) of the women were employed at the time of interview. Nearly two-fifths of the women (41.7%) were nulliparous, while cumulatively similar proportion of respondents (46.6%) had experience of being pregnant- for one time (15.3%), two times (15.8%) and more than three times (15.5%). Regarding household wealth index highest proportion of the respondents belonged to richest wealth quintile (22.2%) followed by richer (21.1%) and middle (20.9%) quintile. Among our study participants, the majority (60.1%) reported that they watched television at least once a week; however, 23.1% did not watch television at all and 16.8% watched television less than once a week. Noticeably, more than quarter (26.5%) of our study participants were overweight, and 12.2% of them were obese.

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2	1903 (15.8)
3	1405 (11.7)
3+	1859 (15.5)
Frequency of Viewing Television	
Not at all	2777 (23.1)
Less than once a week	2015 (16.8)
At least once a week	7227 (60.1)
Body Mass Index (BMI)	
BMI <23 (normal weight and	7373 (61.3)
underweight)	
23 \geq BMI < 27.5 (overweight)	3186 (26.)
BMI ≥27.5 (obese)	1460 (12.2%)

MDHS, Myanmar Demographic and Health Survey

women (80.8% versus 51.7%) than the rural women. Around 30% of the rural women didn't

view television at all, where the proportion was less for the urban women (7.2%) (Figure 2).

The frequency of watching television at least once a week was higher among the urban

prevalence of overweight and obesity across the explanatory variables

Table 3 shows the prevalence of three categories of BMI across the explanatory variables with the chi-square (χ 2) value. Except for current employment status, significant differences were found among the BMI of women across the explanatory variables. The prevalence of overweight and obesity increased with age (p-value<0.0001) and was the most common in Yangon and Kachin region (p-value<0.0001). This prevalence was also higher in the urban areas compared to the rural areas (overweight: 31.1% versus 24.6%; obesity: 17.9% versus 9.8%; pvalue<0.0001). Plausibly, Women with higher educational status, having two children, belonging to the richest wealth group had a higher prevalence of overweight and obesity (p-value<0.0001). The prevalence of overweight and obesity was also higher among the individuals who used to watch television at least once a week (p-value<0.0001).

Table 3: Prevalence of overweight and obesity across the explanatory variables, MDHS 2015-16

Variable		χ2	<i>p</i> -value			
	BMI <23	23≥ BMI <27.5	BMI ≥27.5]		
Age Group (years)						
15-24	82.4	14.3	3.3	173.8569	< 0.0001	
25-34	60.4	27.6	12.0			
35-49	47.7	34.0	18.3			
Place of Residence						
Urban	51.0	31.1	17.9	258.4282	< 0.0001	
Rural	65.6	24.6	9.8			
Region of Residence						
Kachin	54.6	30.0	15.4	240.1499	< 0.0001	
Kayah	63.3	27.1	9.6			
Kayin	59.1	27.1	13.8			
Chin	71.7	23.9	4.4			
Sagaing	58.7	27.7	13.6			
Taninthayi	57.0	28.6	14.4			
Bago	64.5	25.9	9.6			
Magway	67.7	24.0	8.3			
Mandalay	64.2	25.4	10.5			
Mon	59.7	25.0	15.3			
Rakhine	75.3	19.2	5.5			
Yangon	49.7	33.8	16.5			
Shan	60.2	25.7	14.1			
Ayeyarwaddy	64.8	23.3	11.8			
Naypyitaw	63.3	26.0	10.7			
Highest Educational Status						
No formal education	65.4	25.3	9.3	40.4818	0.0003	
Primary	59.8	27.6	12.6			
Secondary	63.1	25.3	11.6			
Higher	56.6	28.1	15.3			

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Current Employment Status					
Yes	61.2	26.6	12.2	0.2181	0.9348
No	61.6	26.4	12.0		
Wealth Index					
Poorest	75.2	18.6	6.2	427.7143	< 0.0001
Poorer	66.8	25.0	8.2		
Middle	61.5	28.0	10.5		
Richer	57.2	28.2	14.6		
Richest	49.9	30.9	19.2		
Parity					
0	75.2	18.4	6.4	759.5925	< 0.0001
1	55.5	30.8	13.7		
2	49.4	32.7	17.9		
3	45.6	36.1	18.3		
3+	54.0	30.4	15.6		
Frequency of viewing					
Television					
Not at all	67.2	24.5	8.3	89.6916	< 0.001
Less than once a week	63.3	25.9	10.8		
At least once a week	58.5	27.5	14.0		

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BMI, body mass index; MDHS, Myanmar Demographic and Health Survey.

Multinomial logistic regression was fitted to find out the association between frequency of viewing television and overweight and obesity. The results are presented in Table 4. In the final model after adjusting for age, place and region of residence, wealth index, highest educational status, current employment status and parity, it was found that, women who watched television at least once a week were 1.3 times higher odds of being obese than the women who never watched television (ARRR: 1.334, 95% CI: 1.089- 1.635; *p*-value=0.006). However, the frequency of watching television and overweight revealed no statistically significant association.

When stratified by urban and rural residence, neither overweight nor obesity showed any significant association with frequency of viewing television in the urban areas. However, in the rural areas, women who viewed television least once a week had 1.4 times likely to be obese than those who didn't watch television at all (ARRR: 1.399, 95% CI: 1.113- 1.759; *p*-value=0.004).

Table 4: Association between the frequency of viewing Television and overweight and obesity among reproductive age women

of Myanmar, MDHS 2015-16

Frequency of viewing Television	Overweight (23≥ BMI <27.5)				Obesity (BMI ≥27.5)			
	CRRR	<i>p</i> -value	ARRR	<i>p</i> -value	CRRR	<i>p</i> -value	ARRR	<i>p</i> -value
Total:								
Not at all	Ref		Ref		Ref		Ref	
Less than once a week	1.122 (0.940 - 1.340)	0.201	0.990 (0.822- 1.193)	0.919	1.371 (1.075- 1.748)	0.011	1.063 (0.831- 1.358)	0.627
At least once a week	1.287 (1.127- 1.469)	<0.000	1.076 (0.928- 1.248)	0.331	1.931 (1.595- 2.337)	<0.000 1	1.334 (1.089- 1.635)	0.006
In Urban Area:								
Not at all	Ref		Ref		Ref		Ref	
Less than once a week	1.285 (0.830- 1.990)	0.258	0.948 (0.562- 1.600)	0.841	1.081 (0.635- 1.840)	0.773	0.948 (0.562- 1.600)	0.841
At least once a week	1.316 (0.886- 1.954)	0.171	1.117 (0.738- 1.691)	0.597	1.242 (0.839- 1.841)	0.276	1.117 (0.738- 1.691)	0.597
In Rural Area:								
Not at all	Ref		Ref		Ref		Ref	
Less than once a week	1.036(0.850- 1.262)	0.727	0.947(0.771-1.161)	0.598	1.273 (0.966-1.678)	0.086	1.055 (0.801- 1.380)	0.702
At least once a week	1.101(0.955- 1.268)	0.184	1.040 (0.891- 1.215)	0.616	1.607 (1.289- 2.004)	<0.000 1	1.399 (1.113- 1.759)	0.004

MDHS, Myanmar Demographic and Health Survey; CRRR, Crude Relative Risk Ratio; ARRR, Adjusted Relative Risk Ratio.

Adjusted for age, place of residence, region of residence, highest educational status, current employment status, wealth index, and parity.

Model goodness-of-fit: To assess the internal validity of the regression model, the F-adjusted mean residual goodness-of-fit test was used. The p-value of the F statistics of the adjusted model was <0.001, indicating an acceptable model fitness

DISCUSSION

To the best of our knowledge, this is the first study to utilize a nationally representative sample to examine the association between frequency of television viewing with the prevalence of overweight and obesity among women of reproductive age group in Myanmar. The prevalence of overweight and obesity was higher among the women living in the urban areas than the in rural areas. This finding is consistent with the study done in other South and South East Asian countries as well as in the other continents. Urban women had a higher frequency of television watching. Similar findings were reported in studies conducted in Bangladesh. This may be due to higher coverage of electricity and a availability of many satellite channels in the urban area in comparison to the rural areas.

It was found in our study that among rural women, the prevalence of obesity was significantly associated with watching television for at least once a week. This finding is also consistent with the finding from Bangladesh.²¹

Despite the frequency of watching television had no association with overweight and obesity among the urban women, they were more likely to be overweight/obese than the rural

women. This may be explained by the sedentary lifestyle and intake of high-calorie food by the urban residents, those determinants had overridden the effect of increased frequency of watching television. On the other hand, due to the presence of less developed transportation facilities, involvement in more laborious work and less consumption of obesogenic diets in the rural area, the prevalence of overweight/obesity is less there.²¹ Those who view television more frequently in the rural area; they are more prone to lead sedentary lifestyle and are at risk of developing obesity.^{21 49 50}

comparison with previous studies

The finding of our study is coherent with a recent study in Bangladesh which showed a positive association between frequency of television viewing and overweight/obesity in women of reproductive age group.²¹ In the context of developed countries (for example, USA and Australia) a positive association between the increased frequency of television viewing and overweight/obesity has been found.^{34 36-38} In a recently published multi-country study, this association has also been observed in case of children and adolescents.⁵¹

policy and program implications

High prevalence of overweight/obesity is associated with increased NCD burden in Myanmar, as shown in the recent evidence. With the economic development of the country, people of Myanmar are getting more used to with sedentary lifestyle and obesogenic food, which, in turn, is raising the burden of overweight/obesity. Considering the epidemiologic,

demographic, and nutritional transition, the policy makers of Myanmar should focus on the prevention and control of both overweight/obesity and NCDs. Newly released 'Myanmar National Health Plan 2017-2021' incorporates the prevention and control programs of NCDs. ⁵³ Along with this, Social Behavioral Change Communication (SBCC) campaign should be developed in order to promote physical activity and create awareness among the population, specially among the children and the adolescents in order to prevent overweight/obesity at the beginning of the life. Further research should be performed among men and adolescents to determine whether this positive association exists among those target population or not.

STRENGTHS AND LIMITATIONS

This is the first study which utilized a nationally representative sample to examine the association between frequency of watching television with overweight/obesity among the reproductive age group women in Myanmar. However, the survey could not establish the temporal relationship between the exposure and outcome variables because of its cross-sectional design. The frequency of television viewing was measured in weeks, not in days/hours; the latter could have given more precise information. In the multivariable analysis, food habit and duration of physical activity were not included because this information was not collected in MDHS. Finally, there may be the presence of reporting bias while measuring the frequency of television watching.

CONCLUSIONS

The rising burden of obesity and overweight is now a global concern., Obesity ultimately leads an individual to develop NCDs and premature death. Our study results demonstrate that watching television is associated with obesity among women in Myanmar. Therefore, necessary steps should be taken to make people aware of harmful consequences of physical inactivity as well as to encourage them to in physical activity. Additional research is also warranted to explore the situation in the general population of Myanmar.

LIST OF ABBREVIATION

- ASEAN- Association of Southeast Asian Nations
- 311 BMI- Body Mass Index
- 312 GDP- Gross Domestic Product
- 313 GNI- Gross National Income
- 314 NCDs- Non-Communicable Diseases
- 315 MDHS- Myanmar Demographic and Health Survey
- 316 SBCC- Social Behavioral Change Communication
- 317 SEARO- South-East Asia Regional Office
- 318 USAID- United States Agency for International Development
- 319 USD- United States Dollar
- 320 WHO- World Health Organization
- 3MDG- Three Millennium Development Goal Fund

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Contributors

RDG, IHS, MH, IS and MS conceptualized the study. RDG, IHS, MH, IS, MRH and MS designed the study and acquired the data. RDG, IHS, MH and IS conducted the data analysis. RDG, IHS, MH, IS, MRH and MS interpreted the data. RDG, IHS, MH, IS and MRH prepared the first draft. RDG, IHS, MH, IS, MRH and MS participated in critical revision of the manuscript and contributed to its intellectual improvement. All authors went through the final draft and approved it for submission. RDG, IHS, MH and IS equally contributed in this work as first author.

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Competing Interests

339 None declared.

Patient consent

None Declared

Disclaimer

The authors are alone responsible for the integrity and accuracy of data analysis and the writing the manuscript.

Ethics approval

The datasets were obtained from DHS Programme with proper procedure. The study exempt from collecting ethical approval because the survey protocols were reviewed and approved by Ethics Review Committee on Medical Research including Human Subjects in the Department of Medical Research, Ministry of Health and Sports as well as from the ICF Institutional Review Board.

Data sharing statement

The dataset of MDHS 2015-16 is available at the Demographic and Health Surveys Program.

Extra data is available which is available on request at http://dhsprogram-com/what-we-

do/survey/survey-display-349.cfm.

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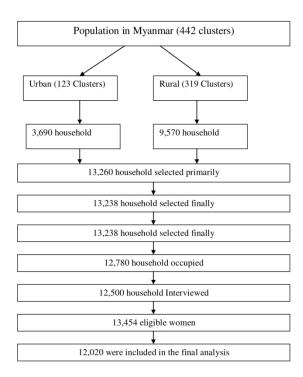
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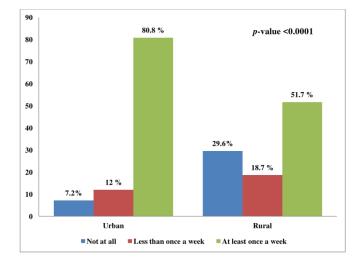
- **Figure 1:** Flowchart showing the process of selecting the participants in the survey
- Figure 2: Distribution of the respondents by place of residence with frequency of watching television

- **Supplementary Materials:**
- **Supplementary File 1:** STROBE Checklist
- Supplementary File 2: Supplementary Table 1: Adjusted odds ratios for factors associated with
- overweight and obesity compared to normal weight among women of Myanmar, MDHS 2015-
- 518 16.
- **Supplementary File 3:** Supplementary Table 2: Adjusted odds ratios for factors associated with
- overweight and obesity compared to normal weight for urban area among women of Myanmar,
- 521 MDHS 2015-16.
- **Supplementary File 4:** Supplementary Table 3: Adjusted odds ratios for factors associated with
- overweight and obesity compared to normal weight for rural area among women of Myanmar,
- 524 MDHS 2015-16.

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Flowchart showing the process of selecting the participants in the survey $143x186mm\;(300\;x\;300\;DPI)$



Distribution of the respondents by place of residence with frequency of watching television $143 \times 186 \text{mm} \ (300 \times 300 \text{ DPI})$

Supplementary Table 1: Adjusted odds ratios for factors associated with overweight and obesity compared to normal weight among women of Myanmar, MDHS 2015-16.

Variable	Ove	erweight (23≥	BMI <27.5)		C	besity (BN	4I ≥27.5)	
Age Group (years)	Adjusted RRR 95%		6 CI	<i>p</i> -value	Adjusted RRR	95%	<i>p</i> -value	
		Lower Limit	Upper Limit			Lower Limit	Upper Limit	
15-24	Ref				Ref			
25-34	2.014178	1.716823	2.363035	<0.0001	3.453528	2.5303 29	4.7135 58	<0.0001
35-49	3.047071	2.576591	3.60346	<0.0001	6.250267	4.5563 71	8.5738 92	<0.0001
Place of Residence								
Urban	Ref				Ref			
Rural	0. 7866087	0.662566	0.933874	0.006	0.6516484	0.5244 415	0.8097 104	<0.0001
Region of Residence								
Kachin	Ref				Ref			
Kayah	0.7747752	0.535260 7	1.121466	0.176	0.5308337	0.3379 477	0.8338 106	0.006
Kayin	0.865386	0.630181	1.188377	0.371	0.8680791	0.6063 682	1.2427 45	0.439
Chin	0.6542445	0.456842	0.936944 4	0.021	0.2413828	0.1530 058	0.3808 067	<0.0001
Sagaing	0.871381	0.619034 6	1.226595	0.429	0.8686633	0.6093 857	1.2382 57	0.435
Taninthayi	1.024705	0.740834 8	1.417348	0.882	1.030117	0.6931 852	1.5308 19	0.883
Bago	0.7593014	0.554719	1.039334	0.085	0.5695773	0.3946 052	0.8221 339	0.003
Magway	0.6498518	0.459306 9	0.919445	0.015	0.4745499	0.3306 871	0.6809 992	<0.0001
Mandalay	0.6863519	0.495081	0.951517	0.024	0.5367759	0.3719	0.7747	0.001

		7	6			034	399	
Mon	0.7907257	0.542886	1.151709	0.220	0.9121818	0.5952	1.3977	0.672
WIOII	0.1701231	6		0.220	0.7121010	813	86	0.072
Rakhine	0.6639056	0.460749	0.956638	0.028	0.4831741	0.3258	0.7165	<0.0001
		3	6			298	004	
Yangon	1.122907	0.796641	1.582797	0.507	0.8897992	0.6200 706	1.2768 59	0.525
Shan	0.84052	0.589794 8	1.19783	0.336	0.9392429	0.6368 666	1.3851 84	0.751
Ayeyarwaddy	0.7594529	0.545486	1.057347	0.103	0.8496266	0.5608 967	1.2869 85	0.441
Naypyitaw	0.744938	0.529284 9	1.048457	0.091	0.5791332	0.3768 765	0.8899 341	0.013
Highest Educational Status								
No Formal Education	Ref				Ref			
Primary	1.153131	0.956893	1.389614	0.134	1.465104	1.1371 68	1.8876 11	0.003
Secondary	1.193937	0.945784 6	1.507198	0.136	1.466041	1.0759 91	1.9974 85	0.015
Higher	1.038379	0.778352 9	1.385272	0.797	1.211783	0.8417 414	1.7445	0.301
Marital Status								
Single	Ref				Ref			
Married	1.574419	1.251288	1.980995	<0.0001	1.878905	1.2909 44	2.7346 55	0.001
Separated/ Divorced/ Widowed	1.052985	0.797765 7	1.389854	0.715	0.9991828	0.6415 03	1.5562 92	0.997
Currently employment								
No	Ref				Ref			
Yes	1.046469	0.922830	1.186673	0.478	1.113853	0.9502 117	1.3056 76	0.183
Wealth index								

Poorest	Ref				Ref			
Poorer	1.463942	1.227376	1.746103	<0.0001	1.446222	1.0736 28	1.9481 21	0.015
Middle	1.859199	1.530768	2.258096	<0.0001	2.117198	1.5618 36	2.8700 35	<0.0001
Richer	1.947941	1.576063	2.407564	<0.0001	2.913029	2.1333 31	3.9776 93	<0.0001
Rich	2.276987	1.771738	2.926319	<0.0001	4.003093	2.8194 04	5.6837 36	<0.0001
Parity								
0	Ref	<u> </u>			Ref			
1	1.448628	1.135308	1.848419	0.003	1.529933	1.0304 49	2.2715 29	0.035
2	1.414514	1.100211	1.818606	0.007	1.677003	1.1357 06	2.4762 89	0.009
3	1.601212	1.231188	2.082445	<0.0001	1.808826	1.2260 71	2.6685 67	0.003
3+	1.243818	.9581223	1.614704	0.101	1.601881	1.0739 8	2.3892 66	0.021
Frequency of watching TV								
Not at all	Ref				Ref			
Less than once a week	0.9904753	0.822553 6	1.192678	0.919	1.062536	0.8313 49	1.3580 14	0.627
At least once a week	1.076105	0.927818 4	1.248092	0.331	1.333905	1.0880 42	1.6353 26	0.006

Supplementary Table 2: Adjusted odds ratios for factors associated with overweight and obesity compared to normal weight for urban area among women of Myanmar, MDHS 2015-16.

Variable	Ove	C	Obesity (BMI ≥27.5)					
Age Group (years)	Adjusted RRR	95%	6 CI	<i>p</i> -value	Adjusted RRR	959	% CI	<i>p</i> -value
		Lower Limit	Upper Limit			Lower Limit	Upper Limit	
15-24	Ref				Ref			
25-34	1.99629	1.511645	2.636315	<0.0001	4.662324	2.9413 63	7.39019 9	<0.0001
35-49	3.631152	2.661972	4.953195	<0.0001	11.90942	7.4392 11	19.0657 7	<0.0001
Region of Residence								
Kachin	Ref				Ref			
Kayah	0.6197694	0.341586 5	1.1245	0.114	0.535549	0.2663 595	1.07678 8	0.079
Kayin	0.9026549	0.633261	1.286651	0.568	0.9352865	0.5386 067	1.62411 8	0.811
Chin	1.010079	0.609345 9	1.674352	0.969	0.4215907	0.2488 876	.714132 5	0.002
Sagaing	0.8465951	0.554011 7	1.293697	0.438	1.131411	0.6621 374	1.93327 1	0.649
Taninthayi	0.6013035	0.347251 6	1.041222	0.069	0.5079112	0.2597 578	0.99313 21	0.048
Bago	0.7487075	0.457641	1.224897	0.246	0.4372885	0.2406 765	0.79451 56	0.007
Magway	0.3872192	0.166439 6	.9008591	0.028	0.5108682	0.2888 877	0.90341 8	0.021
Mandalay	0.8098875	0.558131 7	1.175202	0.264	0.8457557	0.4863 151	1.47086 3	0.550
Mon	0.5160773	0.276257 7	.9640843	0.038	0.6199155	0.2671 926	1.43827	0.263
Rakhine	0.5414014	0.377641	.7761741	0.001	0.6079698	0.3650	1.01241	0.056

		3				95	4	
Yangon	0.9914488	0.651252 6	1.509354	0.968	1.015649	0.5795 707	1.7798 41	0.956
Shan	0.8882496	0.557285 2	1.415769	0.615	1.158867	0.5529 16	2.4288 9	0.694
Ayeyarwaddy	0.6028135	0.360625 4	1.00765	0.053	1.081547	0.5686 131	2.0571 89	0.809
Naypyitaw	0.8093038	0.518803	1.262468	0.348	0.5976147	0.2742 415	1.3022 95	0.193
Highest Educational Status								
No Formal Education	Ref				Ref			
Primary	0.9969074	0.574876 5	1.728761	0.991	1.25865	0.7212 307	2.1965 23	0.415
Secondary	0.923249	0.550566 4	1.548203	0.760	1.322484	0.7063 417	2.4760 86	0.379
Higher	0.8297145	0.473439	1.454096	0.511	0.9428715	0.4966 776	1.7899 07	0.856
Marital Status								
Single	Ref				Ref			
Married	1.706656	1.134786	2.566718	0.011	1.307464	0.7423 622	2.3027 32	0.350
Separated/ Divorced/ Widowed	1.403443	0.859922	2.2905	0.173	0.784481	0.4185 441	1.4703 6	0.445
Currently employment								
No	Ref				Ref			
Yes	1.1686	0.883859	1.545072	0.271	1.423277	1.0829 64	1.8705 29	0.012
Wealth index								
Poorest	Ref				Ref			
Poorer	1.637195	0.845656 8	3.169616	0.142	1.029602	0.2450 144	4.3266 06	0.968
Middle	1.575722	0.759095	3.270869	0.220	2.615763	0.9747	7.0191	0.056

		2				966	22	
Richer	2.159063	1.090346	4.275298	0.028	3.797769	1.3686 44	10.538	0.011
Rich	2.366448	1.198188	4.673787	0.014	4.987571	1.7154 19	14.501 33	0.004
Parity								
0	Ref				Ref			
1	1.324264	0.821752 6	2.134067	0.246	1.606277	0.8523 954	3.0269 12	0.141
2	1.156168	0.729670 7	1.831955	0.533	1.465602	0.8190 305	2.6225 98	0.196
3	1.479512	0.900030	2.432093	0.121	1.931239	1.0921 53	3.4149 8	0.024
3+	1.097445	0.674996	1.784286	0.705	1.970916	1.0695 89	3.6317 77	0.030
Frequency of watching TV								
Not at all	Ref				Ref			
Less than once a week	0.9481362	0.561730	1.600344	0.841	0.9481362	0.5617 306	1.6003 44	0.841
At least once a week	1.1173	0.738124	1.69126	0.597	1.1173	0.7381 243	1.6912 6	0.597
					7/1			

Supplementary Table 3: Adjusted odds ratios for factors associated with overweight and obesity compared to normal weight for rural area among women of Myanmar, MDHS 2015-16.

Variable	Ove	Obesity (BMI ≥27.5)						
Age Group (years)	Adjusted RRR	95%	ό CI	<i>p</i> -value	Adjusted RRR	95%	<i>p</i> -value	
.		Lower Limit	Upper Limit		·	Lower Limit	Upper Limit	
15-24	Ref				Ref			
25-34	1.993053	1.645366	2.414212	<0.0001	2.662185	1.7662 48	4.01259	<0.0001
35-49	2.837788	2.322254	3.467769	<0.0001	4.037205	2.6378 31	6.17895	<0.0001
Region of Residence								
Kachin	Ref		1		Ref			
Kayah	0.8581715	0.527692 5	1.39562	0.536	0.512983	0.2832 599	0.92901 07	0.028
Kayin	0.8802213	0.566909 8	1.366689	0.569	0.8355287	0.5274 436	1.32356 9	0.443
Chin	0.5510667	0.335535 6	.905044	0.019	0.1779341	0.0820 571	0.38583 56	<0.0001
Sagaing	0.9185937	0.583784	1.445422	0.713	0.8014693	0.5151 804	1.24685 1	0.325
Taninthayi	1.242773	0.810830 7	1.904818	0.317	1.292552	0.8196 49	2.03829	0.268
Bago	0.7871062	0.517521	1.197123	0.262	0.6241537	0.3969 461	0.98141 23	0.041
Magway	0.7377705	0.474342 6	1.147494	0.176	0.4485698	0.2820 159	0.71348 76	0.001
Mandalay	0.6591658	0.416675 1	1.042778	0.075	0.4312958	0.2610 264	0.71263 32	0.001
Mon	0.9603201	0.5975	1.543456	0.867	1.121258	0.7191 246	1.74826 4	0.612
Rakhine	0.7224051	0.447117	1.167186	0.183	0.4226528	0.2468	0.72356	0.002

		2				825	45	
Yangon	1.331271	0.809228 8	2.190087	0.259	0.8599715	0.5528 334	1.33774 7	0.502
Shan	0.8526008	0.526012 8	1.381959	0.516	0.8601828	0.5482 5	1.34959 3	0.511
Ayeyarwaddy	0.8402438	0.542896 9	1.300449	0.434	0.7797158	0.4609 332	1.31896 9	0.352
Naypyitaw	0.7125468	0.441512 7	1.149962	0.165	0.5826169	0.3610 18	.940237	0.027
Highest Educational Status								
No Formal Education	Ref				Ref			
Primary	1.155671	0.943010 1	1.416289	0.163	1.475255	1.1063 83	1.96710 9	0.008
Secondary	1.25736	0.954780 5	1.655829	0.103	1.410123	0.9838 434	2.0211	0.061
Higher	1.028378	0.693413	1.525153	0.889	1.541224	0.9218 403	2.57677	0.099
Marital Status								
Single	Ref				Ref			
Married	1.446478	1.08462	1.929057	0.012	2.684179	1.6122 73	4.46873	<0.0001
Separated/ Divorced/ Widowed	0.8678572	0.607186 7	1.240436	0.436	1.35682	0.7291 331	2.52486 3	0.334
Currently employment								
No	Ref				Ref			
Yes	1.011636	0.889311 1	1.150787	0.860	0.9643305	0.7881 907	1.17983 3	0.723
Wealth index								
Poorest	Ref				Ref			
Poorer	1.467707	1.218223	1.768285	<0.0001	1.534762	1.1383 91	2.06914	0.005
Middle	1.943905	1.577616	2.395239	< 0.0001	2.15362	1.5570	2.97882	< 0.0001

Richer				<0.0001		2 0055	-	<0.0001
Richer	1.933188	1.529228	2.443857	<0.0001	2.907661	2.0955 6	4.03448	<0.0001
Rich	2.326294	1.669484	3.241508	<0.0001	4.025519	2.6577 61	6.09716 2	<0.0001
Parity								
0	Ref				Ref			
1	1.529117	1.149527	2.034053	0.004	1.450185	0.8730 671	2.40879 1	0.151
2	1.553539	1.143311	2.110961	0.005	1.755926	1.0416 18	2.96008 4	0.035
3	1.731549	1.254656	2.389708	0.001	1.762302	1.0375	2.99336 7	0.036
3+	1.367349	0.995245 8	1.878574	0.054	1.480344	0.8671 131	2.52725 7	0.150
Frequency of watching TV								
Not at all	Ref			· ·	Ref			
Less than once a week	0.9466965	0.771626	1.161488	0.598	1.054994	0.8013 967	1.38884	0.702
At least once a week	1.040453	0.890802 1	1.215246	0.616	1.399062	1.1126 4	1.75921 7	0.004
					77			

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of cross-sectional studies

Title of the study: Frequency of Television viewing and prevalence of overweight and obesity among women of the reproductive age group in Myanmar: Results from a nationwide survey

Section/Topic	Item #	Recommendation	Reported on page
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	3-4
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6-8
Objectives	3	State specific objectives, including any prespecified hypotheses	7-8
Methods			
Study design	4	Present key elements of study design early in the paper	8-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	8-9
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants	8-9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10-12
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-10
Bias	9	Describe any efforts to address potential sources of bias	12
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	12-13
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	12-13
		(b) Describe any methods used to examine subgroups and interactions	12-13

		(c) Explain how missing data were addressed	12-13
		(d) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(e) Describe any sensitivity analyses	Not applicable
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for	14
		eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	
		(b) Give reasons for non-participation at each stage	Not applicable
		(c) Consider use of a flow diagram	Not applicable
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	14
		(b) Indicate number of participants with missing data for each variable of interest	14
Outcome data	15*	Report numbers of outcome events or summary measures	17
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95%	20
		confidence interval). Make clear which confounders were adjusted for and why they were included	
		(b) Report category boundaries when continuous variables were categorized	Not applicable
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion			
Key results	18	Summarise key results with reference to study objectives	22
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both	24
		direction and magnitude of any potential bias	
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses,	22-24
		results from similar studies, and other relevant evidence	
Generalisability	21	Discuss the generalisability (external validity) of the study results	22-24
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original	26
-		study on which the present article is based	

^{*}Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

 Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.



BMJ Open

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

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Keywords:	Obesity, Overweight, Noncommunicable Disease, Myanmar

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- 1 Title: Frequency of Television viewing and association with overweight and
- obesity among women of the reproductive age group in Myanmar: Results
- 3 from a nationwide cross-sectional survey
- 5 Authors:
- 6 Rajat Das Gupta+*a,b, Ibrahim Hossain Sajal+a,b, Mehedi Hasan+a,b, Ipsita Sutradhar+a,b,
- 7 Mohammad Rifat Haider^c, Malabika Sarker^{a,b,d}
- 9 Author's address and positions:
- ^a Centre for Non-Communicable Diseases and Nutrition, BRAC James P Grant School of Public
- Health, BRAC University, 68 Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka, 1212,
- 12 Bangladesh
- b Centre for Science of Implementation and Scale-Up, BRAC James P Grant School of Public
- 14 Health, BRAC University, 68 Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka, 1212,
- 15 Bangladesh
- ^c Department of Health Services Policy and Management, Arnold School of Public Health,
- 17 University of South Carolina, Columbia, South Carolina, United States of America

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- d Institute of Public Health, University of Heidelberg, Heidelberg, 69120, Germany
- + These authors contributed equally to this work
- 21 * Corresponding author:
- 22 Rajat Das Gupta, Research Associate, BRAC James P Grant School of Public Health, BRAC
- University, 68 Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka 1212, Bangladesh.
- 24 Email: rajat89.dasgupta@gmail.com

ABSTRACT

- Objectives: This study aimed to discern the association between the frequency of television
- viewing and overweight/obesity among reproductive age women of Myanmar.
- **Design:** This was a cross-sectional study.
- **Setting:** This study used Myanmar Demographic and Health Survey (2015-16) data.
- Participants: Total of 12,021 women both aged 15-49 years and also not pregnant or did not
- 31 deliver a child within the two months prior to the survey were included.
- **Primary and secondary outcome measures:** The primary outcome was overweight (23.0 to
- $<27.5 \text{ kg/m}^2$) and obesity ($\ge 27.5 \text{ kg/m}^2$), which was measured using the Asian BMI cut off.
- 34 Ordered logistic regression analysis was conducted to find the association between the
- 35 explanatory and outcome variables.
- Results: The prevalence of overweight was 26.5% and obesity was 12.2% among the study
- participants. The odds of being overweight/obese were 20% higher (adjusted odds ratio (AOR):
- 1.16, 95% CI: 1.02-1.32; p-value = 0.023) among those who watched television at least once a
- week compared to those who did not watch television at all.. Rural women who watched
- 40 television at least once a week were 1.2 times more likely to be obese (AOR: 1.16, 95% CI: 1.01-
- 1.34; p-value = 0.040) compared to those who did not watch television at all.
- 42 Conclusions: Frequent television watching was associated with obesity among rural women of
- 43 reproductive age in Myanmar.
- **Key words:** Obesity, Overweight, Non-communicable Disease, Myanmar
 - 3 | Page

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- This study utilized a nationally representative sample to investigate the association between the frequency of television viewing and overweight/obesity among women of reproductive age from Myanmar.
 - This study utilized standard and valid tools for data collection. The probability of the
 existence of measurement error is lower in this study in comparison to other cross-sectional
 studies conducted in Myanmar.
- Temporal relationship could not be established due to cross-sectional nature of the survey.
- The frequency of television viewing was measured in weeks, not in days/hours; the latter could have given more precise information.
- In the multivariable analysis, food habit and duration of physical activity were not included because that information was not collected in the survey.

INTRODUCTION

Both developed and developing countries are facing the increasing burden of overweight and obesity, which are posing as major public health problems. 1-3 The prevalence of overweight and obesity increased by 27.5% among the global adult population and 47.1% among the global child population between 1980 and 2013. During the same time period, globally, the prevalence of overweight and obesity rose from 29.8% to 38.0% among adult females, in particular. Although this burden is lowest in South and Southeast Asia, countries of this region are still experiencing the rising burden of overweight and obesity. Myanmar is a low and middle-income country (LMIC) situated in the Southeast Asia region. In 2015-16, the first Myanmar Demographic and Health Survey (MDHS) was conducted using a nationally representative sample across the country. The survey found a high prevalence of overweight and obesity among women of reproductive age.

Overweight and obesity is an important risk factor for the development of several non-communicable diseases (NCDs) like diabetes mellitus ⁸, hypertension⁹, cardiovascular diseases ¹⁰, cancer¹¹ and chronic kidney diseases ¹² In addition, overweight and obese women experience complications during pregnancy (gestational diabetes mellitus, pre-eclampsia and eclampsia) more frequently than women of normal body weight. ¹³ ¹⁴

It has been found that energy expenditure is very low among people who spend their leisure time watching television, rather than being involved in physical activities like playing games, gardening, etc. This ultimately increases their risk of gaining excessive body weight.¹⁵ ¹⁶ Television watching is also associated with an increase in energy intake, which may sometimes

be attributable to their frequent exposure to television advertisements of foods and beverages and the subsequent consumption of said foods and beverages. 17-21

Across the world, many studies have shown a positive association between the increased frequency of television viewing and overweight/obesity. In the USA and Australia, it has been found that people who view television more frequently are at higher risk of being overweight/obese. 20 22-24 A study from Bangladesh has found that watching television frequently (at least once a week) was associated with obesity among women of reproductive age.²⁵ However, this association has not been explored in other South and Southeast Asian countries including Myanmar. Therefore, this study was conducted to determine the association between television viewing and the prevalence of overweight and obesity among women of reproductive age in Myanmar using the MDHS 2015-16 data.

METHODS

study settings

According to the 2014 census, the total population of Myanmar was 51.5 million with a population density of 76 persons per square kilometer (km²). The country is home to 135 ethnic groups. ²⁶ ²⁷ The *Gross Domestic Product (GDP)* growth rate of Myanmar was 6.4% and per capita, Gross National Income (GNI) was 1,455 USD in 2016-17. More than a quarter (26.1%) of the population was living under the poverty line in 2014. Myanmar also has the lowest life expectancy at birth (66.6 years) among the Association of Southeast Asian Nations (ASEAN). ²⁶

study design

This study analyzed the data of MDHS 2015-16, the first Demographic and Health Survey of Myanmar.⁶ The detailed method has been published previously.⁶ MDHS 2015-16 was a cross-sectional survey which used a nationally representative sample and was conducted through a joint collaboration between the Ministry of Health and Sports of Myanmar and ICF International. The United States Agency for International Development (USAID) and Three Millennium Development Goal Fund (3MDG) provided financial support for the survey. Twostage cluster sampling techniques were used for sample selection. The sample was stratified for each of the seven states and eight regions of Myanmar. At the first stage, 442 clusters (urban: 123 and rural: 319) were selected randomly from a sample frame of 4,000 clusters. At the second stage, 30 households were selected from each of the clusters. In total, 13,260 households were selected for the final sample. The target group of this study was women of reproductive age (15-49 years). The permanent residents and the visitors who stayed in the selected households the night before the date of data collection were included in the questionnaire survey. Around 96% of eligible women agreed to participate in the survey. Among them, 98% agreed for anthropometric measurement. However, pregnant women and women who had given birth within the preceding two months of the survey were excluded. The final weighted sample size of this study was 12,021 (Figure 1).

survey tools and data collection

A standard woman's questionnaire used by the DHS program was adopted and modified according to the local context and pre-tested to collect the socio-demographic information (e.g. age, sex, household wealth index and place of residence) through face-to-face interviews.

Trained field staff carried out the interviews and anthropometric measurements. Measuring boards specially made by Shorr Productions were used for height measurement and lightweight SECA scales with digital screens were used for measuring the weight of the respondents.

The main outcome variables of this study were overweight and obesity. To define these variables, an Asia specific body mass index (BMI) cut-off value was used.²⁹ Women having a BMI $<23.0 \text{ kg/m}^2$ were considered to be normal weight or underweight, women having a BMI between 23.0 kg/m² and $<27.5 \text{ kg/m}^2$ were considered to be overweight and women having a BMI $\ge 27.5 \text{ kg/m}^2$ were considered to be obese.

The main explanatory variable of interest for this study was the frequency of viewing television. Data were collected as the following categories: (1) not viewing television at all, (2) viewing television less than once a week, and (3) viewing television at least once a week. The other independent variables considered based on the literature review were age group, place of residence, region of residence, education, wealth quintile, current working status, parity and number of household members in the family. The categories of the variables are mentioned in Table 1.

Table 1: List of variables considered for the study

Name of the Variables	Categories
Outcome Variables:	
Body Mass Index (BMI)	a) 0= Normal weight or underweight (BMI <23 kg/m²)
	b) 1= Overweight (BMI 23.0 kg/m ² to <27.5 kg/m ²)
	c) 2= Obesity (BMI ≥27.5 kg/m²)

Explanatory Variable:	
Frequency of Viewing Television	a) 0= Not at all
	b) 1= Less than once a week
	c) 2= At least once a week
Covariates:	
Covariates.	
1. Age Groups	a) 0= 15-24 years
O ₂	b) 1= 25-34 years
	c) 2= 35-49 years
2. Place of Residence	a) 0= Urban
	b) 1= Rural
3. Region of Residence	a) 0= Kachin
	b) 1= Kayah
	c) 2= Kayin
	d) 3= Chin
	e) 4= Sagaing
	f) 5= Taninthayi
	g) 6= Bago
	h) 7= Magway
	i) 8= Mandalay
	j) 9= Mon
	k) 10= Rakhine
	l) 11= Yangon

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	m) 12= Shan
	n) 13= Ayeyarwaddy
	o) 14= Naypyitaw
4. Education	a) 0= No education
	b) 1= Primary education
	c) 2= Secondary education
	d) 3= Higher education
5. Wealth quintile	a) 0= Poorest
10	b) 1= Poorer
	c) 2= Middle
	d) 3= Richer
	e) 4= Richest
6. Current working status	a) 0= Yes
	b) 1= No
7. Parity	a) 0= 0 (nullipara)
	b) 1= 1 (primipara)
	c) 2= 2
	d) 3= 3
	e) 4=>3
8. Number of Household Members	a) 0= ≤5
	b) 1=>5

data analysis

Weighted descriptive statistics (frequency and percentage) were used to present the socio-demographic characteristics of the respondents. A chi-square (γ^2) test was performed to determine whether the groups differed in terms of the explanatory variables according to the BMI status. To find the association between the explanatory and outcome variables, ordered logistic regression analysis was conducted. Initially, bivariate analyses were done. Variables which showed a *p-value* < 0.20 in bivariate analyses were included in the multivariable model. This value of 0.2 was considered significant to prevent residual confounding in multivariable analysis.³⁰ The variables which showed p-value < 0.05 in multivariable analysis were considered to be statistically significant. Both the unadjusted Crude Odd Ratio (COR) and Adjusted Odds Ratio (AOR) were reported. Variance inflation factors (VIF) were assessed to check multicollinearity among the variables; however, no significant multicollinearity was observed. A test for interaction effect between the frequency of TV viewing and the place of residence was performed; however, no significant interaction effect was observed. The cluster effect was adjusted during analysis. All the analyses was done using Stata 13.0. The authors followed the guidelines outlined in the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement in writing the manuscript (Supplementary File 1).

ethical consideration

MDHS received ethical approval from the Ethics Review Committee on Medical Research including Human Subjects in the Department of Medical Research, Ministry of Health and Sports as well as from the ICF Institutional Review Board. Written informed consent was

patient Involvement

Patients were not involved in the study.

FINDINGS

socio-demographic characteristics of the respondents

The data of 12,021 weighted samples were analyzed. More than a quarter (26.5%) of the study participants were overweight, and 12.2% of them were obese (Figure 2). The sociodemographic characteristics of the respondents along with the prevalence of the three categories of BMI across the independent variables with the associated chi-square (χ 2) value are presented in Table 2. The majority of the study participants was aged between 35 and 49 years (42.3%) and was residing in the rural area (70.8%). The highest proportion of participants was from the Yangon Region (15.1%), followed by the Ayeyarwaddy Region (12.5%) and the Mandalay Region (12.2%), whereas the lowest participation was from the Kayah Region (0.5%). Around half of the respondents (41.3%) were educated up to the primary level and about one-third (36.1%) received secondary level education; furthermore, 10.2% received higher education and 12.4% received no education. More than two-thirds (68.1%) of the women were employed at the time of interview. Nearly two-fifths of the women (41.7%) were nulliparous, while cumulatively a similar proportion of respondents (46.6%) had the experience of being pregnant- once (15.3%), twice (15.8%), thrice (11.7%) and more than three times (15.5%). The highest proportion of the

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respondents belonged to the richest wealth quintile (22.2%) followed by richer (21.1%) and middle (20.9%) quintile. Among the study participants, the majority (60.1%) reported that they watched television at least once a week; however, 23.1% did not watch television at all and 16.8% watched television less than once a week. Except for current employment status, significant differences were found among the BMI of women across the explanatory variables. The prevalence of overweight and obesity increased with age (*p*-value <0.0001) and was the most common in the Yangon and Kachin Region (*p*-value <0.0001). This prevalence was also higher in the urban areas compared to the rural areas (overweight: 31.1% versus 24.6%; obesity: 17.9% versus 9.8%; *p*-value <0.0001). Plausibly, Women with higher educational status, having two children and belonging to the richest wealth group had a higher prevalence of overweight and obesity (*p*-value <0.0001). The prevalence of overweight and obesity was also higher among the individuals who used to watch television at least once a week (*p*-value <0.0001) (Table 2).

7.07

, , , , , , , , , , , , , , , , , , ,	DHS 2015-16 (N= 12,021)			680 o		
Variable	BMJ Open Color of the study participants and prevalence		BMI Status (%)	Status (%)		<i>p</i> -value
		BIVII <23	23 ≥ BIVII < 27.5	BIVII <u>≥</u> 45/Parces		
Age Group (years)				n 20 reig		
15-24	3433 (28.6)	82.4	14.3	3.3 to 13.9	173.9	<0.0001
25-34	3504 (29.1)	60.4	27.6	12.0	_	
35-49	5084 (42.3)	47.7	34.0	18.3 a 25		
Place of Residence				it ar		
Urban	3505 (29.2)	51.0	31.1	17.95 हो है	258.4	<0.0001
Rural	8516 (70.8)	65.6	24.6	9.8 a r fr		
Region of Residence				O March 2019. Downloaded from http://Enseignement Superieur (ABES). 12.0 text and data mining 9.8 mining		
Kachin	334 (2.8)	54.6	30.0	15.4 p · S	240.1	<0.0001
Kayah	60 (0.5)	63.3	27.1	9.6 a open		
Kayin	274 (2.3)	59.1	27.1	9.6and		
Chin	90 (0.8)	71.7	23.9	9.6 Al training and simil	_	
Sagaing	1351 (11.3)	58.7	27.7	13.6 c June	_	
Taninthayi	265 (2.2)	57.0	28.6	4.4 similar technologies. 14.4 similar technologies. 9.6s.		
Bago	1197 (9.9)	64.5	25.9	9.6 s . at A	_	
Magway	1030 (8.6)	67.7	24.0	8.3 gence		
Mandalay	1462 (12.2)	64.2	25.4	10.5 Biblio graphique de s.xhtml		

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Mon	432 (3.6)	59.7	25.0	15.3 nc. 46		
Rakhine	695 (5.8)	75.3	19.2	5.5 g on		
Yangon	1822 (15.1)	49.7	33.8	16.59 Na		
Shan	1216 (10.1)	60.2	25.7	inseigi 14. lei		
Ayeyarwaddy	1508 (12.5)	64.8	23.3	20 March 2019. Downloaded from http://bmjopen for uses related to text and data minings. All traini 12. 11. 12. 12. 12. 12. 12. 13. 14. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15		
Naypyitaw	285 (2.3)	63.3	26.0	wnloa 10.78xt a		
Highest Educational Status				ded nd		
No Formal Education	1485 (12.4)	65.4	25.3	9.3 (5)	40.5	0.0003
Primary	4966 (41.3)	59.8	27.6	12.62.83		
Secondary	4345 (36.1)	63.1	25.3	11.65		
Higher	1225 (10.2)	56.6	28.1	15.3.		
Currently Employed				J tr		
Yes	8184 (68.1)	61.2	26.6	12.25	0.2	0.9348
No	3837 (32.9)	61.6	26.4	12.0 💆		
Wealth index				j.c ar		
Poorest	2052 (17.1)	75.2	18.6	6.2 <u>s</u>. 2	427.7	<0.0001
Poorer	2252 (18.7)	66.8	25.0	8.2≝ 9		
Middle	2509 (20.9)	61.5	28.0	8.2 imilar to June 12, 2025 at 19.2 logics 5.8.		
Richer	2533 (21.1)	57.2	28.2	14.65		
Richest	2675 (22.2)	49.9	30.9	19.20 , ,		
Marital Status				19. 2025 at 5.8°.		
Single	4191 (34.9)	76.8	17.4	5.8 is at	120.1	< 0.0001
Currently Married	7021 (58.4)	52.1	31.9	16.0		
Separated/Divorced/Widowed	809 (6.7)	61.1	27.4	16.0 & 11.5 &		
Parity				ΰ D		
0	5010 (41.7)	75.2	18.4	6.4 b	759.6	<0.0001
1	1844 (15.3)	55.5	30.8	13.7 9		
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3				<u> </u>		
	1903 (15.8)	49.4	32.7	17.9 ‡. 🕏		
	1405 (11.7)	45.6	36.1	18.3 <u>5</u> 6		
>3	1859 (15.5)	54.0	30.4	15.6		
Number of Household				n 2 g fa		
Member				or u		
<u>≤5</u>	7402 (61.6)	59.8	27.2	13.0g Eng	7.4	< 0.001
>5	4620 (38.4)	63.9	25.5	10.66.65		
Frequency of Viewing				019 Jnei late		
Television				ner d to		
Not at all	2779 (23.1)	67.2	24.5	8.3 6 6	89.7	< 0.001
Less than once a week				10.8 5 8		
At least once a week	7227 (60.1)	58.5	27.5	14.00 0 0		
			25.9 27.5	'bmjopen.bmj.com/ on June , Al training, and similar tec		
				18-024680 on 20 March 2019. Downloaded from http://bmjopen.bmj.com/ on June 12, 2025 at Agence Bibliographique de l Enseignement Superieur (ABES) . 17.18.15.15.13.10.14.15.15.16.15.16.15.16.15.16.16.16.16.16.16.16.16.16.16.16.16.16.		

The frequency of watching television at least once a week was higher among the urban women than the rural women (80.8% versus 51.7%). Around 30% of the rural women did not view television at all, whereas the proportion was lower for the urban women (7.2%) (Figure 3).

association between the frequency of viewing television and overweight and obesity

Ordered logistic regression was used to discern the association between the frequency of viewing television and overweight and obesity. During the analyses, the normal weight category (BMI < 23 kg/m²) was held as the reference group. The results are presented in Table 3. In the final model after adjusting for age, place and region of residence, wealth index, highest educational status, current employment status, parity and number of household members, it was found that, women who watched television at least once a week were 1.2 times more likely to be overweight/obese than the women who never watched television (AOR: 1.16, 95% CI: 1.02-1.32; *p*-value=0.023).

When stratified by urban and rural residence, overweight/obesity showed significant association with the frequency of viewing television in the urban areas. However, in the rural areas, women who watched television at least once a week were 1.2 times more likely to be overweight/obese than those who did not watch television at all (AOR: 1.16, 95% CI: 1.01-1.34; *p*-value=0.040) (Table 3).

The final logistic regression models are shown in supplementary table 1-3 (supplementary file 2).

Table 3: Association between the frequency of viewing Television and overweight and obesity among reproductive age women of Myanmar, MDHS* 2015-16

Frequency of viewing				for
Television	COR**(95% CI***)	<i>p</i> -value	AOR****(95% CI***)	nsarch 20
Total:				019.
Not at all	Ref		Ref	Do nen i to
Less than once a week	1.20 (1.03-1.40)	0.020	1.01 (0.87-1.19)	0.87(ext a
At least once a week	1.49 (1.32-1.69)	<0.001	1.16 (1.02- 1.32)	0.023 ded from the
In Urban Area:				
Not at all	Ref	/	Ref	ning S) .
Less than once a week	1.15 (0.80-1.67)	0.441	1.05 (0.73-1.51)	g, //bmjoj 0.77 % tr
At least once a week	1.25 (0.93-1.69)	0.144	1.14(0.85-1.52)	0.38% on.bm
In Rural Area:				anc
Not at all	Ref		Ref	d si
Less than once a week	1.11 (0.93-1.32)	0.242	0.98 (0.82-1.17)	0.820 on Ju
At least once a week	1.26 (1.10-1.44)	0.001	1.16 (1.01-1.34)	0.04(£hnold

 * MDHS: Myanmar Demographic and Health Survey

** COR: Crude Odds Ratio

*** CI: Confidence Interval

18 | P a g e

To the best of our knowledge, this is the first study to utilize a nationally representative sample to examine the association between frequency of television viewing with the prevalence of overweight and obesity among women of reproductive age in Myanmar. More than one fourth of the women surveyed were overweight and one in eight women was obese. This study also found that watching television at least once a week was significantly associated with overweight/obesity in women of reproductive age in rural Myanmar.

The prevalence of overweight and obesity among women of reproductive age was found to be 26.5% and 12.2% respectively. The total burden of overweight/obesity (38.7%) was almost similar to the burden of overweight/obesity among the same target group in other South and Southeast Asian countries, including Nepal (32.8%)³¹, Bangladesh (36%)³ and Pakistan (39%).³² Each of these studies utilized a nationally representative sample and the Asian BMI cutoff.

The prevalence of overweight and obesity was higher among the women living in the urban areas compared to those living in the rural areas. This finding is consistent with studies done in other South and Southeast Asian countries, including Bangladesh, as well as in the other continents.³ ²⁵ ³³⁻³⁵ Urban women had a higher frequency of television watching. This may be due to the higher coverage of electricity and the availability of many satellite channels in urban areas in comparison to rural areas.²⁵

It was found that among rural women, the prevalence of overweight/obesity was significantly associated with watching television at least once a week. This finding is also consistent with the finding from Bangladesh.²⁵

Despite the frequency of television watching among urban women, there was no association between this behavior and the prevalence of overweight/obesity. However, they were more likely to be overweight/obese than rural women. A propensity towards a more sedentary lifestyle and the intake of high-calorie foods by the urban residents may be potential determinants that have overridden the effect from an increased frequency of watching television. On the other hand, reliance on less developed transportation facilities, involvement in more laborious work and comparatively lower consumption of obesogenic diets among the rural women are factors that may contribute to a lower prevalence of overweight/obesity.²⁵ Those who view television more frequently in the rural area are more prone to lead a sedentary lifestyle and as such are at greater risk of developing obesity.²⁵

The findings from our study are coherent with a recent study in Bangladesh, which showed a positive association between the frequency of television viewing and overweight/obesity in women of reproductive age.²⁵ Similar positive associations were also found in developed countries (e.g. USA and Australia).²⁰ ²²⁻²⁴ In a recently published multi-country study, this association has also been observed in the case of children and adolescents.³⁶

Policy and Program Implications

The high prevalence of overweight/obesity is associated with an increased burden from NCDs in Myanmar, as shown in recent evidence.⁷ ³⁷ An unintended consequence of the continuing economic development of the country is the increasing preference for a sedentary lifestyle and obesogenic food, which, in turn, is raising the burden of overweight/obesity. Considering the epidemiologic, demographic, and nutritional transition, the policymakers of Myanmar should focus on the prevention and control of both overweight/obesity and NCDs. The

newly released 'Myanmar National Health Plan 2017-2021' incorporates NCD prevention and control programs.³⁸ Furthermore, a Social Behavioral Change Communication (SBCC) campaign should be developed in order to promote physical activity and raise awareness among the population, especially among children and adolescents, in order to prevent overweight/obesity as early as possible. Further research should be conducted among men and adolescents to determine whether this positive association exists among those target population as well.

STRENGTHS AND LIMITATIONS

This is the first study, which utilized a nationally representative sample to examine the association between the frequency of watching television and overweight/obesity among women of reproductive age in Myanmar. Moreover, as MDHS utilized standard and valid tools for data collection, the probability of the existence of any measurement error is lower in this study in comparison to other cross-sectional studies conducted in Myanmar. However, the survey could not establish the temporal relationship between the exposure and the outcome variables because of its cross-sectional design. The frequency of television viewing was measured in weeks, as opposed to days/hours; the latter could have given more precise information. In the multivariable analysis, food habit and duration of physical activity were not included because this information was not collected in MDHS. There may be the presence of reporting bias while measuring the frequency of television watching. The information related to the frequency of time spent on other types of telecommunication devices such as mobile phones or computers was not collected, so the association with those variables with overweight/obesity could not be measured.

CONCLUSIONS

The rising burden of overweight and obesity is now a global concern. Obesity ultimately leads towards the development of NCDs and premature death. The results from this study demonstrate that watching television is associated with obesity among reproductive age women in Myanmar. Therefore, necessary steps should be taken to improve awareness regarding the harmful consequences of watching TV for longer hours and physical inactivity as well as to encouragement of increased physical activity. Additional research is also warranted to explore the situation among the general population of Myanmar.

LIST OF ABBREVIATION

- ASEAN- Association of Southeast Asian Nations
- 304 BMI- Body Mass Index
- 305 GDP- Gross Domestic Product
- 306 GNI- Gross National Income
- 307 NCDs- Non-Communicable Diseases
- 308 MDHS- Myanmar Demographic and Health Survey
- 309 SBCC- Social Behavioral Change Communication
- 310 SEARO- South-East Asia Regional Office
- 311 USAID- United States Agency for International Development
- 312 USD- United States Dollar
- 313 WHO- World Health Organization
- 314 3MDG- Three Millennium Development Goal Fund

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Contributors

RDG, IHS, MH, IS and MS conceptualized the study. RDG, IHS, MH, IS, MRH and MS designed the study and acquired the data. RDG, IHS, MH and IS conducted the data analysis. RDG, IHS, MH, IS, MRH and MS interpreted the data. RDG, IHS, MH, IS and MRH prepared the first draft. RDG, IHS, MH, IS, MRH and MS participated in critical revision of the manuscript and contributed to its intellectual improvement. All authors went through the final draft and approved it for submission. RDG, IHS, MH and IS equally contributed in this work as first author.

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Competing Interests

329 None declared.

Patient Consent

331 None Declared

Disclaimer

The authors are alone responsible for the integrity and accuracy of data analysis and the writing the manuscript.

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Ethics Approval

The datasets were obtained from DHS Programme with proper procedure. The study exempt from collecting ethical approval because the survey protocols were reviewed and approved by Ethics Review Committee on Medical Research including Human Subjects in the Department of Medical Research, Ministry of Health and Sports as well as from the ICF Institutional Review Board.

Data Sharing Statement

The dataset of MDHS 2015-16 is available at the Demographic and Health Surveys Program. Extra data is available which is available on request at http://dhsprogram-com/what-we-do/survey/survey-display-349.cfm

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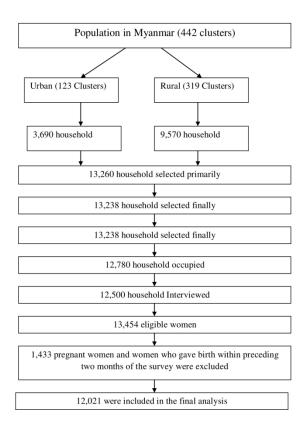
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154	Figures

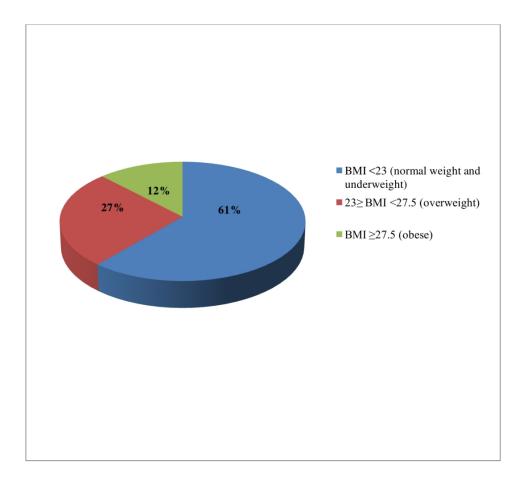
- **Figure 1:** Flowchart showing the process of selecting the participants in the survey
- 456 **Figure 2:** Distribution of the respondents by BMI status
- Figure 3: Distribution of the respondents by place of residence with frequency of watching
- 458 television
- 459

- 460 Supplementary Materials:
- 461 **Supplementary File 1:** STROBE Checklist
- 462 **Supplementary File 2:** Supplementary Tables

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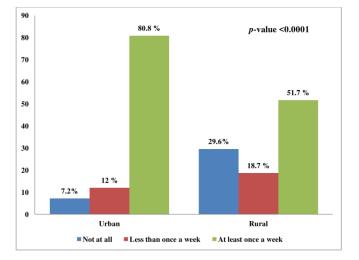


Flowchart showing the process of selecting the participants in the survey $143x186mm\;(300\;x\;300\;DPI)$



Distribution of the respondents by BMI status 334x317mm (96 x 96 DPI)

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Distribution of the respondents by place of residence with frequency of watching television $143 \times 186 \text{mm} \ (300 \times 300 \text{ DPI})$

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of gross sectional studies

Title of the study: 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 Results from a nationwide cross-sectional survey

Section/Topic	Item #	Recommendation (a) Indicate the study's design with a commonly used term in the title or the abstract to the	Reported on page
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and was found	2-3
Introduction		nd de de	
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods		: 19, Al	
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants of selection of participants of selection of participants.	7-8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-10
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions	11
		(b) Describe any methods used to examine subgroups and interactions	11
		For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	

		(c) Explain how missing data were addressed	11
		(c) Explain how missing data were addressed (d) If applicable, describe analytical methods taking account of sampling strategy	Not applicable
		(e) Describe any sensitivity analyses	Not applicable
Results		(e) Describe any sensitivity analyses 5 8	Not applicable
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible xamined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed.	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12-13
		(b) Indicate number of participants with missing data for each variable of interest	7
Outcome data	15*	Report numbers of outcome events or summary measures	12-19
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and the recision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	17-19
		(b) Report category boundaries when continuous variables were categorized	Not applicable
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion		g, an jo	
Key results	18	Summarise key results with reference to study objectives	20
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	22
	20	Give a cautious overall interpretation of results considering objectives, limitations, muliplicity of analyses,	20-22
Interpretation	20	results from similar studies, and other relevant evidence	20-22
	21		20-22
Interpretation Generalisability Other information		results from similar studies, and other relevant evidence	

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Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmederg/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.sgrobe-statement.org. om http://banjopen.bmj.com/ on , (ABES).

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Supplementary Table in normal weight among	1: Crude and Adj women of Myann	iusted odds ratios f nar, MDHS 2015-1	for factors associated	d with overweight	co Maræsity 20 Maræsigner for usæarelate	mpared to
Variable	Crude Odds Ratio (COR)	95% CI	<i>p-</i> value ¹	Adjusted Odds Ratio (AOR)	95% Swal	<i>p</i> -value ¹
Age Group (in years)					oaded from uperieur (AE tt and data r	
15-24	Ref			Ref	BES mini	
25-34	3.11	2.73-3.54	<0.001	2.34	2.6 <u>4</u> -2 5 73	<0.001
35-49	5.21	4.66 - 5.83	<0.001	3.65	jopeh.bmj.com/ on Jime 12, 2025 attraining, and similar dechnologies.	<0.001
Place of Residence					.bmj.com/ on ng, and simil	
Urban	Ref			Ref	om/ on	
Rural	0 .54	0.47-0.61	<0.001	0.74	0.64-0m87	<0.001
Region of Residence					12, 20 hnolo	
Kachin	Ref			Ref	2025 at logies.	
Kayah	0.68	0.49-0.94	0.019	0.68	0.50-0	0.012
Kayin	0.84	0.64-1.10	0.202	0.88	0.69-1	0.301
Chin	0.45	0.33-0.61	<0.001	0.50	0.38-0	<0.001
					raphiq	

Page 39 of 48			ВМЈ	Open		36/bmjopen-2018-024680 on 2 cted by copyright-including to 0	
1 2						oen-201≀ ≎opyrigh	
3 4	Sagaing	0.85	0.65-1.11	0.234	0.88	0. 6 7-1 8 5	0.343
5 6	Taninthayi	0.91	0.70-1.17	0.459	1.03	0.28-1866 in o	0.832
7 8	Bago	0.65	0.51-0.82	<0.001	0.68		0.002
9 10	Magway	0.56	0.43-0.74	<0.001	0.60	0.4600077	<0.001
11 12	Mandalay	0.67	0.52-0.87	0.002	0.64	7 2 0 2 March 2079. Dównloæde Enseignement Superic Fruses related totext and 0. 0. 0. 0.	<0.001
13 14	Mon	0.84	0.64-1.11	0.217	0.87	0.65 0.65 0.66	0.381
15 16	Rakhine	0.39	0.29-0.52	<0.001	0.61	very of the control o	0.001
17 18	Yangon	1.18	0.90-1.55	0.224	0.98	0. ∰ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹	0.854
19 20	Shan	0.81	0.60-1.09	0.165	0.91	0. ₫₫	0.486
21 22	Ayeyarwaddy	0.66	0.50-0.88	0.005	0.81	ng, - 25 0.64 - 150 8	0.152
23 24	Naypyitaw	0.69	0.53-0.90	0.006	0.68	0.52-090	0.008
25 26 27 28	Highest Educational Status					mjopen.bmj.com/ on June 12, 2025; 10. 0. 0. 0. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.	
29	No Formal Education	Ref			Ref	on Ju nilar t	
30 31 32	Primary	1.29	1.13-1.48	<0.001	1.24	1.95-1.45	0.006
33 34	Secondary	1.13	0.97-1.32	0.115	1.26	1. 64 -1 35 3	0.018
35 36	Higher	1.50	1.22-1.83	<0.001	1.10	9.86-1 مير 0.86-1	0.452
37 38	Currently employment					∋nce B	
39 40 41 42 43 44	No	Ref	view only - http://bmioner	2	ut/auidalinas uktus	1.25 at ≱gence Bibliographique de 0.86-1.25 at 1.86 a	

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88			BMJ Open		36/bmjopen	
3+	2.62	2.30-2.99	<0.001	1.42	-2018-022 yrightΩn 1.Ωn	0.003
Number of Household Member					1680 on 20 M cluding for ι	
≤5	Ref			Ref	larch 2019. D Enseigneme Ises related	
>5	0.83	0.76-0.92	<0.001	0.92	0. 631(2) 3 0. 631(2) 3	0.150
Frequency of watching TV					oaded from perieur (AB t and data n	
Not at all	Ref			Ref	http://bmjo ES) . nining, Al tr	
Less than once a week	1.20	1.03-1.40	0.020	1.01	0. 5 7-1 9 9	0.870
At least once a week	1.49	1.32-1.69	<0.001	1.16	1. @2 -1 3 2	0.023
3+ Number of Household Member ≤5 Frequency of watching TV Not at all Less than once a week At least once a week MDHS: Myanmar Demogra CI: Confidence Interval ¹ Variable with p-value less	aphic and Hea ess than <0.2	elth Survey from unadjusted model v peer review only - http://bmj	were included into 4 open.bmj.com/site/al	multivariable	m/ on June 12, 2025 at Agence Bibliographique de l similar technologies.	

Supplementary Table 2: Crude odds ratios for factors associated with overweight and obesity compared to normal weight for urban area among women of Myanmar, MDHS 2015-16.

Variable	Crude Odds Ratio (COR)	95% CI	<i>p-</i> value ¹	Adjusted Odds Ratio (AOR)	on 20 March 2019. Downloaded from Enseignement Superatur (A ingrior uses related to text and data of the control of the contro	p-value ¹
Age Group (in years)					019. [gneme ated	
15-24	Ref			Ref	Downlent Su to tex	
25-34	3.43	2.72-4.33	<0.001	2.67	ct and	<0.001
35-49	7.63	6.32-9.21	<0.001	5.52	4.30- ጟ.(<0.001
Region of Residence					4.30-mhttp://bmjopen.bmj.com/ on 4.30-mining, Al training-and similion.	
Kachin	Ref			Ref	omjope Al traii	
Kayah	0.70	0.42-1.19	0.188	0.63	0.38-1.05	0.075
Kayin	0.95	0.75-1.19	0.646	0.94	0.69- 4 .28	0.675
Chin	0.76	0.56-1.02	0.070	0.71	<u>mi</u> on 0.51-0€995	0.041
Sagaing	0.96	0.72-1.28	0.790	0.99	0.51-0.99-une 0.70-1.40.3	0.943
Taninthayi	0.62	0.47-0.82	0.001	0.61	0.38-6:9825	0.042
Bago	0.71	0.53-0.93	0.015	0.62	0.43-0.89 6	0.010
Magway	0.59	0.36-0.97	0.038	0.50	_	0.013
Mandalay	0.98	0.79-1.22	0.848	0.85	0.29-0.86 Bibliograph	0.334
					jraph	

f 48				BMJ Open		36/bmjopen-2018-024680 on 2 cted by copyright, includes 830 for 32-0.43	
	Mon	0.77	0.49-1.20	0.243	0.62	yright, i.2018-024	0.154
	Rakhine	0.61	0.41-0.89	0.012	0.60	0.43- € :83 9	0.002
	Yangon	1.00	0.76-1.34	0.975	1.01	o 20 0.71-1.46▼	0.944
	Shan	1.03	0.69-1.55	0.885	1.05	Ses to 0.71 is es to 0.71 is est 0.71 is e	0.839
	Ayeyarwaddy	0.74	0.52-1.06	0.099	0.89	2019. dgne.₩	0.632
	Naypyitaw	0.80	0.51-1.25	0.322	0.75	to to to	0.181
	Highest Educational Status				0.73	20 March 2019. Downloaded from http:// 46Ensagnement Superieur (ABES). for-uses-related to text and data mining. 0.55-0.49-	
	No Formal Education	Ref			Ref	om htt ABES a min	
	Primary	1.14	0.84-1.56	0.389	1.10	p://bn	0.605
	Secondary	0.78	0.57-1.06	0.107	1.10	0.76-£58ni 0.76-£58ni 0.76-£68ni 0.76-£68ni	0.530
	Higher	0.84	0.59-1.20	0.346	1.13 0.92	0.70- 5 :08 - 9	0.704
	Currently employment				0.92	0.01- 8 .40 0 v i n	
	No	Ref			Ref	n June ilar tec	
	Yes	1.22	1.00-1.49	0.046	1.29	0.76-bmj.com/ on June 12, 2025 at 0.61-ad similar technologies.	0.010
	Wealth index					5 at A	
	Poorest	Ref			Ref	gence	
	Poorer	1.35	0.76-2.37	0.302	1.44	25 at Agence Bibliographique de l gies. 0.69-2.99	0.330
				6		phique (
		For peer i	review only - http://bm	njopen.bmj.com/sit	e/about/guidelines.xhtr	nl <u>e</u>	

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			BMJ Open		36/bmjopen-2018-024680 on 2 cted by copyright, including for 1.43-1	
Middle	1.53	0.94-2.50	0.089	1.99	-2018-0246 yright, ie64 1.09-€1	0.025
Richer	2.14	1.28-3.57	0.004	2.65	5.43-₹ 91 9.	0.002
Rich	2.43	1.47-4.02	0.001	3.08	ੂ 8 1.63- ≨ .82 ≤	0.001
Marital Status					arch 2 Ensei ses re	
Single	Ref			Ref	2019. I gnem elated	
Married	3.21	2.73-3.78	<0.001	1.46	Downloa to text 1.01-₹	0.042
Separated/ Divorced/ Widowed	2.67	2.01-3.55	<0.001	1.05	nd datain (1967)	0.828
Parity					http:// BES) . mining	
0	Ref			Ref	'bmjor	
1	2.61	2.05-3.33	<0.001	1.36	aining. 0.89-2.08m	0.152
2	3.21	2.60-3.96	<0.001	1.27	0.87- ½ ,85 2	0.221
3	3.95	3.01-5.20	<0.001	1.50	1.03-2.18	0.034
3+	3.91	2.96-5.17	<0.001	1.44	0.97-33.14 %	0.072
Number of Household Member					20 March 2019. Downloaded from http://bmjopen.bmj.com/ on June 12, 2025 at / 82 Enseignement Superieur (ABES) . forceises related to text and data-mining, Al training and similar technologies. 0.87 - 0.97 - 0.97 - 0.97	
≤5	Ref			Ref	Agenc	
>5	0.94	0.79-1.11	0.449	1.13	t Agence Bibliogra	0.250

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Frequency of watching TV*					8-024680 on	
Not at all	Ref			Ref	on 20 N	
Less than once a week	1.15	0.80-1.67	0.441	1.05	uses: ១.73- នៈ ប	0.779
At least once a week	1.25	0.93-1.69	0.144	1.14	eign 19019 0.85-66	0.389

MDHS: Myanmar Demographic and Health Survey

CI: Confidence Interval

¹ Variable with p-value less than <0.2 from unadjusted model were included into multivariable analysis

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Supplementary Table 3: for rural area among wo	Adjusted odds ratio	s for factors associ IDHS 2015-16.	iated with over	weight and obesit	copyrightmpæred to nor y compæred to nor	rmal weight
Variable	Crude Odds	95% CI	<i>p</i> -value ¹	Adjusted Odds	ling for	<i>p</i> -value ¹
	Ratio (COR)			Ratio (AOR)	CI % 4680 o b 20 March Ense	
Age Group (in years)					th 2019. seignen	
15-24	Ref			Ref		
25-34	3.10	2.65-3.62	< 0.001	2.09	1.25 2 1	<0.001
35-49	4.61	4.01-5.30	<0.001	2.89	2.339 gg 9	<0.001
Region of Residence					9 Nicaded from hubberieur (ABE 2.and data m	
Kachin	Ref			Ref	rom h (ABE	
Kayah	0.70	0.46-1.06	0.091	0.71	0 Æ 9	0.091
Kayin	0.85	0.58-1.24	0.401	0.89	0.63-1505	0.497
Chin	0.36	0.23-0.57	< 0.001	0.43	0. 2 8-0 0. 3 8-0 0. 3 1-1 2 5	<0.001
Sagaing	0.90	0.63-1.30	0.586	0.88	0. & i -1 2 5	0.466
Taninthayi	1.10	0.77-1.56	0.606	1.25	0. 8 8-1 2 78	0.206
Bago	0.68	0.49-0.94	0.018	0.72	0.55)-000 0.55)-000	0.044
Magway	0.62	0.44-0.87	0.006	0.62	0. 4 4-0 4 86	0.005
Mandalay	0.58	0.40-0.83	0.004	0.57	<u>~ 0.∰0-0</u> ₹1	0.002
Mon	0.90	0.63-1.29	0.570	1.03	0.48-0.43 0.48-0.43	0.860
Rakhine	0.39	0.26-0.58	<0.001	0.63	0. 4 3-0 4 3	0.022
Yangon	1.07	0.77-1.49	0.681	1.07	0.75-1 ₹ 2	0.713
Shan	0.78	0.51-1.17	0.222	0.86	0.59-1224	0.418
Ayeyarwaddy	0.71	0.49-1.03	0.074	0.82	0.56-1 펉 8	0.282
Naypyitaw	0.64	0.44-0.93	0.020	0.67	0.46-0 9)7	0.035

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					en-2018 opyrigh	
Highest Educational Status					it, in	
No Formal Education	Ref			Ref	680	
Primary	1.27	1.09-1.47	<0.001	1.24	1. 2 4-1 3 47	0.018
Secondary	0.98	0.82-1.17	0.84	1.26	1 Gn_1 S 7	0.047
Higher	1.13	0.84-1.52	0.40	1.18	0.847	0.328
Currently employment					2019 igner	
No	Ref				Warch 2019. Down	
Yes	1.01	0.89-1.14	0.890			
Wealth index						
Poorest	Ref			Ref	d fror ur (A	
Poorer	1.49	1.28-1.73	<0.001	1.50	1.27 m = 7	<0.001
Middle	1.87	1.59-2.20	<0.001	2.00	1.67-2340	<0.001
Richer	2.05	1.72-2.45	<0.001	2.30	1. ૣૄૼ -2 ક 1	<0.001
Rich	2.59	2.01-3.35	<0.001	2.97	1. A83-230pg 1 2. 250pg 1 2. 250pg 2 3. 250p	<0.001
Marital Status					omj.c g, ar	
Single	Ref			Ref	om/	
Married	3.35	2.93-3.83	<0.001	1.69	1. 2 -2 21	<0.001
Separated/ Divorced/ Widowed	1.92	1.53-2.42	<0.001	0.97	0. 7 0-1 5 6	0.877
Parity					1.1ar 12-11 0.1achnologies 2025 at 24 1.12-124	
0	Ref			Ref	025 ogies	
1	2.44	2.07-2.87	<0.001	1.47	1.12-1393	0.005
2	3.37	2.83-4.03	<0.001	1.63	1.22-2 9 8	0.001
3	3.86	3.26-4.57	<0.001	1.71	1.29-2	<0.001
3+	2.92	2.48-3.43	<0.001	1.51	1.12-2 5)2	0.006
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Number of Household					it, in	
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≤5	Ref			Ref	on 2	
>5	0.74	0.66-0.83	<0.001	0.83	о.73-0 20 5	0.005
Frequency of watching TV					arch ; Ensei Ises r	
Not at all	Ref			Ref	2019 igne elate	
Less than once a week	1.11	0.93-1.32	0.242	0.98	0.80 ml d 7	0.829
At least once a week	1.26	1.10-1.44	0.001	1.16	1. ©	0.040

MDHS: Myanmar Demographic and Health Survey

CI: Confidence Interval

¹ Variable with p-value less than <0.2 from unadjusted model were included into multivariable analysis

BMJ Open

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

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Keywords:	Obesity, Overweight, Noncommunicable Disease, Myanmar

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- 3 from a nationwide cross-sectional survey
- 5 Authors:
- 6 Rajat Das Gupta+*a,b, Ibrahim Hossain Sajal+a,b, Mehedi Hasan+a,b, Ipsita Sutradhar+a,b,
- 7 Mohammad Rifat Haider^c, Malabika Sarker^{a,b,d}
- 9 Author's address and positions:
- ^a Centre for Non-Communicable Diseases and Nutrition, BRAC James P Grant School of Public
- Health, BRAC University, 68 Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka, 1212,
- 12 Bangladesh
- b Centre for Science of Implementation and Scale-Up, BRAC James P Grant School of Public
- 14 Health, BRAC University, 68 Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka, 1212,
- 15 Bangladesh
- c Department of Health Services Policy and Management, Arnold School of Public Health,
- 17 University of South Carolina, Columbia, South Carolina, United States of America

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- d Institute of Public Health, University of Heidelberg, Heidelberg, 69120, Germany
- + These authors contributed equally to this work
- * Corresponding author:
- 22 Rajat Das Gupta, Research Associate, BRAC James P Grant School of Public Health, BRAC
- University, 68 Shaheed Tajuddin Ahmed Sarani, Mohakhali, Dhaka 1212, Bangladesh.
- 24 Email: rajat89.dasgupta@gmail.com

ABSTRACT

- Objectives: This study aimed to discern the association between the frequency of television
- viewing and overweight and obesity among reproductive age women of Myanmar.
- **Design:** This was a cross-sectional study.
- **Setting:** This study used Myanmar Demographic and Health Survey (2015-16) data.
- Participants: Total of 12,021 women both aged 15-49 years and also not pregnant or did not
- 31 deliver a child within the two months prior to the survey were included.
- **Primary and secondary outcome measures:** The primary outcome was overweight (23.0 to
- $<27.5 \text{ kg/m}^2$) and obesity ($\ge 27.5 \text{ kg/m}^2$), which was measured using the Asian BMI cut off.
- 34 Ordered logistic regression analysis was conducted to find the association between the
- explanatory and outcome variables. The potential confounders controlled in the multivariable
- analyses were age, place of residence, region of residence, highest educational status, current
- employment status, wealth index, parity and number of household members.
- **Results:** The prevalence of overweight was 26.5% and obesity was 12.2% among the study
- 39 participants. The odds of being overweight and obesewere 20% higher (adjusted odds ratio
- 40 (AOR): 1.16, 95% CI: 1.02-1.32; p-value = 0.023) among those who watched television at least
- once a week compared to those who did not watch television at all. Rural women who watched
- television at least once a week were 1.2 times more likely to be obese (AOR: 1.16, 95% CI: 1.01-
- 1.34; p-value = 0.040) compared to those who did not watch television at all.

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- **Conclusions:** Frequent television watching was associated with obesity among rural women of
- reproductive age in Myanmar.
- Key words: Obesity, Overweight, Non-communicable Disease, Myanmar



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STRENGTHS AND LIMITATIONS OF THE STUDY

- This study utilized a nationally representative sample to investigate the association between the frequency of television viewing and overweight/obesity among women of reproductive age from Myanmar.
- Due to utilization of standard and valid tools for data collection, the probability of the existence of measurement error is lower in this study in comparison to other cross-sectional studies conducted in Myanmar.
- Temporal relationship could not be established due to cross-sectional nature of the survey.
- The frequency of television viewing was measured in weeks, not in days/hours; the latter could have given more precise information.
- In the multivariable analysis, food habit and duration of physical activity were not included because that information was not collected in the survey.

Both developed and developing countries are facing the increasing burden of overweight and obesity, which are posing as major public health problems. The prevalence of overweight and obesity increased by 27.5% among the global adult population and 47.1% among the global child population between 1980 and 2013. During the same time period, globally, the prevalence of overweight and obesity rose from 29.8% to 38.0% among adult females, in particular. Although this burden is lowest in South and Southeast Asia, countries of this region are still experiencing the rising burden of overweight and obesity. Myanmar is a low and middle-income country (LMIC) situated in the Southeast Asia region. In 2015-16, the first Myanmar Demographic and Health Survey (MDHS) was conducted using a nationally representative sample across the country. The survey found a high prevalence of overweight and obesity among women of reproductive age.

Overweight and obesity is an important risk factor for the development of several non-communicable diseases (NCDs) like diabetes mellitus ⁸, hypertension⁹, cardiovascular diseases ¹⁰, cancer¹¹ and chronic kidney diseases ¹² In addition, overweight and obese women experience complications during pregnancy (gestational diabetes mellitus, pre-eclampsia and eclampsia) more frequently than women of normal body weight. ¹³ ¹⁴

It has been found that energy expenditure is very low among people who spend their leisure time watching television, rather than being involved in physical activities like playing games, gardening, etc. This ultimately increases their risk of gaining excessive body weight. ¹⁵ ¹⁶ Television watching is also associated with an increase in energy intake, which may sometimes

be attributable to their frequent exposure to television advertisements of foods and beverages and the subsequent consumption of said foods and beverages. 17-21

Across the world, many studies have shown a positive association between the increased frequency of television viewing and overweight/obesity. In the USA and Australia, it has been found that people who view television more frequently are at higher risk of being overweight/obese. 20 22-24 A study from Bangladesh has found that watching television frequently (at least once a week) was associated with obesity among women of reproductive age.²⁵ However, this association has not been explored in other South and Southeast Asian countries including Myanmar. Therefore, this study was conducted to determine the association between television viewing and the prevalence of overweight and obesity among women of reproductive age in Myanmar using the MDHS 2015-16 data. 04.04

METHODS

study settings

According to the 2014 census, the total population of Myanmar was 51.5 million with a population density of 76 persons per square kilometer (km²). The country is home to 135 ethnic groups. ²⁶ ²⁷ The *Gross Domestic Product (GDP)* growth rate of Myanmar was 6.4% and per capita, Gross National Income (GNI) was 1,455 USD in 2016-17. More than a quarter (26.1%) of the population was living under the poverty line in 2014. Myanmar also has the lowest life expectancy at birth (66.6 years) among the Association of Southeast Asian Nations (ASEAN). ²⁶

This study analyzed the data of MDHS 2015-16, the first Demographic and Health Survey of Myanmar.⁶ The detailed method has been published previously.⁶ MDHS 2015-16 was a cross-sectional survey which used a nationally representative sample and was conducted through a joint collaboration between the Ministry of Health and Sports of Myanmar and ICF International. The United States Agency for International Development (USAID) and Three Millennium Development Goal Fund (3MDG) provided financial support for the survey. Twostage cluster sampling techniques were used for sample selection. The sample was stratified for each of the seven states and eight regions of Myanmar. At the first stage, 442 clusters (urban: 123 and rural: 319) were selected randomly from a sample frame of 4,000 clusters. At the second stage, 30 households were selected from each of the clusters. In total, 13,260 households were selected for the final sample. The target group of this study was women of reproductive age (15-49 years). The permanent residents and the visitors who stayed in the selected households the night before the date of data collection were included in the questionnaire survey. Around 96% of eligible women agreed to participate in the survey. Among them, 98% agreed for anthropometric measurement. However, pregnant women and women who had given birth within the preceding two months of the survey were excluded. The final weighted sample size of this study was 12,021 (Figure 1).

survey tools and data collection

A standard woman's questionnaire used by the DHS program was adopted and modified according to the local context and pre-tested to collect the socio-demographic information (e.g. age, sex, household wealth index and place of residence) through face-to-face interviews.

Trained field staff carried out the interviews and anthropometric measurements. Measuring boards specially made by Shorr Productions were used for height measurement and lightweight SECA scales with digital screens were used for measuring the weight of the respondents.

The main outcome variables of this study were overweight and obesity. To define these variables, an Asia specific body mass index (BMI) cut-off value was used.²⁹ Women having a BMI $<23.0 \text{ kg/m}^2$ were considered to be normal weight or underweight, women having a BMI between 23.0 kg/m² and $<27.5 \text{ kg/m}^2$ were considered to be overweight and women having a BMI $\ge 27.5 \text{ kg/m}^2$ were considered to be obese.

The main explanatory variable of interest for this study was the frequency of viewing television. Data were collected as the following categories: (1) not viewing television at all, (2) viewing television less than once a week, and (3) viewing television at least once a week. The other independent variables considered based on the literature review were age group, place of residence, region of residence, education, wealth quintile, current working status, parity and number of household members in the family. The categories of the variables are mentioned in Table 1.

Table 1: List of variables considered for the study

Name of the Variables	Categories
Outcome Variables:	
Body Mass Index (BMI)	a) 0= Normal weight or underweight (BMI <23 kg/m²)
	b) 1= Overweight (BMI 23.0 kg/m ² to <27.5 kg/m ²)
	c) 2= Obesity (BMI ≥27.5 kg/m²)

	m) 12= Shan
	n) 13= Ayeyarwaddy
	o) 14= Naypyitaw
4. Education	a) 0= No education
	b) 1= Primary education
	c) 2= Secondary education
	d) 3= Higher education
5. Wealth quintile	a) 0= Poorest
10	b) 1= Poorer
	c) 2= Middle
	d) 3= Richer
	e) 4= Richest
	L .
6. Current working status	a) 0= Yes
	b) 1= No
7. Parity	a) 0= 0 (nullipara)
	b) 1= 1 (primipara)
	c) 2= 2
	d) 3= 3
	e) 4=>3
8. Number of Household Members	a) 0= ≤5
	b) 1=>5

Weighted descriptive statistics (frequency and percentage) were used to present the socio-demographic characteristics of the respondents. A chi-square (γ^2) test was performed to determine whether the groups differed in terms of the explanatory variables according to the BMI status. To find the association between the explanatory and outcome variables, ordered logistic regression analysis was conducted considering the proportional odds assumption was fulfilled. Initially, bivariate analyses were done. Variables which showed a p-value <0.20 in bivariate analyses were included in the multivariable model. This value of 0.2 was considered significant to prevent residual confounding in multivariable analysis.³⁰ The variables which showed p-value <0.05 in multivariable analysis were considered to be statistically significant. Both the unadjusted Crude Odd Ratio (COR) and Adjusted Odds Ratio (AOR) were reported. Variance inflation factors (VIF) were assessed to check multicollinearity among the variables. A VIF value greater than 5 was considered as an indication of multicollinearity; however, no significant multicollinearity was observed.³¹ A test for interaction effect between the frequency of TV viewing and the place of residence was performed; however, no significant interaction effect was observed. The cluster effect was adjusted during analysis. All the analyses was done using Stata 13.0. The authors followed the guidelines outlined in the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement in writing the manuscript (Supplementary File 1).

ethical consideration

MDHS received ethical approval from the Ethics Review Committee on Medical Research including Human Subjects in the Department of Medical Research, Ministry of Health

and Sports as well as from the ICF Institutional Review Board. Written informed consent was taken from the participants. In case of minor participants, assent form was signed by the respondents and written informed consent was given by the adult guardian.

patient Involvement

Patients were not involved in the study.

FINDINGS

socio-demographic characteristics of the respondents

The data of 12,021 weighted samples were analyzed. More than a quarter (26.5%) of the study participants were overweight, and 12.2% of them were obese (Figure 2). The sociodemographic characteristics of the respondents along with the prevalence of the three categories of BMI across the independent variables with the associated chi-square (χ 2) value are presented in Table 2. The majority of the study participants was aged between 35 and 49 years (42.3%) and was residing in the rural area (70.8%). The highest proportion of participants was from the Yangon Region (15.1%), followed by the Ayeyarwaddy Region (12.5%) and the Mandalay Region (12.2%), whereas the lowest participation was from the Kayah Region (0.5%). Around half of the respondents (41.3%) were educated up to the primary level and about one-third (36.1%) received secondary level education; furthermore, 10.2% received higher education and 12.4% received no education. More than two-thirds (68.1%) of the women were employed at the time of interview. Nearly two-fifths of the women (41.7%) were nulliparous, while cumulatively a similar proportion of respondents (46.6%) had the experience of being pregnant- once (15.3%),

twice (15.8%), thrice (11.7%) and more than three times (15.5%). The highest proportion of the respondents belonged to the richest wealth quintile (22.2%) followed by richer (21.1%) and middle (20.9%) quintile. Among the study participants, the majority (60.1%) reported that they watched television at least once a week; however, 23.1% did not watch television at all and 16.8% watched television less than once a week. Except for current employment status, significant differences were found among the BMI of women across the explanatory variables. The prevalence of overweight and obesity increased with age (*p*-value <0.0001) and was the most common in the Yangon and Kachin Region (*p*-value <0.0001). This prevalence was also higher in the urban areas compared to the rural areas (overweight: 31.1% versus 24.6%; obesity: 17.9% versus 9.8%; *p*-value <0.0001). Plausibly, Women with higher educational status, having two children and belonging to the richest wealth group had a higher prevalence of overweight and obesity (*p*-value <0.0001). The prevalence of overweight and obesity was also higher among the individuals who used to watch television at least once a week (*p*-value <0.0001) (Table 2).

independent variables, MI	Trequency (%) 3433 (28.6) 3504 (29.1)	v 1 1	•	24680 c ncludir	v	
Variable	Frequency (%)		BMI Status (%)	n 20 I	χ2	<i>p</i> -value
		BMI <23	23≥ BMI <27.5	BMI ≥Æ no Sara		
Age Group (years)				s re		
15-24	3433 (28.6)	82.4	14.3	3.3 te	173.9	<0.0001
25-34	3504 (29.1)	60.4	27.6	3.3ted to		
35-49	5084 (42.3)	47.7	34.0	18.3 t Superieur (ABI 9.8 am 9.8 am 17.9 t Superieur (ABI 9.8 am		
Place of Residence				upe xt a		
Urban	3505 (29.2)	51.0	31.1	17.95 6	258.4	<0.0001
Rural	8516 (70.8)	65.6	24.6	9.8 tr o		
Region of Residence				m htt \BES a mini		
Kachin	334 (2.8)	54.6	30.0	_	240.1	<0.0001
Kayah	60 (0.5)	63.3	27.1	9.6air 9		
Kayin	274 (2.3)	59.1	27.1	13.8 nd co		
Chin	90 (0.8)	71.7	23.9	4.4 mili	1	
Sagaing	1351 (11.3)	58.7	27.7	13.6 June		
Taninthayi	265 (2.2)	57.0	28.6	14.40logies 9.6s at		
Bago	1197 (9.9)	64.5	25.9	• • • • • • • • • • • • • • • • • • • •		
Magway	1030 (8.6)	67.7	24.0	8.3 ence	1	
Mandalay	1462 (12.2)	64.2	25.4	10.5 Bibliographique de es.xhtml	-	

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Mon	432 (3.6)	59.7	25.0	15.3L 02		
Rakhine	695 (5.8)	75.3	19.2	5.5 in 680 or		
Yangon	1822 (15.1)	49.7	33.8			
Shan	1216 (10.1)	60.2	25.7	ses reig 14.1 rei		
Ayeyarwaddy	1508 (12.5)	64.8	23.3	20 March 2019. Downloaded from http://bmjopen.bmj.com/ 11. @ 11. @ 11. @ 11. @ 11. @ 12. @		
Naypyitaw	285 (2.3)	63.3	26.0	10. Tax upo		
Highest Educational Status				eriei Imd		
No Formal Education	1485 (12.4)	65.4	25.3	9 3 # 6	40.5	0.0003
Primary	4966 (41.3)	59.8	27.6	12.63 85		
Secondary	4345 (36.1)	63.1	25.3	11.65.05		
Higher	1225 (10.2)	56.6	28.1	15 %		
Currently Employed	1220 (10.2)	0.00	20.1	# 6		
Yes	8184 (68.1)	61.2	26.6	12.25	0.2	0.9348
No	3837 (32.9)	61.6	26.4	12.05		
Wealth index				an		
Poorest	2052 (17.1)	75.2	18.6	6.2 <u>v.</u> <u>2</u>	427.7	< 0.0001
Poorer	2252 (18.7)	66.8	25.0	6.2 s. d.		
Middle	2509 (20.9)	61.5	28.0	10.5 =		
Richer	2533 (21.1)	57.2	28.2	10.5 14.6 14.6 19.70		
Richest	2675 (22.2)	49.9	30.9	19.22 ,		
Marital Status				19.20gie		
Single	4191 (34.9)	76.8	17.4	5.8 % a	120.1	<0.0001
Currently Married	7021 (58.4)	52.1	31.9	16.0 A		
Separated/Divorced/Widowed	809 (6.7)	61.1	27.4	11.5		
Parity				B		
0	5010 (41.7)	75.2	18.4	6.4	759.6	<0.0001
1	1844 (15.3)	55.5	30.8	13.7		
1 16 P a g e	1844 (15.3)	-	30.8	6.4 bliographique a	759.6	<0.00

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2	1903 (15.8)	49.4	32.7	17 9 -0		
3	1405 (11.7)	45.6	36.1	17.9 - 02 18.32 - 68 15.69 on		
>3	1859 (15.5)	54.0	30.4	15.6		
Number of Household Member				20 M for ι		
<u>≤</u> 5	7402 (61.6)	59.8	27.2	13.0g Eng	7.4	< 0.001
>5	4620 (38.4)	63.9	25.5	10.6		
Frequency of Viewing Television				019. Do nemen lated to		
Not at all	2779 (23.1)	67.2	24.5	8.3 g g	89.7	<0.001
Less than once a week	2015 (16.8)	63.3	25.9	10.8 b 0		
At least once a week	7227 (60.1)	58.5	27.5	14.0 e e e		
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			25.9 27.5	larch 2019. Downloaded from http://bmjopen.bmj.com/ on June 12, 2025 at Agence Bibliographique de l Enseignement Supperieur (ABES) . Isses related to textand data mining, Al training, and similar technologies.		

association between the frequency of viewing television and overweight and obesity

Ordered logistic regression was used to discern the association between the frequency of viewing television and overweight and obesity. During the analyses, the normal weight category (BMI < 23 kg/m²) was held as the reference group. The results are presented in Table 3. In the final model after adjusting for age, place and region of residence, wealth index, highest educational status, current employment status, parity and number of household members, it was found that, women who watched television at least once a week were 1.2 times more likely to be overweight and obesethan the women who never watched television (AOR: 1.16, 95% CI: 1.02-1.32; *p*-value=0.023).

When stratified by urban and rural residence, overweight and obesity showed significant association with the frequency of viewing television in the urban areas. However, in the rural areas, women who watched television at least once a week were 1.2 times more likely to be overweight and obese than those who did not watch television at all (AOR: 1.16, 95% CI: 1.01-1.34; *p*-value=0.040) (Table 3).

The final logistic regression models are shown in supplementary table 1-3 (supplementary file 2).

Table 3: Association between the frequency of viewing Television and overweight and obesity among reproductive age women of Myanmar, MDHS* 2015-16

Frequency of viewing				
Television	COR**(95% CI***)	<i>p</i> -value	AOR****(95% CI***)	p-valarch 20
Total:				2019. related
Not at all	Ref		Ref	Do nen d to
Less than once a week	1.20 (1.03-1.40)	0.020	1.01 (0.87-1.19)	0.870x wnloa
At least once a week	1.49 (1.32-1.69)	<0.001	1.16 (1.02- 1.32)	0.87 (ext and data m
In Urban Area:				
Not at all	Ref	1 h	Ref	ning
Less than once a week	1.15 (0.80-1.67)	0.441	1.05 (0.73-1.51)	
At least once a week	1.25 (0.93-1.69)	0.144	1.14(0.85-1.52)	0.77% trainiopen.bm
In Rural Area:				and
Not at all	Ref		Ref	<u>s.</u> <u>Ž</u>
Less than once a week	1.11 (0.93-1.32)	0.242	0.98 (0.82-1.17)	0.820
At least once a week	1.26 (1.10-1.44)	0.001	1.16 (1.01-1.34)	ne 12, 2025 a
* MDHS: Myanmar Demogr ** COR: Crude Odds Ratio *** CI: Confidence Interval	aphic and Health Surv	ey		on June 12, 2025 at Agence Bibliographique de I
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17 1 a g c				<u>ē</u> Q .
	For peer review only	y - http://bmjopen.bmj.c	om/site/about/guidelines.xht	ml <u>o</u>

** COR: Crude Odds Ratio

*** CI: Confidence Interval

**** AOR: Adjusted Odds Ratio

Results are based on ordered logistics regression and adjusted for age, place of residence, region of residence, highest educational

status, current employment status, wealth index, parity and number of household members. BMI <23 groups that as the reference group.

group.

model goodness-of-fit: To assess the internal validity of the regression model, the F-adjusted mean resident goodness-of-fit test was model goodness-of-fit: To assess the internal validity of the regression model, the F-adjusted mean resident grade used. The p-value of the F statistics of the adjusted model was <0.001, indicating an acceptable model fitties military, and similar technologies.

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DISCUSSION

To the best of our knowledge, this is the first study to utilize a nationally representative sample to examine the association between frequency of television viewing with the prevalence of overweight and obesity among women of reproductive age in Myanmar. More than one fourth of the women surveyed were overweight and one in eight women was obese. This study also found that watching television at least once a week was significantly associated with overweight/obesity in women of reproductive age in rural Myanmar.

The prevalence of overweight and obesity among women of reproductive age was found to be 26.5% and 12.2% respectively. The total burden of overweight/obesity (38.7%) was almost similar to the burden of overweight and obesity among the same target group in other South and Southeast Asian countries, including Nepal (32.8%)³², Bangladesh (36%)³ and Pakistan (39%).³³ Each of these studies utilized a nationally representative sample and the Asian BMI cutoff.

The prevalence of overweight and obesity was higher among the women living in the urban areas compared to those living in the rural areas. This finding is consistent with studies done in other South and Southeast Asian countries, including Bangladesh, as well as in the other continents.³ ²⁵ ³⁴⁻³⁶ Urban women had a higher frequency of television watching. This may be due to the higher coverage of electricity and the availability of many satellite channels in urban areas in comparison to rural areas.²⁵

It was found that among rural women, the prevalence of overweight and obesity was significantly associated with watching television at least once a week. This finding is also consistent with the finding from Bangladesh.²⁵

Despite the frequency of television watching among urban women, there was no association between this behavior and the prevalence of overweight and obesity. However, they were more likely to be overweight/obese than rural women. A propensity towards a more sedentary lifestyle and the intake of high-calorie foods by the urban residents may be potential determinants that have overridden the effect from an increased frequency of watching television. On the other hand, reliance on less developed transportation facilities, involvement in more laborious work and comparatively lower consumption of obesogenic diets among the rural women are factors that may contribute to a lower prevalence of overweight and obesity.²⁵ Those who view television more frequently in the rural area are more prone to lead a sedentary lifestyle and as such are at greater risk of developing obesity.²⁵

The findings from our study are coherent with a recent study in Bangladesh, which showed a positive association between the frequency of television viewing and overweight and obesity in women of reproductive age.²⁵ Similar positive associations were also found in developed countries (e.g. USA and Australia).^{20 22-24} In a recently published multi-country study, this association has also been observed in the case of children and adolescents.³⁷

Policy and Program Implications

The high prevalence of overweight/obesity is associated with an increased burden from NCDs in Myanmar, as shown in recent evidence.⁷ ³⁸ An unintended consequence of the continuing economic development of the country is the increasing preference for a sedentary lifestyle and obesogenic food, which, in turn, is raising the burden of overweight/obesity. Considering the epidemiologic, demographic, and nutritional transition, the policymakers of Myanmar should focus on the prevention and control of both overweight and obesity and NCDs.

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The newly released 'Myanmar National Health Plan 2017-2021' incorporates NCD prevention and control programs.³⁹ Furthermore, a Social Behavioral Change Communication (SBCC) campaign should be developed in order to promote physical activity and raise awareness among the population, especially among children and adolescents, in order to prevent overweight/obesity as early as possible. Further research should be conducted among men and adolescents to determine whether this positive association exists among those target population as well.

STRENGTHS AND LIMITATIONS

This is the first study, which utilized a nationally representative sample to examine the association between the frequency of watching television and overweight/obesity among women of reproductive age in Myanmar. Moreover, as MDHS utilized standard and valid tools for data collection, the probability of the existence of any measurement error is lower in this study in comparison to other cross-sectional studies conducted in Myanmar. However, the survey could not establish the temporal relationship between the exposure and the outcome variables because of its cross-sectional design. As a result, the causal association that frequent TV watching may cause obesity could not be established. The frequency of television viewing was measured in weeks, as opposed to days/hours; the latter could have given more precise information. In the multivariable analysis, food habit and duration of physical activity were not included because this information was not collected in MDHS. There may be the presence of reporting bias while measuring the frequency of television watching. The information related to the frequency of time

spent on other types of telecommunication devices such as mobile phones or computers was not collected, so the association with those variables with overweight/obesity could not be measured.

CONCLUSIONS

The rising burden of overweight and obesity is now a global concern. Obesity ultimately leads towards the development of NCDs and premature death. The results from this study demonstrate that watching television is associated with obesity among reproductive age women in Myanmar. Therefore, necessary steps should be taken to improve awareness regarding the harmful consequences of watching TV for longer hours and physical inactivity as well as to encouragement of increased physical activity. Additional research is also warranted to explore the situation among the general population of Myanmar.

LIST OF ABBREVIATION

- ASEAN- Association of Southeast Asian Nations
- 310 BMI- Body Mass Index
- 311 GDP- Gross Domestic Product
- 312 GNI- Gross National Income
- 313 NCDs- Non-Communicable Diseases
- 314 MDHS- Myanmar Demographic and Health Survey
- 315 SBCC- Social Behavioral Change Communication
- 316 SEARO- South-East Asia Regional Office

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317	USAID- United States Agency for International Development
318	USD- United States Dollar
319	WHO- World Health Organization
320	3MDG- Three Millennium Development Goal Fund
321	Contributors
322	RDG, IHS, MH, IS and MS conceptualized the study. RDG, IHS, MH, IS, MRH and MS
323	designed the study and acquired the data. RDG, IHS, MH and IS conducted the data analysis.
324	RDG, IHS, MH, IS, MRH and MS interpreted the data. RDG, IHS, MH, IS and MRH prepared
325	the first draft. RDG, IHS, MH, IS, MRH and MS participated in critical revision of the
326	manuscript and contributed to its intellectual improvement. All authors went through the final
327	draft and approved it for submission. RDG, IHS, MH and IS equally contributed in this work as
328	first author.
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331	commercial or not-for-profit sectors.
332	commercial or not-for-profit sectors. Acknowledgments
333	The authors acknowledge the DHS program for providing access to the dataset.
334	Competing Interests

Patient Consent

None declared.

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None Declared

Disclaimer

The authors are alone responsible for the integrity and accuracy of data analysis and the writing the manuscript.

Ethics Approval

The datasets were obtained from DHS Programme with proper procedure. The study exempt from collecting ethical approval because the survey protocols were reviewed and approved by Ethics Review Committee on Medical Research including Human Subjects in the Department of Medical Research, Ministry of Health and Sports as well as from the ICF Institutional Review Board.

Data Sharing Statement

The dataset of MDHS 2015-16 is available at the Demographic and Health Surveys Program. Extra data is available which is available on request at http://dhsprogram-com/what-we-do/survey/survey-display-349.cfm

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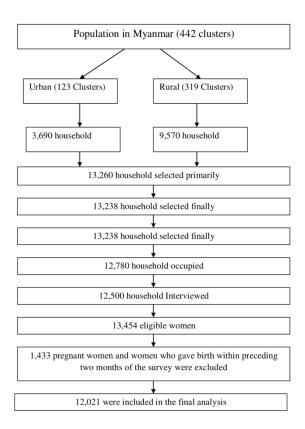
462	Figures:

- **Figure 1:** Flowchart showing the process of selecting the participants in the survey
- Figure 2: Distribution of the respondents by BMI status
- Figure 3: Distribution of the respondents by place of residence with frequency of watching
- 466 television

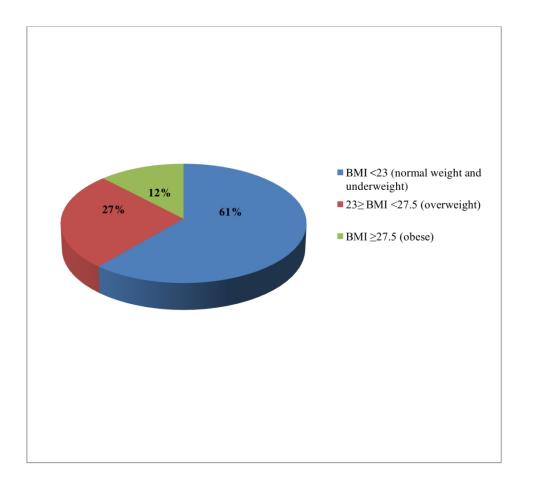
Supplementary Materials:

- **Supplementary File 1:** STROBE Checklist
- **Supplementary File 2:** Supplementary Tables

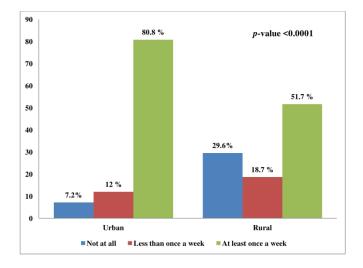
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Flowchart showing the process of selecting the participants in the survey $143x186mm\;(300\;x\;300\;DPI)$



Distribution of the respondents by BMI status 107x101mm (300 x 300 DPI)



Distribution of the respondents by place of residence with frequency of watching television $143 \times 186 \text{mm} \ (300 \times 300 \text{ DPI})$

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of gross sectional studies

Title of the study: 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

Results from a nationwide cross-sectional survey

Section/Topic	Item #	Recommendation	Reported on page
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and was found	2-3
Introduction		nd de	
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	Explain the scientific background and rationale for the investigation being reported State specific objectives, including any prespecified hypotheses	6
Methods		9, Al	
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(a) Give the eligibility criteria, and the sources and methods of selection of participants of selection of select	7-8
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect mediffers. Give diagnostic criteria, if applicable	7-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	8-10
Bias	9	Describe any efforts to address potential sources of bias	11
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	11
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	11
		(b) Describe any methods used to examine subgroups and interactions	11
		For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml	11

		<u> </u>	1.1
		(c) Explain how missing data were addressed	11
		(d) If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	Not applicable
		(e) Describe any sensitivity analyses	Not applicable
Results		for a	
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligient amined for	7
		eligibility, confirmed eligible, included in the study, completing follow-up, and analysed and state of the study of the s	
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	7
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and infogration on exposures and potential confounders	12-13
		potential confounders (b) Indicate number of participants with missing data for each variable of interest	7
Outcome data	15*	Report numbers of outcome events or summary measures	12-19
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and the precision (eg, 95%)	17-19
		confidence interval). Make clear which confounders were adjusted for and why they were included	
		(b) Report category boundaries when continuous variables were categorized	Not applicable
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Not applicable
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	Not applicable
Discussion		g, am j.	
Key results	18	Summarise key results with reference to study objectives	20
		Discuss limitations of the study, taking into account sources of potential bias or imprecasiog. Discuss both	22
Limitations	19	, 01	
•	19	direction and magnitude of any potential bias Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	20-22
Limitations		direction and magnitude of any potential bias Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	
Limitations Interpretation	20	direction and magnitude of any potential bias Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses,	20-22
Limitations Interpretation Generalisability	20	direction and magnitude of any potential bias Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	20-22

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Page 41 of 50			ВМЈ	Open		36/bmjopen-2018-024680 on 2 cted by copyright-including to	
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4	Sagaing	0.85	0.65-1.11	0.234	0.88	0.67-193	0.343
5 6	Taninthayi	0.91	0.70-1.17	0.459	1.03	0. 28 -1 8 6 or	0.832
7 8	Bago	0.65	0.51-0.82	<0.001	0.68	U 0 +-Ua3 /	0.002
9 10	Magway	0.56	0.43-0.74	<0.001	0.60	0.48677 0.486777	<0.001
11 12	Mandalay	0.67	0.52-0.87	0.002	0.64	March 2079. D Enseigneme 0. ser related	<0.001
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15 16	Rakhine	0.39	0.29-0.52	<0.001	0.61	2.45 (1) 0.45 (1) 0.4	0.001
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19 20	Shan	0.81	0.60-1.09	0.165	0.91	0. ₫<mark>.</mark>₩	0.486
21 22	Ayeyarwaddy	0.66	0.50-0.88	0.005	0.81	ng. : 1350 0.621 - 1350 0.621 - 1350	0.152
23 24	Naypyitaw	0.69	0.53-0.90	0.006	0.68	0. 5 2-0	0.008
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33 34	Secondary	1.13	0.97-1.32	0.115	1.26	1. 94 -1 3 3	0.018
35 36	Higher	1.50	1.22-1.83	<0.001	1.10	0.86-1 2 40	0.452
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	Less than once a week	1.20	1.03-1.40	0.020	1.01	0. 5 7-1 9 9	0.870
	At least once a week	1.49	1.32-1.69	<0.001	1.16	1. @ 2-1 33 2	0.023
_	3+ Number of Household Member ≤5 Frequency of watching TV Not at all Less than once a week At least once a week MDHS: Myanmar Demogra, CI: Confidence Interval ¹ Variable with p-value less	phic and Healisss than <0.2 f	ch Survey From unadjusted model v	were included into m 4 open.bmj.com/site/abc	cultivariable	m/ on June 12, 2025 at Agence Bibliographique de l similar technologies.	

Supplementary Table 2			BMJ Open		36/bmjopen	
Supplementary Table i urban area among woi Variable	2: Crude odds ra nen of Myanmar Crude Odds	atios for factors r, MDHS 2015-1	associated with (l.6.	overweight and ol	680 o	normal weight for p-value ¹
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25-34	3.43	2.72-4.33	<0.001	2.67	xt and a 2.07-病	<0.001
35-49	7.63	6.32-9.21	<0.001	5.52	2.07-3 dd from 4.30-7.	<0.001
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Sagaing	0.96	0.72-1.28	0.790	0.71	0.51-Vech 12,	0.943
Taninthayi	0.62	0.47-0.82	0.001	0.61	0.70-800, 2025 0.38-45985 at	0.042
Bago	0.71	0.53-0.93	0.015			0.010
Magway	0.59	0.36-0.97	0.038		en	0.013
Mandalay	0.98	0.79-1.22	0.848	0.85	0.62-1.18 5	0.334
Magway Mandalay	0.59	0.36-0.97	0.038	0.62 0.50 0.85	0.43-0.89 6 ence Biblio 0.29-0.86 0.62-1.186	0.013

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Shan	1.03	0.69-1.55	0.885	1.05	larch 20 Enselg 0.65-	0.839	
Ayeyarwaddy	0.74	0.52-1.06	0.099	0.89	ne. ate	0.632	
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3	3.95	3.01-5.20	<0.001	1.50	1.03-2.18	0.034
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Frequency of watching TV*					18-024680 Jht, includi				
Not at all	Ref			Ref	on 20 ing for				
Less than once a week	1.15	0.80-1.67	0.441	1.05	March uses:	0.779			
At least once a week	1.25	0.93-1.69	0.144	1.14	2019. @ lat6d 0.85- a6	0.389			
At least once a week 1.25 0.93-1.69 0.144 1.05 0.73- 변화 2 0.779									

¹ Variable with p-value less than <0.2 from unadjusted model were included into multivariable analysis

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Supplementary Table 3: for rural area among wo	: Adjusted odds ratio omen of Myanmar, N	s for factors associ IDHS 2015-16.	iated with over	weight and obesit	pen-2018-red to not y compared to not	rmal weight
Variable	Crude Odds	95% CI	<i>p</i> -value ¹	Adjusted Odds	ling for	<i>p</i> -value ¹
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Age Group (in years)					h 2019. seignen s related	
15-24	Ref			Ref		
25-34	3.10	2.65-3.62	< 0.001	2.09	1.25 1.25 1.26 1.26	<0.001
35-49	4.61	4.01-5.30	<0.001	2.89	2. 33 9	<0.001
Region of Residence					Note that the second se	
Kachin	Ref			Ref	rom h (ABE	
Kayah	0.70	0.46-1.06	0.091	0.71	0.48.91.6	0.091
Kayin	0.85	0.58-1.24	0.401	0.89	0.63-155 0.63-155	0.497
Chin	0.36	0.23-0.57	< 0.001	0.43	0. 2 8-064 nii 0. 2 1-1 2 5	<0.001
Sagaing	0.90	0.63-1.30	0.586	0.88	0. & i -1 2 5	0.466
Taninthayi	1.10	0.77-1.56	0.606	1.25	0. 8 8-1 2 78	0.206
Bago	0.68	0.49-0.94	0.018	0.72	0.50-0099	0.044
Magway	0.62	0.44-0.87	0.006	0.62	0.44-046	0.005
Mandalay	0.58	0.40-0.83	0.004	0.57	○ 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0.002
Mon	0.90	0.63-1.29	0.570	1.03	0.62-1239 0.43-0393	0.860
Rakhine	0.39	0.26-0.58	<0.001	0.63	0. 4 3-0 4 3	0.022
Yangon	1.07	0.77-1.49	0.681	1.07	0.75-14 2	0.713
Shan	0.78	0.51-1.17	0.222	0.86	0.59-1224	0.418
Ayeyarwaddy	0.71	0.49-1.03	0.074	0.82	0.56-1 亞 8	0.282
Naypyitaw	0.64	0.44-0.93	0.020	0.67	0.46-0 9)7	0.035

		ВМЈ О		7 36/bmjopen-2018-024680				
Highest Educational Status	I			I	en-2018- opyright,			
Highest Educational Status	D.f.			D. f	0246 , incl			
No Formal Education	Ref	1 00 1 47	<0.001	Ref	udi 80 1.624-1947	0.018		
Primary	1.27	1.09-1.47		1.24	1.164-174/ 5 20-1			
Secondary	0.98	0.82-1.17 0.84-1.52	0.84 0.40	1.26	1.00-1 W / s Ea o @at-7	0.047 0.328		
Higher Currently employment	1.15	0.64-1.32	0.40	1.18	U. Streig Reigi Reigi	0.328		
No	Ref				19. I			
Yes	1.01	0.89-1.14	0.890		7 20fMarch 2019. Downloaded from 17 - Enseignement Superieur (ABE focuses related to text and data 納			
Wealth index	1.01	0.89-1.14	0.090		nload Super			
Poorest	Ref			Ref	led fi			
Poorer	1.49	1.28-1.73	<0.001	1.50	ita (ABB) 1 287 BB → 7	<0.001		
Middle	1.49	1.59-2.20	<0.001	2.00	1.27 E 1. 1. 3 7 E 1. 1. 3 7 - 2.40	<0.001		
Richer	2.05	1.72-2.45	<0.001	2.30	1. (a) -2 (b) 1	<0.001		
Rich	2.59	2.01-3.35	<0.001	2.97	brigger 8 1. Agraming, and simplar 8 2. Agraming, and simplar 8	<0.001		
Marital Status	2.39	2.01-3.33	\0.001	2.91	2.21-330 b g	<0.001		
Single	Ref			Ref	j.cor and			
Married	3.35	2.93-3.83	<0.001	1.69	sim2 1.249-2401	<0.001		
Separated/ Divorced/ Widowed	1.92	1.53-2.42	<0.001	0.97	0.7 a)-1536	0.877		
Parity	1.52	1.00 2.12	101001		1.12-174 0.10 12, 2025 aPA	0.077		
0	Ref			Ref	2025 logie			
1	2.44	2.07-2.87	<0.001	1.47	1.12-1 3 93	0.005		
2	3.37	2.83-4.03	<0.001	1.63	1.22-238	0.001		
3	3.86	3.26-4.57	<0.001	1.71	1.29-2 2 8	<0.001		
3+	2.92	2.48-3.43	<0.001	1.51	1.12-2 5)2	0.006		
	1	10)	1	graphique de l			
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Number of Household						
Member					024680 on , including	
≤5	Ref			Ref	on 2	
>5	0.74	0.66-0.83	<0.001	0.83	0.73-0₹5 % ma	0.005
Frequency of watching TV					rch nse es r	
Not at all	Ref			Ref	2019 igne elate	
Less than once a week	1.11	0.93-1.32	0.242	0.98	0.80 mid 7	0.829
At least once a week	1.26	1.10-1.44	0.001	1.16	1. ₫ % 34	0.040

MDHS: Myanmar Demographic and Health Survey

CI: Confidence Interval

¹ Variable with p-value less than <0.2 from unadjusted model were included into multivariable analysis