# Obesity, overweight, screen time and physical activity in Mexican adolescents

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## Abstract

**Objective**. To determine whether screen time and physical activity is related to overweight or obesity in adolescents. **Material and Methods**. Cross-sectional design. Adolescents aged 10 to 19 were included in the Mexican National Health and Nutrition Survey 2006 (ENSANUT 2006). The dependent variable was overweight or obesity; the independent variable was screen time. A logistic regression model was created to estimate the relationship of overweight and obesity to various factors, including screen time, physical activity, study *vs.* no study, age, sex, indigenous ethnicity, alcohol consumption and tobacco use. **Results**. A total of 18 784 adolescents were included. A positive relation between screen time and overweight and obesity was found. **Conclusions**. Screen time is associated with overweight and obesity in Mexican adolescents.

Key words: overweight; obesity; television/utilization; adolescents; Mexico

**Morales-Ruán MC, Hernández-Prado B, Gómez-Acosta LM, Shamah-Levy T, Cuevas-Nasu L. Obesidad, sobrepeso, tiempo frente a la pantalla y actividad física en adolescentes mexicanos. Salud Publica Mex 2009;51 supl 4:S613-S620.**

## Resumen

**Objetivo**. Determinar si el tiempo que los adolescentes permanecen frente a pantalla y realizan actividad física se asocia con el sobrepeso o la obesidad. **Material y métodos**. Diseño transversal. Se incluyeron adolescentes de 10 a 19 años de edad, de la Encuesta Nacional de Salud y Nutrición 2006 (ENSANUT 2006). La variable dependiente fue el sobrepeso u obesidad y la independiente el tiempo frente a la pantalla. Se ajustó un modelo de regresión logística para estimar la relación entre el sobrepeso u obesidad con el tiempo frente a la pantalla, actividad física, edad, sexo, condición de estudiante, indigenismo, tabaquismo y consumo de alcohol. **Resultados**. Se estudió a 18 784 adolescentes. Se encontró una asociación positiva entre el tiempo frente a pantalla y el sobrepeso u obesidad. **Conclusiones**. El tiempo que los adolescentes mexicanos pasan frente a pantalla está asociado con el sobrepeso u obesidad.

Palabras clave: sobrepeso; obesidad; televisión/utilización; adolescentes; México

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Obesity is a worldwide health problem. In 2005, the WHO estimated that 1 600 million people exceeded normal weight.[1] Obesity is a risk factor for the development of chronic diseases and is increasingly observed among adolescents and children.

The majority of the 150-200 million children with excess weight worldwide live in developing countries.[2] According to the Mexican National Health and Nutrition Survey 2006 (ENSANUT 2006), 31.1% of Mexican male adolescents and 32.5% of Mexican female adolescents aged 12 to 19 are overweight or obese.[3]

Several studies have noted that obesity or overweight during childhood or adolescence increases the risk of obesity in adulthood[4,5] and that obesity that begins in adolescence and continues into adulthood increases morbidity and mortality risks.[6-8] Moreover, obesity in adolescence may negatively impact self-image, resulting in low self-esteem and depression,[9-11] social discrimination and difficulty in performing physical activities.

Strong determinants for overweight and obesity include a diet rich in fat and high calorie foods,[12,13] with inadequate fresh fruit and vegetable intake,[14] limited physical activity[15] and increased TV viewing time.[16-19] Watching TV for long hours may lead to an increased risk of obesity both through reduction of energy use and changes in diet.[20]

TV viewing time and a higher prevalence of obesity have been documented in a US population,[21] and to a lesser extent in a Mexican population.[22] While there is some evidence for this association in Mexico, there is currently no research focusing on Mexican adolescents. This study aims to determine whether screen time and physical activity are related to overweight and obesity in a nationwide sample of Mexican adolescents.

## Material and methods

*Design*: ENSANUT 2006 is a cross-sectional probabilistic survey, representative at national, regional and state levels in Mexico. This survey utilized a stratified multistage sampling design. Basic Geographical Statistical Areas (BGSAs) were selected in the first sampling stage. In a second stage, six blocks were selected at random for each of the BGSA with a probability proportional to the number of homes. Subsequently, in each of the blocks a selection of six houses was chosen using systematic random sampling. In each of the houses, using simple random sampling, an adult, an adolescent, a child and a user of health services were chosen to answer the questionnaires. General methods for ENSANUT 2006 have been described elsewhere.[23]

*Subjects*: Our sample consisted of adolescents aged 10 to 19 living in selected homes at the time of the survey. Informed consent was obtained from the head of the family and verbal consent was obtained from adolescents after the researchers explained the purpose of the survey and the nature of the measurements to be taken from the adolescents. Study procedures were approved by the Research, Ethics and Biosafety Commissions of the National Institute of Public Health (INSP).

### Outcome measurements

*Overweight and obesity.* Height and weight were measured and used to calculate body mass index (weight in kilograms/height in meters$^2$). Weight was determined using *Tanita* electronic scales with 100 g accuracy. Height was measured using Dynatop anthropometers with a capacity of 2 meters and accuracy to 1 mm. Standardization procedures using the *Habitch* technique[24] were established beforehand to minimize errors.

Classification into overweight and obesity was made according to the International Obesity Task Force (IOTF) proposed distribution and cutoff-points.[25] Nine adolescents with BMI under 10 or above 58 k/m$^2$ were excluded from the analysis. The dependent variable in this study was overweight plus obesity.

### Exposure measurements

*Physical activity and screen time:* Information on the number of hours per week adolescents spent engaging in active or passive activity was collected using a semi-quantitative questionnaire. This instrument is based on the Youth Activity Questionnaire developed and validated in adolescents aged 10 to 14 from low and middle income populations in Mexico City.[26]

Screen time was defined as time spent viewing television, videos, or playing video games in TV or computers.

Vigorous physical activity was defined as activity requiring an energy expenditure > 6 MET/hour* (metabolic equivalent), including playing soccer, basketball, volleyball, practicing karate or other martial arts, riding a bicycle, skating or skateboarding, dancing or taking dancing lessons, swimming, and other games and sports

* A unit of metabolic equivalent (MET) represents a multiple of the oxygen consumption at rest, which in turn corresponds to 3.5 mL $O_2$/kg min$^{-1}$. For example, if a person exercising expends 10 MET, that is 10 times the amount of oxygen consumed when at rest.

requiring running or physical exertion; moderate physical activity was defined as activity requiring energy expenditure of 3.0 to 6 MET/hour including cleaning the house, walking (including walking to school) with weight (for example, a schoolbag).[27] Sedentary/light activities were defined as those requiring minimal energy expenditure (< 3 MET/hour) including watching TV, films, videos, or playing videogames.

### Covariates

*Socio-demographic characteristics*: Information on age, urban or rural place of residence, and indigenous ethnicity (using as proxy whether the head of the family spoke an indigenous language) was collected at the time measurements were taken. A socioeconomic status index was constructed using variables on dwelling conditions, possession of appliances and other goods,[28] and categorized in tertiles (low, medium, high).
*Studying at present:* Adolescents were asked whether they were students at the time of the survey.
*Habits on alcohol consumption and tobacco use*: Adolescents were asked whether they smoked or drank alcohol.

### Statistical analysis

Analyses were adjusted according to the sampling design of ENSANUT 2006 using the SVY module for complex samples of STATA Version 9.2.*

The analysis was carried out considering the dependent variable (BMI) as dichotomous (absence or presence of overweight or obesity).

Screen time was classified as acceptable, borderline excessive, and excessive. Screen time was regarded as acceptable if it was up to 7 hours but less than 14 hours per week (the equivalent of 1 to 2 hours per day). The American Academy of Pediatrics recommends no more than one to two hours per day.[29] Screen time was considered borderline excessive if it was between 14 and 21 hours per week (average 2 hours and 30 minutes per day), and excessive if it was over 21 hours per week (three or more hours per day).

Adolescents were classified according to the amount of time they practiced moderate and vigorous physical activities as active, moderately active and inactive. Adolescents who reported performing 7 or more hours a week of moderate or vigorous physical activity were classified as active.[30] Those reporting 4 to 6.99 hours of physical activity per week were considered moderately active, and those reporting less than 4 hours of moderate or vigorous physical activity per week were considered inactive.

Additionally, an index including both physical activity time and screen time was created to describe categories of activity: adolescents who reported screen time of 21 or more hours per week and performing less than 4 hours of moderate or vigorous physical activity were described as *very passive*; those reporting screen time less than 7 hours and performing less than 4 hours of physical activity were categorized as *moderately passive*; adolescents with screen time less than 7 hours and performing moderate to vigorous physical activity more than 7 hours per week were classified as *very active*, and those with screen time more than 21 hours per week but performing more than 7 hours of physical activity per week were regarded as *slightly active*.

A logistic regression model was fit to estimate the relationship between being overweight or obese and screen time and one was fit to estimate the relationship between being overweight or obese and its association with screen time and time devoted to vigorous or moderate physical activity per week. The first model was controlled for gender, urban or rural environment, indigenous ethnicity, studying at present, tobacco use, alcohol consumption, and physical activity classification. The second model was controlled for the same variables except physical activity. A 0.05 level of significance was used for all results.

## Results

There were 24 921 adolescent respondents to the physical activity questionnaire. A BMI for 18 784 adolescents was obtained (9 582 females and 9 202 males). Seventy-one percent of the adolescents lived in an urban setting and 10% belonged to indigenous groups. A total of 38.0% were of low socioeconomic status, 33.0% of medium and 29% of high socioeconomic status (Table I). Mean age was 14.04±0.032 years and mean weight in adolescents was 52.3±15.3 kg, with a mean height of 154.0±11.8 cm and a mean BMI of 21.7±4.6. Table II shows means by age groups. Overall, overweight and obesity prevalences were 21.6% and 9.3%, respectively.

A total of 23.6% (95% CI; 22.1, 25.3) of males and 31.4% (95% CI; 29.6, 33.2) of females spent at least 7 hours per week on screen time and 23.3% (95% CI; 22.0-24.6) of males and 28.7% (95% CI; 27.4-30.1) of females spent between 7 and 13.9 hours per week on screen time; for 19.1% (95% CI; 17.9,20.3) of female adolescents screen time was between 14 to 20.9 hours and for 33.5% (95% CI; 31.8,35.2) of males it was more than 21 hours

* Stata Corp. Intercooled Stata 9.2 College Station Texas, USA, 2006.

**Table I**
**SOCIO-DEMOGRAPHIC CHARACTERISTICS OF MEXICAN ADOLESCENTS AGED 10 TO 19 YEARS. MEXICO, ENSANUT 2006**

| *Variable* | *Mean* | *SD* | |
|---|---|---|---|
| *Age* | *14.04* | *0.032* | |
| | *n* | *N* (thousands)* | *%* |
| Gender | | | |
| Male | 9 202 | 8 595.0 | 49.0 |
| Female | 9 582 | 8 700.8 | 51.0 |
| Setting | | | |
| Urban | 13 063 | 12 196.4 | 71.0 |
| Rural | 5 721 | 5 099.5 | 29.0 |
| Region | | | |
| North | 4 243 | 3 091.7 | 17.9 |
| Center | 7 210 | 6 908.2 | 39.9 |
| Mexico City | 440 | 1 142.0 | 6.6 |
| South | 6 891 | 6 153.9 | 35.6 |
| Socioeconomic level | | | |
| Low | 7 113 | 6 616.6 | 38.0 |
| Medium | 6 588 | 5 770.8 | 33.0 |
| High | 5 083 | 4 908.5 | 29.0 |
| Indigenous ethnicity | | | |
| Yes | 1 831 | 1 804.9 | 10.0 |
| No | 16 953 | 15 490.9 | 90.0 |
| Studying at present | | | |
| Yes | 15 036 | 13 695.6 | 79.2 |
| No | 3 748 | 3 600.3 | 20.8 |

* *N* expanded to estimate the number of case in the population using the sample weighting factors at national level

per week, or the equivalent of over three hours every day; this percentage was lower for females (20.8%, 95% CI; 19.4, 22.3) (Table III).

A total of 42.5% (95% CI; 40.8, 44.3) of females were classified as passive, 24.6% (95% CI; 23.3, 26.0) as moderately active and 32.9% (95% CI; 31.3, 34.5) as active. This was different from males, 36.6% of whom were classified as passive (95% CI; 35.0, 38.3), 25.1% (95%CI; 23.7, 26.5) as moderately active and 38.3% (95%CI; 36.7, 40.0) as active (Table III).

Results from the first logistic regression model showed that screen time was positively associated with the prevalence of overweight and obesity, after adjustment for age, sex, studying at present, tobacco use, alcohol consumption, urban or rural setting, indigenous ethnicity, and physical activity (Table IV). Adolescents from rural settings were less likely to be overweight or obese when compared to those living in urban settings (OR 0.63, 95% CI; 0.56, 0.72). Adolescents not attending school were more prone to be overweight or obese when compared to those who attended school.

In the second logistic regression model (Table V), adolescents who were *very active* (screen time less than 7 hours per week and physically active) were less likely to be overweight or obese when compared to the all the other adolescents together (OR 0.59, 95% CI; 0.48, 0.73).

## Discussion

Screen time was positively associated with overweight or obesity in a probabilistic sample of Mexican adolescents. There was no association between intense or moderate physical activity and overweight or obesity. Furthermore, in the analysis with variables that consider screen time and time dedicated to physical activities, the categories with higher odds of obesity and overweight were the ones that had high screen time, suggesting a high relevance of this variable in the prevention of obesity and overweight

This finding is very important because it is the first to document the time that adolescents performed physical activity and screen time at the national level in Mexican adolescents. In addition, this study can be a basis for intervention programs to reduce screen time, given the high prevalence of overweight and obesity in adolescents in the country.

The results of this study corroborate the findings of the Youth Risk Behavior Survey 1999,[21] which also found an association between TV viewing time and overweight and a weak association between physical activity and a reduction in BMI. In a European cross-sectional study[31] researchers have also reported a positive association between TV viewing time and overweight or obesity.

Other studies with the objective of investigating the association of TV viewing and physical activity with overweight in adolescents[32] have found that adolescents watching low levels of TV did not have increased odds of overweight, with the exception of females with low TV viewing and low physical activity (OR 1.48); females with high TV viewing and low physical activity had the highest odds of overweight (OR 3.11).

One of the limits of this study was the lack of information about food consumption practices during screen time. It is not possible to distinguish whether the

**Table II**
**ANTHROPOMETRIC CHARACTERISTICS OF ADOLESCENTS. MEXICO, ENSANUT 2006**

| *Age groups* | *Female* | | | | *Male* | | | | *Both* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Variable* | *n* | *N*( thousands)* | *Median* | *SD* | *n* | *N* (thousands)* | *Median* | *SD* | *n* | *N *( thousands)* | *Median* | *SD* |
| Weight (kg) | | | | | | | | | | | | |
| 10-13 years | 4 437 | 3 950.0 | 43.9 | 11.7 | 4 519 | 4 031.3 | 44.1 | 13.58 | 8 956 | 7 981.3 | 44.0 | 12.7 |
| 14-16 years | 2 733 | 2 586.1 | 55.6 | 12.0 | 2 769 | 2 728.5 | 59.6 | 13.62 | 5 502 | 5 314.6 | 57.7 | 13.0 |
| 17-19 years | 2 412 | 2 164.7 | 58.2 | 13.2 | 1 914 | 1 835.3 | 66.3 | 14.13 | 4 326 | 4 000.0 | 61.9 | 14.2 |
| Total | 9 582 | 8 700.8 | 51.0 | 13.8 | 9 202 | 8 595.1 | 53.8 | 16.61 | 18 784 | 17 295.9 | 52.3 | 15.3 |
| Height (cm) | | | | | | | | | | | | |
| 10-13 years | 4 437 | 3 950.0 | 146.4 | 9.3 | 4 519 | 4 031.3 | 146.9 | 11.39 | 8 956 | 7 981.3 | 146.6 | 10.4 |
| 14-16 years | 2 733 | 2 586.1 | 155.2 | 6.8 | 2 769 | 2 728.5 | 164.0 | 8.09 | 5 502 | 5 314.6 | 159.7 | 8.7 |
| 17-19 years | 2 412 | 2 164.7 | 155.8 | 6.7 | 1 914 | 1 835.3 | 167.3 | 7.86 | 4 326 | 4 000.0 | 161.0 | 9.3 |
| Total | 9 582 | 8 700.8 | 151.3 | 9.2 | 9 202 | 8 595.1 | 156.7 | 13.44 | 18 784 | 17 295.9 | 154.0 | 11.8 |
| BMI (kg/m$^2$) | | | | | | | | | | | | |
| 10-13 years | 4 437 | 3 950.0 | 20.3 | 4.0 | 4519 | 4 031.3 | 20.1 | 4.18 | 8 956 | 7 981.3 | 20.2 | 4.1 |
| 14-16 years | 2 733 | 2 586.1 | 23.0 | 4.4 | 2769 | 2 728.5 | 22.0 | 4.18 | 5 502 | 5 314.6 | 22.5 | 4.3 |
| 17-19 years | 2 412 | 2 164.7 | 23.9 | 4.9 | 1914 | 1 835.3 | 23.6 | 4.51 | 4 326 | 4 000.0 | 23.8 | 4.7 |
| Total | 9 582 | 8 700.8 | 22.0 | 4.6 | 9202 | 8 595.1 | 21.5 | 4.48 | 18 784 | 17 295.9 | 21.7 | 4.6 |
| IOTF category | | | % | | | | % | | | | % | |
| Normal | 6 372 | 5 941.6 | 68.3 | | 6 191 | 6 012.7 | 67.3 | | 12 563 | 11 954.3 | 69.1 | |
| Overweight | 2 293 | 1 975.0 | 22.7 | | 1 994 | 1 764.6 | 21.7 | | 4 287 | 3 739.7 | 21.6 | |
| Obese | 917 | 784.1 | 9.0 | | 1 017 | 817.8 | 11.0 | | 1 934 | 1 601.9 | 9.3 | |

* *N* expanded to estimate the number of cases in the population using the sample weighting factors at national level
IOTF: International Obesity Task Force

association between screen time, especially TV viewing, and overweight and obesity occurs due to a reduction of physical activity or an increase in energy consumption attributable to snacking while watching TV. Studies have found evidence that food consumption increases during the time spent watching TV.[33-35] This limitation, however, does not invalidate the association between screen time and being overweight and obese, since the study controlled for physical activity.

The cross-sectional design does not distinguish the direction of the association; it is possible that excess body weight causes reduced physical activity and sedentary behavior.

Another possible limitation is the instrument used to measure screen time and physical activity. The instrument is based on reports from the adolescents and not on direct observation or the use of an accelerometer. Nevertheless, this instrument that has been validated for the Mexican population, has been proven to be valid, and yielded reproducible results for screen time and moderate and vigorous activity measurements.[26]

The instrument used to assess physical activity or screen time, although validated in the Mexican population, may have non-random measurement errors that could attenuate the association between physical activity and screen time with obesity. Therefore, the estimates presented may be conservative and the associations may be stronger than the ones documented in this paper.

The strength of this study lies in its design, which is probabilistic and includes a national representative sample. However, since this was a cross-sectional study, it was not possible to determine a cause-effect relation between screen time and overweight and obesity in adolescents. Other longitudinal studies corroborate a similar relationship.[36] Randomized trials in which the

**Table III**
**CLASSIFICATION OF ADOLESCENTS ACCORDING TO SCREEN TIME AND PHYSICAL ACTIVITY, BY AGE GROUPS. MEXICO, ENSANUT 2006**

| | | | *Screen time (hours per week)* | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | *< 7 h‡* | | *≥ 7 < 14 h‡* | | *≥ 14 < 21 h* | | *≥ 21 h* | |
| | *n* | *N* (thousands)* | *%* | *95% CI* | *%* | *95% CI* | *%* | *95% CI* | | *95% CI* |
| Women | | | | | | | | | | |
| 10-13 years | 4 437 | 3 950.0 | 32.8 | (30.5 , 35.2 ) | 28.1 | (26.1 , 30.3 ) | 18.9 | (17.2 , 20.8 ) | 20.1 | (18.2 , 22.1 ) |
| 14-16 years | 2 733 | 2 586.1 | 28.2 | (25.7 , 30.8 ) | 30.8 | (28.4 , 33.2 ) | 19.9 | (17.9 , 22.1 ) | 21.2 | (19.0 , 23.6 ) |
| 17-19 years | 2 412 | 2 164.7 | 32.5 | (29.5 , 35.7 ) | 27.2 | (24.6 , 30.0 ) | 18.5 | (16.4 , 20.8 ) | 21.8 | (19.0 , 24.8 ) |
| Total | 9 582 | 8 700.8 | 31.4 | (29.6 , 33.2 ) | 28.7 | (27.4 , 30.1 ) | 19.1 | (17.9 , 20.3 ) | 20.8 | (19.4 , 22.3 ) |
| Men | | | | | | | | | | |
| 10-13 years | 4 519 | 4 031.3 | 23.5 | (21.4 , 25.6 ) | 23.9 | (22.0 , 25.8 ) | 19.8 | (18.1 , 21.6 ) | 32.9 | (30.6 , 35.3 ) |
| 14-16 years | 2 769 | 2 728.5 | 24.5 | (22.1 , 27.1 ) | 21.0 | (18.9 , 23.3 ) | 19.4 | (17.3 , 21.7 ) | 35.1 | (32.3 , 37.9 ) |
| 17-19 years | 1 914 | 1 835.3 | 22.6 | (19.7 , 25.8 ) | 25.4 | (22.5 , 28.6 ) | 19.4 | (16.9 , 22.1 ) | 32.5 | (29.4 , 35.9 ) |
| Total | 9 202 | 8 595.0 | 23.6 | (22.1 , 25.3 ) | 23.3 | (22.0 , 24.6 ) | 19.6 | (18.3 , 20.9 ) | 33.5 | (31.8 , 35.2 ) |

| | | | *Physical activity (hours per week)* | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | *Passive (< 4 h)* | | *Moderately Active (≥4 < 7 h)* | | *Active (≥7 h)§* | |
| | *n* | *N* (thousands)* | *%* | *95% CI* | *%* | *95% CI* | *%* | *95% CI* |
| Women | | | | | | | | |
| 10-13 years | 4 437 | 3 950.0 | 43.0 | (40.6 , 45.4 ) | 27.0 | (25.0 , 29.1 ) | 30.0 | (28.1 , 32.1 ) |
| 14-16 years | 2 733 | 2 586.1 | 39.8 | (37.1 , 42.7 ) | 24.9 | (22.7 , 27.2 ) | 35.3 | (32.6 , 38.1 ) |
| 17-19 years | 2 412 | 2 164.7 | 44.9 | (41.9 , 47.9 ) | 19.9 | (17.6 , 22.5 ) | 35.2 | (32.2 , 38.3 ) |
| Total | 9 582 | 8 700.8 | 42.5 | (40.8 , 44.3 ) | 24.6 | (23.3 , 26.0 ) | 32.9 | (31.3 , 34.5 ) |
| Men | | | | | | | | |
| 10-13 years | 4 519 | 4 031.3 | 37.1 | (34.9 , 39.3 ) | 24.4 | (22.7 , 26.3 ) | 38.5 | (36.2 , 40.8 ) |
| 14-16 years | 2 769 | 2 728.5 | 35.4 | (32.7 , 38.2 ) | 26.7 | (24.2 , 29.4 ) | 37.9 | (35.0 , 40.8 ) |
| 17-19 years | 1 914 | 1 835.3 | 37.3 | (34.0 , 40.7 ) | 24.0 | (21.0 , 27.2 ) | 38.7 | (35.5 , 42.1 ) |
| Total | 9 202 | 8 595.0 | 36.6 | (35.0 , 38.3 ) | 25.1 | (23.7 , 26.5 ) | 38.3 | (36.7 , 40.0 ) |

* *N* expanded to estimate the number of cases in the population using the sample weighting factors at national level
‡ Time recommended by the American Academy of Pediatrics (1 to 2 hours per day)[29]
§ Recommended physical activity time[30]

intervention was a reduction in TV viewing time have found a reduction in obesity.[37,38]

In the US and UK, there is consensus that children should have at least 60 minutes of moderate to vigorous physical activity daily.[39,40] In Canada, public health policies recommend not only increasing moderate and intense physical activity but also reducing sedentary activity.

This recommendation is important and applicable to the adolescent population in Mexico, given the high prevalence of adolescents who are inactive and the inadequate prevalence of screen time.

Obesity prevalence among adolescents in Mexico and lack of physical activity indicate the need to promote intense physical activity and to reduce sedentary activity such as TV viewing and videogame playing.

**Table IV**
**LOGISTIC REGRESSION MODEL FOR OVERWEIGHT AND OBESITY RELATED TO SCREEN TIME IN ADOLESCENTS. MEXICO, ENSANUT 2006**

| *Variables* | *Crude OR* | *95% CI* | *Adjusted OR** | *95% CI* |
|---|---|---|---|---|
| Screen time (hours per week) | | | | |
| < 7 hours | 1 | | 1 | |
| ≥ 7 hours to < 14 hours | 1.32 | (1.16 , 1.51) | 1.20 | (1.05 , 1.36) |
| ≥ 14 hours to < 21 hours | 1.32 | (1.14 , 1.53) | 1.18 | (1.02 , 1.36) |
| ≥ 21 hours | 1.51 | (1.32 , 1.72) | 1.29 | (1.13 , 1.48) |
| Female | 1 | | 1 | |
| Male | 0.88 | (0.80 , 0.97) | 0.90 | (0.82 , 0.99) |
| Age (in years) | 1.01 | (0.99 , 1.02) | 0.99 | (0.97 , 1.01) |
| Studying at present (yes) | 1 | | 1 | |
| Studying at present (no) | 1.13 | (1.00 , 1.27) | 1.14 | (1.00 , 1.29) |
| Tobacco use (no) | 1 | | 1 | |
| Tobacco use (yes) | 1.04 | ( 0.92 , 1.17) | 0.94 | (0.83 , 1.07) |
| Alcohol consumption (no) | 1 | | 1 | |
| Alcohol consumption (yes) | 1.15 | (0.99 , 1.33) | 1.12 | (0.95 , 1.32) |
| Urban setting | 1 | | 1 | |
| Rural setting | 0.63 | (0.56 , 0.72) | 0.66 | (0.58 , 0.75) |
| Indigenous ethnicity (no) | 1 | | 1 | |
| Indigenous ethnicity (yes) | 0.62 | (0.52 , 0.75) | 0.69 | (0.58 , 0.82) |
| Physical activity (hours per week) | | | | |
| Inactive (< 4 hours) | 1 | | 1 | |
| Moderately Active (≥4 < 7 hours) | 0.99 | (0.88 , 1.10) | 0.96 | (0.86 , 1.08) |
| Active (≥7 hours) | 0.92 | (0.83 , 1.01) | 0.93 | (0.83 , 1.03) |

* Adjust for gender, urban o rural setting, and indigenous ethnicity, studying at present, tobacco use, alcohol consumption and physical activity

## References


1. Organización Mundial de la Salud. Obesidad y sobrepeso. Descriptive note 311. September 2006. [Consulted 2007 March 13]. Available at: www.who.int.
2. Lobstein T, Baur L, Uauy R, IASO. International Obesity Task Force. Obesity in children and young people: a crisis in public health. Obes Rev 2004;5 (suppl 1):4-104.
3. Olaiz-Fernández G, Rivera-Dommarco J, Shamah-Levy T, Rojas R, Villalpando-Hernández S, Hernández-Ávila M, *et al*. Encuesta Nacional de Salud y Nutrición 2006. Cuernavaca, México: Instituto Nacional de Salud Pública, 2006.
4. Stark O, Atkins E, Wolff OH, Douglas JWB. Longitudinal study of obesity in the National Survey of Health and Development. Br Med J 1981;283:12-17.
5. Freedman D, Kettel L, Serdula M, Dietz W, Srinivasan S, Berenson G. The relation of childhood BMI to adult adiposity: the Bogalusa Heart Study. Pediatrics 2005;115:22-27.
6. Must A, Jacques PF, Dallal GE, Bajema CJ, Dietz WH. Long-term morbidity and mortality of overweight adolescents: a follow-up of the Harvard Growth Study of 1922 to 1935. N Engl J Med 1992;327:1350-1355.
7. Dietz W. J. Childhood weight affects adult morbidity and Mortality. J Nutr 1998;128: 411S-414S.
8. Dietz W. Health consequences of obesity in youth: childhood predictors of adult disease. Pediatrics 1998;101;518-525.
9. Erickson SJ, Robinson TN, Haydel KF, Killen JD. Are overweight children unhappy? Body mass index, depressive symptoms, and overweight concerns in elementary school children. Arch Pediatr Adolesc Med 2000;154:931-935.
10. Xie B, Chou CP, Spurjit-Metz D, Liu C, Xia J, Gong J, *et al*. Effects of perceived peer isolation and social support availability on the relationship between body mass index and depressive symptoms. Int J Obes (Lond) 2005;29(9):1137-1143.


**Table V**
**LOGISTIC REGRESSION MODEL FOR OVERWEIGHT AND OBESITY AND THEIR ASSOCIATION TO SCREEN TIME AND DOING PHYSICAL ACTIVITY IN ADOLESCENTS. MEXICO, ENSANUT 2006**

| *Variables* | *Crude OR* | *95% CI* | *Adjusted OR** | *95% CI* |
|---|---|---|---|---|
| Categories by screen time and time performing physical activity (hours per week) | | | | |
| Very passive (≥ 21 screen time hours, <4 physical activity hours) | 1 | | 1 | |
| Moderately passive (< 7 screen time hours, <4 physical activity hours) | 0.69 | (0.56 , 0.85) | 0.79 | (0.64 , 0.98) |
| Slightly active (≥ 21screen time hours, ≥ 7 physical activity hours) | 0.93 | (0.75 , 1.14) | 0.95 | (0.77 , 1.17) |
| Very active (< 7 screen time hours, ≥ 7 physical activity hours) | 0.59 | (0.48 , 0.73) | 0.70 | (0.57 , 0.88) |
| Female | 1 | | 1 | |
| Male | 0.82 | (0.71 , 0.95) | 0.85 | (0.73 , 0.98) |
| Age | 1.00 | (0.97 , 1.02) | 0.98 | (0.95 , 1.01) |
| Studying at present (yes) | 1 | | 1 | |
| Studying at present (no) | 1.13 | (0.95 , 1.35) | 1.18 | (0.98 , 1.43) |
| Tobacco use (no) | 1 | | 1 | |
| Tobacco use (yes) | 0.84 | (0.70 , 1.01) | 0.74 | (0.61 , 0.91) |
| Alcohol consumption (no) | 1 | | 1 | |
| Alcohol consumption (yes) | 1.21 | (0.96 , 1.52) | 1.32 | (1.02 , 1.72) |
| Urban setting | 1 | | 1 | |
| Rural setting | 0.64 | (0.53 , 0.78) | 0.68 | (0.56 , 0.83) |
| Indigenous ethnicity (no) | 1 | | 1 | |
| Indigenous ethnicity (yes) | 0.52 | (0.41 , 0.67) | 0.59 | (0.45 , 0.76) |

* Adjust for gender, urban o rural setting, indigenous ethnicity, studying at present, tobacco use and alcohol consumption

11. Needhham BL, Crosnoe R. Overweight status and depressive symptoms during adolescence. J Adolesc Health 2005;36(1):48-55.
12. WHO/FAO. Diet, nutrition and the prevention of chronic diseases. Report of a Joint WHO/FAO Expert Consultation. World Health Organ Tech Rep Ser 2003;916:i–viii, 1-149.
13. Quatromoni PA, Copenhafer DL, D'Agostino RB, Millen BE. Dietary patterns predict the development of overweight in women: The Framingham Nutrition Studies. J Am Diet Assoc 2002;102:1239-1246.
14. Schulz M, Nothlings U, Hoffmann K, Bergmann MM, Boeing H. Identification of a food pattern characterized by high-fiber and low-fat food choices associated with low prospective weight change in the EPICPotsdam cohort. J Nutr 2005;135:1183-1189.
15. US Department of Health and Human Services. Physical activity and health: a report of the surgeon general. Atlanta (GA): US Department of Health and Human Services, Center for Chronic Diseases Prevention and Health Promotion, 1996.
16. Maffeis C, Talamini G, Tatò L. Influence of diet, physical activity and parent's obesity on children's adiposity: a four year longitudinal study. Int J Obes Relat Metab Disord 1998;22:758-764.
17. Crespo CJ, Smit E, Trojano RP, Barlet SJ, MaceraCA, Andersen RE. Television watching, energy intake, and obesity in US children: results from the third National Health and Nutrition Examination Survey, 1988-1994. Arch Pediatr Adolesc Med 2001;155(3):360-365.
18. Dietz WH. Physical activity and childhood obesity. Nutrition 1991;7:295-297.
19. Gortmaker S, Must A, Sobol A, Peterson K, Colditz G, Dietz W. Television viewing as a cause of increasing obesity among children in the United States, 1986-1990. Arch Pediatr Adolesc Med 1996;150:356-362.
20. Dietz WH, Gortmaker SL. Do we fatten our children at the television set? Obesity and television viewing in children and adolescents. Pediatrics 1985;75:807-812.
21. Einsenmann J, Bartee T, WANG Q. Physical Activity, TV viewing, and weight in US youth: 1999 Youth Risk Behavior Survey. Obes Res 2002;10:379-385.
22. Hernandez B, Gortmaker SL, Colditz GA, Peterson KE, Laird NM, Parra-Cabrera S. Association of obesity with physical activity, television programs and other forms of video viewing among children in Mexico City. Int J Obes 1999;23:845-854.
23. Palma O Shamah-Levy T, Franco A, Olaiz G, Méndez-Ramírez I. Metodología. In: Olaiz-Fernández G, Rivera-Dommarco J, Shamah-Levy T, Rojas R, Villalpando-Hernández S, Hernández-Avila M, *et al*. Encuesta Nacional de Salud y Nutrición 2006. Cuernavaca, México: Instituto Nacional de Salud Pública, 2006: 19-33.
24. Habitch JP. Estandarización de métodos epidemiológicos cuantitativos sobre el terreno. (Standardization of anthropometric methods in the field.) PAHO Bull 1974;76:375-384.
25. Cole T, Bellizi M. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 2000;320:1-6.
26. Hernández B, Gortmarker S, Larid N, Colditz G, Parra-Cabrera, Peterson K. Validez y reproducibilidad de un cuestionario de actividad e inactividad física para escolares de la ciudad de México. Salud Publica Mex 2000;42:315-323.
27. Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, *et al*. Compendium of physical activities. Med Sci Sports Exerc 2000;32(9 Suppl):S498-S504.
28. Resano E, Méndez I, Shamah T, Rivera J, Sepúlveda J. Methods of the National Nutrition Survey 1999. Salud Publica Mex 2003:45 Suppl 4:S558-S564.
29. American Academy of Pediatrics. Committee on Public Education Pediatrics. Pediatrics 2001;108:1222-1225.
30. Council on Sports Medicine and Fitness and Council on School Health. Active Healthy Living: Prevention of Childhood Obesity Through Increased Physical Activity. Pediatrics 2006;117:1834-1842.
31. Velde S, De Bourdeaudhuij I, Thorsdottir I, Rasmussen M, Hagströmer M, Klepp KI, *et al*. Patterns in sedentary and exercise behaviors and associations with overweight in 9-14-year-old boys and girls –a cross-sectional study. BMC Public Health 2007;31:7-16.
32. Eisenmann JC, Bartee RT, Smith DT, Welk GJ, Fu Q. Combined influence of physical activity and television viewing on the risk of overweight in US youth. Int J Obes 2008;32:613-618.
33. Cleland VJ, Schmidt MD, Dwyer T, Venn AJ. Television viewing and abdominal obesity in young adults: is the association mediated by food and beverage consumption during viewing time or reduced leisure-time physical activity? Am J Clin Nutr 2008;87(5):1148-1155.
34. Coon KA, Goldberg J, Rogers BL, Tucker KL. Relationships between use of television during meals and children's food consumption patterns. Pediatrics 2001;107:E7.
35. Stroebele N, de Castro JM. Television viewing is associated with an increase in meal frequency in humans. Appetite 2004;42:111-113.
36. Xu F, Li J, Ware RS, Owen N. Associations of television viewing time with excess body weight among urban and rural high-school students in regional mainland China. Public Health Nutr 2008;11(9):891-896.
37. Robinson TN. Reducing children's television viewing to prevent obesity: a randomized controlled trial. JAMA 1999;282:1561-1567.
38. Gortmaker SL, Peterson K, Wiecha J, Sobol AM, Dixit S, Fox MK, *et al* . Reducing obesity via a school-based interdisciplinary intervention among youth: Planet Health. Arch Pediatr Adolesc Med 1999;153:409-418.
39. Biddle S, Sallis J, Cavill N. Policy framework for young people and health-enhancing physical activity. In: Biddle S, Sallis J, Cavill N, Ed. Young and active: young people and physical activity. London, England: Health Education Authority, 1998: 3-16.
40. Strong WB, Malina RM, Blimkie CJ, Daniels SR, Dishman RK, Gutin B, *et al.* Evidence based physical activity for school-age youth. J Pediatr 2005;146:732-737.