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RESEARCH ARTICLE

# Association between socioeconomic factors and soft drink consumption among adults in Cambodia: a cross-sectional study

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## Abstract

**Background:** Soft drinks are an attractive and popular drink, consumed by many people to fulfill their energy. However, soft drink consumption is an important risk factor for non-communicable diseases. This study aimed to investigate the association between socioeconomic factors and soft drink consumption among adults in Cambodia.

**Methods:** A cross-sectional analytical study with multi-stage random sampling was used to select 749 respondents from 12 communes across 5 districts in Phnom Penh, the capital city of Cambodia. A structured questionnaire was used to assess socioeconomic factors and soft drink consumption. Data were analyzed using bivariate and multivariable logistic regression. Crude odds ratios and adjusted odds ratios (AORs) with 95% confident intervals (CI) were calculated to show the strength of associations.

**Results:** The overall prevalence of soft drink consumption was 44.73% (95%CI: 41.16-48.30%) across the sample population. The final model of multiple logistic regression showed only four factors to be significantly associated with soft drink consumption: gender, age, family size and income. Respondents most likely to consume soft drinks were men (AOR: 1.49, 95%CI: 1.10-2.00; p=0.009), those aged 31-59 years (AOR: 1.93, 95%CI: 1.98-4.62; p<0.001), those in a household of less than 5 individuals (AOR: 1.38, 95%CI: 1.44-3.19; p=0.036), and those earning <300$/month (AOR: 1.59, 95%CI: 1.10-2.31; p=0.003).

**Conclusion:** The prevalence of soft drink consumption in Cambodia is a major concern for public health. The predictive factors significantly associated with soft drink consumption identified by this study were gender, age, household size and income. Therefore, all stakeholders should contribute to social marketing and intervention focusing on reducing the consumption of soft drinks through advertising on social media, television and other popular media platforms. Furthermore, additional taxation of soft drinks should be considered.

**Keywords**
Socio-economic, adults, multiple logistic regression, Cambodia

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## Introduction

Nutritional status is a principle determinant of health. Assessment of nutritional status, dietary intake, and related factors are of worldwide importance to public health. Although recent studies reported that nutritional status has improved remarkably over the last few decades, the rates of people being classed as underweight or overweight remain high. In general, being overweight/obese or underweight severely affect an individual's health and their quality of life, increase their risk of developing infectious diseases, reduce their ability to work, prolong hospitalization and increase the risk of illness and death. Thus, achieving and maintaining an ideal body weight is highly advisable[1,2].

There are many factors influencing becoming overweight and obese. Lifestyle, cultural activities, socioeconomic factors, physical inactivity and diet are the main factors that have been found to have an association with being overweight and obese[3–6]. Many studies have reported that one of the main factors influencing becoming overweight and obese is inappropriate diet, especially soft drink consumption[7–10].

Soft drinks provide little nutritional value and are energy-dense[11]. Dietary patterns have changed rapidly throughout the world, especially in Western countries where consumption of soft drinks is popular[12]. However, this trend has been extended across Asian countries, including Cambodia, where soft drink consumption has replaced nutritional Asian foods such as fish, vegetables and other less energy-dense foods.

A number of developing and developed countries in the world are facing what is described by the World Health Organization (WHO) as the double burden of malnutrition, the simultaneous impacts of undernutrition and overweightness/obesity[13]. Research has shown the prevalence of individuals being overweight to be significantly higher in urban compared to rural areas[14]. However, the true relationships between socioeconomic factors and soft drink consumption among adults in urban Cambodia is hitherto unknown.

As such, the present study aimed to determine the association between socioeconomic factors and soft drink consumption of adults in Phnom Penh, the urban metropolis of Cambodia, providing vital information for public health professionals and policy makers in order to prepare educational programs and interventional policies.

## Methods

### Study setting and design

A structured questionnaire was administered from March, 2018 to July, 2018 at participant homes in participants' free time using a cross-sectional multi-stage random sampling method in order to select 749 samples among 12 communes out of 5 districts in the Phnom Penh municipality of Cambodia.

The study design was reviewed by the Khon Kaen University ethics committee and was approved for human research (Reference No. HE582071). Data collection was conducted by administering the questionnaire in a face-to-face interview. All participants gave written informed consent to participate in the study. If the participant was unable to read the consent form, the researcher read it aloud for them.

### Study participants

Multi-stage random sampling was used to select the samples in this study. Phnom Penh capital city was selected and 5 districts were randomly selected from the total of 12 districts of Phnom Penh capital city. Then 2 or 3 communes were randomly selected from each selected district, for a total of 12 communes to be selected. Each household in each commune was listed and assigned a number and a systematic random sampling procedure was used to select 748 households from the total 44,436 households. Finally, one member aged 18-59 of each household was randomly selected if the household had more than one member in this age category.

The inclusion criteria for the study were that participants over 18 years of age, and were able to understand the questionnaire. Exclusion criteria were any serious health problems (causing them to be bedbound), diarrhea at the time of data collection (defecating more than 3 times per day), pregnancy, mental illness, deformity and lower limb amputation.

The sample size for this study was calculated using an established formula[15] and the estimated sample size was 749.

The outcome measure used in this study is soft drink consumption, for which a threshold of ≥3 times per week was chosen. This threshold was used as it has been previously associated with being overweight/obese, and having metabolic syndrome[16–18].

### Questionnaire

A structured questionnaire was developed based on the research questions and relevant literature. The questionnaire consisted of two parts: part 1, demographic and socioeconomic characteristics, including gender, age, marital status, educational attainment, occupation, number of family members and personal monthly income; part 2, lifestyle and behavior characteristics, including tobacco use, alcohol consumption, food habits, soft drink consumption, physical activity and sedentary behavior.

As the questionnaires were developed for data collection, a pretest of the questionnaire was conducted in 30 participants from different areas from the target group. Reliability was calculated using Cronbach's alpha coefficient, and was 0.857. Then the questionnaire was developed and tested for content validity by five experts. Finally, a forum of researchers edited and rearranged the questionnaire based on the results of the field test, with the aim to ensure the validity and reliability of the tool.

***Dependent variable***. Participants consuming soft drinks more than three times per week was the dependent variable used in this study. Participants were asked "How many times per week have you drunk a soft drink in the last month?" Participant answers were classified into two groups: those who drank soft drinks less than 3 times per week ("no" = 0) and 3 times per week of more ("yes" = 1).

*Predictor variables*. Age, household income and expenditure, and the number of individuals in the household were coded as continuous variables. Categorical variables comprised gender (male or female), marital status (single, married or divorced), level of education (no formal education, primary, secondary, high school, associated degree, Bachelor' degree, Master's degree or higher), occupation (farmer, unemployed, NGO employee, self-employed, student, government officer, home maker, unskilled worker, or other) and the people they were cohabiting with (spouse, parents, relatives, none, friend, or other).

## Statistical analysis

Data were imported to Stata version 13 (College Station, Texas, USA) for analysis. Continuous and categorical data were inspected using descriptive statistics to determine the frequencies and percentages (categorical variables) and means, medians and standard deviations (continuous variables) of each socio-economic and demographic characteristic collected. Bivariate logistic regression was used to estimate the association between each

socioeconomic factor and the outcome measure of soft drink consumption. Crude odds ratios (CORs) were computed using 95% confidence intervals (CIs) and variables with significance of $p<0.25$ were entered into the final model. In this final model, multivariate logistic regression was used to estimate the association between socioeconomic factors and soft drink consumption. Adjusted odds ratios (AORs) were then computed using the 95% CI. Significance was considered at a threshold of $p<0.05$.

## Results

### Socioeconomic characteristics of the participants

A total of 749 participants from 5 districts and 12 communes were recruited into the study. The socio-demographic characteristics of respondents are summarized in Table 1. In total, 50.2% of participants were women and 49.80% were men, and the mean age of participants ($\pm$ standard deviation) was $32.26\pm11$ years. The marital status of participants was 53.94% married, 43.52% single and 2.54% divorced. The most frequent level of participants' highest educational attainment was high school

**Table 1. Baseline characteristics of respondents (n=749).**

| Characteristics | N (%) |
|---|---|
| **Gender** | |
| Male | 373 (49.80) |
| Female | 376 (50.20) |
| **Age (years)** | |
| 18–20 | 106 (14.15) |
| 21–30 | 253 (33.78) |
| 31–40 | 229 (30.57) |
| 41–50 | 98 (13.08) |
| >50 | 63 (8.41) |
| Mean (SD) | 32.26±11 |
| Median (Min: Max) | 30 (18-59) |
| **Marital status** | |
| Single | 326 (43.52) |
| Married | 404 (53.94) |
| Widowed | 19 (2.54) |
| **Highest level of education** | |
| Master's degree or higher | 15 (2.00) |
| No formal education | 69 (9.21) |
| Bachelor's degree | 198 (26.44) |
| Secondary school | 95 (12.68) |
| Associated degree | 19 (2.54) |
| Primary school | 114 (15.22) |
| High school | 239 (31.91) |
| **Occupation** | |
| Unemployed | 7 (0.93) |
| Housewife | 48 (6.41) |

| Characteristics | N (%) |
|---|---|
| Student | 151 (20.16) |
| Farmer | 5 (0.67) |
| Self-employed | 160 (21.36) |
| Unskilled worker | 25 (3.34) |
| Private company worker | 217 (28.97) |
| NGO employee | 11 (1.47) |
| Government officer | 69 (9.21) |
| Others | 56 (7.48) |
| **Household size (number of persons)** | |
| <5 | 430 (57.41) |
| ≥5 | 319 (42.59) |
| **Household constituents** | |
| Parents | 190 (25.37) |
| Alone | 50 (6.68) |
| Others | 20 (2.97) |
| Spouse | 359 (47.93) |
| Relatives | 97 (12.95) |
| Friend | 33 (4.41) |
| **Income (USD/Month)** | |
| >300 | 316 (42.19) |
| ≥300 | 433 (57.81) |
| Mean (±SD) | 495 (±686.7) |
| Median (Min: Max) | 300 (40-5,100) |
| **Expenditure (USD/Month)** | |
| >500 | 526 (70.27) |
| ≥500 | 223 (29.77) |
| Mean (±SD) | 288.5 (±394.1) |
| Median (Min: Max) | 200 (20-3,750) |

(31.91%), followed by Bachelor's degree (26.44%) and primary school level (15.22%). The most frequent occupations were private company workers (28.97%), self-employed (21.36%) and students (20.16%), with only 0.67% of the participants being farmers and 0.93% unemployed. More than half of the participants (57.41%) had a household size of less than 5 members, and participants most frequently reported living with their spouse (47.93%), parents (25.37%) and relatives (12.95%). Monthly income ranged from US$40 to $5,100 with a mean (±SD) of US$495±686.7. Monthly expenditure ranged from US$20 to $3,750 USD with mean of US$288.5±394.1 (see Table 1).

## Factors associated with soft drink consumption with simple logistic regression

The overall prevalence of soft drink consumption was 44.73% (95%CI: 41.16–48.30%). Educational attainment, gender, age, occupation, household composition, household size, and income were found to have associations with soft drink consumption (p<0.25) in the bivariate analysis (Table 2).

## Factors associated with soft drink consumption with multiple logistic regressions

The final model found only four factors associated with soft drink consumption: gender, age, household size and income. Men (AOR: 1.49, 95%CI: 1.10-2.00; p = 0.009), those aged 31–59 years (AOR: 1.93, 95%CI: 1.98-4.62; p <0.001), those in smaller households (AOR: 1.38, 95%CI: 1.44-3.19; p = 0.036), and those earning <US$300/month (AOR: 1.59, 95%CI: 1.10-2.31; p = 0.003) were more likely to consume soft drinks at least three times a week (Table 3).

## Discussion

This study found that the prevalence of soft drink consumption among Cambodian adults was 44.73% (95%CI: 41.16-48.30). Almost one-third of adults aged 18–59 consumed soft drinks more than 3 times per week in Cambodia. The trend of soft drink consumption has rapidly increasing over a period of the last few years[19], during which time the Cambodian economy has increased twofold in economic growth rates. Globally, the

**Table 2. Odds ratio (ORs) of socioeconomic factors associated with soft drink consumption (SDC) and their 95% confidence intervals (CIs) (n=749).**

| Characteristics | N | %SDC | OR | 95%CI | p-value |
|---|---|---|---|---|---|
| **Overall** | **749** | 44.73 | N/A | 41.16-48.30 | N/A |
| **Gender** | | | | | 0.037 |
| Female | 376 | 40.96 | 1 | | |
| Male | 373 | 48.53 | 1.36 | 1.02 - 2.81 | |
| **Age (years)** | | | | | <0.001 |
| 31–59 | 390 | 36.67 | 1 | | |
| 18–30 | 359 | 53.48 | 1.98 | 1.48-2.66 | |
| **Marital status** | | | | | |
| Married | 404 | 39.60 | 1 | | 0.002 |
| Unmarried | 345 | 50.72 | 1.60 | 1.17- 2.09 | |
| **Educational attainment** | | | | | 0.042 |
| ≤High school | 278 | 39.93 | 1 | | |
| >High school | 471 | 47.56 | 1.36 | 1.01-1.84 | |
| **Occupation** | | | | | 0.051 |
| Employed | 543 | 42.54 | 1 | | |
| Unemployed | 206 | 50.49 | 1.38 | 0.99- 1.90 | |
| **Household size (persons)** | | | | | 0.112 |
| ≥5 | 319 | 41.38 | 1 | | |
| <5 | 430 | 47.21 | 1.27 | 0.94- 1.70 | |
| **Household constituents** | | | | | 0.532 |
| With Family | 646 | 44.27 | 1 | | |
| Without Family | 103 | 47.57 | 1.14 | 0.75-1.73 | |
| **Income (US Dollar/Month)** | | | | | 0.001 |
| ≥300 | 433 | 39.26 | 1 | | |
| <300 | 316 | 52.22 | 1.69 | 1.26- 2.27 | |
| **Expenditure (US Dollar/Month)** | | | | | 0.212 |
| ≥500 | 223 | 41.26 | 1 | | |
| <500 | 526 | 46.20 | 1.22 | 0.89-1.68 | |

**Table 3.** Adjusted odds ratio (ORs) of socioeconomic factors associated with soft drink consumption (SDC) and their 95% confidence intervals (CIs) (n=749).

| Characteristics | N | %SDC | Crude OR | Adjusted OR | 95%CI | p-value |
|---|---|---|---|---|---|---|
| **Overall** | **749** | 44.73 | N/A | N/A | 41.16-48.30 | N/A |
| **Gender** | | | | | | 0.009 |
| Female | 376 | 31.65 | 1 | 1 | | |
| Male | 373 | 45.84 | 1.36 | 1.49 | 1.10-2.00 | |
| **Age (years)** | | | | | | <0.001 |
| ≤30 | 359 | 21.45 | 1 | 1 | | |
| ≥31 | 390 | 54.62 | 1.98 | 1.93 | 1.98-4.62 | |
| **Household size** | | | | | | 0.036 |
| ≥5 | 319 | 41.38 | 1 | 1 | | |
| <5 | 430 | 47.21 | 1.27 | 1.38 | 1.44-3.19 | |
| **Income (US Dollar/Month)** | | | | | | 0.003 |
| ≥300 | 342 | 39.26 | 1 | 1 | | |
| <300 | 407 | 52.22 | 1.69 | 1.59 | 1.10-2.31 | |

consumption of soft drinks is higher in upper-middle income countries (0.8 servings per person per day) compared to the lower-middle income countries (0.59 servings per day)[20]. The findings of the present study are consistent with findings from Malaysia showing that 53.3% of individuals consume soft drinks three times per week or more[21], with similar findings also in Saudi Arabia (40%) and Nigeria (42.8%). Daily consumption has been reported in developed countries such as the USA (40%)[22] and the UK (20.4%)[23] and similarly in South Africa (48.3%)[24]. This may be related to the culture of western and European countries preferring fast food and artificially sweetened soft drinks. Furthermore, there may be a tendenc towards busier lifestyles with less emphasis on making time to cook. In the present study, the factors associated with soft drink consumption were found to be gender, age, household size and income.

Gender was found to be significantly associated with soft drink consumption. Men were more likely (AOR: 1.49; 95%CI:1.10-2.00) to consume soft drinks compared to their female counterparts. This finding is consistent with a study from the USA, which revealed that men were more likely to consume soft drinks than women[22]. A study in Australia also found the men are 2.11 times more likely to consume soft drinks compared to women[11]. In the context of Cambodia, it might be that men go out to work more often, requiring more energy and undertake activities where soft drinks are often consumed in order to counteract fatigue both during and after work.

Many studies have found age to be significantly associated with soft drink consumption, and the present study's results support this. Our finding was that 31–59-year-olds are more likely to consume soft drinks compared to 18–30-year-olds

(AOR:1.93; 95%CI: 1.98-4.62). However, there are also published studies that contradict this finding[11,21]. The age range in the present study was 18–59-year-olds; therefore, the older age bracket (31 to 59) are likely to be in paid employment, and not yet in retirement. These individuals may be more likely to consume soft drinks to combat fatigue while working, and this may be more prevalent amongst older individuals within the subgroup.

Finally, income was found to be significantly associated with soft drink consumption. Those who earned less than US$300 per month were more likely to consume soft drinks (AOR:1.59; 95%CI: 1.10-2.31) compared to those who earned more than US$300 per month. This finding is consistent with research from Singapore showing that high and medium earners consumed less soft drinks when compared to low earners[11]. Conversely, a study from Australia reported that households with higher annual incomes were more likely to consume soft drinks compared to households with lower annual incomes[24].

## Conclusion
The prevalence of soft drink consumption in Cambodia has become a recent concern for public health. Predictive factors found in this study that are significantly associated with higher soft drink consumption are being a man, aged 31–59 years, living in a household of less than 5 individuals, and having a monthly income of less than US$300.

Based on our research findings, we recommend taking measures to reduce the frequency of soft drink consumption. All stakeholders within each ministry in Cambodia should promote and raise awareness of the impacts of soft drink consumption within the population. Specifically, the Ministry of Health should develop and launch a social marketing and intervention

program focusing on reducing the consumption of soft drinks through advertising on social media, television and other means. Furthermore, the taxation of soft drinks should be considered.

## Data availability
### Underlying data
Figshare: Underlying Data 1, https://doi.org/10.6084/m9.figshare.12612998.v1[25]

This project contains the following underlying data:
- Raw data from a survey the consumption of fast food and soft drinks in Phnom Penh municipality of Cambodia in 2019.

- Code book for interpreting the data

### Extended data
Figshare: Extended data, https://doi.org/10.6084/m9.figshare.12612992.v1[26]

This project contains the following extended data:
- Questionnaire in Khmer
- Questionnaire in English

Data are available under the terms of the Creative Commons Zero "No rights reserved" data waiver (CC0 1.0 Public domain dedication).

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