Sociodemographic differences affecting insufficient fruit and vegetable intake: a population-based household survey of Thai people

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Sirinya Phulkerd, Sasinee Thapsuwan, Natjera Thongcharoenchupong, Rossarin Soottipong Gray and Aphichat Chamratrithirong

Institute for Population and Social Research, Mahidol University, Nakhon Pathom, Thailand

Abstract

Purpose – The sociodemographic determinants of insufficient fruit and vegetable (FV) consumption in the general population in Thailand remain understudied. The purpose of this study was to investigate the association between sociodemographic characteristics and insufficient FV consumption in Thailand.

Design/methodology/approach – This nationally representative survey employed a cross-sectional multi-stage sampling design. A total of 6,991 individuals aged 15 years or older participated in the study. Information on participants' FV consumption and sociodemographic characteristics were collected via questionnaire. The data were analyzed using binary logistic regression.

Findings – The overall prevalence of insufficient FV consumption in the study sample was 65.6%. Age of the participants, sex, marital status, place of residence, occupation, income and education were found to be significantly associated with insufficient FV consumption among this sample of the Thai population.

Originality/value – Findings suggest the need for promotion of FV consumption and intervention policies aimed at increasing FV intake by taking into account sociodemographic characteristics of the population.

Keywords Thai population, Fruit and vegetable intake, Socio-demographic factors, Non-communicable diseases

Paper type Research paper

Introduction

Insufficient intake of fruits and vegetables (FV) is one of the major causes of death and disability worldwide and an important determinant of overall cardiovascular risk and certain cancers. Based on World Health Organization (WHO) statistics, insufficient intake of FV is

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estimated to cause about 14% of gastrointestinal cancer deaths, 11% of ischemic heart disease deaths and 9% of stroke deaths globally [1].

Thailand is among the top 10 best-performing countries for the prevention and control of non-communicable diseases (NCDs) globally. Thailand achieved 12 of the 19 indicator targets (up from eight in 2015) according to the WHO NCD Progress Monitor 2017 [2]. This made Thailand the best performer in Asia and placed the country on a par with Finland and Norway for NCD control. Despite its achievement, Thai progress in implementing policies to address the shared and modifiable NCD risk factors, such as an unhealthy diet and, in particular, low FV consumption, has been insufficient.

A large-scale cross-sectional survey conducted in 2014 showed that most (74.1%) of the Thai population aged 15 years or older did not consume sufficient FV (at least five portions per day) [3]. The median number of FV servings consumed was 3.3 per person per day. According to the most recent estimate, this underconsumption accounted for 341,000 disability-adjusted life years and 21,650 Thai deaths in 2014 [4].

There is considerable evidence of associations between certain sociodemographic factors and FV consumption in industrialized countries [5, 6] as well as in developing countries [7, 8]. The results of worldwide investigations generally show that the level of FV consumption varies according to place of residence, socioeconomic status, educational attainment, occupation, household income and other non-modifiable factors such as age, gender and ethnicity. However, there is little information about relationships between demographic characteristics of members of the Thai population and insufficient FV consumption.

In response to accelerating progress toward achieving the NCD prevention and control targets, the purpose of this study was to investigate the association between sociodemographic characteristics and insufficient FV consumption in Thailand. This information should help the relevant Thai government agencies to understand the precise dynamics and potential sociodemographic correlates of FV consumption, which can, in turn, help guide the development of more effective FV policies, interventions and promotion strategies targeting the Thai adult population.

Methods

Data collection and study population

This nationally representative, cross-sectional study employed a multi-stage sampling technique to recruit study participants aged 15 years or older from the four geographic regions of Thailand and Bangkok during May 2018. The first stage involved a systematic sample of two provinces, within each geographic region. From these selections, postal districts within each province were sampled and, from these, enumeration areas (EA) and households were selected as sampling units (20 households in each EA). A list of households was obtained through the National Statistical Office. From the households list, households were randomly selected and subsequently contacted. The data were collected from all the household members who were present. If the data collector failed to reach a household member after three visits, that member was excluded; a replacement was not taken. The overall sampling frame is presented in Table I, which shows that the total response rate was nearly 100%. It was possible that this high completion rate was due to local support and coordination. During the survey, village leaders and coordinators helped accommodate the research team to find each household and introduce them to the household members. This built a rapport and developed trust with the respondents in the first place that increased their participation willingness.

Ethics approval for the study was obtained from the Institutional Review Board of the Institute for Population and Social Research of Mahidol University (COA. No. 2018/02-070).

As detailed in Table I, a nationally representative sample of 3,720 households was involved. Members of 3,670 households were successfully interviewed face-to-face by trained

staff members using a structured questionnaire. The interviews lasted about 30–45 minutes and each participant was given an opportunity to clarify questions and answers regarding the survey. Upon completion, participants were given a souvenir (equivalent value of about US$2) as a token of appreciation for participating. A written informed consent form was obtained from each participant before the interview. A total of 7,075 adults aged 15 years or older were recruited for interviews. Of those, 6,991 adults successfully completed the survey.

Measures

Details of the measures used in this study are briefly described below. These measures have been used extensively in prior research on FV consumption involving Asian populations [7, 9].

FV intake. This study used the validated semi-food frequency questionnaire which was adopted from the National Health Examination Survey [3]. Data on FV intake were collected based on the frequency (number of days) the respondent ate FV in a typical week and quantity (number of servings) the respondent ate on each day. Servings were determined based on the response after showing pictures of raw and cooked FV items in one serving size, adapted from the "Healthy Eating Guidelines" from the Bureau of Nutrition, Department of Health, Ministry of Public Health, Thailand [10]. A standard serving was applied based on the Thai food guide known as a "Nutrition Flag" [11]. One serving (or 40 g) of vegetables equaled one rice-serving spoon of raw vegetables or two rice-serving spoons of cooked vegetables. One serving (70–120 g) of fruit equaled one medium-sized fruit (such as an orange or cultivated banana), half of a large-sized fruit (such as a Cavendish banana or mango), six to eight aggregate fruits (such as grapes or longan) and six to eight medium-sized pieces of chopped fruit (such as pineapple, papaya or watermelon).

WHO recommends at least 400 g of FV per day – or five servings of 80 g each; consuming less than this level of FV is considered to be insufficient [1]. Due to the difference in typical food serving sizes between Thailand and the WHO recommendation, this study measured total FV intake per day by summing all recorded servings and calculated grams (based on Thailand's serving sizes).

Sociodemography. This study included age, gender, marital status, place of residence, income, educational attainment and job types. Ethnicity was not included as one of the independent variables in the study. Though such ethnic diversity exists, no ethnic categories can be expected to have numbers in this sample that would allow separate analysis or perhaps even use of ethnic classification in the analysis.

Data analysis

The binary logistic regression analysis was employed to test the hypotheses regarding insufficient FV intake and their association with sociodemographic characteristics of the participants. The dependent variable of the analysis was FV intake, operationalized as a binary response variable – insufficient intake (those who reported an average daily intake of less than 400 g of FV = 1) and sufficient intake (those who reported an average daily intake of

Region	Number of households		Response rate (%)
	Sampled	Interviewed	
Bangkok	620	619	99.8
Central	660	637	96.5
North	720	707	98.2
Northeast	920	908	98.7
South	800	799	99.9
Total	*3,720*	*3,670*	*98.7*

Table I. Number of sample households and response rate of the survey

at least 400 g of FV = 0). Independent variables in the logistic regression equation were age, gender, marital status, place of residence, income, educational attainment and occupation.

In the analysis, the reference groups for the sociodemographic variables were as follows: female for gender, 30–44 years for age, being married for marital status, living in a provincial urban area for residence, bachelor's or higher degree for education, a farming job for occupation and 10,000 THB or higher for monthly income. Odds ratio (ORs) were calculated and estimates were presented with a 95% confidence interval (CI). The ORs are the probability of having insufficient FV intake. *P* values of 0.05 or less (two-tailed) were considered statistically significant. All analyses were performed with SPSS Statistics Version 18.

Results

A total of 7,075 adults aged 15 years or older agreed to be interviewed. Of those, 6,991 adults successfully completed the interview. The composition of the study sample in terms of sex, age, place of residence and education attainment in comparison to the general population according to the 2010 Population and Housing Census of Thailand (http://web.nso.go.th/en/cen.htm) is shown in Table II. While the composition of the sample was consistent with the same composition in the 2010 census, the sample population was noticeably older than the census population. This may be due to the sampling frame used for this study which was kept up to date in response to population growth in 2018.

Sociodemographic information of the study sample is presented in Table III. The mean age for the study participants was 46.7 years (SD = 48). A vast majority of the participants were married (69.2%), had an education level that was lower than secondary school (51.0%) and a monthly cash income lower than 10,000 baht (US$1 = 32 baht) (64.1%). One-third (32.2%) of the study participants were unemployed. The demographic characteristics of the sample were similar to those reported in the national population survey of the Thai population by the National Statistical Office [12].

Variables	Study population		Thai population	
	N	%	*N*	%
Total	*6,991*	*100.0*	*53,295,868*	*100.0*
Sex				
Female	3,374	48.3	25,843,729	48.5
Male	3,617	51.7	27,452,139	51.5
Age (years)				
15–29	1,280	18.2	14,684,706	27.6
30–44	1,628	23.3	16,681,778	31.3
45–59	2,618	37.5	13,421,186	25.2
60 years or older	1,465	21.0	8,508,198	16.1
Place of residence				
Bangkok	747	10.7	8,305,218	15.6
Urban	2,440	34.9	16,180,286	30.4
Rural	3,804	54.4	28,810,364	54.0
Education attainment				
Primary school or less	3,565	51.0	27,711,324	52.0
Secondary school	2,777	39.7	17,689,642	33.2
Bachelor's degree or higher	649	9.3	7,063,090	13.3
Do not know/religious study	–	–	831,812	1.5

Note(s): According to the 2010 Population and Housing Census of Thailand

Table II.
Composition of the study sample in terms of sex, age, place of residence and education attainment in comparison to the general population

Variables	*N*	Total %	FV intake (eating per day) (%) ≥400 grams	<400 grams
Total	6,991	100.0	34.4	65.6
Sex				
Female	3,617	51.7	37.4	62.6
Male	3,374	48.3	31.3	68.7
Age (years)				
15–29	1,280	18.2	25.6	74.4
30–44	2,619	23.3	37.1	62.9
45–59	1,628	37.5	39.1	60.9
60 years or older	1,465	21.0	32.1	67.9
Marital status				
Single	1,314	18.8	25.6	74.4
Married	4,839	69.2	37.1	62.9
Widowed/divorced/separated	838	12.0	32.3	67.7
Place of residence				
Bangkok	747	10.7	23.0	77.0
Urban	2,441	34.9	38.4	61.6
Rural	3,804	54.4	34.1	65.9
Education				
Primary school or less	3,565	51.0	34.5	65.5
Secondary school	2,777	39.7	33.2	66.8
Bachelor's degree or higher	649	9.3	39.0	61.0
Occupation				
Unemployed	2,249	32.2	31.1	68.9
Government job	313	4.5	38.7	61.3
Company-hiring job	533	7.6	23.7	76.3
Own business	1,410	20.2	63.3	36.7
Labor job	1,084	15.5	30.4	69.6
Farming job	1,402	20.0	43.5	56.5
Monthly income (baht)				
No income	1,424	20.4	29.5	70.5
Less than 10,000	3,054	43.7	35.9	64.1
10,000 or higher	2,513	35.9	35.4	64.6

Note(s): #US$1 = 32 baht

Table III. Sociodemographic characteristics of the study sample (*N* = 6,991)

FV intake

On average, the study participants consumed FV 336.9 g (median = 295.7) per day. Mean fruit intake was 212.3 g (median = 162.9) per day; mean vegetable intake was 124.6 g (median = 120.0) per day. Two-thirds (65.6%) of the study sample consumed less than 400 g per day (insufficient FV). The prevalence of insufficient FV consumption was significantly higher in Thai men (68.7%), persons aged between 15 and 29 years (74.4%) and among participants living in a rural area (65.9%).

Sociodemographic correlates of insufficient FV intake

Results from the logistic regression analysis are shown in Table IV. The outcome (an OR) of each category of all variables is presented in relation to the omitted category shown as the reference group in the Table and in the previous section. Results indicate that men were 1.3

Variables	Adjusted OR (95% CI)
Sex (reference group = Female)	
Male	1.323 (1.188–1.474)***
Age (years) (reference group = 30–44)	
15–29	1.479 (1.220–1.794)***
45–59	1.140 (0.992–1.310)
60 or older	1.399 (1.166–1.679)***
Marital status (reference group = Married)	
Single	1.398 (1.171–1.656)***
Widowed/divorced/separated	1.166 (0.988–1.375)
Place of residence (reference group = Provincial urban)	
Bangkok	1.838 (1.510–2.237)***
Rural	1.256 (1.126–1.400)***
Education (reference group = Bachelor or higher)	
Primary school or less	1.463 (1.185–1.805)***
Secondary school	1.318 (1.086–1.600)**
Occupation (reference group = Farming job)	
Unemployed	1.370 (1.136-1.651)**
Government job	1.529 (1.156–2.022)**
Company-hiring job	2.519 (1.957–3.243)***
Own business	1.437 (1.216–1.698)***
Labor job	1.750 (1.473–2.080)***
Income (baht) (reference group = 10,000 or higher)	
No income	1.290 (1.040–1.601)*
Less than 10,000	1.053 (0.920–1.204)

Note(s): Cox and Snell $R^2 = 0.046$, *Sig. ≤ 0.05, **Sig ≤ 0.01, ***Sig ≤ 0.001

Table IV. Logistic regression results of sociodemographic factors associated with insufficient FV (less than 400 g of FV per day) intake ($N = 6{,}991$)

times more likely than women to have insufficient FV intake (OR = 1.323, 95% CI = 1.188–1.474). The probability of insufficient FV intake among people aged between 15 and 29 years (OR = 1.479; 95% CI = 1.220–1.794) was much higher than people of older age. The participants who were single were 1.4 times more likely to have insufficient FV intake than those who were married. People who resided in Bangkok or rural areas were 1.8 and 1.3 times, respectively, more likely to have insufficient FV intake than those who resided in a provincial urban area.

The participants who worked for a private company, in manual labor, for a government agency, who owned their business or who were unemployed were more likely to have insufficient FV intake in comparison to those who worked as farmers. The probability of insufficient FV intake was significantly higher among people who worked for a private company (OR = 2.519, 95% CI = 1.957–3.243).

The participants who had a lower education level than a bachelor's degree were more likely to have insufficient FV intake than those who completed at least a bachelor's degree. The participants with a primary school or a lower level of education had the highest probability of having insufficient FV intake levels (OR = 1.463, 95% CI = 1.185–1.805).

This study found a significant association between the participants with no income and insufficient FV intakes. These participants were 1.3 times more likely to have insufficient FV intakes than the participants who had a monthly cash income of 10,000 baht or higher.

The adjusted analysis did not find an association between the 45 and 59 age group, widowed/divorced/separated status or annual income less than 10,000 baht and insufficient FV consumption.

Discussion

In a nationally representative sample of the Thai adult population, this study examined the prevalence of insufficient FV consumption and sociodemographic factors associated with insufficient FV intake. Despite a slightly higher FV intake (compared with similar studies), the prevalence of insufficient FV intake is still high, accounting for 65.5% of the sample. Mean FV intake was still below the recommended level with 336.9 g per day.

In general, this study's hypothesis was that sociodemographic characteristics are related to insufficient FV intake. All eight sociodemographic characteristics (age, sex, marital status, place of residence, geographic region, education, occupation and income) were found to have significant associations with insufficient FV intake. Consistent with prior research, Thai men were found to be more likely to have insufficient FV intake than that of Thai women [7, 8]. That finding may reflect gender differences in health consciousness and awareness of the need for a healthy diet. Also, Thai gender norms may give women better access to food resources [13]. By contrast, Thai men tend to be more concerned about projecting a "macho" image than having a healthy diet [14]. In some studies in other countries, the masculine role was linked with the men's preferences for consumption of meat, energy-dense foods and alcohol (such as beef burgers, fries, pizza and beer) [15]. This finding suggests that gender can be used as a strategic factor for FV promotion for both sexes. The government can promote vegetables and plant-based proteins that appeal to men by linking the benefits of these foods to masculinity goals. For example, some vegetable nutrients promote muscle growth.

Age was another demographic factor that was related to insufficient FV intake, with the youngest (15–29 years) and oldest (60 years or older) age categories being more likely to have insufficient FV intake. This was not surprising and is consistent with published research. After the transition out of adolescence, young adults begin independent living and are potentially vulnerable to unhealthy eating behaviors such as snacking, skipping main meals and displaying other facets of poor dietary behavior [16]. It is therefore important to promote healthy diets including sufficient FV consumption in adolescence so that healthy habits are learned and persist into adulthood [17]. Such health behavior will not only affect their own health but also the health of their partner and/or children. According to a scoping review [18], insufficient FV intake of older persons could be due to disability or mobility impairment which creates barriers in acquiring, preparing and eating FV. These physical conditions are aggravated by social isolation and inadequate transportation. Another possible reason is a high level of tooth loss in Thai older people, with 8.7% and 31% of Thai older people aged 60–74 and 80–85 years having no teeth, respectively, according to the 2017 National Oral Health Survey. This poor oral health may reduce sense of taste, cause reduced appetite and contribute to poor eating habits including low FV consumption. Accordingly, it is important to develop appropriate interventions that target-specific barriers faced by older adults in obtaining and consuming FV in the community setting. Importantly, the standard recommendation on FV intake for older people should be reviewed by the relevant government agencies since the existing standard may not be appropriate for many of today's senior citizens. Each individual should be assessed based on their individual needs and health conditions and not age alone.

The findings of this study are consistent with the literature [19, 20] suggesting that unmarried people were more likely to have insufficient FV intake than married people. This may be due to the tendency for a committed romantic relationship to be associated with mutual health-promoting behaviors by the couple [20]. In marital relationships, both individuals learn more about their own and their partner's healthy or unhealthy behavior patterns, and this may help the individual to be more conscious of their own actions and possible adverse consequences for themselves and their partner [21]. Another possible reason is the presence of children in the household that need care to promote their healthy eating

behaviors. As noted, this study found a statistically significant association of being single (i.e., never married) with insufficient FV intake. Thus, interventions to promote FV eating among single adults are important. In particular, programs need to prioritize single people who live alone. However, this study did not find any association of marital status of divorced or separated participants with insufficient FV intake. This contradicts the findings of previous studies that found an association of marital dissolution with a reduction in FV variety and quantity of intake, particularly in men [19]. This outcome may be due to other factors that should be taken into account such as time of marital transition or duration of marital status and remarriage. Moreover, the Thai family is typically in regular contact between households. People whose marriages fail may receive emotional and practical support from family members so that their health and dietary behaviors are not too adversely affected.

There was a significant variation in FV intake across the geographic areas. That finding is consistent with previous studies [22, 23], and this may reflect significant differences between urban and agricultural areas where lifestyle and cultural standards can vary widely. Thus, it is unsurprising that residents living in Bangkok were more likely to experience insufficient FV intake than those living in other areas. This may be because daily life in Bangkok is constrained by commuting schedules and limited time for lunch breaks. Also, since a majority of the Bangkok labor force works outside the home, employees may not be able to access fresh FV as easily as their counterparts elsewhere [24]. Another possible reason is eating out behaviors of people due to modern daily living and a busy hectic lifestyle. These lifestyles are often associated with a higher frequency of dining out at restaurants, which also tends to be associated with lower FV intake. It is noteworthy that residents living in a provincial urban area were less likely to have insufficient FV intake than the residents in rural areas. This may be explained by the fact that the provincial urban residents live in an environment where markets are convenient and there is abundant fresh FV. Also, most of the organized healthy-eating campaigns have occurred in provincial urban Thailand. Accordingly, interventions should focus more on promoting healthy food environments. There is also a need for greater attention to, and targeted solutions for, Bangkok and the rural settings especially the more remote communities.

Participants who worked in a company were more likely to have insufficient FV intake compared to those working in other workplace settings. According to previous studies, while people spend much of their time at work, the business workplace provides an environment where unhealthy food is frequently available [25]. Coworker behaviors, consumption of unplanned meals, time constraints and worker stress were found to be the most significant barriers to healthy workplace eating [26]. This suggests that despite available workplace-based interventions for healthy diets, several areas should be targeted to improve Thai workers' healthy diets and, in particular, FV consumption. For example, there could be a workplace policy to promote a healthy and productive workforce by providing convenient access to a balanced diet, counteracting coworkers' influence, managing time better and coping with work-related stress.

People with higher educational attainment were less likely to have insufficient FV consumption. This could be explained by the fact that the level of education might be associated with a higher level of nutrition knowledge [27], which in turn, tends to be associated with favorable attitudes about healthy food habits. However, according to the theory of planned behavior [28], education alone that produces knowledge is not a reliable determinant of individual behavior formation. In addition to gaining knowledge, individuals need to go through the following process for sustained behavior change: attitude toward behavior, subjective norms, perceived behavioral control and, finally, behavioral intention to adopt a behavior as part of everyday life. Therefore, on top of the level of education, there

could be other factors (such as easy access to FV and FV availability at home and worksite) that enable and facilitate people to translate their knowledge into FV consumption.

Consistent with many studies [29, 30] is the finding that there was a positive association of income with FV consumption. This could be explained by the fact that income indicates material resources [31] and that can shape food habits by providing more opportunity and affordability to purchase healthy food, including FV. In our study, the absolute poverty group (no income) is the ones who suffer mostly from insufficient intake of FV. Even though individual incomes matter to consumption, having a monthly cash income of less than 10,000 baht was not associated with insufficient FV intake among the Thai population. Although some minimum amount of money matters for FV consumption, people do not need to be well off to attain healthy eating behaviors. Some FV are cheap and readily available in areas where people reside and FV can be easily grown at home at little cost. Accordingly, the Thai government needs to formulate a policy to create an enabling and supportive environment to increase access to FV and motivate people to increase that component of their diet. Financial incentives should be considered to help households grow kitchen gardens with nutritious FV.

Despite the population representativeness of the survey, this study has limitations. Firstly, all data, including FV intake, were self-reported, which might lead to bias and inaccuracy in recall and reporting. This limitation should be taken into account when interpreting the results. Secondly, this study used the WHO definition of insufficient FV intake which means that the results can be compared directly to other insufficient FV intake prevalence studies, both locally and internationally. However, using different definitions might give different results in the analyses. Thirdly, the cross-sectional study design renders any causal inferences implausible. Nevertheless, this study is an important first step in the exploration of sociodemographic determinants of insufficient FV intake in Thailand. The findings can help inform future studies of a similar nature and help identify entry points for public health policies for the government. Lastly, this study did not include community-health promotion and policy-level data which is needed to allow a better understanding of how insufficient FV intake is related to or influenced by community and national-level health policy and whether and how it interacts with sociodemographic characteristics. Future studies should place more emphasis on policy-level determinants of insufficient FV intake and overall policy effectiveness in the context of people's socioeconomic situation. Also, the specific mechanism of the sociodemographic determinants affecting insufficient FV intake should be further investigated for a better understanding of their causal relationship that would require longitudinal studies to investigate the individual change in FV intake and draw out the causal relationship.

Conclusions

The current study contributes to the extant FV intake literature by documenting a high prevalence of insufficient FV intake among a representative sample of the Thai population. Findings also indicate important differences in FV intake among study participants across geographic areas, and several sociodemographic characteristics are associated with insufficient FV intake. Collectively, the findings from this study suggest that both government and local agencies need to consider FV promotion policies and develop intervention and prevention strategies by taking into consideration the potential sociodemographic characteristics affecting insufficient FV intake of Thais. Since little is known about the specific mechanism by which sociodemographic determinants affect insufficient FV intake, studies are needed to identify predictors of insufficient FV intake. Longitudinal data are also needed to investigate the causal relationship between the sociodemographic determinants and insufficient FV intake.

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Corresponding author
Sirinya Phulkerd can be contacted at: sirinya.phu@mahidol.ac.th