

Prevalence and variation of underweight and overweight among adult population in Thai Nguyen province of Vietnam

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INTRODUCTION

Overweight and obesity prevalence is increasing worldwide both in developed and developing countries. In the United States, obesity increased for both sexes, as well as across ages, and ethnicities [1]. In 2008, 33.9% of American adults was obese and 34.4% was overweight [2]. Moreover in 2010, there was no state in the United States that had a prevalence of obesity less than 20% [3]. In 2010, 18.1% of Canadians aged 18 and older reported height and weight that classified them as obese; in addition, 41.1% men and 27.2% women were overweight [4]. In European countries, the prevalence of obesity was about 10% and the overweight prevalence was 36.6% and 25.6% among men and women [5]. Individuals in the United Kingdom had the highest prevalence of obesity (12%), while Italians, French and Swedes had the lowest levels of obesity (about 7%) [5]. In Asia, the prevalence of overweight and obesity were lower than the North of America. The prevalence rate of overweight and obesity among Chinese adults were 21.51% and 2.92% respectively, with higher prevalence seen in the north than in the south, more in females than in males, and more in older age than in younger [6]. The prevalence of overweight and obesity among Thai adults was 31.5% and 7.8% (2003) [7]. In Malaysia, overweight and obesity prevalence were 41.1% and 14.4% (2003) [7].

The prevalence of underweight is low in developed countries but it remains high in developing countries. The prevalence of underweight in the United States and Canada is 2.4% [7] and 2.0% [8] respectively. In Asian countries, the prevalence of underweight is very high: 19.2% in Thailand in 2003 [7]; 9.6% in Malaysia in 2003 [7]; and 20.9% in Vietnam in 2005 [9]. Underweight and overweight are coexisted in all countries around the world; Many developing countries face the dual challenge of continuing underweight and increasing overweight [10]. Literature focusing on urbanization and health showed that the prevalence of overweight is significantly higher in urban than in rural areas [11].

Assessment of the socio-economic disparities in underweight, overweight and obesity is important to addressing health problems. It is widely found that both underweight and overweight can cause an increased risk of mortality [12]; overweight and obese are associated with higher risk of having a chronic disease [13], diabetes, coronary heart disease, hypertension, stroke and cancer [14, 15]. Besides, knowledge of the distribution of weight status and how weight status may vary by socio-economic factors can provide baseline information for national monitoring and developing health promotion programs [16].

Vietnam is also facing the dual challenge of a high prevalence of underweight and increasing overweight [17]. In 2005, the prevalence of overweight following the classification for Asian and the Pacific population, i.e. $BMI \geq 25 \text{ kg/m}^2$, was 6.6% and the prevalence of underweight defining as $BMI \leq 18.5 \text{ kg/m}^2$ was 20.9% [9]. Nonetheless, the data is outdated and such studies on overweight and underweight are still limited in the country. Information is even more limited while looking at variations of underweight and overweight by socioeconomic factors at provincial level.

This study aims to shed light on prevalence of underweight and overweight and its variations by socioeconomic factors in Thai Nguyen province of Vietnam. The province locates in the northeastern mountainous region of the country and houses many poor and ethnic minorities.

METHODS

The health study in Thai Nguyen

This study use data from a cross-sectional and population-base health survey entitled “*Improved access, equity, quality and utilization of CHC services, in particular by women from poor, ethnic minorities and remote areas in Thai Nguyen province, Vietnam*”. The study was carried out by the Institute of Population, Health and Development in collaboration with the Population Council, Thai Nguyen Provincial Health Department, Thai Nguyen University of Medicine and Pharmacy, and Central General Hospital of Thai Nguyen. The survey or data collection was carried out in early 2011.

The study sample consists of adult populations aged 18 or older who were living in the province at the time of the survey. The poor communes that received the Government pro-poor program (known as the P135 communes) were over-sampled to gain enough number of the poor and the ethnic minority people as they are over-represent in those communes for meaningful comparisons between them and the non-poor and/or the Kinh ethnic majority. A multi-stage stratified cluster sampling was applied. Weights were applied in analysis. A total of 2695 respondents were successfully completed the questionnaire. Beside the individual questionnaire, household questionnaire was developed to collect data at household level. The two datasets were merged and used in this study.

BMI measurements

Body mass index (BMI) is a simple measure of body fat based on height and weight. It is commonly used to classify underweight, overweight and obesity among adult population. It is defined as the weight in kilograms divided by the square of the height in meters. In this survey, respondents were measured and weighted after their interview and those measurements were recorded in the questionnaire.

Table 1 presents international classification of underweight, overweight and obese. The Table also presents the classification using the WHO cut-off points for Asian and Pacific (AP) adult population following the recommendation of the International Association for the Study of Obese, the International Obesity Task Force, and the WHO [18]. The cut-off points following the AP standard was also recommended by the WHO for public health action or interventions. Both standards are used in this study.

Table 1: The WHO international classification of adult underweight, overweight and obesity according to BMI and the classification for Asian and Pacific populations

Cut-off points	BMI (kg/m ²) classification	
	International	Asian & Pacific Populations
< 18.50	Underweight	Underweight
< 16.00	Severe thinness	
16.00-16.99	Moderate thinness	

17.00-18.49	Mild thinness	
18.50-22.99	Normal range	Normal range
23.00-24.99		Overweight
25.00-27.49	Overweight	Obese
27.50-29.99		
≥ 30.00	Obese	

Note: * Source WHO (http://apps.who.int/bmi/index.jsp?introPage=intro_3.html);

** Source: Low et al, 2009.

Measurements of socioeconomic factors

Socioeconomic factors that were available and included in the analysis are: ethnicity, sex, age, rural/urban place of residence, marital status, level of education that was completed by the respondent and household income per capita quintile. Brief descriptions and measurements of those variables are presented in Table 2.

Table 2: Descriptions and measurements of socioeconomic variables

Variable	Description
Ethnicity	Ethnicity of the respondent: Kinh = 0; Non-Kinh = 1 Non-Kinh is other ethnicities, also named ethnic minorities (EM).
Sex	Sex of the respondent: Female = 0; Male = 1
Age group	Age of the respondent by group. Age was estimated by subtraction of the year of birth from the year of the study. Age groups include: 18 – 24; 25 – 29; 30 – 34; 35 – 39; 40 – 44; 45 – 49; 50 – 54; 55 – 59; 60 – 64; 65+
Place of residence	Living place of the respondent at the time of interview: Rural = 0; City = 1; Town = 2
Marital status	Marital status of the respondent at the time of interview: currently married = 0; never been married = 1; widowed/divorced/separated = 2.
Completed education	Highest education level completed by the respondent: <ul style="list-style-type: none"> ▪ Primary education or less (completed grade 5 or less) = 0 ▪ Junior Secondary (grade 6 to 9) = 1 ▪ Senior Secondary (grade 10 to 12) = 2 ▪ College/University (or higher) = 3
Household income per capita quintile	Respondent's household monthly income per capita by quintile (in VND): lowest fifth = 0; second fifth = 1; middle fifth = 2; fourth fifth = 3; highest fifth = 4

Statistical analysis

Descriptive statistics were used for frequencies. Bivariate analysis was applied to see variation of underweight and overweight by socioeconomic factors. Multinomial logistic regressions were applied to identify independent association between exercise, socioeconomic factors, underweight and overweight. Appropriate statistical tests were used and presented at significant levels of 0.1, 0.05, and 0.01. Statistical analyses were performed using Stata software with the svy procedures to deal with the complex design of the survey in this study.

RESULTS

Characteristics of the study population

Descriptive characteristics of the study population are presented in Table 3. As expected, the EM population accounted for more than one-third of the adult population in the province. This proportion is close to finding from the most recent 2009 Census data as this study data was weighted with the 2009 Census data; the share of the EM population is relatively high compared to other provinces in the country. Also as expected, males accounted for a smaller proportion than females in the study population and a very large majority of people lived in rural areas. The majority, i.e. around 80%, of the respondents were working. Besides, the majority of them were currently married but there was a greater proportion of the never married among males compared to females while females had a greater proportion of people who were widowed, divorced or separated.

Table 3: Characteristics of the study population

Variables	Total	Female	Male	Kinh	EM
Ethnicity					
Kinh	61.9	61.8	62.1	-	-
EM	38.1	38.2	37.9	-	-
Sex					
Female	56	-	-	56	56.3
Male	44	-	-	44	43.7
Age group					
18 – 24	12.0	11.7	12.5	10.8	14
25 – 29	12.5	13	11.9	11.2	14.6
30 – 34	11.0	10.8	11.2	10	12.6
35 – 39	10.6	10.7	10.4	10.9	9.9
40 – 44	11.8	12.4	11.1	12	11.5
45 – 49	11.3	10.9	11.9	11.1	11.5
50 – 54	10.6	10.6	10.5	11	10
55 – 59	6.8	6.5	7.1	7.4	5.9
60 – 64	4.2	3.7	4.8	4.9	3
65+	9.2	9.9	8.6	10.7	7
Place of residence					
Rural	83.1	82.8	83.3	76.8	93.1
Town	5.8	5.4	6.3	6.7	4.3
City	11.1	11.8	10.4	16.5	2.6
Marital status					
Currently married	80.8	79.2	82.8	80.6	81.2
Never been married	11.4	8.9	14.6	11.3	11.4
Widowed/Divorced/Sepa	7.8	11.9	2.6	8.1	7.5
Completed education					
Primary or less	18.7	21.4	15.3	16.5	21.9
Junior secondary	51.0	50.2	52.0	50.4	52.3
Senior secondary	19.9	18.1	22.2	21.4	17.6

College/university	10.3	10.3	10.4	11.7	8.2
Household income per capita quintile					
Lowest fifth	20.0	26.2	21.6	15.8	26.8
Second fifth	20.3	18.6	18.6	16.7	25.8
Middle fifth	23.8	23.2	21.8	24.4	22.9
Fourth fifth	16.6	16.4	19.0	18.9	13
Highest fifth	19.3	15.6	19.0	24.2	11.5
Total	100 %	100 %	100 %	100 %	100 %

Prevalence of adult underweight and overweight

The prevalence of underweight among adult population aged 18 or older in Thai Nguyen is 20.1%; the prevalence of overweight is 5.2% under the international classification or 15.5% under the AP classification. The equivalent estimated number of underweight adults in the province is 156 thousand people; and the estimated number of overweight adults in the province is 41 thousand and 120 thousand people under the international and AP classification respectively. The prevalence of obese in Thai Nguyen under the international classification is extremely low at 0.1%; when the AP classification is applied, it is 5.2%.

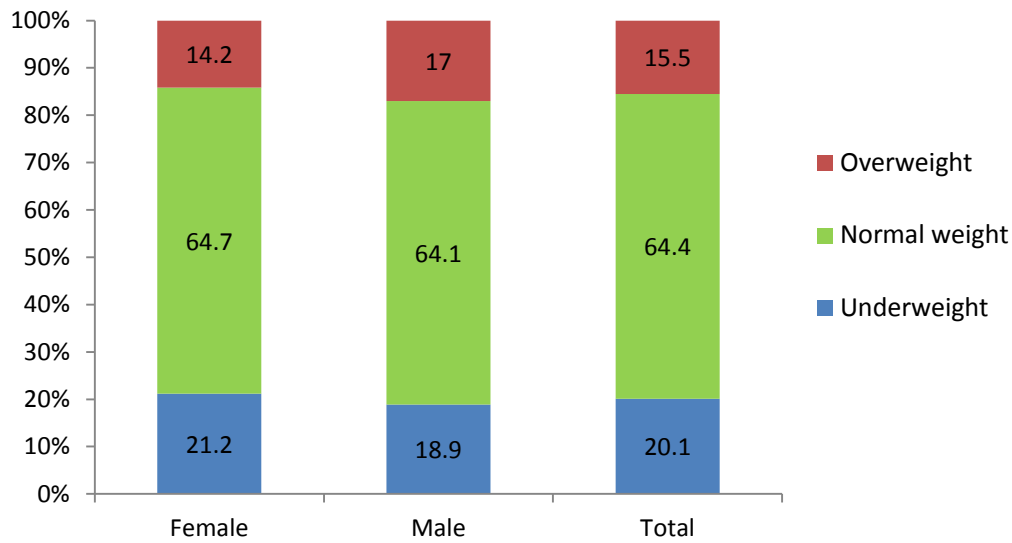
The prevalence of severe to moderate thinness and obese is very low for both male and female populations: there was less than 1.5% of the Thai Nguyen adult population with severe thinness. The prevalence of moderate thinness is also very low at less than 5%.

Table 4: Prevalence of adult underweight, overweight and obesity

Classification	International	AP
Underweight	20.1 %	20.1 %
Severe thinness	1.4 %	-
Moderate thinness	4.1 %	-
Mild thinness	14.5 %	-
Normal range	74.6 %	64.4 %
Overweight	5.2 %	15.5 %
Obese	0.1 %	5.2 %

The prevalence of underweight among adult females is 21.2% and this is not significantly higher than 18.9% or the prevalence among adult males. Similarly, no significant difference between adult males and females in the prevalence of overweight is observed.

Figure 1: Prevalence of underweight and overweight among adult males and females



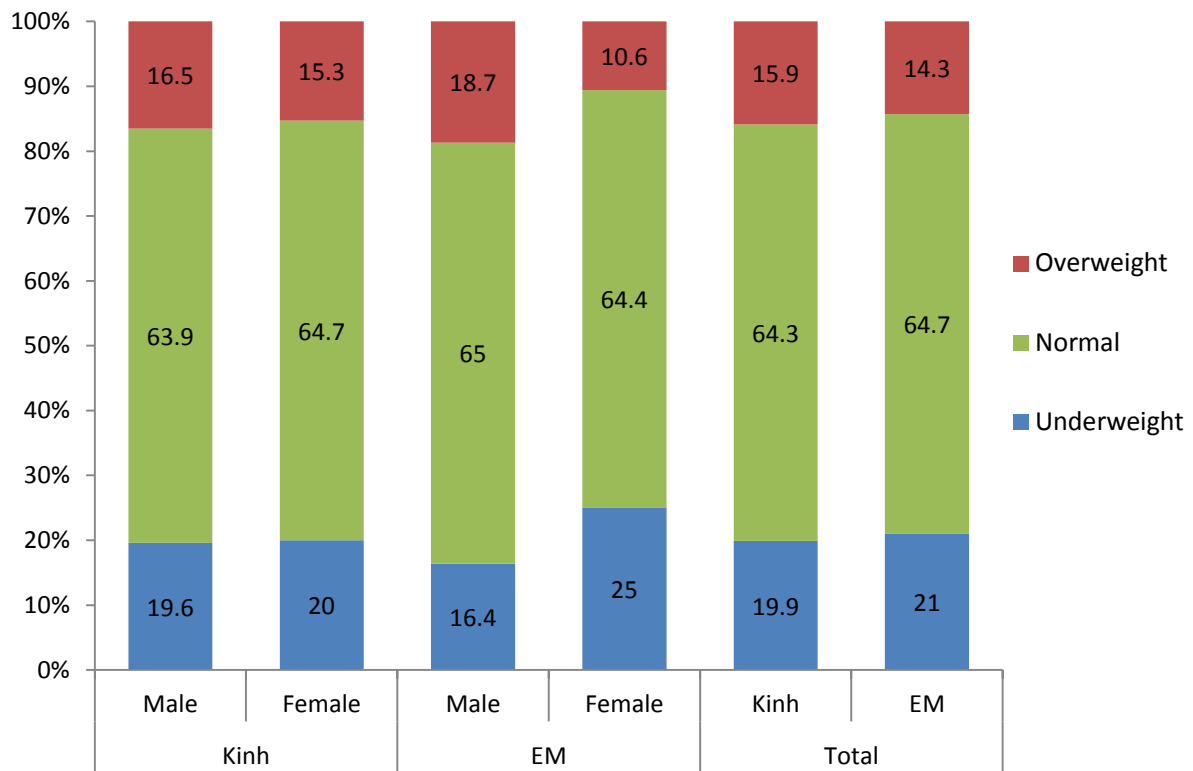
Note: AP classification is used.

Variation by ethnicity

Given the more vulnerable conditions of the EM, i.e. they usually live in remote mountainous areas in poor living conditions and poor accessibility to resources and social services, it is usually believed that underweight is more prevalent among the EM than the Kinh. Results from this study show that the prevalence of underweight among the EM is higher than the Kinh but the difference is marginal and not significant: it is 21% among the EM vs. 20% among the Kinh. On the other end, there is also no significant difference between the Kinh and the EM in the prevalence of overweight.

It is interesting to see that while no significant difference in prevalence of overweight and underweight is found by gender or ethnicity, significant difference is found while looking at the interaction between those two factors and it is mainly caused by the great gender difference among the EM. Specifically, there is no difference by gender in prevalence of overweight or underweight among the Kinh population. Among the Kinh population, the prevalence of underweight is around 20% and the prevalence of overweight is around 15% for both males and females. However, the prevalence of underweight is significantly higher among EM females compared to EM males (24.9% vs. 16.1%) while the prevalence of overweight is significantly lower among EM females compared to EM males (10.5% vs. 18.5%). This picture shows female EM is still a vulnerable population and more works are needed to close those gender differences.

Figure 2: Prevalence of overweight and underweight by ethnicity and gender

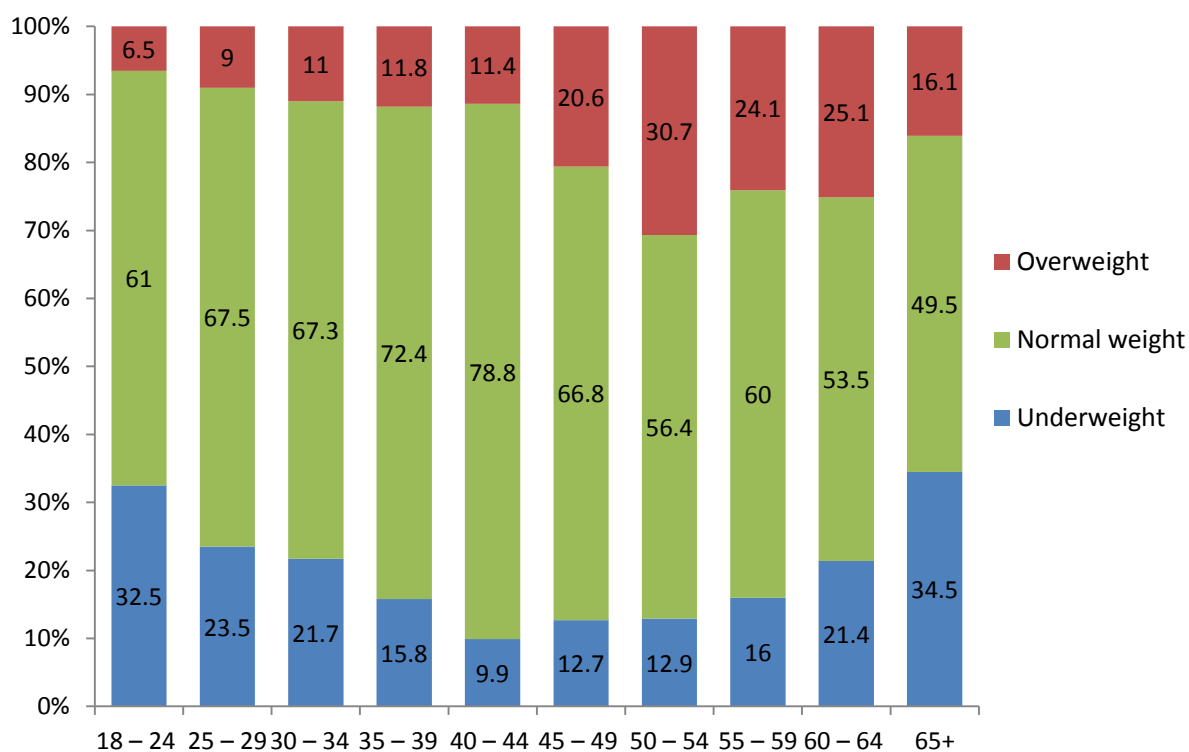


Note: AP classification is used.

Variation by age

The prevalence of underweight by age follows a U-shape curve while the prevalence of overweight by age follows an inverse U-shape curve. Specifically, almost one-third of young adults aged 18-24 are underweight; this proportion reduces as age is increasing till the early 40s but it then reverses and increases after this age; the lowest prevalence of underweight is around 10% among the adults at their early 40s year old and the prevalence of underweight among the elderly aged 65 or older is as high as the young adults aged 18 to 24. In contrast, the prevalence of overweight is lowest among young adults aged 18 to 24, it increases as age is increasing and reaches highest prevalence around the early 50s; after that age, it decreases as age is increasing. It should be noted that the U-shape curve for underweight is symmetry but the inverse U-shape curve for overweight is skewed to higher ages, i.e. while both young adults and the elderly have lower prevalence of overweight than the middle ages, overweight is still more prevalent among the elderly than the young adults.

Figure 3: Prevalence of underweight and overweight by age

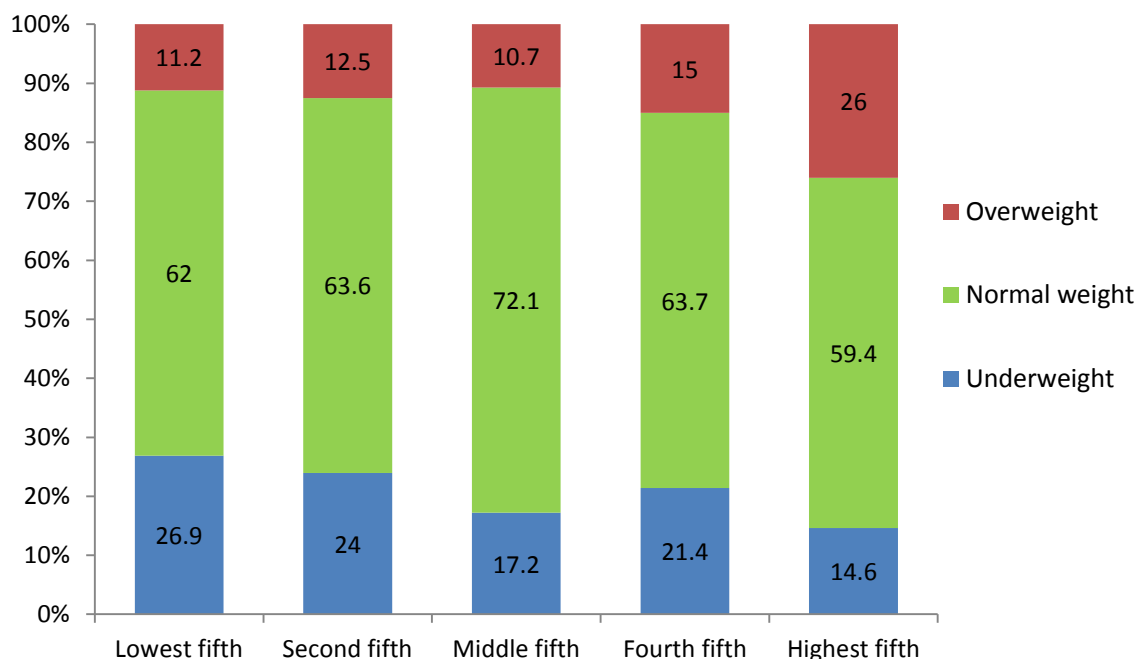


Note: AP classification is used.

Variation by household income per capita

Similar to what were found in other countries, the wealthier people have lower share of underweight but higher share of overweight population. However, this pattern is only clear when looking at the highest household income per capita quintile group compared to the other groups. The prevalence of underweight among population in the lowest household income quintile per capita is slightly but not significantly higher than that of the other income groups.

Figure 4: Prevalence of underweight and overweight by household income per capita quintiles

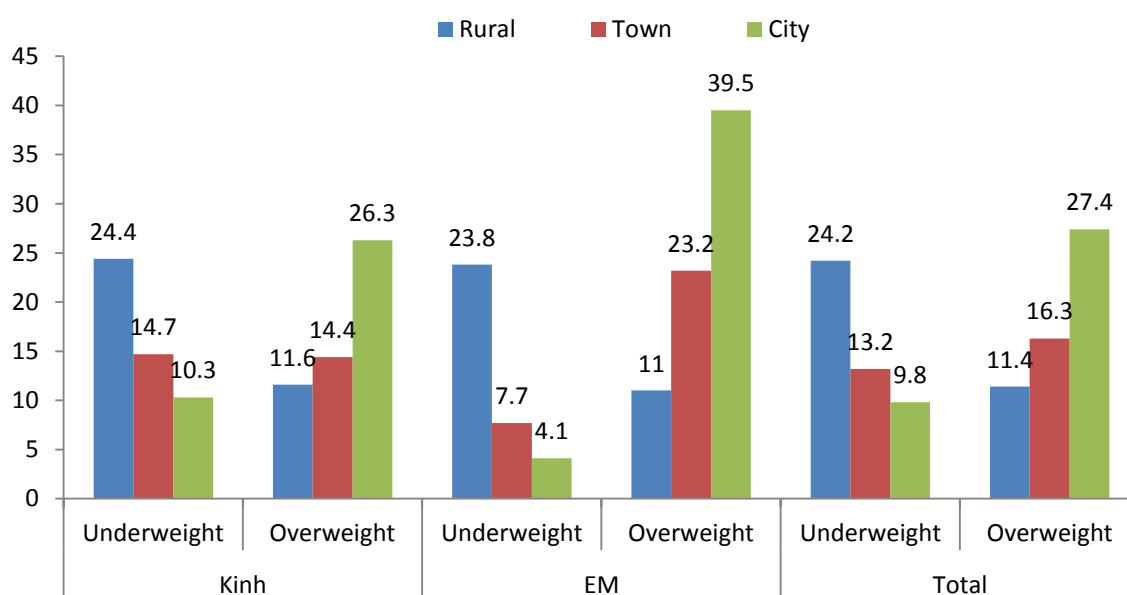


Note: AP classification is used.

Variation by rural and urban place of residence

Variation by rural and urban place of residence has been observed. As expected, underweight is more prevalent in rural areas while overweight is more prevalent in urban areas, especially in the city or the more urbanized setting. The patterns are the same for both Kinh and EM groups. The EMs who live in the city is an interesting group as they have the lowest prevalence of underweight and the highest prevalence of overweight.

Figure 5: Prevalence of underweight and overweight by place of residence

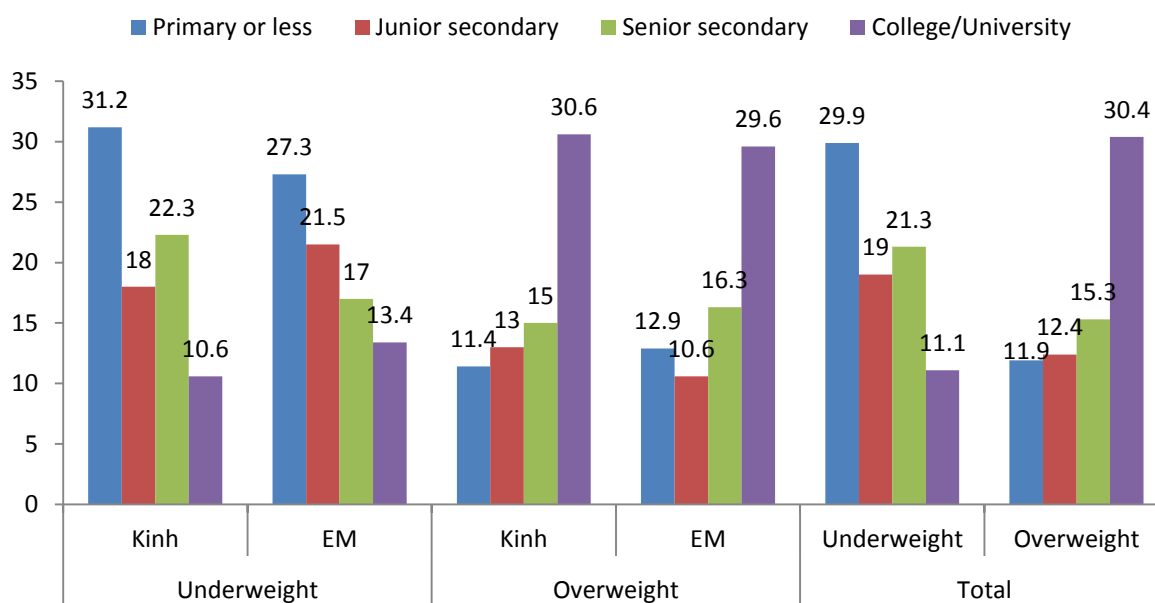


Note: AP classification is used.

Variation by education

The highest level of education one has completed has a negative association with prevalence of underweight while it has a positive association with prevalence of overweight. There is a considerable change in the prevalence of overweight when a person moved to completion of college or university.

Figure 6: Prevalence of underweight and overweight by education



Note: AP classification is used.

Independent associations between socioeconomic characteristics and the prevalence of underweight and overweight

Findings from multinomial logistic regressions show that ethnicity do not have significant and independent association with the prevalence of underweight and overweight. Among the Kinh people, there was no significant difference in prevalence of underweight and overweight by gender. However, evidence indicates clear gender differences among the ethnic minority even after controlling for other covariates: the prevalence of underweight is significantly lower while the prevalence of overweight is higher, although at marginal level of significant, among male compared to female EM people. The symmetrical U-shape curve of the relationships between age and the prevalence of underweight and the inverse U-shape and right-skewed curve of the relationship between age and the prevalence of overweight also remained after controlling for other covariates.

People in the fourth household income quintile have the lowest likelihood of being underweight. Results from the multinomial logistic regression shows that overweight becomes an issue only if the respondent is a Kinh person living in the highest household income quintiles or the richest households.

The likelihood of underweight is consistently and significantly lower in the more urbanized areas. The likelihood of overweight tends to be higher in more urbanized areas but the

difference is only significant among the EM people and between the city and the rural place of residence. After controlling for other covariates, evidence does not show significant differences of the prevalence of underweight or overweight by marital status or by education.

Table 6: Results (relative risk ratios /RRR) from multinomial logistic regressions predicting associations between ethnicity and other general characteristics and underweight/overweight in Thai Nguyen province

Variables	Total		Kinh		EM	
	Under weight	Over weight	Under weight	Over weight	Under weight	Over weight
Ethnicity						
Kinh ^a	1	1	-	-	-	-
EM	0.8	1.3	-	-	-	-
Sex						
Female ^a	1	1	1	1	1	1
Male	0.9	1.2	1.0	1.2	0.6**	1.7
Age group						
18 – 24 ^a	1	1	1	1	1	1
25 – 29	0.8	1.3	0.6	1.1	0.9	0.8
30 – 34	0.6	1.6	0.5	1.0	0.7	4.0***
35 – 39	0.4***	1.7	0.3***	1.2	0.7	3.5***
40 – 44	0.3***	1.5	0.2***	0.8	0.3**	6.7***
45 – 49	0.4***	3.2***	0.3**	2.2	0.5	5.5***
50 – 54	0.5**	4.9***	0.4**	3.7***	0.9	6.7***
55 – 59	0.6	3.8***	0.5	2.7	0.7	6.0***
60 – 64	0.9	3.9**	0.7	1.7	1.7	32.7***
65+	1.1	3.2***	1.2	2.2	1.5	6.4**
Place of residence						
Rural ^a	1	1	1	1	1	1
Town	0.5***	0.9	0.5**	0.8	0.3***	1.6
City	0.4***	1.5	0.4***	1.4	0.2	3.5***
Marital status						
Currently married ^a	1	1	1	1	1	1
Never been married	1.3	0.8	1.0	0.5	1.9	1.4
Widowed/Divorced/ Separated	0.8	0.7	0.9	0.9	1.1	0.2*
Completed education						
Primary or less ^a	1	1	1	1	1	1
Junior secondary	0.7*	0.9	0.7	0.9	0.8	0.7
Senior secondary	1.0	1.1	1.1	1.2	0.6	1.2
College/University	0.7	1.6	0.7	1.8	0.7	1.0
Household income per capita quintile						
Lowest fifth ^a	1	1	1	1	1	1
Second fifth	0.8	0.9	0.8	1.2	0.7	0.6
Middle fifth	0.8	0.9	0.7	0.7	1.0	1.8*
Fourth fifth	0.5***	1.1	0.5***	1.1	0.6	1.2
Highest fifth	0.8	1.9***	0.8	1.9***	0.8	1.6

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$; ^a reference category; AP classification is used.

DISCUSSION AND CONCLUSION

Our analyses show that the prevalence of underweight in Thai Nguyen province is around or lower than the national level and it is high compared to international level. Analyses of the 1992 Vietnam Living Standard Survey or VLSS [17], the 2000 National Nutrition Survey or VNNS [9], the 2002 National Health Survey or VNHS [17], the 2005 National Adult Obesity Survey or VNAOS [9] showed that the prevalence of adult underweight was 32.6%, 25.0%, 24.8%, and 20.9% respectively. The studies using the 2000 VNNS and the 2005 VNAOS looked at the adults aged 25 to 64; hence, their associated prevalence of adult underweight would be slightly lower when they looked at adults aged 18 to 65 or the age range used in the studies with the 1992 VLSS and the 2002 VNHS because of the prevalence of underweight among adults aged 18 to 24 is lower than that of the older adult population as seen in this study. Those national data showed a tendency of reducing underweight by around 8% over 10 years and this tendency suggested that the national prevalence of underweight among adults aged 18 to 65 in 2011 would be about 17% to 18%. This study found that the prevalence of underweight among adult population aged 18 or older in Thai Nguyen is 20.1% and it is 18.7% when limited to age 18 to 65. So, the prevalence of underweight in Thai Nguyen province would be higher than the predicted national level in the same year but the difference would be marginal. Compared with other provinces in its Northeast region, the prevalence of underweight in Thai Nguyen was lower [9]. Besides, this level is much higher than the level found in many other developed and also developing countries as seen in the WHO's global database on BMI [7] (see <http://apps.who.int/bmi/index.jsp>). This finding suggests that improvement of nutrition programs is still desired in Thai Nguyen in particular and in Vietnam in general.

This study found that the prevalence of overweight and/or obesity in Thai Nguyen is lower than the national level. Analyses of the 1992 VLSS, the 2000 VNNS, the 2002 VNHS, and the 2005 VNAOS showed that the prevalence of adult overweight with the WHO cut-offs at national level was 2% [17], 3.5% [9], 5.2% [17], and 6.6% [9] respectively; Those studies show a clear increasing tendency of overweight over time and this trend was also observed in other studies [19, 20]. The prevalence of overweight found in Thai Nguyen province at 5.2% with the WHO cut-offs in 2011 was higher than the average level found in its Northeast region at 3.1% [19] but it is already lower than the national level in the early 2000s and hence would be considerably lower than the expected national level in 2011. This level is much lower than that found in other Asia countries, e.g. 32.5% in Singapore in 2004, 18.9% in China in 2002, 41.1% in Malaysia in 2003, 31.1% in Thailand in 2003 [6, 7, 21, 22]. Similar results were found when using the AP cut-offs: the prevalence of overweight in Thai Nguyen province in 2011 was 15.5% and it was lower than 16.3% or the national level in 2005 [9]. The prevalence of obesity in Thai Nguyen province is very low at 0.1% and this is lower than the national level at 0.2% and 0.4% in 2000 and 2005 as found from the 2000 VNNS and the 2005 VNAOS respectively [9]. This is extremely low compared to the level found in other countries as seen in the WHO's global database on BMI [7] (see <http://apps.who.int/bmi/index.jsp>). Using the AP cut-offs, the prevalence of obesity in Thai Nguyen province is 5.2%, which is about the level of obesity in HCM city in mid-2000 (5.7% in Trinh et al., 2009; 6.4% in Cuong et al., 2007) [22, 23] but it is higher than the rate in Hanoi (2.1% in Walls et al., 2009) [24]. While the prevalence of overweight and obesity remain low in Thai Nguyen province, they would have been increasing as observed in the other studies in Vietnam; unfortunately, this study cannot explore the change of the prevalence over time as it use cross-sectional data at one point in time; further studies

may want to explore this further to have a more comprehensive picture of overweight and obesity in the province.

This would be the very first study looking at difference of adult overweight and underweight by ethnicity in Vietnam. Our analyses show that the prevalence of adult underweight among the ethnic minority people in general is not significantly higher than the Kinh majority people regardless of the poorer education and living status of the ethnic minority people. Besides, no significant difference between males and females were evidenced in Thai Nguyen. However, this study also shows that underweight remains an issue among the ethnic minority females as it is still high and significantly higher than that of the ethnic minority males, the Kinh males, and the Kinh females. This finding is contradictory to the frequently found finding of the higher obesity among females compared to males [23] and the finding of the overweight exceeding underweight among females in most developing countries [11]. This finding would be a result of various disadvantages of females, such as poor nutrition care, heavy work load, physiological characteristics, and a high prevalence of early childhood under nutrition [9]. This finding suggests that while Vietnam has made great achievements in gender equality in general, greater efforts are still needed for specific vulnerable populations like the ethnic minority to fully achieve the MDGs.

Under-nutrition remains a major challenge in rural areas while over-nutrition emerges in the city of Thai Nguyen. All are equal, rural residents clearly have a significantly higher likelihood of being underweight than urban residents in the city or towns. Although the likelihood of being overweight among residents of the city is still not significantly higher than rural residents, the tendency is clear. The prevalence of overweight with AP cut-offs in Thai Nguyen city is as high as 27.4%, which is very close to the prevalence found in the largest cities of Vietnam like Hanoi at 28.6% in 2004 [24], Da Nang at 33.7% in 2010 [25], and Ho Chi Minh city at 27.5% in 2005 [23]. Living in towns appeared healthiest as people who live here has a low likelihood of being underweight and also a low likelihood of being overweight. This finding suggests that the urban health penalty would only be applicable to large urban areas; the urban health advantage exceeds the urban penalty in mid-size urban areas; further studies may want to explore this relationship in other settings.

Consistent with other studies in Vietnam [20, 22], this study shows that the prevalence of overweight has a positive relationship with household income. However, the difference is on significantly only between members of the households in the highest income quintile and other people.

Finally, this study reveals that the relationship between the prevalence of underweight and age follows a U-shape curve while the relationship between the prevalence of overweight and age follows a right-skewed, i.e. skewed to older ages, and inverse U-shape curve. Pattern of the relationship between underweight and age in Thai Nguyen is very similar to what was found in Hanoi [25] but it is different from the linear relationship found in HCM city [21]. Findings from this study suggest that programs on under-nutrition should keep its focus on children and adolescents as well as the elderly; and programs on over-nutrition may want to target people at their early 40s as the prevalence of overweight rises fast and highest around the middle-age, i.e. 45 to 64 years old.

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HUMAN RESEARCH PARTICIPANTS PROTECTION

The study was approved by the Population Council and a NIH-standard and registered Institutional Review Board (IRB) of PHAD.

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