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Original Article

Prevalence and Factors Associated with Obesity among Community-Dwelling Persons 80 Years and Older: Longitudinal National Evidence from the Health, Aging, and Retirement in Thailand Study, 2015-2022

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ABSTRACT

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Introduction: Few studies have longitudinally assessed the prevalence and factors associated with obesity among persons 80 years and older. This study aimed to estimate these based on 4-wave national longitudinal data from Thailand.

Methods: Data from the Health, Aging, and Retirement in Thailand study from 2015, 2017, 2020 and 2022 were utilized. The sample was restricted to community-dwelling persons 80 years and older with complete self-reported body weight and height values (analytic sample: n=2986 observations). For the pooled sample, the average age was 85.3 years (range 80-107 years). Thai obesity was defined using Thai criteria (body mass index-BMI ≥25 kg/m2) and World Health Organization (WHO) criteria (BMI ≥30 kg/m2). Random effects (RE) logistic regressions were utilized to estimate the factors associated with Thai and WHO obesity.

Results: The average BMI was 21.6 (SD = 4.4), 23.0% were underweight, 17.4% had Thai obesity, and 3.6% had WHO obesity. RE regssions showed that age and male sex were negatively associated with Thai and WHO obesity. Being married or cohabiting and higher subjective economic status were associated with WHO obesity. Having no exercise was associated with WHO obesity. Living alone was negatively associated with Thai obesity, and having a greater number of chronic conditions was associated with both Thai and WHO obesity.

Conclusion: This longitudinal study enhances our understanding of the factors associated with obesity among people 80 years of age and older. Strategies to delay or decrease chronic conditions and increase physical activity may help reduce obesity.

Keywords: Aged, Obesity, Longitudinal Study, Thailand

Introduction

Thailand's population is aging quickly (1); 1.4 million (1.9% of the population) are aged ≥ 80 years. This figure is predicted to increase by 7% annually (2) to reach 3 million by 2039 (3). Along with the increasing aging population, multimorbidity, including obesity, and the health care needs and costs increase, and are probably significantly higher in the 80+ age group than in the younger age groups (4). Obesity is an increasing major public health problem (5). Considering increases in life expectancy, obesity may also increase in older age groups (6). Obesity increases the risk of numerous diseases (6), including hypertension, heart disease, diabetes, arthritis, a cumulative number of non-communicable diseases (7), dementia (8), and functional disability (9).

A recent review (10) found that the pooled prevalence of obesity in the oldest-old (≥ 80 years) based on 19 studies (14 in high-income and five in middle-income countries, including China, South Africa, Mexico, and Brazil) was 17.8% (95% CI: 13.3%-22.2%). Only three studies used longitudinal data, two from Germany and one from China, and only three studies investigated the correlates of obesity among the oldest-old; two in Germany (11, 12) and one in Finland (13). Due to rapid ageing in middle-income countries, such as Thailand, understanding the prevalence and correlates of obesity is particularly important and can assist in intervention planning. According to the previous review (10), in particular longitudinal data on the prevalence and correlates of obesity among the oldest-old in Asia are urgently needed.

Socio-demographic factors associated with obesity among the oldest-old people include decreasing age (11,12), women (14), no education, lower socioeconomic status (15), and men changing their living situation to living alone (11). Health-related factors associated with obesity among the oldest-old people include an increase in the number of chronic conditions (11).

Given the dearth of data on this subject, especially in relation to longitudinal studies in low- and middle-income countries and among the oldest-old, our study sought to investigate the prevalence and factors associated with obesity among the very old (80 years and older) based on national, longitudinal community-dwelling data in Thailand from 2015 to 2022. Understanding the elements that contribute to obesity is essential to developing interventions aimed at assisting the very old. These findings may be relevant to other middle-income countries with rapid population aging, including Iran. This is important because obesity can contribute to morbidity and mortality (6-9).

Methods

Participants and procedures

Four waves of health, ageing, and retirement in Thailand (HART) studies conducted in Thailand (2015, 2017, 2020, and 2022) were analysed. Through a multi-stage national sampling plan, one adult (aged ≥ 45 years) was randomly selected per household as the inclusion criterion and interviewed in the home; further details are presented elsewhere (16). In this analysis, the sample was restricted to participants who were 80 years and older. The analytic pooled sample consisted of 2986 observations in four study assessments in 2015, 2017, 2020, and 2022, and among living respondents the response rate was 72.3% in wave 4. From 956 participants at baseline, 37 had died, five refused, and 257 could not be traced at wave 4.

Compared to participants who stayed in the study, participants lost to follow-up did not significantly differ on any variables assessed, including key sociodemographics (age, education, economic status, living alone, residence, work, and marital status) and health-related variables (number of chronic conditions, and obesity).

Measures

Outcome variable

Body mass index (BMI) was assessed by self-reported body weight and height and classified into "underweight (< 18.5 kg/m2), normal weight (18.5–22.9 kg/m2), overweight (23–24.9 kg/m2), and obesity (≥ 25 kg/m2) using Asian criteria" (17), and World Health Organization (WHO) criteria for obesity (≥ 30 kg/m2) (18). The outcome variables were Thai obesity and WHO obesity (yes/no).

Independent variables

Sociodemographic variables included age, education, marital status, living situation, work, and subjective economic status. The latter was evaluated by asking, "How satisfied are you with your economic situation?" (Scores ranged from 0 to 10, with higher scores indicating higher economic status) (19).

The frequency of physical exercise or activity was assessed by asking, "How often do you exercise?" (1 = 0 days, 2 = 1-2 days, 3 = 3-4 days, 4 = 5-6 days or 5 = 7 days per week). Responses were coded into having no exercise = 1 and any exercise = 0 (20).

Chronic conditions (0-14), included diabetes, hypertension, bone diseases, cardiovascular disease, psychiatric/emotional disorder, liver/gastrointestinal disease, kidney disease, lung disease, prostate disease, diseases related to the uterus or ovaries, cancer, gynaecological conditions, glaucoma/cataract/pterygium, and other illnesses affecting daily life are diagnosed by healthcare providers (21).

Data analysis

The sample was described using descriptive statistics. Chi-square and t-tests were used to calculate percentage differences for the study waves. Using the panel data structure of four study waves, random-effects (RE)

logistic regressions were used to estimate the factors associated with Thai obesity and WHO obesity. RE logistic regression considers between and within variations in panel data, allowing for correlations between time-constant unobserved factors and explanatory variables (22). The choice of RE logistic regression was confirmed from the Hausman specification test between the fixed-effects model and the random-effects model (for Thai obesity: (18.35) p = 0.078) and for WHO obesity: (13.20) p = 0.280). In addition, in sensitivity analyses fixed effects models were estimated for Thai obesity for the total sample and stratified by sex. Only complete cases (missing cases were < 4% across study variables) were analysed, and p < 0.05 was considered significant. StataSE 16.0 (College Station, TX, USA) was used for statistical analysis.

Ethical considerations

The Human Research Ethics Committee of the National Institute for Development Administration (ECNIDA 2020/00012) granted approval for the study's protocol, and participants gave their informed written consent. All methods were carried out in accordance with relevant guidelines and regulations and have been performed in accordance with the Declaration of Helsinki. Data is publicly available at HART: https://hart.nida.ac.th/download-center/

Results

Sample characteristics

The pooled analytical sample consisted of 2986 observations with completed body weight and height: 956 in Wave 1, 718 in Wave 2, 655 in Wave 3, and 657 in Wave 4. For the pooled sample, average age was 85.3 years (range 80-107 years), 43.8% were male, 62.5% were widowed, 15.5% had no formal education, and 15.5% were living alone. The average BMI was 21.6 (SD = 4.4); 23.0% were underweight, 17.4% had Thai obesity, and 3.6% had WHO obesity. Sociodemographic characteristics (age, sex, subjective economic and work status) and covariates (living alone, exercise, and sum of chronic conditions) differed by study wave. (Table 1)

Table 1. Analytic sample characteristics, pooled and by study wave, HART 2015-2022

Variable (range)	All waves N = 2986 N (%)/Mean (SD)	Wave 1: 2015 N = 956 N (%)/Mean (SD)	Wave 2: 2017 N = 718 N (%)/Mean (SD)	Wave 3: 2020 N = 655 N (%)/Mean (SD)	Wave 4: 2022 N = 657 N (%)/Mean (SD)	p
Body mass index	21.6 (4.4)	21.5 (4.6)	21.3 (4.4)	21.6 (4.2)	21.9 (4.6)	0.083
Underweight	687 (23.0)	230 (24.1)	174 (24.2)	151 (23.1)	132 (20.1)	0.225
Thai obesity (BMI ≥25kg/m^2)	520 (17.4)	168 (17.6)	106 (14.8)	124 (18.9)	122 (18.6)	0.167
WHO obesity (BMI ≥30 kg/m^2)	108 (3.6)	35 (3.7)	21 (2.9)	22 (3.4)	30 (4.6)	0.421
Age (80-107 years)	85.3 (4.4)	84.6 (4.2)	85.2 (4.3)	85.6 (4.3)	86.1 (4.8)	<0.001
Sex (male)	1309 (43.8)	455 (47.6)	324 (45.1)	268 (40.9)	262 (39.9)	0.006
Marital status						
Single/divorced/separated/widowed	1978 (66.8)	596 (66.4)	489 (64.9)	443 (67.1)	450 (69.0)	0.436
Married/cohabiting	985 (33.2)	302 (33.6)	264 (35.1)	217 (32.9)	202 (31.0)	
Education						
None	459 (15.5)	173 (18.1)	113 (15.9)	90 (14.0)	83 (12.7)	0.083
primary	2321 (78.2)	722 (75.5)	559 (78.6)	512 (79.4)	528 (80.6)	
> Primary	187 (6.3)	61 (6.4)	41 (5.5)	43 (6.7)	44 (6.7)	
Subjective economic status (0-10)	6.4 (2.0)	6.4 (1.9)	6.3 (2.0)	6.1 (2.2)	6.9 (2.0)	<0.001
Work status (working)	190 (6.6)	74 (8.0)	65 (10.2)	19 (2.9)	32 (4.9)	<0.001
Living alone	461 (15.5)	111 (11.6)	176 (24.5)	105 (16.0)	69 (10.6)	<0.001
Exercise (no)	1703 (57.1)	530 (57.8)	384 (51.0)	394 (59.6)	395 (60.4)	<0.001
Number of chronic conditions (0-14)	1.4 (1.2)	1.3 (1.2)	1.4 (1.2)	1.5 (1.2)	1.5 (1.2)	0.002

[a]based on Chi-square tests or t-tests

Associations with Thai and WHO obesity using RE logistic regressions

RE logistic regressions showed that age (OR: 0.93, 95% CI: 0.89-0.93, and OR: 0.89, 95% CI: 0.81-0.98, respectively), and male sex (OR: 0.58, 95% CI: 0.37-0.92, and OR: 0.28, 95% CI: 0.11-0.74, respectively) were negatively associated with Thai obesity and WHO obesity. Being married or cohabiting was positively associated with WHO obesity (OR: 2.78, 95% CI: 1.14-6.77), and higher subjective economic status was positively associated with WHO obesity (OR: 1.22, 95% CI: 1.02-1.46). Not exercising was associated with WHO obesity (OR: 2.27, 95% CI: 1.12-4.63). Living alone (OR: 0.60, 95% CI: 0.37-0.98) was negatively associated with Thai obesity, and having a greater number of chronic conditions were positively associated with Thai obesity (OR: 1.43, 95% CI: 1.24-1.64) and WHO obesity (OR: 1.55, 95% CI: 1.16-2.08). (Table 2)

Associations with Thai obesity using FE logistic regressions

FE logistic regressions showed that age was negatively associated with Thai obesity in the overall sample (OR: 0.93, 95% CI: 0.86-0.99) and among men (OR: 0.83, 95% CI: 0.73-0.95). (Table 3)

Discussion

The aim of this study was to estimate for the first time the prevalence and factors associated with obesity among the very old (80 years and older) in Thailand based on national, longitudinal community-dwelling data from 2015 to 2022. The prevalence of Thai obesity (17.4%) in this study was similar to the pooled prevalence of obesity among the oldest-old based on 19 studies (18 studies with the WHO obesity) (17.8%) (10), and the prevalence of WHO obesity (3.6%) was higher than WHO obesity in China (0.7%) and Chinese obesity criteria (≥28 kg/m2) (2.8%) (23) but lower than in Shanghai community residents (≥ 28 kg/m2) (8.9%) (24). This study substantially contributes to current knowledge, mainly based on very few longitudinal studies.

RE regressions showed that age and male sex were negatively associated with Thai and WHO obesity. Being married or cohabiting and higher subjective economic status were associated with WHO obesity. Having no exercise was associated with WHO obesity. Living alone was negatively associated with Thai obesity, and having a greater number of chronic conditions was associated with both Thai and WHO obesity.

Table 2. Associations with Thai obesity (0 = BMI < 25kg/m^2 and 1 = BMI ≥ 25kg/m^2) and WHO obesity (0 = BMI <30kg/m^2 and 1 = BMI ≥30kg/m^2). Results of random-effects logistic regressions (waves 1, 2, 3 and wave 4)

Independent variables	BMI ≥ 25kg/m^2		BMI ≥ 30kg/m^2	
	AOR (95% CI)	p	AOR (95% CI)	p
Study wave				
Wave 1	(Reference)		(Reference)	
Wave 2	0.75 (0.51 to 1.11)	0.153	0.80 (0.38 to 1.72)	0.572
Wave 3	1.35 (0.90 to 2.03)	0.151	1.18 (0.54 to 2.57)	0.684
Wave 4	1.27 (0.81 to 1.98)	0.295	1.64 (0.75 to 3.62)	0.217
Age	0.93 (0.89 to 0.93)	<0.001	0.89 (0.81 to 0.98)	0.019
Sex				
Female	(Reference)		(Reference)	
Male	0.58 (0.37 to 0.92)	0.021	0.28 (0.11 to 0.74)	0.010
Education				
>Primary	(Reference)		(Reference)	
Primary	1.24 (0.57 to 2.68)	0.589	0.99 (0.19 to 5.10)	0.993
None	0.99 (0.41 to 2.41)	0.987	2.98 (0.50 to 17.78)	0.230
Marital status				
Single/divorced/separated/widowed	(Reference)		(Reference)	
Married/cohabiting	1.15 (0.74 to 1.78)	0.528	2.78 (1.14 to 6.77)	0.024
Subjective economic status	1.06 (0.98 to 1.15)	0.136	1.22 (1.02 to 1.46)	0.026
Work status (not working)	0.87 (0.45 to 1.70)	0.686	0.31 (0.09 to 1.05)	0.059
Living arrangement				
Living with others	(Reference)		(Reference)	
Living alone	0.60 (0.37 to 0.98)	0.044	1.01 (0.38 to 2.67)	0.987
Exercise (no)	1.02 (0.73 to 1.41)	0.911	2.27 (1.12 to 4.63)	0.024
Number of chronic conditions	1.43 (1.24 to 1.64)	<0.001	1.55 (1.16 to 2.08)	0.003
Observations	2917		2921	
Individuals	1643		1645	

AOR = Adjusted Odds Ratio, CI = Confidence Interval

Table 3. Associations with Thai obesity (0 = BMI < 25kg/m^2 and 1 = BMI ≥ 25kg/m^2). Results of fixed-effects logistic regressions (waves 1, 2, 3 and wave 4)

Independent variables	All		Male		Female	
	AOR (95% CI)	p	AOR (95% CI)	p	AOR (95% CI)	p
Age	0.93 (0.86 to 0.99)	0.040	0.83 (0.73 to 0.95)	0.010	0.97 (0.88 to 1.06)	0.493
Marital status						
Single/divorced/separated/ widowed	(Reference)		(Reference)		(Reference)	
Married/cohabiting	0.54 (0.22 to 1.34)	0.184	0.74 (0.20 to 2.81)	0.664	0.33 (0.08 to 1.36)	0.126
Subjective economic status	1.08 (0.97 to 1.21)	0.168	0.96 (0.78 to 1.19)	0.720	1.12 (0.97 to 1.29)	0.123
Work status (not working)	0.81 (0.30 to 2.16)	0.675	1.32 (0.36 to 4.81)	0.677	0.42 (0.07 to 2.34)	0.320
Living arrangement						
Living with others	(Reference)		(Reference)		(Reference)	
Living alone	0.56 (0.29 to 1.08)	0.082	0.55 (0.19 to 1.59)	0.273	0.52 (0.21 to 1.26)	0.149
Exercise (no)	0.78 (0.50 to 1.21)	0.265	0.50 (0.24 to 1.06)	0.070	1.07 (0.60 to 1.91)	0.829
Number of chronic conditions	1.15 (0.93 to 1.43)	0.207	1.15 (0.83 to 1.61)	0.404	1.21 (0.90 to 1.64)	0.210
Observations	461		190		268	
Individuals	160[a]		66		93	

[a]Fixed-effects models include only individuals with within-person variation in obesity status across waves (n = 160)

Consistent with previous studies in Germany (11, 12), this study found that age was negatively associated with obesity, which may be explained by a decline in lean body mass with increasing age (12, 25). Similar to a study among the oldest-old in the USA (14), women were associated with a higher prevalence of obesity than men, while in Germany, no sex differences were found (11, 12). Consistent with a previous study among the oldest-old in China (15), this study found that no education increased the odds of WHO obesity, but this was not significant. However, higher subjective economic status (SES) increased the odds of WHO obesity, contrary to the China study (15). This could indicate that, in contrast to China, where a rapid epidemiological transition has occurred from high SES to low SES individuals, the burden of obesity in Thailand has not yet moved from high SES to low SES individuals (26, 27).

Furthermore, being married or cohabiting was associated with WHO obesity in this study. This relationship is often driven by shared lifestyle habits, reduced pressure to maintain a certain weight, and the stabilizing effect of companionship on routines, which can lead to a positive energy balance—consuming more calories than are burned (28, 29). In a previous study in Germany (11), men changing their living situation to living alone was associated with obesity, while in this study change to living alone was protective against Thai obesity. Similar to living alone decreasing Thai obesity, a study among older adults in Korea found that males who made the move to live alone were more likely to lose at least five kg of weight (30). It is possible that the oldest-old transitioning to living alone are lonelier and/or more depressed, and as found in a systematic review (31) being married or cohabiting was associated with WHO obesity.

Not participating in exercise was associated with WHO obesity in this study. The benefits of physical activity, especially in obese older individuals who are inactive, have been stated (32). For the oldest-old, multicomponent regimens that primarily combine aerobic and resistance exercise should be implemented (33). Among older adults in Korea, unemployment was associated with obesity (34), while in our study, among the oldest-old not working was marginally negatively associated with WHO obesity.

Moreover, consistent with previous studies (12), a higher number of chronic conditions was associated with Thai and WHO obesity. In additional analyses (not shown), among the chronic conditions assessed, having diabetes, hypertension, kidney disease, heart disease and bone diseases were significantly positively associated with Thai obesity. Previous research in older persons showed that a greater BMI was linked to a higher risk of heart disease, diabetes, and hypertension (7, 35). Some of these chronic conditions, such as bone diseases, may restrict mobility, which may consequently contribute to obesity, while other conditions, such as cancer, may lead to unintentional weight loss (12).

Study limitations and strengths

The study includes a longitudinal, national community-dwelling sample and established measures from the HRS and KLOSA. One study limitation is that all data were assessed by self-report, including height and body weight assessment, and future assessments should also include objective measures, such as anthropometric measurements and individual biomarkers (15). Several previous studies among the oldest-old have used self-reported height and weight for BMI (e.g., 11, 12). Agreement between self-reported and measured anthropometric indicators declines markedly in advanced age, particularly among the oldest-old (≥ 80 years), where height is commonly overestimated due to age-related shrinkage and weight may be misreported, leading to systematic underestimation of BMI (36-38). Therefore, it is assumed that in this study obesity is likely

underestimated and underweight overestimated. The HART study among the oldest-old had a fairly good response rate. Attrition analysis in this study showed no significant differences in terms of sociodemographic, social and most health variables. A further limitation was that exercise was only assessed with a single-item, and future studies should use more comprehensive physical activity measures, including duration, intensity, or type of exercise. Given the number of statistical tests conducted, some significant associations may be due to chance, and findings should be interpreted cautiously. Finally, the sample did not include oldest-old adults living in institutional or assisted living communities, which may have yielded different rates of obesity than in community-dwelling oldest-old adults.

Conclusion

The study showed that almost one in five persons 80 years and older have obesity, and the longitudinal study enhances our understanding of its correlates. Strategies to increase physical activity and improve subjective economic status, as well as to delay or decrease chronic conditions, may help in reducing obesity. In addition to the current policies, separate programmes for the oldest-old should be developed and implemented, such as physical activity promotion, screening, and management of chronic conditions.

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Conflict of interests

The authors declare that they have no competing interests.

Authors' contributions

All authors fulfil the criteria for authorship. SP, KP, AH, and RG conceived and designed the research, performed statistical analysis, drafted the manuscript, and made critical revisions of the manuscript for key intellectual content. All authors read and approved the final version of the manuscript and have agreed to the authorship and order of authorship for this manuscript.

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