Association between the Nutritional and Health Status of the Elderly

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ABSTRACT

The deterioration of the elderly results in several health problems and sometimes malnutrition. This study investigates the association between factors of an anthropometric assessment and health status for developing simple tools for self care in the elderly. A descriptive cross sectional survey was conducted for the elderly from Boung Yee Thoa municipal area, Thanyaburi, Pathumtanee province. Four survey data collections were conducted with 426, 334, 367, and 361 elderly, respectively. Triceps skinfold thickness, percent body fat, weight, height, waist and hip circumference were measured as anthropometric data. Results in male elderly (60-69 yrs.) were**:** BMI, waist circumference, percent body fat and triceps skinfold thickness were related to hypertension (systolic). BMI was associated with hypertension (diastolic) and diabetes. Triceps skinfold thickness correlated with diabetes. In female elderly (60-69 yrs., BMI, waist circumference, percent body fat and triceps skinfold thickness was related to hypertension (diastolic). Waist circumference, triceps skinfold thickness and waist hip ratio were related to diabetes. Percent body fat and triceps skinfold thickness correlated with hypertension (systolic). BMI, triceps skinfold thickness, percent body fat were associated with hypertension or diabetes in both male and female elderly, 60-69 years old.

Key words: nutritional status, health status, elderly, anthropometry

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Introduction

Since 2009, it has been recognized that Thai society is becoming an aging society, and by 2025 A.D. about 20% of the total population will be elderly. This is a drastic increase within 20 years.[1] Elderly care should be a concern of policy makers and health officers, providing elderly better care and living conditions. Several national surveys[1-4] found that Thai elderly had various health problems and risk behaviors, which could lead to nutritional problems. Anthropometry provides one means of nutritional assessment which elderly could do by themselves to monitor their nutritional and health status. For example, the body mass index is one routine assessment in the health service, but if elderly are humpback, height will be difficult to measure. Either waist or body fat may be used as an alternative tool for anthropometric assessment in the elderly, but it is not known if these measures have any relation with health status or not. One of this study's objectives is to find out the association between anthropometric assessment and health status; another is to find a simple nutritional tool for the elderly to look after their own nutritional status.

Materials and Methods

A cross sectional survey was carried out for the elderly who live in Boung yee Thoa municipality, Thunyaburi district, Pathumtanee province, during November 2010 through July 2011. The elderly surveyed were categorized into three age groups: 60-69 years, 70-79 years, and 80 years and over[5]. The sample size was calculated at 384 persons[6] (plus 20% for possible attrition, was 460 cases) and sampling was by convenience method. Data collection was collected on four occasions, and there were different samples on each occasion: 426 the first time, 334 the second time, 367 the third time, and 361 the fourth time. The study was approved by the Human Ethic Committee of Thammasat University, Faculty of Medicine, and informed consent was obtained from the study participants.

Individual weight was measured by digital scale and height was measured using a microtoise, then body mass index was calculated as weight/height^2. Percent body fat was assessed using a body fat monitor (model HBF-306) and triceps skinfold thickness was measured by digital skinfold calipers. Unfortunately, triceps skinfold thickness could not assessed on the fourth survey collection due to problems with the digital calipers, with no replacement available. Waist circumference and hip circumference were measured with a waist-hip tape.

In the survey, we assessed hypertension and diabetes as health status of the elderly. Blood pressure was measured by sphygmomanometer and diabetes was diagnosed by fasting blood sugar (dextrose strip). Fasting blood sugar was omitted on the second survey collection, since enough test strips were not available and could not be supplied in time. The cut off point of hypertension for systolic blood pressure was more than 140 mmHg, and for diastolic blood pressure was more than 90 mmHg.[7] Before measuring

blood pressure, we let the elderly have a seat and take a rest for 5 minutes at least, then measured their blood pressure in a sitting position. Fasting blood sugar more than 126 mg/dl was the cut off point for diabetes.[8] Body mass index was categorized into four levels; less than 18.5 (kg/m^2) was lean, 18.5-24.9 was normal, 25-29 was overweight, and more than 30 was obese.[9] Percent body fat was categorized into three levels in both sexes ; for males, less than 12% was below average, 12-18% was average, and more than 18% was above average; for females, less than 20% was below average, 20-27% was average, and more than 27% was above average,[9] Triceps skinfold thickness was measured on the back of the right arm over the triceps muscle, midway between the elbow and the acromion process of the scapula, and categorized into three levels based on percentile and sex; for males, less than 11.3 mm was level 1, 11.3-12.5 mm (standard) was level 2, and more than 12.5 was level 3; for females, less than 14.9 mm[9] was level 1, 14.9-16.5 mm (standard) was level 2, and more than 16.5 was level 3.[9] Cut off point for male waist circumference was 94 cm, and for female was 80 cm measured at the umbilicus level.[9] Waist to hip ratio in males should not be more than 1, and should not be more than 0.8 in females.[9]

Statistical analysis

General characteristics of the elderly were described in percentage, mean and standard deviation. The association between anthropometric assessment and health status were calculated by chi-square. Sex and age group were analyzed separately for males and females and in three age groups.

Results

Table 1, most participants were early elderly, except at second data collection, and had normal body mass index (BMI). More than 60% of both sexes had systolic blood pressure at ≥ 140 mmHg and 6.4-25% had high blood sugar. Less than 50% of males and females had diastolic blood pressure at ≥ 90 mmHg. Percent body fat was above average for more than 90% of males and more than 80% of females. Average waist by sex was a little bit different. Triceps skinfold thickness of most females was at 60 percentile, which was below standard, while most males were above standard. In Table 2, which shows findings for males, BMI, waist and percent body fat is associated with hypertension (systolic) at first survey data collection, while at the second and third survey data collections, triceps skinfold thickness was related to hypertension (systolic) and diabetes. BMI was also associated with hypertension (diastolic) and diabetes. In Table 3, which shows findings for females, triceps skin fold thickness was associated with hypertension (systolic and diastolic) and diabetes, while percent body fat was related to hypertension (systolic and diastolic). Waist and waist hip ratio also correlated with hypertension (diastolic) and diabetes. BMI was only related to hypertension (diastolic).

Table 1 General Characteristics of the Elderly[9].

Characteristic	The First Time (n=426)		The Second Time (n=334)		The Third Time (n=367)		The Forth Time (n=361)	
	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)
Age group (years)	n=136	n=290	n=114	n=220	n=125	n=242	n=128	n=233
- 60-69	69.9	69.0	40.4	37.7	76.8	79.8	77.3	68.7
- 70-79	25.0	25.5	34.2	35.0	18.4	14.4	21.1	24.0
- 80 and over	5.1	5.5	25.4	27.3	4.8	5.8	1.6	7.3
- Average (SD)	67.39 (6.16)	67.30(6.34)	71.71(8.30)	72.30(7.76)	65.95(5.45)	65.79(5.59)	65.82(5.55)	67.58(6.69)
Weight (average) kg (SD)	64.09(10.29)	58.37(10.73)	59.72(10.37)	57.10(9.67)	59.26(10.31)	57.27(9.52)	64.46(10.97)	61.15(10.74)
Height (average) cm (SD)	164.14(7.37)	153.86(6.91)	158.43(8.02)	157.06(7.23)	158.67(7.19)	156.22(7.09)	174.67(131.71)	154.58(6.75)
Body mass index (kg/m^2)								
- <18.5	5.9	6.9	4.4	8.6	4.8	8.3	6.3	4.3
- 18.5-24.9	60.3	50.3	55.3	69.1	54.4	65.7	57.8	40.8
- 25.0-29.9	30.9	31.7	34.2	15.9	36.0	19.4	32.0	41.6
- ≥30	2.9	11.0	6.1	6.4	4.8	6.6	3.9	13.3
- Average (SD)	23.69(3.270	24.67(4.26)	24.55(3.74)	23.35(3.81)	24.48(3.79)	23.63(3.82)	24.05(3.74)	25.28(4.29)
Blood pressure (systolic) mmHg								
- <120	38.2	29.7	33.3	39.5	23.2	35.5	38.3	36.1
- 120-139	33.8	40.7	32.5	44.5	33.6	42.6	33.6	33.5
- ≥140	27.9	29.7	34.2	16.0	43.2	21.9	28.1	30.5
- Average (SD)	130.15(22.71)	131.01(19.17)	130.58(19.70)	127.08(15.82)	135.49(19.56)	129.23(19.06)	131.76(18.02)	130.96(16.39)

Table 1 General Characteristics of the Elderly (cont.)

Characteristic	The First Time (n=426)		The Second Time (n=334)		The Third Time (n=367)		The Forth Time (n=361)	
	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)
Blood pressure (diastolic)								
mmHg								
- <80	44.9	50.7	57.0	32.7	56.8	36.0	51.6	75.1
- 80-90	33.8	32.1	27.2	45.5	23.2	42.6	27.3	19.3
- ≥90	21.3	17.2	15.8	21.8	20.0	21.5	21.1	5.6
- Average (SD)	82.57(12.53)	80.48(11.82)	80.47(11.61)	83.86(11.14)	81.06(11.43)	83.12(11.49)	82.71(10.14)	77.12(8.49)
Fasting blood sugar								
(mg/dl)								
- 70-90	46.3	53.8	-	-	48.0	55.0	33.6	38.4
- 100-125	41.2	37.2	-	-	45.6	34.7	41.4	41.8
- >126	12.5	9.0	-	-	6.4	10.3	25.0	19.8
- Average (SD)	107.10(29.87)	101.89(25.70)			102.7(17.01)	104.04(27.57)	118.89(41.42)	114.18(35.97)
Percent body fat								
Male								
- <12%	1.5	-	1.8	-	1.6	-	1.6	-
- 12-18%	6.6	-	2.6	-	1.6	-	2.3	-
- >18%	91.9	-	95.6	-	96.8	-	96.1	-
Female								
- <20%	-	2.4	-	4.5	-	3.3	-	2.1
- 20-27%	-	9.7	-	10.9	-	9.9	-	13.7
- >27%	-	87.9	-	84.5	-	86.8	-	84.1
Waist (cm)								
- normal	82.4	50.3	88.6	70.9	89.6	62.4	72.7	24.5
- obesity	17.6	49.7	11.4	29.1	10.4	37.6	27.3	75.5
- Average (SD)	84.11(11.84)	81.35(11.87)	80.84(11.43)	76.63(11.90)	82.04(10.70)	78.28(12.13)	89.52(10.84)	87.67(11.37)

Table 1 General Characteristics of the Elderly (cont.)

Characteristic		The First Time (n=426)	The Second Time (n=334)	The Third Time (n=367)
Ttriceps skinfold thickness (mm)				
Male	percentile			
≤7.5	60	11.8	8.8	5.6
7.6-8.8	70	8.8	5.3	4.8
8.9-10.0	80	8.8	7.9	10.4
10.1-11.3	90	9.6	9.6	8.8
11.4-12.5	standard	13.2	10.5	7.2
>12.5	over standard	47.8	57.9	63.2
Female	percentile			
≤9.9	60	30.0	55.9	47.5
10.0-11.6	70	13.1	7.7	7.0
11.7-13.2	80	10.0	5.5	4.5
13.3-14.9	90	16.2	5.9	9.9
15.0-16.5	standard	9.7	7.3	6.6
>16.5	over standard	20.7	17.7	24.4

Table 2 Association Between Anthropometric Assessment and Health Status of Male Elderly, 60-69 Years.

Hypertension (systolic)				
- BMI	10.232**	2.267	3.734	2.791
- waist	8.016**	1.054	0.014	0.719
- triceps skin fold	0.945	7.091*	12.834**	-
- typical body fat	12.921**	4.073	4.611	1.313
- waist hip ratio	0.538	0.545	N/A	0.012
Hypertension (diastolic)				
- BMI	2.723	14.144**	1.873	3.095
- waist	3.243	0.707	0.301	0.339
- triceps skin fold	1.037	3.850	5.170	-
- typical body fat	1.274	0.754	1.156	2.085
- waist hip ratio	0.617	0.761	N/A	0.365
Diabetes				
- BMI	1.521	-	6.949*	1.521
- waist	2.824	-	0.781	0.838
- triceps skin fold	2.341	-	6.480*	-
- typical body fat	0.268	-	5.572	1.485
- waist hip ratio	0.189	-	N/A	2.608

* $\alpha < 0.05$ ** $\alpha < 0.01$

Table 3 Association Between Anthropometric Assessment and Health Status of Female Elderly, 60-69 Years.

Variable	The First Time (n= 200) χ^2	The Second Time (n=83) χ^2	The Third Time (n=193) χ^2	The Forth Time (n=160) χ^2
Hypertension (systolic)				
- BMI	1.370	2.674	0.886	5.969
- waist	0.375	2.105	1.350	0.187
- triceps skin fold	0.869	7.521*	8.345*	-
- typical body fat	1.269	2.514	8.777*	0.695
- waist hip ratio	0.192	2.373	0.158	0.833
Hypertension (diastolic)				
- BMI	1.189	1.467	8.967*	1.099
- waist	0.619	3.960	14.088**	0.048
- triceps skin fold	0.077	6.6*	7.395*	-
- typical body fat	0.204	6.723*	6.991*	0.119
- waist hip ratio	1.680	3.257	12.462**	1.361
Diabetes				
- BMI	1.258	-	2.907	0.240
- waist	0.498	-	4.913*	1.085
- triceps skin fold	3.786	-	8.324*	-
- typical body fat	2.747	-	0.284	0.195
- waist hip ratio	0.264	-	5.694*	2.939

* $\alpha < 0.05$ ** $\alpha < 0.01$

Discussion

We found that not only BMI, as used in routine health service assessment, but also triceps skin fold thickness correlated with hypertension and diabetes in both sexes of the early elderly. There was not an association for the middle elderly and late elderly because of the small sample size for analysis. Percent body fat was another measure which should be included as a routine service, since it also was associated with hypertension in both sexes.

A population health care behavior survey 2009[2], reported that most Thai elderly had three meals daily and sufficient food for health needs. Some elderly ate snacks to satisfy their hunger, but most of them avoided any food which would be a risk to their health, especially fast food and crispy snacks. More than half of elderly females had chronic diseases, while this was lower among males in this study[10].

Even though most Thai elderly had good health care practices and nutrition, health officers should give special attention to continuously promote the health of the elderly by active and passive activities such as home visits and surveillance, especially of nutritional status, since malnutrition can cause many health problems, from both chronic and acute disease. Anthropometric assessment is one of the tools that health officers can use for monitoring elderly nutritional status, since it is associated with some health outcomes. Jassen and Mark's meta-analysis [10] found a relationship between BMI and waist circumference in obese elderly and risk of death, while Beydoun and colleagues'[11] systematic review also showed that the relation between BMI and dementia was in a U shape, and that weight gain and high waist circumference or skinfold thickness increased the risk of dementia. In addition, body size was significantly associated with blood pressure among Asian populations, and waist hip ratio may be a preferable clinical tool for identifying individuals at elevated risk of hypertension compared with other simple measures[12]. Similarly, Kalmijn and colleagues[13] also showed that BMI is related to hypertension, and waist hip ratio (after adjusting for BMI) increased risk of death from heart disease. Decoda's study group[14] and Korhonen and colleagues[15] found a relationship between waist size and diabetes. BMI and waist size in females was able to predict risk of death better than body composition[16], waist hip ratio could predict fat change in ten years[17], and BMI and waist size could better predict health status in the elderly than in younger age groups[18]. Suwanna[19] found that the cutoff point for waist circumference at 85 cm for Thai males and 79 cm for Thai females was highly sensitive for metabolic syndrome diagnosis. Most of

these studies findings were consistent with our study, but our study was descriptive of relationships but not designed to show causal relationships or be predictive in the Thai population.

Several limitations of this study were present or became evident. For example, we could not keep the full complement of participants as calculated for our samples, since some elderly registered with the municipality, but at the time of data collection, they were not at home and since we used consenting elderly for our study, in order to keep an adequate sample size, we had to add replacement participants. Thus, the data for some variables were not consistent in all four survey data collections, that is, from the same persons. *Second*, there were small numbers of participants who were middle elderly or late elderly, so we did not find any correlation in these two age groups. *Third*, we found it impossible to control measures of height .since some elderly had humpbacks and it making estimates due to posture was not systematic.. *Fourth*, diagnostic bias was presented through digital calipers used for triceps skinfold thickness. The calipers produced variations that led to measurement error, so that we had to skip this measurement during the fourth survey data collection. Similarly, the strips for testing blood sugar ran out and some participants could not be tested during the second survey data collection. Thus, the average of the blood sugar level was just based on three measures, which reduced the power of the test for association between anthropometric factors and diabetes. *Last*, some elderly could not provide us information about their diseases, so the data of their disease history, that was previously diagnosed by a physician, could not be collected completely, resulting in the loss of relevant data for analysis.

Conclusion

BMI, triceps skinfold thickness, percent body fat was associated with hypertension or diabetes in both male elderly and female elderly at 60-69 years old. Results indicate that it would be best if we could collect the data continuously through a surveillance system from the same persons every time. This would enable the confirmation of the association between health status and nutritional status. Although most of the elderly surveyed were 60-69 years, results indicate assessment would still be useful for disease prevention at earlier ages too, and should be done by health officers to develop health profiles that can be monitored for follow up on the elderly anytime.

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ความสัมพันธ์ระหว่างภาวะโภชนาการกับสถานะสุขภาพของผู้สูงอายุ

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บทคัดย่อ

ภาวะเสื่อมของร่างกายของผู้สูงอายุจะนำมาซึ่งปัญหาสุขภาพต่างๆ และภาวะทุพโภชนาการได้ การศึกษาครั้งนี้เพื่อศึกษาความสัมพันธ์ระหว่างภาวะโภชนาการด้วยการวัดสัดส่วนร่างกาย กับสถานะสุขภาพในผู้สูงอายุ และค้นหาเครื่องมือการดูแลตนเองแบบง่ายๆสำหรับผู้สูงอายุ เป็นการสำรวจเชิงพรรณนาภาคตัดขวาง ศึกษากลุ่มผู้สูงอายุที่อาศัยอยู่ในเขตพื้นที่เทศบาลตำบลบึงยี่โถ อ.ธัญบุรี จ.ปทุมธานี เก็บข้อมูลทั้งหมด 4 ครั้ง ครั้งที่ 1 ผู้สูงอายุจำนวน 426 คน ครั้งที่ 2 ผู้สูงอายุจำนวน 334 คน ครั้งที่ 3 ผู้สูงอายุจำนวน 367 คน ครั้งที่ 4 ผู้สูงอายุจำนวน 361 คน โดยใช้เครื่องมือวัดไขมันใต้ผิวหนังบริเวณกล้ามเนื้อไตรเซปแบบดิจิตอล เครื่องวัดปริมาณไขมันในร่างกายแบบดิจิตอล เครื่องชั่งน้ำหนัก ที่วัดส่วนสูง และสายวัดรอบเอว ผลการศึกษาคือ ดัชนีมวลกาย รอบวงเอว ปริมาณไขมันในร่างกาย ความหนาไขมันใต้ผิวหนังบริเวณกล้ามเนื้อไตรเซปมีความสัมพันธ์กับความดันโลหิตสูง (ค่าซิสโตลิค) ค่าดัชนีมวลกายมีความสัมพันธ์กับความดันโลหิตสูง (ค่าไดแอสโตลิค) และโรคเบาหวาน ค่าไขมันใต้ผิวหนังบริเวณกล้ามเนื้อไตรเซปมีความสัมพันธ์กับโรคเบาหวาน ทั้งหมดนี้พบในผู้สูงอายุเพศชายอายุ 60-69 ปี ส่วนช่วงอายุอื่นไม่พบความสัมพันธ์ใดๆ ดัชนีมวลกาย รอบวงเอว ปริมาณไขมันในร่างกาย ความหนาไขมันใต้ผิวหนังบริเวณกล้ามเนื้อไตรเซปมีความสัมพันธ์กับความดันโลหิตสูง (ค่าไดแอสโตลิค) ขนาดรอบเอว ความหนาของไขมันใต้ผิวหนังบริเวณกล้ามเนื้อไตรเซปและอัตราส่วนรอบเอวต่อรอบสะโพกมีความสัมพันธ์กับโรคเบาหวาน ปริมาณไขมันในร่างกายและความหนาไขมันใต้ผิวหนังบริเวณกล้ามเนื้อไตรเซปมีความสัมพันธ์กับความดันโลหิตสูง (ค่าซิสโตลิค) ทั้งหมดนี้พบในผู้สูงอายุเพศหญิง อายุ 60-69 ปี สรุปผล ดัชนีมวลกาย ความหนาไขมันใต้ผิวหนังบริเวณกล้ามเนื้อไตรเซป ปริมาณไขมันในร่างกาย มีความสัมพันธ์กับความดันโลหิตสูงและเบาหวานในผู้สูงอายุทั้งเพศชายและเพศหญิงที่ช่วงอายุ 60-69 ปี

คำสำคัญ: ภาวะโภชนาการ, สถานะสุขภาพ, ผู้สูงอายุ, การวัดสัดส่วนร่างกาย

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