Anthropometric characteristics and nutritional status of older adults in the Lake Victoria Basin of East Africa: region, sex, and age differences

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Abstract

Background: Malnutrition, either as undernutrition or overnutrition, leads to detrimental alterations in body composition. The objective of this study was to investigate selected anthropometric measurements, and the nutritional status of older men and women living in the Lake Victoria Basin. This was a cross-sectional study.

Setting: The setting was selected rural and urban areas of Kisumu, Jinja, and Mwanza, in Kenya, Uganda and Tanzania, respectively.

Subjects: The subjects were older adults (227 men and 310 women) aged ≥ 60 years.

Outcome measures: The outcome measures were weight, height, arm span, mid-upper-arm circumference (MUAC) and triceps skin-fold thickness (TSF). Body mass index (BMI) and arm muscle area (AMA) were computed using standard equations.

Results: The results show that older adults in the three regions were significantly different (p-value < 0.05) in all anthropometric measurements, except MUAC. The women had significantly higher (p-value < 0.05) BMI, TSF, and MUAC, than the men. Negative slopes indicated a decline in all anthropometric measurements with age. Overall underweight (BMI < 18.5 kg/m^2) was 26.4%, 58.3% were normal (BMI 18.5-24.9 kg/m^2), 10.8% were overweight (BMI 25-29.9 kg/m^2), and 4.5% were obese (BMI ≥ 30 kg/m^2). Older men (29.5%) were significantly more underweight (p-value < 0.05) than older women (24.2%), with overweight (12.5%) and obesity (6.8%) being significantly higher (p-value < 0.05) in older women.

Conclusion: The findings suggest energy depletion and loss of muscle mass, with significant differences in the three regions, and in the sex and age groups. A small proportion was overweight and obese. The decline in anthropometric measurements with age indicates poor nutritional status with aging. Thus, nutrition and health interventions should be specific to regions.

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Introduction

Anthropometric measurements are important nutritional status indicators, as they provide information on body size, proportion and distribution of body fat, and lean body mass.[1] They are valuable in predicting mortality, in determining changes in nutritional status over time, and in monitoring the effectiveness of nutritional intervention.[2-5] Malnutrition, either as under- or overnutrition, alters body composition, and increases susceptibility to illnesses that may be prevented or delayed through the provision of nutrition interventions.[6] Both low and high body measurements have negative implications for health.[7,8] Thus, appropriate nutrition interventions are dependent on the comprehensive assessment of nutritional status.[9]

Body mass index (BMI) is strongly associated with body mass, and its reduction is an independent risk factor of adverse health outcomes.[10] In older adults, low BMI (thinness) carries a greater risk of diminished immune response and morbidity, impairment in cognitive function, and reduced physical and functional ability, which in turn affect nutritional status, forming a vicious cycle.[1,11] High BMI is associated with chronic diseases, which are the leading causes of mortality.[3,7,12,13] Since low and high BMI are associated with a wide range of prevailing conditions,[14] the achievement and maintenance of good nutritional status are critical to health and functioning,[15] and enhances older adults' independence, enabling them to contribute longer to society.[16] Diet and physical activity modulate aging-associated anthropometric changes.[5-10] Therefore, older people require an adequate and varied diet to assure optimal health and nutrition.[2,6,11,17]

In many developing countries, older adults are at risk of malnutrition because of poverty, poor access to health care, and diverse diets.[17,18] Despite many risk factors, there is little information on anthropometric and nutritional status, thus limiting comparisons with studies in other countries.[19] The Lake Victoria Basin, which is shared by Kenya (6%), Uganda (43%) and Tanzania (51%), is faced with poor food and nutrient diversity and unsustainable food consumption patterns, due to poverty.[20] Fishing, the main source of livelihood, has become highly commercialised, leading to the marginalisation of poor households.[21] Therefore, the aim of this study was to investigate selected anthropometric measurements and the nutritional status of older men and women living around Lake Victoria. The study was the second phase of the larger, ongoing Victoria Research Initiative (Vicres), a project that aims to alleviate poverty through the improvement of living conditions in households in the Lake Victoria Basin. The data provides baseline information for planning health and nutritional programmes.

Method

Study design and sampling

A cross-sectional study was conducted from 2006-2008 in the urban and rural areas of Kisumu, Jinja, and Mwanza, in the Lake Victoria Basin, falling in Kenya, Uganda and Tanzania, respectively. The three study sites were purposively selected as project areas. In Kisumu, the Winam, Kadibo, Kombewa and Maseno divisions were selected as study areas. Locations within these divisions were then randomly selected for the study. Kagoma, the Jinja municipality and the Buwenge counties of the Jinja District, and Bugogwa, Sangabuye and the Kayenze wards of Ilemela District in Mwanza, were also randomly selected from the total number of wards in the district. Clusters from these selected wards were obtained from the National Bureau of Statistics. Participating households with older adults were then identified by systematic random sampling. The total sample comprised 227 men and 310 women.

Data collection, processing and analysis

Anthropometry

Ethical approval to undertake the study was obtained from the relevant authorities. The participants were briefed on the objectives of the study, and gave verbal consent to participate. The research assistants were trained in anthropometric measurement techniques. Anthropometric measurements included weight, height, arm span, mid-upper-arm circumference (MUAC) and triceps skin-fold thickness (TSF). Standard procedures of taking body measurements were followed.[1] Weights were not measured in individuals with oedema. Arm span was used to estimate height for individuals who were unable to stand upright. Body mass index (BMI) was computed using the formula, weight (kg)/height squared (m^2). Mid-arm muscle area (AMA) was computed from MUAC and TSF as AMA = [MUAC (cm) – (π) × TSF cm)^2]/4 π , and corrected for bone area.[22] Measurements were taken twice by the same trained person, to minimise inter-observer errors.

Statistical analysis

Anthropometric measurements were compared across countries, and age groups, and between sexes. BMI ≤ 18.5 kg/m² was considered underweight, 18.5-24.9 kg/m² was considered normal, 25-29.9 kg/m² was considered overweight, and ≥ 30 kg/m² was considered to be obese.[1] MUAC cut-offs of 23 cm and 22 cm were used to define undernutrition in men and women respectively.[1] TSF values < 12 mm and 23 mm, in men and women respectively, were considered an indication of fat depletion.[1] SPSS® version 16 (SPSS, Chicago, USA) was used to analyse all the data. Means, percentages and percentiles were used to describe the data. Chi-square tests were used to compare nutritional status. Independent sample t-test and one-way analysis of variance (ANOVA) were used to investigate gender differences, and regional and age group mean differences, respectively. The relationship between age and anthropometric measurements was determined by linear regression. P-value values < 0.05 were considered to be statistically significant.

Results

Demographic characteristics

The study sample comprised 42.3% men and 57.7% women, aged between 60-95 years, with a mean ± standard deviation (SD) of 66.1 ± 8.7 years. Mean ages were 65.7 ± 7.9 and 66.5 ± 9.4 years, for

Table I: Means and standard deviations of anthropometric measurements of older adults in the Lake Victoria Basin by region and sex

Measurement	Sex	Kisumu (n = 157)*	Jinja (n = 198)*	Mwanza (n = 182)*	All regions (n = 537)§
Weight (kg)	Male	59.9 ± 13.4[c]	54.5 ± 8.6[a]	54.2 ± 11.7[a]	55.5 ± 11.1
	Female	55.8 ± 14.5[a]	51.8 ± 10.8[a]	52.9 ± 12.3[a]	53.6 ± 12.7
Height (m)	Male	168.0 ± 7.0[b]	164.0 ± 7.0[a,b]	166.0 ± 9.0[a]	166.0 ± 8.0
	Female	159.0 ± 7.0[b]	156.0 ± 6.0[a]	157.0 ± 7.0[a]	157.0 ± 7.0
Body mass index (kg/m^2)	Male	20.5 ± 5.1[b]	20.2 ± 2.8[a,b]	19.6 ± 3.2[a]	20.2 ± 3.3§
	Female	21.9 ± 5.2[a]	21.4 ± 4.1[a]	21.5 ± 4.8[a]	21.6 ± 4.7§
Mid-upper-arm circumference (cm)	Male	26.5 ± 3.9[a]	26.1 ± 2.9[a]	25.5 ± 3.3[a]	25.9 ± 3.3§
	Female	27.1 ± 4.5[a]	27.3 ± 3.7[a]	27.1 ± 4.1[a]	27.2 ± 4.1§
Triceps skin-fold thickness (mm)	Male	18.5 ± 8.56[c]	7.07 ± 4.23[a]	10.0 ± 6.0[b]	10.84 ± 7.58§
	Female	20.9 ± 9.37[b]	14.25 ± 6.9[a]	18.0 ± 11.0[b]	17.89 ± 9.49§
Arm muscle area (cm^2)	Male	24.3 ± 8.3[a]	35.8 ± 9.3[c]	30.6 ± 9.1[b]	31.0 ± 10.4
	Female	29.6 ± 11.8[a]	35.7 ± 8.9[b]	30.0 ± 6.4[a]	31.7 ± 9.9

Data is represented as mean and standard deviation.
* = Mean values in rows with different letters are significantly different (Tukey's test), significance, p-value < 0.05 by analysis of variance; § = Mean values in column are significantly different between sexes, p-value < 0.05 by t-test

Table II: Means, standard deviations, and percentiles of older men in the Lake Victoria Basin by age group

	n	Mean ± standard deviation	Percentiles						
			5	10	25	50	75	90	95
Weight (kg)									
60-64 years	103	55.8 ± 11.0[b]	40.6	42.9	48	55	62	69.1	75.4
65-69 years	54	58.0 ± 10.9[b]	44.4	45	49.7	56.1	63.1	74.4	84.4
70-74 years	29	52.2 ± 8.9[a,b]	38	43	46.9	51	56.2	61.6	75.8
75–79 years	22	57.6 ± 14.4[b]	38.1	44.1	49.8	55	61.8	86.3	97.7
≥ 80 years	19	47.8 ± 5.8[a]	38	39	44	48	51	58	-
Height (m)									
60-64 years	103	1.66 ± 0.08[a]	1.53	1.56	1.60	1.66	1.72	1.78	1.79
65-69 years	54	1.66 ± 0.07[a]	1.53	1.56	1.62	1.65	1.71	1.75	1.78
70-74 years	29	1.63 ± 0.06[a]	1.48	1.55	1.58	1.65	1.68	1.70	1.72
75-79 years	22	1.63 ± 0.06[a]	1.49	1.50	1.59	1.64	1.67	1.68	1.69
≥ 80 years	19	1.58 ± 0.08[a]	1.46	1.47	1.51	1.60	1.65	1.70	-
Body mass index (kg/m²)									
60-64 years	103	20.1 ± 3.2[a,b]	15.3	16.3	18.5	19.9	22.3	24.8	26.2
65-69 years	54	20.9 ± 3.4[b]	16.4	17.6	18.5	20.1	22.8	25.2	29.3
70-74 years	29	19.2 ± 2.5[a,b]	14.8	15.8	17.7	19.1	20.5	21.8	24.8
75-79 years	22	21.4 ± 4.8[b]	16.4	16.6	18.6	19.8	23.8	28.5	35.5
≥ 80 years	19	18.2 ± 2.3[a]	14.2	14.9	17.2	17.8	20.8	21.4	-
Mid-upper-arm circumference (cm)									
60-64 years	103	26.4 ± 3.2[b]	21	22.3	24.5	26	28.2	30.4	32.4
65-69 years	54	26.1 ± 3.2[b]	20.4	22.8	24.8	26.2	27.8	30.8	32
70-74 years	29	24.9 ± 3.5[a,b]	17.5	20.5	23.5	24.5	26.2	29	32.7
75-79 years	22	26.5 ± 3.7[b]	21.2	22.3	24.3	26	27.6	33.6	36.2
≥ 80 years	19	23.5 ± 2.3[a]	17.4	20.2	22.3	24	25	26.2	-
Triceps skin-fold thickness (mm)									
60-64 years	103	11.5 ± 7.5[a]	3	4	5	10	15	25	27
65-69 years	54	10.4 ± 8.1[a]	2.7	3	5	8	15	21.2	24.4
70-74 years	29	9.9 ± 6.9[a]	3	3	4	9	14.8	21.2	25.2
75-79 years	22	10.2 ± 6.8[a]	4	4	5	8	14	19.6	29.9
≥ 80 years	19	8.5 ± 6.1[a]	3	3	4	6	12.3	19.5	-
Arm muscle area (cm²)									
60-64 years	103	31.9 ± 10.9[a]	15.3	18.6	24.7	30.8	39	47.7	52.8
65-69 years	54	32.4 ± 9.9[a]	13.1	19.9	26.6	33.7	39.3	42.9	47.7
70-74 years	29	28.4 ± 12.3[a]	4.5	16.9	20.7	28.5	34.8	42.9	57.5
75-79 years	22	31.7 ± 8.3[a]	17	19.8	25.3	32.9	39.7	41.9	44.5
≥ 80 years	19	26.1 ± 6.9[a]	14.2	17.4	20.7	25.2	31.4	36.9	-

Mean values in column with different letters were significantly different (Tukey's test), significance, p-value < 0.05 by analysis of variance

men and women respectively. The mean age for men in Kisumu, Jinja, and Mwanza, was 66.4 ± 7.2, 65.8 ± 7.7, and 65.5± 8.5 years, respectively. Women were aged 66.5 ± 5.0, 63.8 ± 7.8, and 69.6 ± 11.0 years, in Kisumu, Jinja, and Mwanza, respectively. In all the regions combined, the respondents aged from 60-64 years comprised 44.2%; 17.4% were aged between 65-69 years, whereas 15.7%, 10.9%, and 11.7%, were aged 70-74, 75-79, and ≥ 80 years, respectively.

Anthropometric characteristics

Table I shows that most anthropometric measurements were significantly different (p-value < 0.05) across the regions. Notable findings are that older adults in Kisumu had higher values for all anthropometric measurements, except arm muscle area. Men in Kisumu were heavier, taller, and had higher TSF. In Mwanza, men had significantly lower BMI. Older women differed significantly in height, TSF and AMA, but not in weight, BMI and MUAC. AMA was significantly higher in Jinja men and women. In the combined regions, women had significantly higher (p-value < 0.05) BMI, TSF and MUAC than men.

Tables II and III show anthropometric measurements distributed by age group for men and women respectively. In men, a significant difference (p-value < 0.05) was evident in weight, BMI and MUAC across age groups. Those ≥ 80 years had the lowest levels. No significant differences were found in women. Generally, there was a decline in anthropometric measurements with increasing age in the selected percentiles.

Table III: Means, standard deviations, and percentiles of older women in the Lake Victoria Basin by age group

	n	Mean ± standard deviation	Percentiles						
			5	10	25	50	75	90	95
Weight (kg)									
60-64 years	143	55.5 ± 13.4[a]	39.8	42.4	47	53	59.6	72.3	86.1
65-69 years	37	52.5 ± 14.7[a]	33.8	35.3	43	48.5	58.7	71.4	94.2
70-74 years	57	53.4 ± 11.6[a]	38.9	41.9	45.4	51	60.5	69.1	80
75-79 years	39	51.6 ± 9.8[a]	35.5	38	44	51.5	60	65	70.7
≥ 80 years	34	49.6 ± 12.1[a]	32.6	36.3	42	45.8	56	68.9	74.5
Height (m)									
60-64 years	143	1.57 ± 0.07[a]	1.47	1.49	1.53	1.57	1.62	1.66	1.68
65-69 years	37	1.57 ± 0.07[a]	1.46	1.47	1.52	1.56	1.62	1.69	1.70
70-74 years	57	1.55 ± 0.05[a]	1.46	1.49	1.52	1.56	1.58	1.63	1.65
75-79 years	39	1.57 ± 0.07[a]	1.45	1.47	1.53	1.57	1.60	1.67	1.75
≥ 80 years	34	1.57 ± 0.05[a]	1.44	1.48	1.52	1.58	1.62	1.64	1.65
Body mass index (kg/m²)									
60–64 years	143	22.4 ± 4.9[a]	16.1	17.3	19	21.3	24.6	28.9	35.9
65-69 years	37	21.1 ± 4.8[a]	14.3	15.4	17.7	20.3	23.9	27.8	32.7
70-74 years	57	21.9 ± 4.7[a]	16.7	17.2	18.9	20.9	23.8	27.8	33.8
75-79 years	39	20.7 ± 3.8[a]	13.6	16.1	18.3	20.7	23.3	25.5	27.5
≥ 80 years	34	19.8 ± 4.5[a]	12.5	14.4	16.7	18.7	22.3	27.1	29.5
Mid-upper-arm circumference (cm)									
60-64 years	143	27.6 ± 4.1[a]	23	23.5	24.9	27.2	29	33.3	36.4
65-69 years	37	27.2 ± 4.8[a]	19.9	20	25.1	27.3	29.5	33.9	39.1
70-74 years	57	27 ± 4.5[a]	21.9	22.1	23.	25.5	28.9	33.2	36.2
75-79 years	39	26.9 ± 3.6[a]	22	22.8	24	27	29.5	32.1	33
≥ 80 years	34	26.1 ± 3.8[a]	19.6	21.4	23.9	25.6	27.6	33	33.8
Triceps skin-fold thickness (mm)									
60-64 years	143	18.6 ± 8.8[a]	7	9	12	18	24	28.9	35.9
65-69 years	37	18.3 ± 10.8[a]	4.9	6.6	10.5	15	25	33	45.1
70-74 years	57	16.9 ± 11.7[a]	5.7	7.4	9.5	14	20.5	27.4	41.9
75-79 years	39	18.2 ± 9.0[a]	5	6	9	19	25	30	32
≥ 80 years	34	15.5 ± 6.8[a]	5.4	7	10	15	19.5	25	27.2
Arm muscle area (cm²)									
60-64 years	143	32.6 ± 11.5[a]	17.4	20.9	25.2	32.1	38.1	46.1	53.6
65-69 years	37	30.7 ± 8.6[a]	16.1	18.5	23.8	31.4	37.6	42.0	42.7
70-74 years	57	32.7 ± 7.8[a]	21.7	22.9	27.2	32.3	37.4	43.6	45
75-79 years	39	29.5 ± 7.1[a]	16.6	18.1	24.7	29.5	34.5	37.9	43.8
≥ 80 years	34	30.5 ± 10.2[a]	16	16.9	24.6	28.9	34.5	48.9	53.9

Mean values in column with common letter indicates no significant difference (Tukey's test), significance, p-value > 0.05 by analysis of variance

Table IV shows the sex-specific intercepts and slopes for age in association with anthropometric measurements. Negative slopes indicate a decline in body measurements with increasing age, which showed a greater magnitude in men in than women, except for BMI and MUAC.

Prevalence of malnutrition

The prevalence of underweight was 26.4%, 58.3% had a normal weight, 10.8% were overweight, and 4.5% were obese. A significantly higher proportion of men, than women, were underweight (p-value < 0.05), with more women being overweight and obese. Overall undernutrition was 8.8% using MUAC; 14.7% and 4.8% in men and women respectively (Table V).

Discussion

This study provides information on the anthropometric and nutritional status of older people in the Lake Victoria Basin, East Africa. The comparisons across regions and age groups, and between older men and women, facilitate focused nutrition interventions in these areas. Although the mean BMI in the three countries was within the normal range (18.5-24.9 kg/m²), a high proportion of the people (26.4%) were considered to be undernourished. The overall prevalence of undernutrition among older people in sub-Saharan Africa is reported to be between six per cent in Cameroon, and 48% in Ghana.[19] Generally, undernutrition is reported to be higher in men (7-42%) than in women (2-45%). The prevalence of overweight is between 2.5-21%, with larger proportions of women being overweight than men. Our study showed similar trends. In the current study, the

Table IV: Regression coefficients for the association between age and anthropometric measurements in older adults in the Lake Victoria Basin

	Men		Women	
Dependent variable	Intercept (standard error)	Slope for age in years (standard error)	Intercept (standard error)	Intercept (standard error)
Weight (kg)	71.21 (2.64)	-0.99 (0.05)	73.44 (2.26)	-0.13 (0.04)
Height (m)	84.64 (10.18)	-11.44 (6.14)	61.53 (10.61)	-3.14 (6.72)
Body mass index (kg/m²)	69.93 (3.17)	-0.21 (0.16)	74.48 (2.43)	-0.37 (0.11)
Mid-upper-arm circumference (cm)	78.57 (4.05)	-0.12 (0.07)	74.88 (3.49)	-0.31 (0.13)
Triceps skin-fold thickness (mm)	67.13 (0.93)	-0.49 (0.16)	68.37 (1.15)	-0.02 (0.06)
Arm muscle area (cm²)	69.45 (1.66)	-0.12 (0.06)	69.57 (1.78)	-0.09 (0.05)

Table V: Nutritional status of older adults in the Lake Victoria Basin

Measurement	Proportion (%)				
	Sex	Kisumu (n = 157)	Jinja (n = 198)	Mwanza (n = 182)	All regions (n = 537)
Body mass index					
Underweight[a]	Male	21.3	21.4	38.9	29.5
	Female	27.3	24.0	21.6	24.2
	Both	25.6	24.3	29.7	26.4
Normal[a]	Male	63.8	65.6	54.4	60.8
	Female	50.0	58.3	62.0	56.5
	Both	54.1	61.6	58.2	58.3
Overweight[a]	Male	10.6	10.0	5.6	8.4
	Female	13.6	12.0	12.0	12.5
	Both	12.7	11.1	8.8	10.8
Obese[a]	Male	4.3	0	1.1	1.3
	Female	9.1	5.6	5.4	6.8
	Both	7.6	3.0	3.3	4.5
Mid-upper-arm circumference					
Undernourished	Male	15.6	14.4	14.6	14.7
	Female	5.5	4.6	4.3	4.8
	Both	7.0	8.6	10.5	8.8
Normal	Male	84.4	85.6	85.4	85.3
	Female	94.5	95.4	95.7	95.2
	Both	93.0	91.4	89.5	91.2

a = Chi-square tests showed a non-significant difference (p-value > 0.05) across countries for both men and women, but a significant difference between men and women

significant differences in anthropometry in the three countries may be attributed to different food consumption and physical activity patterns.[6,17] It was evident that older adults in Kisumu were better nourished, while in general, those from Mwanza (Tanzania) had lower anthropometric measurements. In Tanzania, older adults had a lower mean BMI (< 18.5 kg/m²) compared to those in other countries in sub-Saharan Africa.[19] The older adults in Jinja had a higher lean body mass and less fat, thus more protein reserves, but clearly deficient fat stores. This may be attributed to limitations in caloric adequacy in contrast to protein intake, or to intensive physical activity. In addition, the findings suggest protein energy malnutrition in Mwanza, and protein inadequacy in Kisumu. Overall, they suggest a high prevalence of protein energy malnutrition in the study area.

Age-related changes in anthropometric measurements occurred in a sex-differential manner, suggesting differentials in future ill health, functional impairment and mortality.[1] Women had better anthropometric characteristics than men. They had higher BMI and MUAC, and more subcutaneous fat (greater TSF values) than men. This may be attributed to a combination of short stature and the absence of activity that requires heavy physical exercise, thereby leading to the deposition of excess fat.[5] Therefore, the women had more energy stores than the men, although they were equally deficient in protein reserves, as indicated by the insignificant difference (p-value > 0.05) in muscle mass (AMA). This suggests that, in developing countries, older adults may be equally vulnerable to protein deficiency.

In concurrence with other studies, a decrease in body measurements with an increasing age (greater in men) indicates a poor nutritional status with advancing age.[4,6,9] This is because changes in body weight parallel energy and protein balance.[1] This means that older age groups are at greater nutritional risk. Izawa et al[23] demonstrated that a severe loss of available energy reserves can result in increased morbidity or mortality. Although overweight and thinness carry risks of mortality in older adults, thinness has greater risks.[1,14]

MUAC is sensitive to changes in energy balance. It reflects caloric adequacy and lean muscle mass. Lower values indicate energy depletion.[5] Similarly, small triceps skin folds indicate energy depletion, and are associated with subsequent increased mortality, while larger skin folds are associated with survival.[24] Muscle mass indirectly indicates protein reserve.[1] Its decline with age contributes to the reduction in muscle strength, which largely relates to functionality and overall nutritional status.[8,25] Thus, a decrease in strength may place older persons at greater risk of dependence and institutionalisation. It also affects gait and balance, which, when impaired, increases the risk of falls and consequent injury.

Price et al[10] have indicated that abdominal obesity increases mortality risks, more so than higher BMI. Although fat reserves are beneficial during nutritional deprivation, they confer risks for the development of chronic diseases.[3,7,12] Excess fat deposition, present in a small proportion of our sample, may increase the risks of age-related chronic diseases.[3,7,12] This may be due to changes in eating patterns and physical activity, characterised by a shift to diets high in fat, sugar, and refined grains, as well as greater tobacco use and sedentary behavior.[19] Overall, lower anthropometric indices in the Lake Victoria Basin can be attributed to food insufficiency and chronic energy deficiency.[17,20] Many older people may be vulnerable to infections, functional impairment, and overall mortality.[2,11] Assessing their nutritional status helps to identify those at risk of malnutrition, for early intervention.[9]

Conclusion

The findings indicate differences in anthropometric measurements between men and women and in different age groups. Although individual anthropometric measurements differed across countries, no difference was found in the body mass index of women, as well as in the MUAC of both men and women. Low fat and lean body mass indicate energy depletion and a loss of muscle mass in many older adults. More men, than women, were undernourished, with more of the latter being overweight and obese. A decline in anthropometric measurements with age indicates poor nutritional status with aging. Therefore, nutrition interventions in the Lake Victoria Basin should be specific to regions, and more attention should be given to the older age groups.

References

1. Physical status: the use and interpretation of anthropometry. World Health Organization. Geneva: World Health Organization; 1995.
2. Kagansky N, Berner Y, Koren-Morag N, et al. Poor nutritional habits are predictors of poor outcome in very old hospitalised patients. Am J Clin Nutr. 2005;82(4):784-791.
3. Nemesure B, Wu S, Hennis A, Leske C. The relationship of body mass index and waist-hip ratio on the 9-year incidence of diabetes and hypertension in a predominantly African-origin population. Ann Epidemiol. 2008;18(8):657-163.
4. Coqueiro RS, Barbosa AR, Borgatto AF. Anthropometric measurements in the elderly of Havana, Cuba: age and sex difference. Nutrition. 2009;25(1):33-39.
5. Landi F, Russo A, Liperoti R, et al. Mid arm muscle circumference, physical performance and mortality: results from the aging and longevity study in the Sirente geographic area (ilSIRENTE study). Clin Nutr. 2010;29(4):441-447.
6. Tsai AC, Liou J, Chang M, Chuang Y. Influence of diet and physical activity on aging-associated body fatness and anthropometric changes in older Taiwanese. Nutr Res. 2007;27(5):245-251.
7. Li C, Chen S, Lan C, et al. The effects of physical activity, body mass index (BMI) and waist circumference (WC) on glucose intolerance in older people: a nationwide study from Taiwan. Arch of Gerontol Geriatr. 2011;52(1):54-59.
8. Reddy KK, Papa R. Nutritional status impairs functional ability among the elderly. Open Anthropol J. 2010;3:192-199.
9. Marais ML, Marais D, Labadarios D. Assessment of nutritional status of older people in homes for the aged in the Somerset West area. S Afr J Clin Nutr. 2007;20(3):102-108.
10. Price GM, Uauy R, Breeze E, et al. Weight, shape, and mortality risk in older persons: elevated waist hip ratio, not high body mass index, is associated with a greater risk of death. Am J Clin Nutr. 2006;84(2):449-460.
11. Carrier N, West GE, Oullet D. Cognitively impaired resident's risk of malnutrition is influenced by food service factors in long-term care. J Nutr Elderly. 2006;25(4):73-87.
12. Adedoyin RA, Mbada CE, Bisiriyu LA, et al. Relationship of anthropometric indicators with blood pressure levels and the risk of hypertension in Nigerian adults. Int J Gen Med. 2009;1:33-40.
13. Christensen DL, Friis H, Mwaniki DL, et al. Prevalence of glucose intolerance and associated risk factors in rural and urban populations of different ethnic groups in Kenya. Diabetes Res Clin Pract. 2009;84(3):303-310.
14. Kvamme J, Wilsgaard T, Florholmen J, Jacobsen BK. Body mass index and disease burden in elderly men and women: Tromso study. Eur J Epidemiol. 2010;25(3):183-193.
15. Chai W, Nigg C, Pagano IS, et al. Association of quality of life with physical activity, fruit and vegetable consumption in a free living multi-ethnic population in Hawaii: a longitudinal study. Int J Behav Nutr Phys Act. 2010;7:83.
16. Clausen T, Wilson AO, Molebatsi RM. Diminished mental health- and physical function and lack of social support are associated with shorter survival in community dwelling older persons of Botswana. BMC Pub Health. 2007;7:144.
17. Maruapula SD, Chapman-Novakofski KM. Health and dietary patterns of the elderly in Botswana. J Nutr Elderly. 2007;39(6):311-39.
18. Ngatia EM, Gathece LW, Macigo FG, et al. Nutritional status and oral health of elderly population in Nairobi. East Afr Med J. 2008;85(8):378-385.
19. Kimokoti RW, Hamer DH. Nutrition, health, and aging in sub-Saharan Africa. Nutrition Reviews. 2008;66(11):611-623.
20. Walingo MK, Liwenga ET, Kangalawe RY, et al. Perceived impact of land use changes and livelihood diversification strategies of communities in the Lake Victoria Basin of Kenya. J Agric Biotechnol Sust Develop. 2009;1(3):69-78.
21. Geheb K, Kalloch S, Medard M, et al. Nile perch and the hungry of Lake Victoria: status and food in an East African fishery. Food Policy. 2008;33(1):85-98.
22. Heymsfield SB, McManus C, Smith J, et al. Anthropometric measurements of muscle mass revised equation for calculating bone free arm muscle area. Am J Clin Nutr. 1982;36:680-690.
23. Izawa S, Enoki H, Hirakawa Y, et al. Lack of body weight measurement is associated with mortality and hospitalization in community-dwelling frail elderly. Clin Nutr. 2007;26(6):764-770.
24. Enoki H, Kuzuya M, Masuda Y, et al. Anthropometric measurements of mid-upper arm as a mortality predictor for community-dwelling Japanese elderly: the Nagoya Longitudinal Study of Frail Elderly (NLS-FE). Clin Nutr. 2007;26(5):597-604.
25. Kikafunda JK, Lukwago FB. Nutritional status and functional ability of the elderly aged 60 to 90 years in the Mpigi District of Central Uganda. Nutriton. 2005;21(1):59-66.