ajfand
SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 19 No. 2
March 2019
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Afr. J. Food Agric. Nutr. Dev. 2019; 19(2): 14319-14336 DOI: 10.18697/ajfand.85.17790

UNDERNUTRITION IN THE ISOLATED ELDERLY POOR: PERSPECTIVES FROM A DEVELOPING COUNTRY HUMANITARIAN PROGRAM

Burani JC [1]* and PJ Longo[2]

Johanna C. Burani

Palma J. Longo

*Corresponding author email: jburani@gmail.com

[1]Nutrition Works, LLC, 32 De Hart Street, Morristown, New Jersey, 07960, USA

[2]School of Health Professions, University of Texas Southwestern Medical Center, Office of Medical Education, Dallas, Texas, 75390-9139, USA

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 19 No. 2
March 2019
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

ABSTRACT

Elderly people living in sub-Saharan countries are at risk of undernutrition due to food insecurity, feebleness and for some, abandonment. A cross-sectional community-based survey was conducted on 62 elderly men and women, aged 61-101 years, living in two isolated villages in the rural Ngara District of northwestern Tanzania. All subjects received supplemental food for 21 months prior to the survey from a local humanitarian program, The Village Angels of Tanzania (TVAT). The aim of this study was to compute the nutritional status of the participants using the anthropometric measurements of Body Mass Index (BMI), Mid Upper Arm Circumference (MUAC), and Triceps Skinfold (TSF), and to identify on-going program strategies to address their nutritional needs. SPSS version 24 and basic descriptive statistics were used to analyze all data. Based on the World Health Organization (WHO) accepted ranges for adults, the BMI data showed 53% men and 70% women were in the healthy range, 40% men and 21% women were undernourished, and 7% men and 9% women were mildly overweight. The MUAC cut-off point of $\leq$ 22.5 cm which corresponds to BMI <18.5 kg/m², the WHO cut-off reference for undernutrition, indicated 87% men and 72% women had both normal muscle mass and subcutaneous fat levels and 13% men and 28% women were undernourished. The TSF figures, also based on WHO ranges, indicated 88% men and 96% women had depleted fat stores and 12% men and 4% women had normal fat stores. Body Mass Index showed strong positive correlations with MUAC ($r = 0.75$, $N = 62$, $p < 0.001$) and with TSF ($r = 0.58$, $N = 62$, $p < 0.001$). The supplemental food likely played a positive role in the healthy weight status (BMI) and normal muscle mass and subcutaneous fat levels (MUAC) of the majority of participants (62%, 80% respectively) but not in their depleted fat stores status (TSF). These findings culminated in recommendations that adroitly targeted newly identified nutritional concerns. Increasing dietary variety, especially meat, fish, vegetables and fruits, and increasing the quantity and nutrient density of a nutritional powder made from stoneground peanuts, soya beans, maize, and millet were two new dietary strategies immediately implemented at the conclusion of the study. Positive TSF trends would support the effectiveness of TVAT's food delivery program to improve this crucial nutritional parameter for this population.

Key words: elderly, undernutrition, anthropometric measurements, nutritional status, food program, Tanzania

DOI: 10.18697/ajfand.85.17790

INTRODUCTION

Undernutrition is an insufficient intake of energy and nutrients to support the maintenance of good health. The World Health Organization (WHO) defines undernutrition as a form of malnutrition manifested by stunted growth, wasting of lean body mass and fat stores, underweight and micronutrient insufficiencies or deficiencies [1]. According to 2014-2016 estimates of the United Nation's Food and Agriculture Organization (FAO), more than one in four people living in the sub-Saharan African continent are undernourished, representing the highest prevalence of undernourishment in the world (23%) [2].

The United Republic of Tanzania is a sub-Saharan country of 59 million people. Approximately three percent of the population is currently over the age of 64 years [3]. As such, elderly health is not an important national priority. The United Nation demographic estimates, however, predict that the number of Tanzanians over the age of 60 will nearly triple between 2020 and 2050 [4]. Therefore, elder care will require greater national and local attention. Like most African countries, Tanzania offers its elderly citizens minimal or no social benefits, welfare or old-age pension assistance. The majority of old people (60%) live in multigenerational families and some live in isolated places entirely alone [4]. No matter their age or physical state, these elderly people must forage for food every day, and fetch water and firewood for cooking just to survive.

In the northwestern corner of Tanzania, bordering Rwanda, lies the Ngara District, an isolated, underdeveloped and impoverished region of the country. This area has no industry or infrastructure. The country's border in this location was the point of escape for 535,000 Rwandan refugees during the 1994 genocide [5]. The United Nations erected tents in the Ngara District for the refugees, where they remained until 2002. When the Rwandans returned home, the indigenous Tanzanian population was left with damaged farm and grazing land, disintegrated social and family structures and an abject absence of opportunity and advancement.

In 2015, Sister Dativa Daniel Mukebita, FSSB, a local Catholic nun, founded a US-based 501(c)3 non-profit organization, The Village Angels of Tanzania (TVAT), to address the humanitarian needs of the elderly people of the Ngara District. The program recruits and trains 16 local unemployed youths to deliver supplemental food to 70 elders accepted into the program because they had no other source of assistance. They were living on beans, bananas, cassava and millet, and consumed one or two meals/day. Under Sister Dativa's guidance the youths began visiting each elder once a week and delivered beans, rice, cooking oil and a nutritional flour. These supplemental foods added approximately 5,400 calories and 125 grams of protein weekly to the participants' traditional diet (Table 1A). An attempt was made to collect food diaries from the elders but reliable information was not obtained. While actual prior consumption quantities remain unknown, the program started recording the quality and quantity of foods it provided in September 2015.

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 19 No. 2 March 2019 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

Food deliveries were upgraded in July 2017 to provide approximately 14,000 calories and 575 grams of protein every week, (Table 1B). These most recent quantities meet WHO subsistence-level energy requirements for people aged 60 years or older living in developing countries [6]. A second attempt was made to quantify the elders' food intake using a food frequency format. This approach also proved unproductive. The TVAT weekly records, however, continued to itemize its food deliveries. A nutritional assessment study was begun at this time by the primary author, a Registered Dietitian. Its objective was to categorize each individual's nutritional status and provide indications for addressing their nutritional needs through TVAT's food program.

The nutritional status of the elderly people of the Ngara District has never been clinically measured. Since TVAT is dedicated to addressing the nutritional needs of the recipients of their food program, the initial focus of this study was to examine their participants' current nutritional status using the anthropometric measures of BMI (weight condition), MUAC (muscle mass and subcutaneous fat levels) and TSF (body fat stores) and compare them to established reference ranges. The second focus of the study was to correlate best program practices with the elders' nutritional needs. Identified deficiencies can be targeted by dietary increases in calories (BMI), calories and protein-rich foods (MUAC) or calories, protein and healthful fat-rich foods (TSF). Knowing the prevalence and degree of the elders' malnutrition encourages appropriate allocation of TVAT funds for improved food deliveries and hopefully will translate into less sickness and an improved quality of life.

MATERIALS AND METHODS

Study design

A cross-sectional community-based survey approach was used to assess the nutritional status of the participants in TVAT's supplemental food program. All subjects were living in two neighboring villages, considered one statistical unit for this study. Their BMI, MUAC and TSF measurements were recorded and assessed by the primary author, a Registered Dietitian, using established reference ranges [7,8, 9].

Sampling Technique

Local village people, 70 years or older, who were living alone or received no assistance from their impoverished family members were assessed for admittance into The Village Angels of Tanzania program by the program's director. Seventy elders were admitted into the TVAT program and all were included in this study. All of them, 17 men and 53 women, lived in small mud huts in an inaccessible rural ecosystem with no immediate access to water or electricity. Two severely ill men were excluded from the study. Six women were also excluded because of severe illness, unavailability or their ages were unknown. The final cohort number was 62: 15 men (24%) and 47 women (76%).

Data Collection and analysis

The participants' background information (age, civil status, living conditions, proximity to family and neighbors, financial assistance) was retrieved from TVAT program records or from the subjects' direct verbal responses (Table 2). Height,

DOI: 10.18697/ajfand.85.17790

ajfand SCHOLARLY, PEER REVIEWED AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT Volume 19 No. 2 March 2019 PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST ISSN 1684 5374

weight, body mass index (BMI), mid-upper arm circumference (MUAC) and triceps skinfold (TSF)and their corresponding means were measured, calculated and recorded by the primary author (Table 3). The BMI, MUAC, TSF Correlation Matrix was calculated and tabulated by the secondary author (Table 4).

Body Mass Index (BMI) is an anthropometric standard used to assess body composition (muscle, fat, bone). It categorizes weight-for-height status (underweight, healthy range, overweight and obese). It is calculated by dividing the subject's weight (kg) by his/her height (m) squared. It is generally accepted that for the elderly, low BMI may indicate risk for increased health concerns, suggesting the possible need to establish new thresholds for the elderly. For this study, the WHO-approved BMI classifications were used: severe underweight <16, moderate underweight 16.0-16.9, mild underweight 17.0-18.4, healthy range 18.5-24.9, overweight 25.0-29.9, and obese ≥ 30 [7]. National Institutes of Health BMI calculator was used for BMI scores [10].

Weight was measured to the nearest 0.5 kg using a locally purchased portable dial scale with subjects wearing no shoes and light clothing. Height was measured to the nearest 0.1 cm using a retractable steel tape measure. Subjects stood erect, facing forward with their backs against a wall. A straight wooden plank was used if measurements were taken outdoors. To calculate height for seven severely kyphotic females, arm-span measurements were taken three times and rounded to the nearest 0.1 cm. These subjects stood in the same posture as for height measurement. However, they extended their arms horizontally (help was offered as needed) with forward-facing palms and a tape measure was passed across the clavicle, measuring from the tip of the right middle finger to the tip of the left middle finger. The average armspan measurement was applied to the standard female equation for estimated height in each case [8].

Mid- Upper- Arm Circumference (MUAC) is an assessment tool for determining nutritional status. It measures both arm muscle and subcutaneous fat. It was measured using the left upper arm at the midpoint between the tip of the shoulder and the tip of the elbow. Each participant stood erect, with the bare left arm bent at the elbow 90 degrees across the abdomen. Measurements were taken three times, using an appropriate marker, averaged and recorded to the nearest 0.1 cm while the arm hung loosely at the side of the body. The MUAC cut-off point of ≤ 22.5 cm has been previously established as corresponding to BMI <18.5 kg/m², the reference for undernutrition [11].

Triceps Skinfold Thickness (TSF) quantifies subcutaneous fat thickness in the upper arm, which reflects percentage of total body fat. Low TSF values correspond to less available body fat for metabolic functions and a muted immune response during sickness, injury or prolonged stress. Each participant hung his/her arm loosely along the side of the body. The skin and subcutaneous fat were grasped by the thumb and forefinger slightly above the midpoint MUAC mark. The skin was gently pulled away from any underlying muscle. The Lange Skinfold Caliper pinched the skinfold at the previously measured midpoint mark and the measurement was read to the nearest 1.0 mm after approximately three seconds. The average of three readings was calculated

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 19 No. 2
March 2019
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

and recorded. The TSF cut-off points for undernutrition of < 12 mm for men and < 23mm for women have been previously determined [9].

The relationship between BMI, MUAC and TSF variables were investigated using Pearson product-moment correlation coefficient (Table 4). Data were calculated and tabulated by the secondary author.

The values for BMI and MUAC can be used interchangeably for nutritional assessment when either height/weight cannot be measured (BMI) or a measuring tape is not available (MUAC). The MUAC value is less affected by edema and ascites (common in starvation) than BMI and, therefore, commonly used in developing countries in screening for tissue atrophy and malnutrition. The BMI value does not distinguish between lean body and fat masses in the body. Therefore, TSF data provide unique information about stored body fat. Knowing TSF values can help attenuate ensuing problems of malnutrition.

All background information and measurement data were collected and recorded at pre-designated meeting areas or individual huts. Each individual's information was documented on his/her personal information sheet and a photograph was attached to assure accuracy.

Microsoft Office Excel 2016 was used for data entry and Statistical Package for Social Sciences (SPSS version 24) was used for all data analysis. Basic descriptive statistics were run for means, standard deviations and ranges for all anthropometric measurements and participants' ages.

Ethical approval for this study was obtained from the Assistant District Executive Director of the Ngara District Health Council, Ngara, Tanzania and the Superior General of the Franciscan Sisters of St. Bernadette (FSB), Rulenge, Tanzania. A simple description of the study was presented to the subjects in Swahili by the Executive Director and all participants gave prior verbal consent.

DOI: 10.18697/ajfand.85.17790

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 19 No. 2
March 2019
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

RESULTS AND DISCUSSION

Socio-economic Demographics

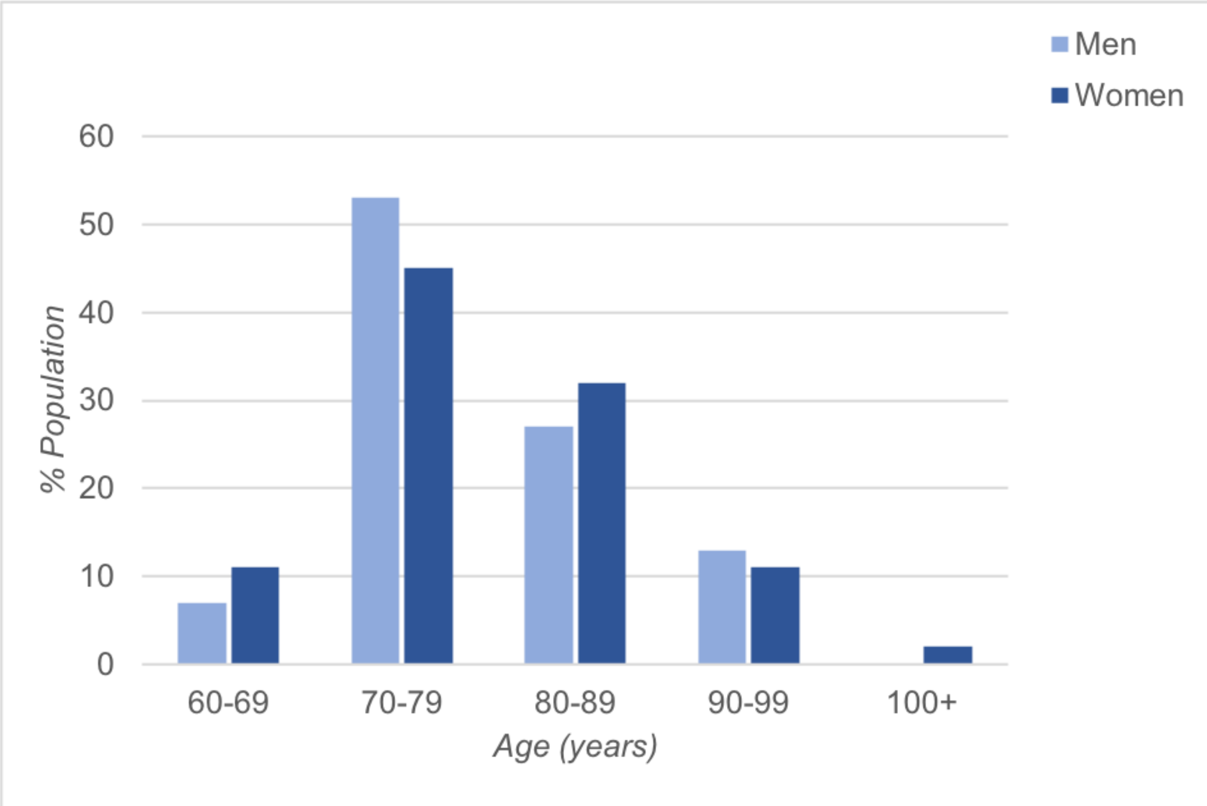

Figure 1: Gender-specific Age Characteristics of Participants

Figure 1 illustrates gender-specific age variations. The mean age for the men was 77.8 years (7.1), ranging between 68-90 years, and the mean age for the women was 78.6 years (8.3), ranging between 61-101years. The largest age groups were the 70-79 year-olds for both males (53%) and females (45%), followed by the 80-89 year-olds for both males (27%) and females (32%). Of note, 97% of this population reached ages that exceeded the current national thresholds for life expectancy [3].

Table 2 describes gender-specific socio-demographic characteristics of the participants. Twelve men (80%) were married and 3 (20%) were widowed while 45 women (96%) were widowed, 1 was married (2%) and 1 was divorced (2%). All participants lived alone or with their spouse; no one lived with extended family. This does not accurately reflect the Tanzanian culture of multi-generational communal living, where 60% of elderly people live with family members [4]. However, the devastating aftermath of the Rwandan refugee crisis, the alarming on-going HIV-AIDS crisis and the chronic lack of opportunity, resources and infrastructure in this area, have left these elderly people abandoned [5,12]. They have to find their own food, fetch their own water and firewood and maintain the soundness of their mud huts as best as they can. No one has any income or financial assistance from family members or others.

DOI: 10.18697/ajfand.85.17790

Anthropometric Measurements
Table 3 shows mean and total mean values of age- and gender-specific anthropometric measurements.

HEIGHT: Total mean height for the men (165.1 cm) was greater than for the women (154.6 cm) (p<0.001). This held true in all age categories. The men were 14.5 cm taller on average than the women. Kyphosis was absent in all male subjects but was severe in 7 women (15%). The mean height values (cm) were higher in men and women aged 60-69 years than in men and women 90 years or older. Similar comparative results were reported in a study of 316 community-dwelling older adults in northeastern Brazil [13].

WEIGHT: In all age categories total mean weight was greater for men (53 kg) than for women (45 kg) (p<0.001). The men averaged 5 kg heavier than the women. The mean weight values were higher in both the youngest men and women compared to the oldest men and women. These data concurred with the weight data noted in the above-mentioned Brazilian study [13].

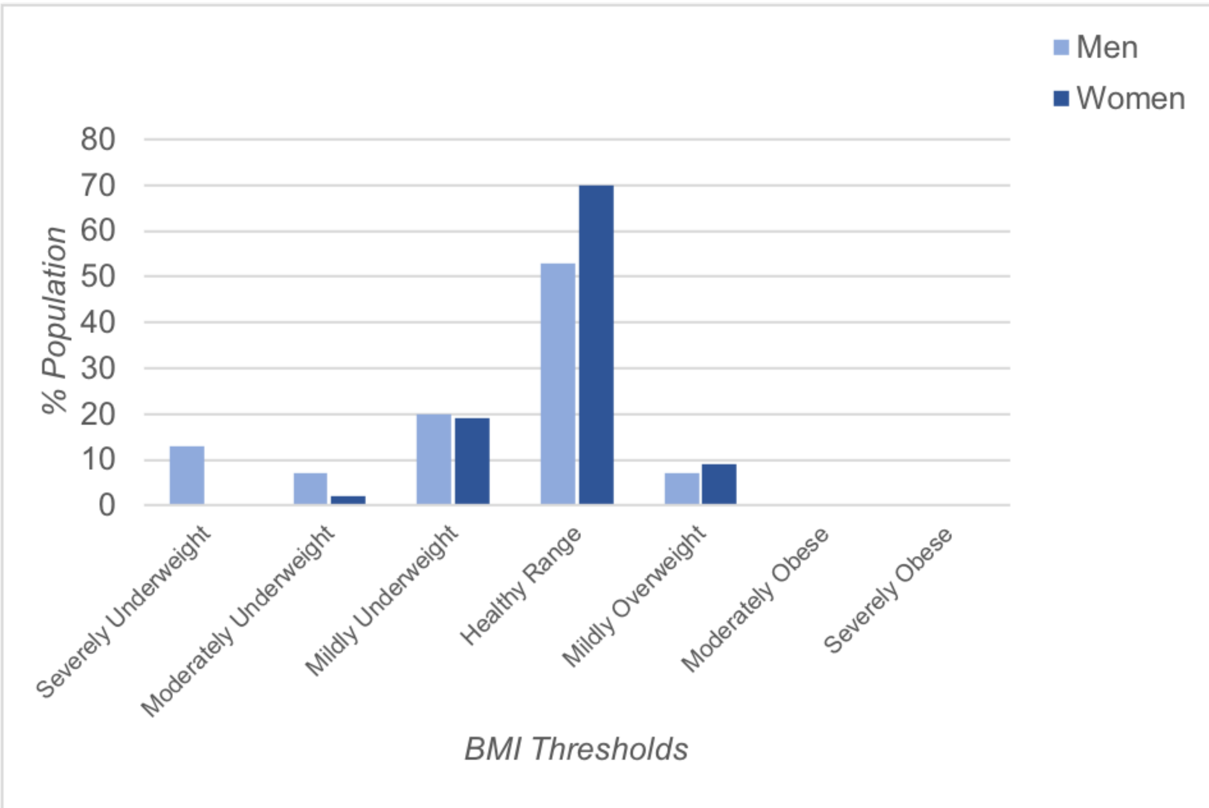

Figure 2: Gender-specific Characteristics of BMI Thresholds of Participants

BMI: Figure 2 illustrates gender-specific variations in BMI status. Fifty-three percent of men and 70% of women were noted in the healthy range. Men showed a greater degree of underweight (40%) than women (21%). Mild overweight was noted in 7% of men and 9% of women. No one was moderately or severely obese. It has been noted that it may be advantageous for the elderly to be classified as overweight. A 20-year

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 19 No. 2
March 2019
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

cohort study of 2,090 elderly subjects from Beijing concluded that a stable BMI in the overweight range showed a reduced mortality [14]. An Australian study examined 9,240 men and women (ages 70-75) and found mortality risk was lowest for overweight subjects [15]. A Norwegian study of 19,515 elderly people also concluded that overweight elderly had the lowest mortality rate [16]. Total mean BMI values in all age categories were greater for women (20.7) than for men (19.3) ($p<0.0001$). Men had a 6.8% lower total mean BMI value than women. The mean BMI value of the youngest men was higher compared to the oldest men. Several studies indicate that elderly women have 1-10% higher BMIs than their male counterparts [8, 9, 13, 17, 18, 19] although one Australian study found male subjects averaged 2% higher BMIs than their female counterparts [15]. In this study, the BMI mean value of the youngest women was lower than those of the oldest women. The Brazilian study showed higher mean BMI values in both the youngest men and women compared to the oldest men and women [13]. This disparity may be explained by a greater age-related individual height shrinkage in the Tanzanian oldest female population.

Other parallel results were recorded in a recent study of 400 elderly people living in Northern Ghana [17] and in a study of more than 500 elderly people from the Lake Victoria Basin of East Africa [9] and in Accra, Ghana [18]. The smaller stature and lighter physical activity of the women may explain their overall greater index of fatness (BMI) compared to the men.

The majority of TVAT subjects (61.5%) were within the healthy weight range (53% males, 70% females), 30.5% were undernourished (40% males, 21% females) and 8% were slightly overweight (7% males, 9% females). These statistics suggest a more favorable weight profile when compared with some studies [9, 17]. A plausible reason for this may be that the participants in this study had been receiving supplemental food for 21 previous months. Unfortunately, no baseline data were available for comparison. Nonetheless, almost 1/3 of the population remained undernourished even under the current conditions.

DOI: 10.18697/ajfand.85.17790

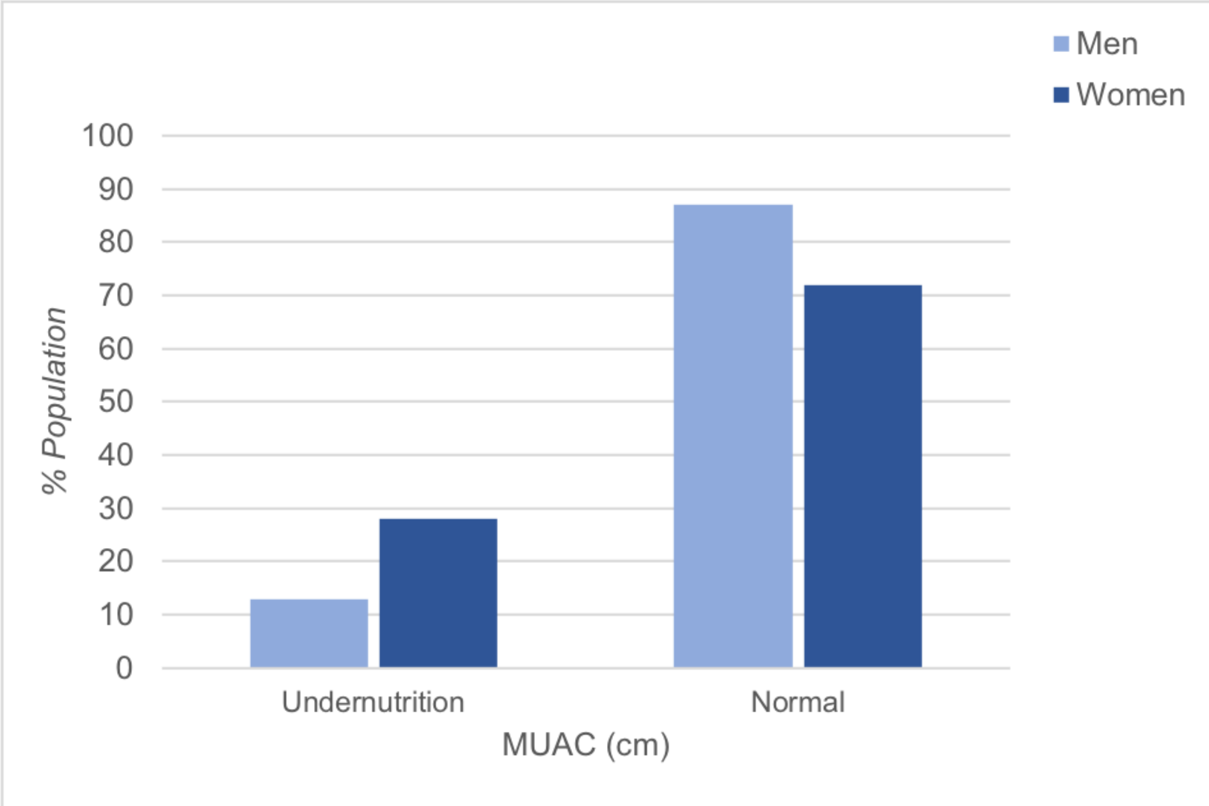

Figure 3: Gender-specific Prevalence of Undernutrition of Participants

MUAC: Figure 3 shows gender-specific differences in muscle mass and subcutaneous fat status. It indicates that 79.5% of the participants had muscle mass and subcutaneous fat stores within the normal range (87% males, 72% females), 20.5% were undernourished (13% males, 28% females). Unlike the previously mentioned studies, where women exhibited greater MUAC values than men [9, 18], the total mean MUAC values for these men and women were identical (24 cm). It is possible that the prior 21 months of supplemental food supplies began to improve depleted energy stores of this population. The mean MUAC values were noted higher for the youngest men and women compared to the oldest men and women, comparable to MUAC data in the Brazilian study [13]. Some studies have shown lower MUAC values with age: 5-11% in men and 5-17% in women [9 14, 17]. Elderly females in some populations show higher MUAC values than their male peers [8, 9], while the reverse is true in other areas [13, 19].

Table 4 illustrates the correlation analysis of MUAC against BMI revealed a strong and positive correlation (r = 0.75, N =62, p <0.001).

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 19 No. 2
March 2019
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

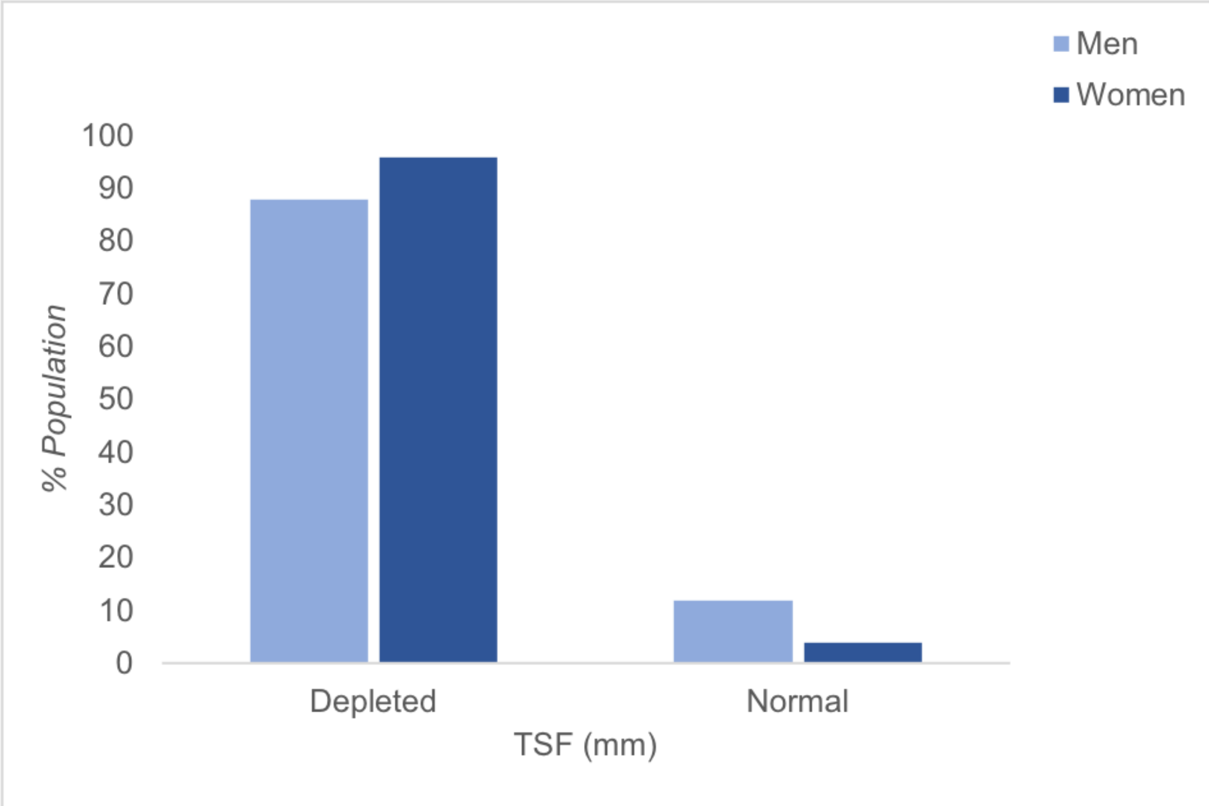

Figure 4: Gender-specific Prevalence of Depleted Fat Stores of Participants

TSF: Figure 4 highlights gender-specific variations in fat stores status. The subjects' depleted fat stores were starkly noted at 92% (88% men, 96% women). The total mean TSF value for men was 6.7 mm and 13.9 mm for women. As indicated in Table 3, the most severely depleted group was men aged 60-69 years (mean 5.2 mm). The TSF data from the Lake Victoria Basin study were similar, albeit at higher ranges (7.1mm – 20.9 mm) [9]. Another study of 344 Malay elderly produced comparable results, also at higher ranges (10.3 mm – 15.6 mm) [19]. The mean TSF value for the youngest men was lower than for the oldest men. This may be due to a more strenuous work load for the younger men resulting in a greater depletion of fat stores. The mean TSF value for the youngest women was higher than for the oldest women. Possible explanations for this may be a declining appetite among the oldest women and increased food sharing with others. The Brazilian study reported an age-related incline in mean TSF values for both the youngest men and women compared to the oldest men and women [13]. The TSF values are generally higher in elderly women compared to elderly men by as much as 41% [19]. The TSF values decrease, with age 6-26% in men and 17-34% in women as per some studies [9, 13, 19].

Table 4 shows the correlation analysis of TSF against BMI showed a strong, positive correlation (r =0.58, N = 62, p <0.001).

CONCLUSION

The BMI and MUAC data illustrate the majority of participants were neither underweight nor malnourished (60% men, 79% women) and the majority were within normal ranges for muscle mass and subcutaneous fat (67% men, 77% women). In strong contrast, TSF data revealed an extensive prevalence of depleted fat stores (88% men, 96% women). This is a nutritionally noteworthy finding since depleted fat stores impede recovery from illness, injury or prolonged stress.

In conclusion, this survey suggests that the isolated elderly poor of the Ngara District remain at risk of undernutrition. The Village Angels of Tanzania nutritional program will continue to record the elders' measurements of BMI, MUAC and TSF annually to track nutritional progress resulting from program intervention. Special attention will be given to Triceps Skinfold Thickness (TSF) trends. An effective food consumption assessment approach and an upgrading of the current supplemental food program, as indicated by nutritional assessment data, are strategies to assist this focus.

ACKNOWLEDGEMENTS

The authors are grateful to Sister Dativa Daniel Mukebita, FSSB Executive Director of The Village Angels of Tanzania for her assistance in the data collection. Her clarifications of local customs and relevant participant background information proved essential to accurate reporting and comprehension of the data recorded. The authors also wish to thank the 16 youths in the TVAT program who deliver food and compassion to the elders every week. They are the backbone of this humanitarian work being done in the Ngara District, Tanzania.

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 19 No. 2
March 2019
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 1A: TVAT Weekly Supplemental Food Program (September, 2015)

Food	*Quantity*
Cowpea beans	125 grams
Rice or maize	500 grams
Sunflower oil	250 milliliters
Nutritional flour (peanuts, soya, maize, millet)	250 grams
Totals/week: 5372 Kcal, 125 g PRO, 277 g FAT, 615 g, CHO, 53 g Fiber	

Table 1B: TVAT Weekly Supplemental Food Program (July 2017)

Food	*Quantity*
Cowpea beans	1 kilogram
Rice or maize	1 kilogram
Sunflower oil	250 milliliters
Avocado	2
Dried sardine-like fish	100 grams
Nutritional flour(peanuts, soya, millet)	1 kilogram
Totals/week: 13,897 Kcal, 574 g PRO, 446 g FAT, 1,964 g CHO, 341 g Fiber	

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 19 No. 2
March 2019
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 2: Gender-Specific Socio-Demographic Characteristics of Participants

Characteristics	*Category*	*Men N (%)*	*Women N (%)*
Social status	Married	12 (80)	1 (2)
	Divorced	0 (0)	1 (2)
	Widowed	3 (20)	45 (96)
Lives with	Spouse	12 (80)	1 (2)
	Alone	3 (20)	46 (98)
Income/aid	Yes	0 (0)	0 (0)
	No	15 (100)	47 (100)

DOI: 10.18697/ajfand.85.17790

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 19 No. 2
March 2019
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 3: Age- and Gender-Specific Mean and Total Mean Values of Participants

Variables	Men (N=15)		Women (N=47)		Total (N=62)	
	N(%)	Mean(SD)	N (%)	Mean(SD)	N (%)	Mean(SD)
HEIGHT (cm)						
60-69 yrs.	1(7)	175.0 (.)	5(10.5)	151.0(5.8)	6(10)	163.1(16.9)
70-79 yrs.	8(53)	163.3(6.2)	21(45)	151.5(6.4)	29(47)	157.2(8.6)
80-89 yrs.	4(27)	161.7(5.2)	15(32)	147.1(6.1)	19(31)	154.4(10.3)
90-99 yrs.	2(13)	162.2(6.8)	5(10.5)	146.8(7.2)	7(11)	154.5(10.9)
=/>100 yrs.	0(0)	0(0)	1(2)	156.5(.)	1(1)	156.5(.)
Total Mean	15(100)	165.1(5.5)	47(100)	150.6(5.1)	62(100)	157.1(9.3)
WEIGHT (kg)						
60-69 yrs.	1(7)	60.0(.)	5(10.5)	47.1(14.1)	6(10)	53.6(9.1)
70-79 yrs.	8(53)	50.3(7.5)	21(45)	45.6(6.7)	29(47)	48.0(3.3)
80-89 yrs.	4(27)	51.8(7.5)	15(32)	45.4(5.0)	19(31)	48.6(4.5)
90-99 yrs.	2(13)	50.0(15.6)	5(10.5)	46.0(11.7)	7(11)	48.0(2.8)
=/>100 yrs.	0(0)	0(0)	1(2)	42.0(.)	1(1)	42.0(.)
Total Mean	15(100)	53.0(7.7)	47(100)	45.2(7.5)	62(100)	48.0(3.9)
ARMSPANcm						
60-69 yrs.	0(0)	0(0)	1(14)	152.5(2.0)	1(14)	152.5(2.0)
70-79 yrs.	0(0)	0(0)	3(43)	159.8(2.6)	3(43)	159.8(2.6)
80-89 yrs.	0(0)	0(0)	2(29)	152(3.9)	2(29)	152.3(3.9)
90-99 yrs.	0(0)	0(0)	1(14)	140.0(.)	1(14)	140.0(.)
=/>100 yrs.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Total Mean	0(0)	0(0)	7(100)	151.2(2.1)	7 (100)	151.2(2.1)
BMI (%)						
60-69 yrs.	1(7)	19.6(.)	5(10.5)	20.4(4.3)	6(10)	20.0(0.6)
70-79 yrs.	8(53)	19.0(3.3)	21(45)	19.8(2.3)	29(47)	19.4(0.6)
80-89 yrs.	4(27)	19.7(1.8)	15(32)	21.2(2.0)	19(31)	20.5(1.1)
90-99 yrs.	2(13)	18.8(4.4)	5(10.5)	21.1(3.8)	7(11)	20.0(1.6)
=/>100 yrs.	0(0)	0(0)	1(2)	21.0(.)	1(1)	21.0(.)
Total Mean	15(100)	19.3(2.4)	47(100)	20.7(2.5)	62(100)	20.2(0.8)
MUAC (cm)						
60-69 yrs.	1(7)	25.5(.)	5(10.5)	24.9(4.3)	6(10)	25.2(0.4)
70-79 yrs.	8(53)	24.0(1.7)	21(45)	24.0(2.9)	29(47)	24.0(0.0)
80-80 yrs.	4(27)	24.2(2.0)	15(32)	24.2(1.6)	19(31)	24.2(0.0)
90-99 yrs.	2(13)	22.3(2.5)	5(10.5)	23.7(4.0)	7(11)	22.9(1.2)
=/>100 yrs.	0(0)	0(0)	1(2)	23.0(1.0)	1(1)	23.0(0.0)
Total Mean	15(100)	24.0(1.6)	47(100)	24.0(2.8)	62(100)	23.9(0.3)
TSF (mm)						
60-69 yrs.	1(7)	5.2(.)	5(10.5)	16.8(4.0)	6(10)	11.0(8.2)
70-79 yrs.	8(53)	8.7(5.6)	21(45)	13.0(5.1)	29(47)	10.9(3.0)
80-89 yrs.	4(27)	7.2(0.6)	15(32)	12.8(3.6)	19(31)	10.0(4.0)
90-99 yrs.	2(13)	5.6(1.3)	5(10.5)	16.0(8.8)	7(11)	10.8(7.4)
=/>100 yrs.	0(0)	0(0)	1(2)	11.0(.)	1(1)	11.0(.)
Total Mean	15(100)	6.7(1.8)	47(100)	13.9(4.3)	62(100)	10.7(4.5)

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 19 No. 2
March 2019
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

Table 4: BMI, MUAC, TSF Correlation Matrix

		BMI	MUAC	TSF
BMI	Pearson Correlation	1	.745**	.576**
	Sig. (2-tailed)		.000	.000
	N	62	62	62
MUAC	Pearson Correlation	.745**	1	.590**
	Sig. (2-tailed)	.000		.000
	N	62	62	62
TSF	Pearson Correlation	.576**	.590**	1
	Sig. (2-tailed)	.000	.000	
	N	62	62	62

** Correlation is significant at the 0.01 level (2-tailed)

DOI: 10.18697/ajfand.85.17790

ajfand SCHOLARLY, PEER REVIEWED
AFRICAN JOURNAL OF FOOD, AGRICULTURE, NUTRITION AND DEVELOPMENT
Volume 19 No. 2
March 2019
PUBLISHED BY AFRICAN SCHOLARLY SCIENCE COMMUNICATIONS TRUST
ISSN 1684 5374

REFERENCES

1. **World Health Organization** What is malnutrition? Online Q&A, July 8, 2016. Available at: http://www.who.int/features/qa/malnutrition/en/. (Accessed September 28, 2017).

2. **World Hunger Organization** 2016 World Hunger and Poverty Facts and Statistics. Available at: http://www.worldhunger.org/2015-world-hunger-and-poverty-facts-and-statistics/. (Accessed September 28, 2017).

3. **World Population Review** Tanzania Population (2018-01-23). Available at: http://worldpopulationreview.com/countries/tanzania-population/. (Accessed March 22, 2018).

4. **Osberg L and T Mboghoina** Social Protection of the Elderly in Tanzania: Current Status and Future Possibilities. Research on Poverty Alleviation (REPOA) Brief No. 24, March, 2011.

5. **Janowski K ed. and R Redmond** Eight-year Rwandan refugee saga in Tanzania comes to an end. UNHCR, January 3, 2003. Available at: http://www.unhcr.org/en-us/news/latest/2003/1/3e15a6397/eight-year-rwandan-refugee-saga-tanzania-comes-end.html. (Accessed September 29, 2017).

6. **The UN High Commissioner of Refugees World Food Programme** WFP/UNHCR Guidelines for Estimating Food and Nutritional Needs in Emergencies, December, 1997. WHO Technical Report Series No. 724, Annex I:5-7.

7. **Food and Agriculture Organization Corporate Document Repository** The state of food insecurity in the world 2015. Nutritional status and vulnerability, 2015. Available at: http://www.fao.org/docrep/x8200e/x8200e04.htm#P566 14968. (Accessed October 4, 2017).

8. **Chilima DM and SJ Ismail** Anthropometric characteristics of older people in rural Malawi. *Eur. J. Clin. Nutri.* 1998; **52(9)**: 643-649.

9. **Cheserek MJ, Tuitoek PJ, Waudo JN, Msuya JM and JK Kikafunda** Anthropometric characteristics and nutritional status of older adults in the Lake Victoria Basin of East Africa: region, sex, and age differences. *So. Afric. J. Clin. Nutri.* 2012; **25**(**2**): 67-72.

10. **National Institutes of Health** BMI Calculator. Available at: https://www.nhlbi.nih.gov/health/educational/lse_wt/BMI/bmi-m.htm. (Accessed October 4, 2017).

11. **Brito NB, Suarez Llanos JP, Ferrer MF, Garcia JGO, Brito ID, Pereyra-Garcia Castro F, Castellanos NC, Rodriguez CXA and EP Abizanda** Relationship between mid-upper arm circumference and body mass index in inpatients, 2016. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4975446/doi: 10.1371/journal.pone.0160480. (Accessed March 20, 2018).

12. **World Bank** Old and vunerable: the status of Tanzania's elders, 2012. Available at: http://blogs.worldbank.org/african/old-and-vunerable-the-status-of-tanzania-s-elders. (Accessed March23, 2018).

13. **Rodrigues Brandao Correia A, da Silva Coqueiro R, Santos MC, de Souza Leal Neto J, de Queiroz BM, Rodrigues Barbosa A and MH Fernandez** Anthropometric reference values for community-dwelling older adults from northeastern Brazil. *Rev Bras Cineantropom Desempenho Hum.* 2014; **16(5)**: 494-503.

14. **Wang YF, Tang Z, Guo J, Tao LX, Liu L, Li HB, Li DT, Guo XH and XH Yang** BMI and BMI changes in all-cause mortality among the elderly in Beijing: a 20-year cohort study**.** *Biomed Environ Sci.* 2017; **30(2)**: 79-87**.**

15. **Flicker L, McCaul KA, Hankey GJ, Jamrozik K, Brown WJ, Byles JE and OP Almeida** Body mass index and survival in men and women aged 70 to 75. *J Amer Geri Soc.* 2010; **58(2):** 234-241.

16. **Kvamme JM, Holmen J, Wilsgaard T, Florholmen J, Midthjell K and BK Jacobsen** Body mass index and mortality in elderly menm and women: the Tromso and HUNT studies. *J Epidemiol Community Health.* 2012; **66**: 611-614.

17. **Aganiba BA, Owusu WB, Steiner-Asiedu M and S Dittoh** Association between lifestyle and health variables with nutritional status of the elderly in the northern region of Ghana. *Afric. J. Food, Agri., Nutri. Dev.* 2015; **15(4)**: 10198-10216.

18. **Tayie F, Adjetey-Sorsey E, Armah J, Busolo D and E Imaya** Prevalence of undernutrition among elderly persons in Accra. *Ghana Med. J.* 2004; **38(2)**: 51-55.

19. **Rahman SA, Zalifah MK, Zainorni MJ, Shafawi S, Mimie Suraya S, Zarina N and WA Wan Zainuddin** Anthropometric measurements of the elderly. *Malay. J. Nutri.* 1998; **4**: 55-63.