

1 **Nutrition Knowledge, Dietary Patterns and Anthropometric Indices of Older Persons in**
2 **Four Peri-urban Communities in Ga West Municipality, Ghana**

3 Faith Agbozo^{1*}, Joyce Amardi-Mfoafo², Helen Dwase² and Basma Ellahi³

4 ¹Department of Family and Community Health, School of Public Health, University of Health and
5 Allied Sciences, Ho, Ghana

6 ²Department of Family and Consumer Sciences, College of Agriculture and Consumer Sciences,
7 University of Ghana, Legon, Accra

8 ³Faculty of Health and Social Care, University of Chester, Chester, CH1 4BJ, UK;

9 *Corresponding author: Department of Family and Community Health, School of Public Health,
10 University of Health and Allied Sciences, Ho, Ghana; PMB 31, Ho, Ghana

11 Email: faagbozo@uhas.edu.gh

12

13 Running Head: **Nutrition Knowledge, Diet and BMI of Elderly**

14 **Acknowledgement**

15 Heartfelt thanks to Ms. Deepak Kumar of the University of Chester for assisting in drafting
16 portions of the manuscript.

17

18

19 **Nutrition Knowledge, Dietary Patterns and Anthropometric Indices of Older Persons in**
20 **Four Peri-urban Communities in Ga West Municipality, Ghana**

21 **ABSTRACT**

22 **Background:** Older adults are vulnerable to malnutrition due to sociologic, physiologic and
23 anatomical effects of ageing.

24 **Objective:** To investigate the influence of nutrition knowledge and dietary patterns on nutritional
25 status of community-dwelling ambulatory older adults.

26 **Methods:** This cross-sectional survey involved 120 elderly aged 60-70 years purposively selected
27 from four peri-urban communities in Ga West municipality, Ghana. Nutrition knowledge was
28 assessed using a structured questionnaire and dietary intakes obtained using a standardized food
29 frequency questionnaire. BMI from weight/height measurements was proxy for nutritional status.
30 Data was analyzed descriptively in SPSS. Associations were tested using correlation analyses (-
31 $1 < r < +1$).

32 **Results:** 28% had adequate knowledge on geriatric nutrition. Dietary patterns were mostly fair
33 (40%) or poor (53%). Bloating (25%), constipation (18%), appetite loss (12%) and chewing
34 difficulties (11%) affected intakes. Underweight was 10% while 21.7% were overweight or obese
35 (16.6%). Positive insignificant correlations existed between knowledge and nutritional status
36 ($r=0.261$) and with diet quality ($r=0.415$). However, strong significant ($p=0.027$) positive
37 correlation ($r=0.699$) existed between diet quality and nutritional status.

38 **Conclusion:** Nutrition knowledge was adequate but dietary intake was poor and a quarter were
39 malnourished. The associations reaffirm that supporting the elderly to make healthy dietary
40 choices and ensuring household food security is crucial to preventing malnutrition.

41

42 **Keywords:** Dietary knowledge; Food diversity; Body mass index; Elderly; Geriatric nutrition

43

44 **INTRODUCTION**

45 Life expectancy has increased due to advancement in medicine, paramedical sciences and
46 technology (1). By 2050, the proportion of the world's population >60 years will double to 22%
47 (2). This rapid demographic change will be evident in low and middle-income countries (3). In
48 Ghana, between 1960 and 2010, population of the elderly increased by more than seven-folds with
49 1,643,381 persons out of the total 24,658,823 Ghanaian population above the age of 60 years. This
50 is projected to increase from 5.3% to 8.9% by 2050 (4). The WHO defines older persons,
51 traditionally called the elderly, as persons who have reached the age of retirement. The elderly are
52 categorized them into three age groups: 'young old' (60-74); 'old old' (75-84); and 'oldest old'
53 (≥ 85 years) (5).

54 Good nutrition is particularly important to older persons because of the physiological changes that
55 occur in the body as one ages. Poor diets contribute to frailty, complicating functional limitations
56 and leading to loss of muscle mass, metabolic abnormalities and diminished immunity (6).
57 Adequate diet and optimum nutritional status play a critical role in maintaining immune response
58 of the aged by promoting resistance to infection and other immune-related diseases (7). The
59 functional capacity and health of the older person depends on their nutritional status and food
60 security, which are the cornerstone in determining nutritional well-being (8, 9). However, older
61 persons are most unlikely to eat balanced diets to meet the nutrient needs of their changing

62 physiologic state (10, 11). This makes them vulnerable to malnutrition with the associated poor
63 health outcomes.

64 Globally, malnutrition rates in older persons vary based on the screening tools used, whether the
65 study population is community (free) living or institutionalized as well as the geographic location.
66 Using the Mini Nutritional Assessment tool, the prevalence of malnutrition in Italy was 26%
67 among females and 16.3% in males (12). In Iran, 10.3% of the elderly residents in nursing homes
68 were malnourished (13). In The Netherlands, Germany and Austria, the prevalence were 18.3%,
69 20.1% and 22.5% respectively (14). In the Lake Victoria Basin in East Africa, 26.4% of the elderly
70 were underweight while 15.3% were overweight/obese (15).

71 In rural Ghana, a 41% underweight and 16.9% overweight/obesity prevalence has been observed
72 among elderly women aged 60 to 92 years (16). The overall prevalence of undernutrition among
73 older persons in sub-Saharan Africa varies across countries ranging from 5% in South Africa to
74 48% in Ghana making Ghana one of the countries in sub-Saharan Africa with a high burden of
75 malnutrition (>40%) among the elderly population (11, 16, 17). The high prevalence of
76 malnutrition among older persons in Ghana though a worrying trend is not surprising as in the
77 national capital Accra, only 39.1% of the elderly have been found to be food secure (18).

78 Major health problems for which older adults seek care in health facilities in Ghana are
79 hypertension, stroke, diabetes and osteoarthritis (19, 20). Most of these diseases have underlying
80 nutrition-related causes. Also, due to ongoing nutrition and epidemiological transition in Ghana,
81 wealthy and urban communities are at higher risk of obesity and chronic diseases whereas poor
82 and rural communities are at higher risk of undernutrition, infections as well as chronic diseases
83 (20, 21). Nutritional intervention programmes such as dietary counseling and nutrient supplements

84 could improve nutritional status (22-24). Adequate diets and healthy dietary patterns improve
85 nutritional status (10), decreases risk of nutrition-related chronic diseases associated with cognitive
86 decline (25), reduce morbidity and mortality and increase longevity (26). Nonetheless, dietary
87 intakes of most older persons have been shown to be of poor quality (27, 28). Also, nutrition
88 knowledge of most older persons is poor (29) and usually weakly associated with dietary intakes
89 thereby not translating in optimum nutritional status (30).

90 Studies on malnutrition among the elderly in Ghana have concentrated in urban areas (17, 18) with
91 few conducted in rural communities (16). Due to urbanization with its associated rapid expansion
92 of cities, hitherto rural communities located at peripheries of big cities are transiting into
93 cosmopolitan areas. The elderly are the most affected by increased complexity of communities,
94 hence the need to focus on peri-urban elderly dwellers. This study assessed the level of nutrition
95 knowledge, dietary patterns and food choices, and anthropometric indices of the elderly. The
96 existence of associations among these nutritional status indicators was also tested.

97 **MATERIALS AND METHODS**

98 **Study setting**

99 The study was conducted in the Ga West municipality, one of the 16 administrative districts located
100 in the north-western end of the Greater Accra Region, Ghana. The municipality occupies a land
101 area of approximately 300 square kilometres and comprises 219,788 inhabitants. Out of these,
102 4.3% are above the age of 60 years with females constituting 56% (31). The four largest peri-urban
103 communities in the municipality (Pokuase, Amasamnan, Medie and Ofankor) were all part of the
104 study setting.

105 Hitherto, care of the aging population was a collective role shared by the extended family. Now,
106 the nuclear family particularly children are the forefront care providers. Socio-economic,
107 urbanization and demographic transitions have affected dynamics of the traditional family system.
108 Increasing, the elderly are responsible for carrying out their everyday tasks due to decreasing social
109 support. Although aged care services are becoming common in Ghana, at the time of conducting
110 this study, there were no such facilities in the Ga West municipality.

111 **Study design and target population**

112 The study was a descriptive cross sectional observational household survey. The target population
113 was all “young old” adults age 60 to 70 years. An upper limit of 70 years was set because the study
114 protocol involved recall of dietary intakes as well as the taking of anthropometric measurements.
115 Ability to stand upright and memory accuracy were crucial since anatomical functioning and
116 cognitive have been shown to reduce with advancing age (6, 32).

117 **Sample size and sampling procedure**

118 In the Ga West municipality, adults aged 60-70 years constitute 2.5% (5,595) of the total municipal
119 population (31). With the aid of Cochran’s formula (33), using the population size of 5,595 at 95%
120 confidence level (5% error margin), 1,96 alpha, 7% confidence interval and 17% prevalence of
121 undernutrition among the elderly (16), this generated a sample size of 109. Allocating 10% for
122 missing and incomplete data, the final sample size recruited was 120. Thirty participants were
123 allocated to each of the four study communities. Inclusion criteria were age limits of 60 and 70
124 years, ambulatory, ability to stand upright and freewill to decide on what to eat. Interviewers were
125 assigned to the north, south, east and west ends of each study community and moved inwards
126 towards the central part. The first house to be visited was determined by a random walk and the
127 zigzag principle followed thereafter. Respondent were primarily purposively selected. Where there

128 was difficulty getting eligible participants, subsequent recruitments were made using the snowball
129 sampling procedure.

130 **Data collection and analyses**

131 A structured questionnaire containing open and closed ended questions was used to collect
132 information on respondents' socio-demographic data, dietary intakes and nutrition knowledge. The
133 questionnaire was translated into Ga and Akan, the two predominate local languages spoken in the
134 study area. Data generated was hand-coded and entered into the SPSS software (version 20) to
135 generate frequency and percentage distributions. Spearman rank-order correlation coefficient (r)
136 statistic was used to measure the strength and direction of association between two ranked
137 variables involving either nutrition knowledge, dietary patterns or nutritional status. These
138 variables were categorized as ordinal data and the monotonic relationship between the permuted
139 variables were determined using $-1 < r < +1$ at 5% level of significance ($p < 0.05$). Correlation
140 coefficient < 0.5 implied a weak association, > 0.5 implied a strong association, $r = 0.0$ implied no
141 association whilst $r = 1.0$ signified a perfect correlation.

142

143 ***Nutrition knowledge***

144 Due to the absence of a validated nutrition knowledge questionnaire suitable for the local context,
145 a nutrition knowledge questionnaire was specifically designed to achieve our objectives. However,
146 it was standardized in accordance with the format of knowledge assessment questionnaires used
147 in similar studies. Issues tackled centered on nutrients; health benefits of food; the diet-disease
148 relationship; fruits and vegetables; water; and physical activity. In the questionnaire were ten
149 nutrition-related thematic sub-sections on a five-point rating scale ranging from strongly agree,
150 agree, neutral, disagree to strongly disagree. For each statement, scores ranging from zero to five

151 were assigned to the appropriate response category. Total knowledge scores were calculated with
152 highest and lowest possible scores of 50 and 10 respectively. Based on the minimum and maximum
153 ranges of the aggregate knowledge scores as well as the mean and median values of the
154 distribution, nutrition knowledge was categorized and rated as good if the aggregate score was
155 from 36-50, satisfactory if the aggregate score was from 20-35 and poor if the aggregate score was
156 less than 20 scores.

157 *Dietary patterns, diversity and quality*

158 A food frequency questionnaire (FFQ) comprising seven major food groups with frequency of
159 consumption categories was used to collect qualitative information on the usual food consumption
160 patterns of participants to determine the diet quality and diversity. The seven major food groups
161 from which meals were prepared on daily basis in Ghana are cereals and grains; roots tubers and
162 plantain; animal products; vegetables; fruits; legumes nuts and oily seeds; and fats and oils. The
163 dietary diversity scores were determined on the basis of adequacy of daily intake of foods from
164 the seven food groups. Diets that included at least one food item from either six or seven of the
165 food groups were rated as adequate; diets that included food items from five out of the seven food
166 groups were rated as fair diets whereas diets that included food items from four or less food groups
167 were rated as poor.

168 *Nutritional status*

169 Standing height and weight was measured using 'SECA' stadiometre and digital weighing scale
170 to the nearest 0.1 centimetres and 0.1 kilogram respectively. The anthropometric measurements
171 were used to calculate participant's body mass index (BMI) as weight in kilogram divided by
172 height in meters squared. The BMI were classified and interpreted according to WHO age and sex

173 specific guidelines and used as proxy to determine nutritional status: underweight ($<18.5 \text{ kg/m}^2$),
174 normal weight ($18.50\text{-}24.9 \text{ kg/m}^2$), overweight ($\geq 25.0\text{-}29.9 \text{ kg/m}^2$) and obese ($\geq 30.0 \text{ kg/m}^2$) (34).

175 **RESULTS**

176 **Background characteristics of study participants respondents**

177 One hundred and twenty participants were recruited comprising 78 females and 42 males. Table 1
178 shows their socio-demographic characteristics of the respondents. Nearly 60% were aged between
179 60 and 65 years. Sixty percent had little or no formal education. Ninety percent were Christians
180 while the rest were either Muslims (7%) or traditionalist. Although a third of the participants were
181 not engaged in any income generating activity, they all had subsistence either from regular job,
182 pension benefits or as financial support from family and friends. Forty percent lived alone, a third
183 with their spouses while the remaining proportion lived with their children and other family
184 members.

185 **Nutrition and health related knowledge of respondents**

186 From ten statements used to assess nutrition knowledge, 38% of the participants believed that it
187 was necessary to drink water only when thirsty. Most (74%) agreed that a healthy diet was one
188 that contained varied foods necessary to meet an individual's nutrient requirements. Thirty percent
189 thought that with advancing age, physical activity should be reduced. Almost half (47.6%) felt that
190 constipation occurred as result of ageing and the use of laxatives was the way out. Almost 90%
191 knew that daily consumption of fruits and vegetables promotes health. Also, 55% thought it was
192 necessary for the elderly to take nutrient supplements routinely to complement their diets. Most
193 (72%) of the participants agreed that nutrition was pivotal in the prevention of diseases and the
194 promotion of health. In relation to intake of protein-rich foods, 33% disagreed that older persons

195 required high quantities of protein for growth and maintenance of body tissues. Seventy percent
196 agreed with the statement that obese people could be malnourished and 75% believed that older
197 persons could skip meals if they lose appetite.

198 From the aggregate knowledge ratings, 5.8% of the respondents scored below 10, indicating poor
199 nutrition knowledge; 65.8% scored from 20-35, indicating satisfactory nutrition knowledge
200 whereas 28.3% had cumulative score above 35, indicating good nutrition knowledge.

201 **Dietary patterns, diversity and diet quality of respondents**

202 Dietary habits and dietary-related challenges experienced by the respondents are presented in table
203 2. Half cited hunger as the primary reason for eating and a further 37.5% mentioned health and
204 vitality. Nearly half (47%) prepared their own meals while 46% had their meals prepared by either
205 their wives or children. Over 90% ate two to three times a day with a little over half eating three
206 meals daily. Most (66%) of these meals were usually home-prepared. The most influential factors
207 affecting respondents' food choices were appetite (43.9%) and availability of food (33.3%). More
208 than half of the respondents routinely took supplements in the form of iron and multivitamins
209 tablets and herbal supplements. A quarter (25.8%) avoided foods such as cassava, snails, okra and
210 beans. Although 12% did not complain of any problems associated with eating, the majority
211 contended mainly with stomach bloating (28%), constipation (18%), loss of appetite, difficulty
212 chewing and bitterness in the mouth. Diagnosed dietary-related medical conditions included
213 osteoarthritis, cardiovascular diseases (hypertension & stroke), dental problems, diabetes mellitus
214 and stomach ulcer.

215 Dietary diversity of the respondents is shown in figure 1. On a daily basis, most frequently
216 consumed foods were tomatoes (97%), onions (95%) and pepper (85%). This was followed by
217 bread (78%), fish (76%); maize (67%), green leafy vegetables (66%) and palm oil (66%). Over

218 half consumed rice (54%), plantain (52%) and cowpeas (48%); whereas approximately 40%
219 consumed cassava (40%), milk (39%) and groundnuts (39%). Apart from oranges that were
220 consumed by half of the respondents on a daily basis, only a quarter ate any other fruits in a day.

221 Respondents' diet quality was determined based on the adequacy of daily intake of foods from the
222 seven food groups. Only 6.7% consumed foods from six or all seven food groups daily and
223 therefore met the criteria for adequate diet. Dietary intake of 40% was rated as fair quality because
224 daily, the diets included foods from five out of the seven food groups. Half (53.3%) consumed
225 poor quality diets as less than five food groups were included in their meals on daily basis.

226 **Nutritional status of respondents**

227 The BMI of half (51.7%) of the respondents was normal; 10.0% were underweight; 21.7% were
228 overweight whereas 16.6% were obese.

229 **Correlation between nutrition knowledge, diet quality and nutritional status**

230 Table 3 reveals that the correlation between nutrition knowledge and nutritional status was weak
231 positive ($r=0.261$) but insignificant ($p=0.352$). Similarly, there was an insignificant positive
232 correlation ($r=0.415$) between nutrition knowledge and diet quality ($p=0.792$). However, a
233 significant ($p=0.027$) strong positive correlation ($r=0.699$) was observed between diet quality and
234 nutritional status.

235 **DISCUSSION**

236 Over 90% of participants had satisfactory to good nutrition knowledge. This was contrary to
237 studies in India and Taiwan where nutrition knowledge of urban and rural elderly was mainly
238 unsatisfactory (29, 35). In China however, almost half of respondents had good knowledge of

239 nutrition and health (36). In this study, although respondents' knowledge on daily water intake,
240 constituents of a healthy diet, importance of physical activity and consumption of fruits and
241 vegetables was particularly good, responses on intake of protein-rich foods, causes and remedy for
242 constipation, meal skipping as result loss of appetite, warrant attention. Higher educational level
243 and living in less remote areas are shown to correlate with nutrition knowledge (25, 29, 36).
244 Although majority of the study participants received no formal education, residency in a peri-urban
245 setting might be advantageous due to better access to information and healthcare. It is worth noting
246 that social and health interventions in Ghana targeted at the elderly such as free registration unto
247 the National Health Insurance Scheme and the establishment of geriatric unit at out-patient
248 department of hospitals provide an avenue for improved healthcare delivery through client
249 counselling on healthy lifestyles. This could contribute to the good nutrition knowledge
250 demonstrated by the study participants.

251 Regarding dietary patterns, apart from vegetables and grains/cereals, fish was the most consumed
252 on daily basis. These three food groups have been found to be the highest contributors of daily
253 meals in several places (10, 37, 38). Diet quality of more than half of the respondents was poor.
254 Similar results have been found in other studies (27, 28). A lot of factors affect the quality of diets
255 of older persons and consequently, their nutrition and health status. The positive determinants
256 include education, nutrition knowledge, availability of money, number of daily meals eaten,
257 perceived physical health, and hunger sensation. The negative determinants are living alone,
258 alcohol consumption, dental problems and regular eating outside the home (28, 39-41). From this
259 study, proportion of respondents without any formal education, no guaranteed source of income,
260 who lived alone, prepared their own meals, ate outside home and drink alcohol were fairly high.
261 Living alone for instance, have been associated with meal skipping, obesity, underweight and

262 unhealthy eating behaviors (41). While appetite and hunger sensations decline with age (42),
263 increased food preferences affect older person's food choices and hence their dietary patterns.
264 Most (>90%) of the respondents ate two to three times a day with a little over half eating three
265 meals daily. Reduce meal patterns could be attributed to ageing or disease related impairments in
266 appetite, taste sensation, chewing, swallowing, digesting and absorbing nutrients (43, 44).
267 Contrarily, older persons in Ghana have been shown to skip meals primarily due to lack of money
268 (18) whereas daily meal frequency in other studies have been higher (45, 46). Therefore although
269 nutrition knowledge of a quarter respondents was adequate, with about 60% of the elderly in urban
270 Ghana reportedly food insecure (18), food choices will largely depend on food availability and not
271 knowledge on what is appropriate or inappropriate.

272 Undernutrition prevalence was 10% whereas 38% were overweight/obese. Although this is similar
273 to the 12% underweight documented in Senegal (11), it is far less than the 48% (11, 17) and 41%
274 (16) recorded in earlier studies in Ghana. In the Lake Victoria Basin of East Africa, underweight
275 prevalence was 26% (15) whereas using the mini-nutritional assessment tool, 28.4% of older
276 persons age 65 to 88 years were malnourished in DR Congo (47). Conversely, overweight/obesity
277 levels were 20%-points higher than the 17% documented by Blankson and Hall in Ghana (16).
278 Their studies were conducted among 'old old' and 'oldest old' rural and institutionalized urban
279 elderly dwellers, known to be at highest risk of undernutrition. After 70 years, some weight loss
280 occurs and is attributed to the aging process itself. The implication of this idiopathic weight loss
281 is higher levels of underweight with advancing age. Waist circumference gives a better indication
282 of adiposity and sarcopenic obesity (48) as there is usually some height loss with ageing (32).
283 Therefore it could have been a better nutritional status indicator. The global epidemiological
284 transition caused by urbanization, reduced physical activity, low consumption of whole grains,

285 fruits and vegetables and increased intake of fats/oils, sugar-sweetened beverages, is evident in
286 Ghana (21, 49). The consequent effect is a shift from undernutrition to obesity as seen in this study.

287 Even though correlations between nutrition knowledge and dietary intakes and between nutrition
288 knowledge and nutritional status were positive, the associations were weak and insignificant.

289 However, a systematic review has reported a significant but weak positive associations between
290 nutrition knowledge and dietary intake (30). A plausible explanation for the knowledge not

291 translating into practice in our study might be the physical discomforts that reportedly
292 characterized the feeding of majority of the respondent contributing to meal skipping. Also, lack

293 of regular income influences one's ability to purchase nutritious diversified diets. This aggravates
294 the food insecurity situation observed by Steiner-Asiedu et al among the elderly in Ghana (18).

295 Aside appetite and hunger, availability of food and money ranked high in determining respondents'
296 food choices. This buttress the impact of socio-economic status and food security on dietary
297 intakes and consequently nutritional status.

298 Associations between dietary patterns and nutritional status have generally been inconsistent (50).

299 From this study, the positive relationship found between nutritional status and diet quality suggest
300 that healthy dietary intakes could contribute to the achievement of optimum nutritional status in
301 older persons as documented in other studies (51, 52).

302 The key limitation of this study is the use of non-probability sampling procedures in participant

303 selection. It does not allow for generalization of findings to the general population. Findings also

304 provide little evidence of causality because the likelihood of non-random sampling eliminating

305 confounding variables within the study itself is low. Also, participant recruitment is prone to

306 selection bias. This could affect accuracy of the nutritional status estimates and contribute to a

307 distortion in the measure of association. Again, because rigorous socio-economic status indicators

308 (SES) were not employed, it is difficult to establish the relationship between SES, diet quality and
309 nutritional status. Nevertheless, this is one of the few studies conducted among free community-
310 dwelling ambulatory ‘young old’ adults resident in peri-urban areas of Ghana. This study has
311 provided new insights not only on the quality of diets consumed but reaffirmed the emergent
312 nutrition and epidemiological transition even among the ageing population in Ghana.

313 **Conclusion**

314 Majority of the respondents had satisfactory to adequate knowledge on nutrition issues as relate to
315 the elderly. However, this knowledge neither translated to improved dietary intakes nor optimum
316 nutritional status. Conversely, adequate dietary intakes correlated positively with nutrition status.
317 Although access to health-promoting information is vital for lifestyle modification, this study has
318 reaffirmed that adequate nutrition knowledge does not necessarily imply an improvement in
319 dietary intakes. To encourage and facilitate healthy dietary habits in older people requires family
320 support, nutrition-sensitive social interventions and safety net for the elderly to ensure household
321 food security.

322

323 **Competing interest**

324 The authors declare that they have no competing interests.

325 **Funding**

326 We did not receive any funding for this research.

327 **REFERENCES**

- 328 1. Roberts SB, Rosenberg I. Nutrition and aging: changes in the regulation of energy
329 metabolism with aging. *Physiological reviews*. 2006;86(2):651-67.
- 330 2. Carstensen LL. Our Aging Population—It May Just Save us All. *The Upside of Aging:
331 How Long Life is Changing the World of Health, Work, Innovation, Policy, and Purpose*.
332 2014:1-18.
- 333 3. WHO. Ageing and Life Course. Facts about aging Geneva, Switzerland World Health
334 Organization <http://www.who.int/ageing/about/facts/en/>; 2014 [cited 2015 01/08/15].
- 335 4. Ghana Statistical Service. 2010 POPULATION & HOUSING CENSUS REPORT. The
336 elderly in Ghana Accra, Ghana: Ghana Statistical Service
337 http://www.statsghana.gov.gh/docfiles/publications/2010phc_the_elderly_in_Gh.pdf, 2013.
- 338 5. WHO. A glossary of terms for community health care and Services for older persons
339 Geneva, Switzerland World Health Organization Centre for Health Development Ageing and
340 Health Technical Report Volume 5
341 http://www.who.int/kobe_centre/ageing/ahp_vol5_glossary.pdf, 2004.
- 342 6. Vellas B, Gillette-Guyonnet S, Nourhashemi F, Rolland Y, Lauque S, Ousset P, et al.
343 Falls, frailty and osteoporosis in the elderly: a public health problem. *La Revue de medecine
344 interne/fondee par la Societe nationale francaise de medecine interne*. 2000;21(7):608-13.
- 345 7. Munkyong Pae SNM, Dayong Wu. The Role of Nutrition in Enhancing Immunity in
346 Aging. *A&D*. 2012;3(1):91-129.
- 347 8. Jyrkkä J, Enlund H, Lavikainen P, Sulkava R, Hartikainen S. Association of
348 polypharmacy with nutritional status, functional ability and cognitive capacity over a three-year
349 period in an elderly population. *Pharmacoepidemiology and drug safety*. 2011;20(5):514-22.

- 350 9. Chilima D. Assessing nutritional status and functional ability of older adults in
351 developing countries. *Development in Practice*. 2000;10(1):108-13.
- 352 10. Anderson AL, Harris TB, Tyllavsky FA, Perry SE, Houston DK, Hue TF, et al. Dietary
353 patterns and survival of older adults. *Journal of the American Dietetic Association*.
354 2011;111(1):84-91.
- 355 11. Kimokoti RW, Hamer DH. Nutrition, health, and aging in sub-Saharan Africa. *Nutrition*
356 *reviews*. 2008;66(11):611-23.
- 357 12. Donini LM, Scardella P, Piombo L, Neri B, Asprino R, Proietti A, et al. Malnutrition in
358 elderly: social and economic determinants. *The journal of nutrition, health & aging*.
359 2013;17(1):9-15.
- 360 13. Nazemi L, Skoog I, Karlsson I, Hosseini S, Mohammadi MR, Hosseini M, et al.
361 Malnutrition, Prevalence and Relation to Some Risk Factors among Elderly Residents of Nursing
362 Homes in Tehran, Iran. *Iranian journal of public health*. 2015;44(2):218.
- 363 14. van Nie-Visser NC, Meijers J, Schols J, Lohrmann C, Bartholomeyczik S,
364 Spreeuwenberg M, et al. Which characteristics of nursing home residents influence differences in
365 malnutrition prevalence? An international comparison of The Netherlands, Germany and Austria.
366 *The British journal of nutrition*. 2014;111(6):1129-36.
- 367 15. Cheserek MJ, Tuitoek P, Waudu J, Msuya JM, Kikafunda JK. Anthropometric
368 characteristics and nutritional status of older adults in the Lake Victoria Basin of East Africa:
369 region, sex, and age differences. *South African Journal of Clinical Nutrition*. 2012;25(2):67-72.
- 370 16. Blankson B, Hall A. The anthropometric status of elderly women in rural Ghana and
371 factors associated with low body mass index. *The journal of nutrition, health & aging*.
372 2012;16(10):881-6.

- 373 17. Tayie F, Adjetey-Sorse E, Armah J, Busolo D, Imaya E. Prevalence of undernutrition
374 among elderly persons in Accra. *Ghana Medical Journal*. 2006;38(2):51-5.
- 375 18. Steiner-Asiedu M, Mombo Pelenah, J., Bediako-Amoa, B., Danquah, A. The Nutrition
376 Situation of the Elderly in Ghana: A Case Study. *Asian Journal of Medical Sciences*. 2010;2:95-
377 103.
- 378 19. Ayernor PK. Diseases of Ageing in Ghana. *Ghana Medical Journal*. 2012;46(2):18-22.
- 379 20. Minicuci N, Biritwum RB, Mensah G, Yawson AE, Naidoo N, Chatterji S, et al.
380 Sociodemographic and socioeconomic patterns of chronic non-communicable disease among the
381 older adult population in Ghana. *Global health action*. 2014;7.
- 382 21. Agyei-Mensah S, de-Graft Aikins A. Epidemiological Transition and the Double Burden
383 of Disease in Accra, Ghana. *Journal of urban health*. 2010;87(5):879-97.
- 384 22. Nykänen I, Rissanen T, Sulkava R, Hartikainen S. Effects of individual dietary
385 counseling as part of a Comprehensive Geriatric Assessment (CGA) on nutritional status: A
386 population-based intervention study. *The journal of nutrition, health & aging*. 2014;18(1):54-8.
- 387 23. Sahyoun NR, Pratt CA, Anderson A. Evaluation of nutrition education interventions for
388 older adults: a proposed framework. *Journal of the American Dietetic Association*.
389 2004;104(1):58-69.
- 390 24. Bandayrel K, Wong S. Systematic literature review of randomized control trials assessing
391 the effectiveness of nutrition interventions in community-dwelling older adults. *Journal of*
392 *nutrition education and behavior*. 2011;43(4):251-62.
- 393 25. Shatenstein B, Ferland G, Belleville S, Gray-Donald K, Kergoat M-J, Morais J, et al. Diet
394 quality and cognition among older adults from the NuAge study. *Experimental gerontology*.
395 2012;47(5):353-60.

- 396 26. McNaughton SA, Bates CJ, Mishra GD. Diet quality is associated with all-cause
397 mortality in adults aged 65 years and older. *The Journal of nutrition*. 2012;142(2):320-5.
- 398 27. Santos D, Rodrigues S, De Oliveira B, De Almeida MV. Diet quality in elderly
399 Portuguese households. *The journal of nutrition, health & aging*. 2014;18(3):243-50.
- 400 28. Irz X, Fratiglioni L, Kuosmanen N, Mazzocchi M, Modugno L, Nocella G, et al.
401 Sociodemographic determinants of diet quality of the EU elderly: a comparative analysis in four
402 countries. *Public Health Nutrition*. 2014;17(05):1177-89.
- 403 29. Lin W, Lee Y-W. Nutrition knowledge, attitudes and dietary restriction behaviour of
404 Taiwanese elderly. *Asia Pacific journal of clinical nutrition*. 2005;14(3):221-9.
- 405 30. Spronk I, Kullen C, Burdon C, O'Connor H. Relationship between nutrition knowledge
406 and dietary intake. *British Journal of Nutrition*. 2014;111(10):1713-26.
- 407 31. Ghana Statistical Service. 2010 Population and housing census. District analytical report.
408 Ga West municipality. Accra, Ghana
409 [http://www.statsghana.gov.gh/docfiles/2010_District_Report/Greater%20Accra/GA%20WEST.p](http://www.statsghana.gov.gh/docfiles/2010_District_Report/Greater%20Accra/GA%20WEST.pdf)
410 [df](http://www.statsghana.gov.gh/docfiles/2010_District_Report/Greater%20Accra/GA%20WEST.pdf): Ghana Statistical Service, , 2014.
- 411 32. Videman T, Battié MC, Gibbons LE, Gill K. Aging changes in lumbar discs and
412 vertebrae and their interaction: a 15-year follow-up study. *The Spine Journal*. 2014;14(3):469-78.
- 413 33. Cochran WG. *Sampling techniques*: John Wiley & Sons; 2007.
- 414 34. WHO. *Obesity: preventing and managing the global endemic* WHO: Geneva,
415 Switzerland: World Health Organization
416 http://apps.who.int/iris/bitstream/10665/42330/1/WHO_TRS_894.pdf?ua=1&ua=1, 2000.

- 417 35. Jain M, Purnima PJ, Gupta K. Appraisal of Nutrition and Health Related Knowledge,
418 Attitude and Practices of Rural and Urban Elderly Using A Gender Lens. *Indian Journal of*
419 *2013;27(3):519-29.*
- 420 36. Yin Z, Geng G, Lan X, Zhang L, Wang S, Zang Y, et al. Status and determinants of
421 health behavior knowledge among the elderly in China: a community-based cross-sectional
422 study. *BMC public health.* 2013;13(1):710.
- 423 37. Santos D, Oliveira B, Rodrigues S, De Almeida M. Effect of sociodemographic variables
424 and time on food group contribution to total food availability in Portuguese elderly households.
425 *The journal of nutrition, health & aging.* 2014;18(5):471-8.
- 426 38. Kieft-de Jong JC, Mathers JC, Franco OH. Nutrition and healthy ageing: the key
427 ingredients. *Proceedings of the Nutrition Society.* 2014;73(02):249-59.
- 428 39. Shatenstein B, Gauvin L, Keller H, Richard L, Gaudreau P, Giroux F, et al. Baseline
429 determinants of global diet quality in older men and women from the NuAge cohort. *The journal*
430 *of nutrition, health & aging.* 2013;17(5):419-25.
- 431 40. Ramic E, Pranjić N, Batic-Mujanović O, Karić E, Alibasić E, Alic A. The effect of
432 loneliness on malnutrition in elderly population. *Med Arh.* 2011;65(2):92-5.
- 433 41. Tani Y, Kondo N, Takagi D, Saito M, Hikichi H, Ojima T, et al. Combined effects of
434 eating alone and living alone on unhealthy dietary behaviors, obesity and underweight in older
435 Japanese adults: Results of the JAGES. *Appetite.* 2015;95:1-8.
- 436 42. Pilgrim AL, Robinson SM, Sayer AA, Roberts HC. An overview of appetite decline in
437 older people. *Nursing Older People.* 2015;27(5):29-35.

- 438 43. Elmadfa I, Meyer AL. Body Composition, Changing Physiological Functions and
439 Nutrient Requirements of the Elderly. *Annals of Nutrition and Metabolism*. 2008;52(suppl
440 1)(Suppl. 1):2-5.
- 441 44. Kalyan G, Sarin J, Gulia R, Rani R, Malik R. Diet Associated Problems and Nutritional
442 Status of Elderly of Selected Community of District Ambala, Haryana. *Nursing and Midwifery
443 Research*. 2015;11(2):78.
- 444 45. Mekary RA, Giovannucci E, Cahill L, Willett WC, van Dam RM, Hu FB. Eating patterns
445 and type 2 diabetes risk in older women: breakfast consumption and eating frequency. *The
446 American journal of clinical nutrition*. 2013;98(2):436-43.
- 447 46. Mekary RA, Giovannucci E, Willett WC, van Dam RM, Hu FB. Eating patterns and type
448 2 diabetes risk in men: breakfast omission, eating frequency, and snacking. *The American
449 journal of clinical nutrition*. 2012;95(5):1182-9.
- 450 47. Andre MB, Dumavibhat N, Eitoku M, Hirota R, Suganuma N. Mini Nutritional
451 Assessment and functional capacity in community-dwelling elderly in Rural Luozi, Democratic
452 Republic of Congo. *Geriatrics & gerontology international*. 2013;13(1):35-42.
- 453 48. Ashwell M, Gunn P, Gibson S. Waist-to-height ratio is a better screening tool than waist
454 circumference and BMI for adult cardiometabolic risk factors: systematic review and meta-
455 analysis. *Obesity reviews*. 2012;13(3):275-86.
- 456 49. Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity in
457 developing countries. *Nutrition reviews*. 2012;70(1):3-21.
- 458 50. Cutler GJ, Flood A, Hannan PJ, Slavin JL, Neumark-Sztainer D. Association between
459 major patterns of dietary intake and weight status in adolescents. *British Journal of Nutrition*.
460 2012;108(02):349-56.

461 51. Ford DJ, Jensen GL, Bailey R, Smiciklas-Wright H, Erickson P, Wood C, et al. The
462 association between diet quality, BMI and health-related quality of life in the Geisinger Rural
463 Aging Study (GRAS). The FASEB Journal. 2013;27(1_MeetingAbstracts):245.1.

464 52. Boggs DA, Rosenberg L, Rodríguez-Bernal CL, Palmer JR. Long-term diet quality is
465 associated with lower obesity risk in young African American women with normal BMI at
466 baseline. The Journal of nutrition. 2013;143(10):1636-41.

467

468

469 **Tables**470 **Table 1. Socio-demographic characteristics of study participants**

Background characteristics	N=120	%
Sex		
Females	78	65.0
Males	42	35.0
Age (years)		
60 – 65	71	59.2
66 – 70	49	40.8
Educational Level		
None	54	45.0
Elementary School	18	15.0
Middle School	26	21.6
Secondary/Technical/Vocational	11	9.2
Tertiary	11	9.2
Religious affiliation		
Christian	107	90.0

Others *	13	10.0
Income generating activities engaged in		
Trading	53	44.1
Artisanal work †	18	15.0
Farming	11	9.2
None	38	31.7
Source of income for livelihood‡		
Money earned from income-generated activities	83	45.0
Money from children	48	34.3
Pension allowance	15	10.7
Financial support from other relations and friends	14	9.1
Person with whom respondent resided		
Alone	48	40.0
Spouse	41	34.3
Children	24	20.0
Other family members	7	6.0

471 *Muslims and traditionalists; †dress making, driving, bread baking, carpentry and mason; ‡multiple
472 responses were obtained

473 **Table 2. Eating habits, well-being and diet quality of participants**

Characteristics	N	%
Reasons for eating		
Hunger satiety	52	49.2
Health and vitality	45	37.5
Growth and longevity	13	10.8
Person responsible for meal preparation		
Respondent	56	46.7
Wife	30	25.0
Children	25	20.8
Other relations	9	7.5
Number of times respondents ate per day		
Two times	49	40.8
Three times	63	52.5
Four times	8	6.7
Usual source of meals		
Home prepared	79	65.9
Purchased	41	34.1

Factors influencing respondents' food choices

Appetite & hunger	53	43.9
Availability of food	40	33.3
Availability of money	17	13.9
No particular reason	10	8.9

Routine intake of nutrient supplements

Yes	66	55.0
No	54	45.0

Food allergies

Yes *	31	25.8
No	89	74.2

Health problems associated with eating †

Gastrointestinal gas	61	24.7
Constipation	44	17.8
Loss of appetite	28	11.3
Difficulty chewing	26	10.5
Bitterness in the mouth	26	10.5

Diarrhoea	20	8.1
Diagnosed medical conditions[†]		
Osteoarthritis	35	19.0
Visual impairment	35	19.0
Cardiovascular diseases (hypertension & stroke)	30	16.3
Dental problems	24	13.0
Hearing impairment	15	8.2
Diabetes mellitus	13	7.1
Stomach ulcer	13	7.1
Healthy habits[‡]		
Fruit consumption	41	34.2
Physical activity	37	30.8
Unhealthy habits[‡]		
Alcohol consumption	15	12.5
Tobacco smoking	9	7.5
High salt intake	6	5.0
Diet quality[¶]		

Adequate	8	6.7
Fair	48	40.0
Poor	64	53.3

474 *Common allergens allergic cassava, snails, okra, beans and pork. †Data generated from multiple
475 responses. ‡Habits were indulged in at least three times per week. ¶Dietary quality was determined
476 based on adequacy of intake of foods from seven food groups daily. Diets that included foods from
477 6-7 food groups were rated as adequate; diets that included foods from 5 groups were rated as fair
478 whilst diets that included foods from ≤ 4 groups were rated as poor.

479 **Table 3. Correlation of nutrition knowledge, diet quality and nutritional status**

Variable	% (N)	Variable	Correlation* coefficient	P value†
Nutrition knowledge*		BMI levels	0.261	0.352
Good	28.3 (34)			
Satisfactory	65.8 (79)			
Poor	5.8 (7)			
Dietary intakes †		Nutrition knowledge	0.415	0.792
Adequate	6.7 (8)			
Fair	40.0 (48)			
Poor	53.3 (64)			
BMI levels ‡		Dietary intakes	0.699	0.027
Underweight	10.0 (12)			
Normal	51.7 (62)			
Overweight	21.7 (26)			
Obese	16.6 (20)			

480 *Derived from responses given to nutrition knowledge-related statements and aggregate scores
 481 categorized as: good (36-50); fair (20-35); and poor (<20). †Determined based on adequacy of

482 intake of foods from seven food groups daily. Diets that included foods from 6-7 food groups were
483 rated as adequate; diets that included foods from 5 groups were rated as fair whilst diets that
484 included foods from ≤ 4 groups were rated as poor. †Body mass index classified as underweight
485 (BMI<18.49), overweight (BMI 25.00-29.9) and obesity (BMI >29.99)

486