

Nutrition predictors of accelerated PLHIV ageing in the ART clinics of Kampala, UgandaPeter S. Kirabira^{1&2}, Florence Nakaggwa³, Robert Basaza⁴

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ABSTRACT**Introduction**

Nutrition has important long-term consequences for health. Healthy longevity is a tangible possibility for many persons living with HIV and ageing on ART, with nutritional factors playing a key role in modulating the likelihood of their healthy ageing. In this study, we set out to understand the geriatric nutrition factors that accelerate ageing among HIV-infected persons who are actively on ART in Makindye Division in Uganda. Specifically, we assessed how un-healthy diet, fruits and vegetables, fatty foods, starchy foods, and salt intake could be having a bearing in predicting accelerated ageing among PLHIV aged 45 years and above.

Methods

A cross-sectional study was conducted in public and faith-based healthcare facilities in Makindye Division, the highest populated in Kampala District. This involved 478 PLHIV participants actively on ART aged 45 and above. They were sampled from Nsambya Hospital, Kiruddu Hospital and Ggaba Fishing Community ART clinic. Data collectors were trained, a pre-testing done, and data was exported to STATA for analysis.

Results

Confidence about current nutrition knowledge, ($p < 0.001$), eating breakfast ($p = 0.039$), preference for half the plate consisting of fruits or vegetables ($p = 0.031$), including unsalted nuts and seeds in diet ($p = 0.013$) and regularly adding salt to food during cooking ($p = 0.028$) remained with a statistically significant association with ageing among this study population even after adjusting for potential con-

founders.

Conclusion

In conclusion, eating breakfast, the preference for half the plate being fruits/vegetables, including unsalted nuts and seeds in one's diet, and regularly adding salt to food during cooking were risk factors to accelerated ageing among PLHIV aged 45+ on ART in Makindye. However, being confident about the current nutrition knowledge was protective against accelerated ageing in this particular group. We recommend sensitization and training of PLHIV aged 45+ in their ART clinics on the nutritional risk factors to their accelerated ageing, conducting of daily health education sessions and provision of IEC materials to build the confidence about their current nutrition knowledge.

Keywords: Ageing, lifestyle, Accelerated ageing, diet, fruits and vegetables, fatty foods, starchy foods, salt intake.

Introduction

HIV and sub-optimal nutrition may cause severe immunodeficiency and poor health outcomes among older persons living with HIV (WHO, 2018). Studies have shown that the prevalence of malnutrition in PLHIV may also depend on the use of HAART and presence of co-infection(s). In a study to evaluate the nutritional status prior to initiation of HAART, malnutrition was found in 22% of asymptomatic PLHIV, but the percentage changed depending on the progression of the disease (Diaz-Ramos et al., 2016). It is undisputable that patients ageing with HIV are susceptible to nutritional deficits as a result of insufficient consumption of food, anorexia, age-related changes in metabolism, and increased body demands for both macro-nutrients and micro-nutrients.

A vegetarian and plant-based diet is many times associated with slower healthier ageing and lower risk of age-related non-communicable diseases. Proper diet promotes the maintenance of optimal immune function among persons ageing with HIV. Dietary modifications, in this regard, can significantly extend the lifespan of humans, which may delay the onset of age-associated changes. One of the unhealthy improving lifestyles among PLHIV is having an unhealthy diet. It is believed, though with weak evidence in humans, that better feeding patterns delay ageing in at least two ways; by reducing pervasive damaging processes for instance inflammation, oxidative stress/redox changes and metabolic stress; and by enhancing cellular capacities for damage management and repair (Malcomson and Mathers, 2018). In a study by Kieft-de Jong et al., (2014), it was revealed that high intake of fruits, vegetables, fish, whole grains and legumes, and potatoes were associated consistently with longevity and better cardio-metabolic and cognitive health. In the same study, it was noted that older persons ended up over-cooking certain foods such as vegetables that they find hard to chew or swallow, which practice compromised their intake of crucial nutrients such as vitamin C, dietary fibre, among others. On the contrary, Daryl (2017) hypothesised that just because you don't eat meat does not mean that you are healthy, and hence concluded writing that a vegan or vegetarian diet exacerbates ageing. He argued that what vegans do not eat is a problem too because they virtually do

not get the essential fatty acids that are readily got from meat, seafood, and dairy products.

Fat is the most energy-dense nutrient, i.e. it contains the most calories per gram, and an important energy source that facilitates the absorption of fat-soluble vitamins A, D, E and K. Poor-quality foods, such as trans-fats, cause inflammation yet ageing is essentially a chronic inflammatory condition. It should also be noted that fatty meats also highly saturated fats (Gina Shaw). It is, therefore, advised that the elderly should eat fatty meat or other fatty or oily foods sparingly

The aim of this study was to investigate the association of nutrition factors with accelerated ageing among HIV clients attending the ART clinics in Makindye Division, specifically assessing how unhealthy diet, fruits and vegetables, fatty foods, starchy foods, and salt intake could be having a bearing in predicting accelerated ageing among PLHIV aged 45 years and above in the division.

Methods

Study design, setting and population

The study was cross-sectional in design, conducted over a period of 3 months from 1st August 2021 to 31st October 2021 in public and faith-based healthcare facilities in Makindye Division, the highest populated in Kampala District. A total of 478 participants was sampled from PLHIV aged 45 and above actively on ART in 3 purposively selected health facilities, namely Nsambya Hospital (a faith based facility), Kiruddu Hospital (a public facility) and Ggaba Fishing Community ART clinic. These are high volume outpatient clinics that offer comprehensive HIV prevention, care and treatment services at no cost to a total of over 40,000 patients in the division with daily clinic attendance of 400-

500 patients. We determined the number of clients required in each health facility using a Probability Proportionate by Size (PPS) sampling, while sampling within the sampled health facilities was by simple random sampling technical to randomly select the ART client numbers for the cases based on the computer generated appointment list in each facility before commencement of data collection.

Data collection

The enrolled study participants were subjected to an interviewer administered structured questionnaire by graduate level, who were first trained as data collectors. Pre-testing of the tools was done, and the interviews were conducted in either English or Luganda (the native and most commonly used local language in the clinic catchment region). Demographic characteristics including age, gender, weight, height, religion, marital status, highest educational level attained, ever disclosure of their HIV status, current ARV drug combination and duration on treatment. In addition, information on unhealthy diet, fruits and vegetables, fatty foods, starchy foods, and salt intake was collected. The data was entered in KoBoCollect Software Application and then exported to STATA for analysis. The qualitative key informant data was analysed using thematic analysis. Confidentiality and privacy were ensured. Ethical approval was sought and informed consents obtained from the study participants, with both the local approving IRB/REC and national regulatory body, the Uganda National Council for Science and Technology closely monitoring the study.

Results

A majority of the respondents indicated that they eat a healthy diet (63.2%), were confident about their current nutrition knowledge (63.2%), had a set eating pattern and indicated that they eat breakfast

(88.7%); only a quarter of the respondents indicated that they snack between meals (25.3%). Regarding consumption of fruits and vegetables, almost all the participants (98.1%) thought that eating fruits and vegetables was important, however, only 9% and 10.7% said that they ate 5 portions fruits and vegetables on a daily basis respectively; additionally, 35.4% and 37.9% respectively indicated that they eat more than four (4) different varieties of fruits and vegetable varieties weekly. More than half of the respondents preferred that half of their plate was fruits or vegetables (57.5%).

Table 1: Nutrition factors associated with ageing among HIV positive clients aged 45 years and above

Variable	Frequency (N=478)	No (N=268)	Yes (210)	p-value
Eat a healthy diet				0.081
No uncertain	139 (29.1%)	67 (48.2%)	72 (51.8%)	
Yes	37 (7.7%)	21 (56.8%)	16 (43.2%)	
	302 (63.2%)	180 (59.6%)	122 (40.4%)	
Confident about current nutrition knowledge				0.000*
No	174 (36.4%)	75 (43.1%)	99 (56.9%)	
Yes	304 (63.6%)	193 (63.5%)	111 (36.5%)	
Have set eating pattern				0.129
No	282 (59.0%)	150 (53.2%)	132 (46.8%)	
Yes	196 (41.0%)	118 (60.2%)	78 (39.8%)	
Eat breakfast				0.016*
No	54 (11.3%)	22 (40.7%)	32 (56.3%)	
Yes	424 (88.7%)	246 (58.0%)	178 (42.0%)	
Snack in between meals				0.274
No	357 (74.7%)	195 (54.6%)	162 (45.4%)	
Yes	121 (25.3%)	73 (60.3%)	48 (39.8%)	
Think it is important to eat fruits& vegetables				0.085†
No	9 (1.9%)	8 (88.9%)	1 (11.1%)	
Yes	469 (98.1%)	260 (55.4%)	209 (44.6%)	
Eat more than 5 portions of fruit daily				0.972
No	435 (91.0%)	244 (56.1%)	191 (43.9%)	
Yes	43 (9.0%)	24 (55.8%)	19 (44.2%)	
Eat more than 5 portions of vegetables daily				0.170
No	427 (89.3%)	244 (57.1%)	183 (42.9%)	
Yes	51 (10.7%)	24 (47.1%)	27 (52.9%)	
Eat > 4 different fruit variety weekly				0.070
No	308 (64.6%)	163 (52.9%)	145 (47.1%)	
Yes	169 (35.4%)	104 (61.5%)	65 (38.5%)	
Eat > 4 different vegetable variety weekly				0.106
No	297 (62.1%)	158 (53.2%)	139 (46.8%)	
Yes	181 (37.9%)	110 (60.8%)	71 (39.2%)	
Prefer that half your plate is fruits/vegetables				0.000*
No	203 (42.5%)	133 (65.5%)	70 (34.5%)	
Yes	275 (57.5%)	135 (49.1%)	140 (50.9%)	
Choose low fat products when available				0.197
No	196 (41.0%)	103 (52.6%)	93 (47.5%)	
Yes	282 (59.0%)	165 (58.5%)	117 (41.5%)	

Choose baked, steamed, grilled options				0.334
No	115 (24.1%)	60 (52.2%)	55 (47.8%)	
Opt for lean meat cuts/remove visible fat		<u>208 (57.3%)</u>		0.301
No	229 (47.9%)		95 (41.5%)	
Yes		134 (58.5%)		
Include unsalted nuts and seeds in diet				0.000*
No	372 (77.8%)	225 (60.5%)	147 (39.5%)	
Base main meals around starchy foods				0.547†
No	11 (2.3%)	5 (45.5%)	6 (54.6%)	
Regularly choose whole meal bread				0.360
No	376 (80.3%)	212 (56.4%)	164 (43.6%)	
Regularly eat whole grain cereal-no added sugar				0.222
No	422 (90.0%)	230 (54.5%)	192 (45.5%)	
	47 (10.0%)	30 (63.8%)	17 (36.2%)	
Regularly include pulses in diet				0.460
No	98 (20.6%)	58 (59.2%)	40 (40.8%)	
Add sugar to drinks				0.733
No	41 (8.6%)	22 (53.7%)	19 (46.3%)	
Regularly drink sweet carbonated drinks				0.349
No	232 (48.5%)	125 (53.9%)	107 (46.1%)	
Regularly eat cakes, mandazi, sweets biscuits				0.073
No	330 (69.0%)	194 (58.8%)	136 (41.2%)	
Regularly add salt to food during cooking				0.004*
No	37 (7.7%)	29 (78.4%)	8 (21.6%)	
Regularly add salt to meals at the table				0.608
No	263 (55.1%)	145 (55.1%)	118 (44.9%)	
Regularly eat salty snacks				0.684
No	203 (42.5%)	116 (57.1%)	87 (42.9%)	
Regularly eat processed meats				0.268
No	423 (88.5%)	241 (57.0%)	182 (43.0%)	

* Denotes statistical significant at $p<0.05$ †Fisher's exact test used

Confidence about current nutrition knowledge ever, revealed that the odds of ageing among respondents who eat breakfast remained the same. (p<0.001) was associated with ageing while on ART. However, at multivariate analysis, there was

a 10% increase in the odds for respondents who were confident about their nutrition knowledge from 0.4 to 0.5 (adjOR=0.5; 95%CI 0.3-0.7). The preference for half the plate being fruits/vegetables (p<0.001) was associated with ageing while on ART. At multivariate analysis, there was

a reduction in the odds of ageing among respondents who preferred that half their plate consisted of fruits or vegetables (from unadjOR=2.0 to adjOR=0.5; 95%CI 0.3-0.7). Eating breakfast (p=0.016) was associated with respondents who preferred that half their plate consisted of fruits or vegetables (from unadjOR=2.0 to adjOR=0.5; 95%CI 0.3-0.7). Multivariate analysis, however, revealed that the odds of ageing among respondents who eat breakfast remained the same. (p<0.001) was associated with ageing while on ART. However, at multivariate analysis, there was

jOR=1.6).

Including unsalted nuts and seeds in one’s diet (p<0.001) was associated with ageing while on ART. At multivariate analysis, there was a reduction in the odds of ageing among respondents who included unsalted nuts and seeds in their diet and (from unadjOR=2.2 to adjOR=1.8).

Regularly adding salt to food during cooking (p=0.004) was associated with ageing while on ART. Multivariate analysis revealed that there was a reduction in the odds of ageing among respondents who regularly added salt to their food during cooking (from unadjOR=3.1 to adjOR=2.6).

Hence at bivariate level, the nutrition factors that were found associated with ageing while on ART were confidence about current nutrition knowledge (p<0.001), eating breakfast (p=0.016), preference

for half the plate being fruits/vegetables (p<0.001), including unsalted nuts and seeds in one’s diet (p<0.001) and regularly adding salt to food during cooking (p=0.004).

At multivariate analysis, the odds of ageing among respondents who eat breakfast remained the same, while there was a 10% increase in the odds for respondents who were confident about their nutrition knowledge from 0.4 to 0.5 (adjOR=0.5; 95%CI 0.3 -0.7). While there was a reduction in the odds of ageing among respondents who preferred that half their plate consisted of fruits or vegetables (from unadjOR=2.0 to adjOR=1.6), those who included unsalted nuts and seeds in their diet and (from unadjOR=2.2 to adjOR=1.8) and those who regularly added salt to their food during cooking (from unadjOR=3.1 to adjOR=2.6), these respondents still had higher odds compared to those that had responded “no” to these components.

Table 2: Relationship between ageing and nutrition factors

Variable	Unadj OR (95%	p-value	Adj. OR (95%	p-value
Confident about current nutrition knowledge				
No	1 (Reference)		1 (Reference)	
Yes	0.4 (0.3-0.6)	<0.001*	0.5 (0.3-0.7)	<0.001*
Eat breakfast				
No	1 (Reference)		1 (Reference)	
Yes	0.5 (0.3-0.9)	0.018*	0.5 (0.3-1.0)	0.039*
Prefer that half your plate is fruits/vegetables				
No	1 (Reference)		(Reference)	
Yes	2.0 (1.4-2.8)	<0.001*	1.6 (1.0-2.3)	0.031*
Include unsalted nuts and seeds in diet				
No	1 (Reference)		(Reference)	
Yes	2.2 (1.4-3.5)	<0.001*	1.8 (1.1-2.9)	0.013*
Regularly add salt to food during cooking				
No	1 (Reference)		1 (Reference)	
Yes	3.1 (1.4-6.9)	0.006*	2.6 (1.1-5.9)	0.028*
* Denotes statistical significant at p<0.05				

In summary, Confidence about current nutrition knowledge, (p<0.001), eating breakfast (p=0.039), preference for half the plate consisting of fruits or vegetables (p=0.031), including unsalted nuts and seeds in

diet ($p=0.013$) and regularly adding salt to food during cooking ($p=0.028$) remained with a statistically significant association with ageing among this study population even after adjusting for potential confounders.

Discussion

Nutrition is all about eating a balanced healthy diet so that the body of the HIV positive client gets its nutrient requirements by looking at the quality and variety food and the pleasure of eating it. A majority of the respondents indicated that they eat a healthy diet (63.2%) and were confident about their current nutrition knowledge (63.2%). In fact, bivariate analysis revealed that confidence about current nutrition knowledge ($p<0.001$) was associated with ageing while on ART. There is still a co-existence of high malnutrition rates HIV/AIDS in Eastern Africa hence the need for additional knowledge and nutritionists in every ART clinic. The odds of ageing were lower among respondents who were confident about their nutrition knowledge (unadjOR=0.4; 95%CI 0.3-0.6). At multivariate analysis, there was a 10% increase in the odds for respondents who were confident about their nutrition knowledge from 0.4 to 0.5 (adjOR=0.5; 95%CI 0.3-0.7). It's been noted that many HIV clients on ART tend to be limited in their confidence to demonstrate this nutritional knowledge when they come to the clinic for drug refill. One of the Key informants actually said that: For years though, we've all been told that breakfast is the most important meal of the day, but it be noted that the consumption of breakfast is associated with positive outcomes for diet quality, micronutrient intake, weight status and lifestyle factors (Adolphus., 2013). In this study, 88.7% of the respondents had a set eating pattern and indicated that they eat breakfast and bivariate analysis revealed that eating breakfast ($p=0.016$) was associated with ageing while on ART. The odds of ageing were lower among respondents who said that they eat breakfast compared to those that did not. At multivariate analysis, the odds of ageing among respondents who eat breakfast remained the same. This implies that breakfast also makes a large contribution to daily micronutrient intake (Balvin Frantzen et al., 2013). What you put on your plate might affect what you see in the mirror. Regarding consumption of fruits and vegetables, almost all the study participants (98.1%) thought that eating fruits and vegetables was important, however, only 9% and 10.7% said that they ate 5 portions fruits and vegetables on a daily basis respectively, and more than half of the respondents preferred that half of their plate was fruits or vegetables (57.5%). However, bivariate analysis also revealed that preference for half the plate being fruits/vegetables ($p<0.001$) was associated with ageing while on ART. In fact, the odds of ageing were 2 times higher among respondents who preferred that half their plate consisted of fruits or vegetables (unadjOR=2.0; 95%CI 1.4-2.8). A diet rich in fruits and vegetables can slow the ageing process simply because fruits and vegetables are full of antioxidants and helper molecules which are both key in searching for free radicals in the body and can prevent oxidative damage to cells which increases with age (Bogdonas., 2019). At multivariate analysis, there was a reduction in the odds of ageing among respondents who preferred that half their plate consisted of fruits or vegetables (from unadjOR=2.0 to adjOR=1.6). this is in agreement with one study that found eating at least five portions of fruit and vegetables every day can add three years to your life (Linda Carroll.,

2021). This would extend life and reduced the rate of ageing among HIV patients on ART. In reality the goal should be having 5-9 servings of fruits and vegetables every day which is equivalent to half of a plate with different fruits and vegetables at each meal so as to obtain the maximum minerals and vitamins as they age on ART.

Nuts are rich in monounsaturated and polyunsaturated fatty acids, fiber, vitamins and minerals that have a synergistic effect to reduce inflammation and its effects on the body (Fetters., 2016). In this study, less than a quarter of the respondents indicated that they include unsalted nuts and seeds in their diet (22.2%) and bivariate analysis additionally revealed that including unsalted nuts and seeds in one's diet ($p < 0.001$) was associated with ageing while on ART. In fact, the odds of ageing were more than twice higher among those who included unsalted nuts and seeds in their diet (unadjOR=2.2; 95%CI 1.4-3.5). Most nuts, almonds especially, reduce inflammation that can cause skin to look older prematurely. Eating nuts and seeds is a great healthy snack option that also has anti-aging properties. At multivariate analysis, there was a reduction in the odds of ageing among respondents who included unsalted nuts and seeds in their diet and (from unadjOR=2.2 to adjOR=1.8). Uganda has a lot of pumpkin and sunflower nuts and seeds which largely contain vitamin E, which keeps the skin radiant and healthy-looking, hence this finding was protective among the HIV clients aged 45 years and above in the ART clinics of Makindye division.

There are certain "forbidden" foods which are only okay to eat in moderation, primarily because of their risk of medical conditions as they get older, particularly faster ageing, heart disease, high blood pressure and type 2 diabetes. The study respondents who regularly ate salty snacks and ate processed meat were 57.6% and 11.5% respectively and bivariate analysis in addition revealed that regularly adding salt to food during cooking ($p=0.004$) was associated with ageing while on ART. The ageing process is majorly accelerated by exposure to free radicals as a result of crosslinking which affects the DNA molecules hence weakening the elasticity of the skin, which is worsened when you consume a lot of salt that automatically leads to dehydration of the skin. In this study, the odds of ageing were over 3 times higher for those who regularly added salt to food during cooking (unadjOR=3.1 (1.4-6.9), but at multivariate analysis, there was a reduction in the odds of ageing among respondents who regularly added salt to their food during cooking (from unadjOR=3.1 to adjOR=2.6). This was not in line with findings by other scholars that although sodium was known to raise the blood pressure, which can lead to fatal heart attacks and strokes, eating too much salt was discovered speed up the ageing process for the first time (Knapton., 2014). It is envisaged that Ugandans, particularly those in the ART clinics in Makindye Division, do not take it as important to keep their salt intake as low as possible as they get older so as to help them make sure that their blood pressure stays within a healthy range.

Conclusions and Recommendations

Eating breakfast, the preference for half the plate being fruits/vegetables, including unsalted nuts and seeds in one's diet, and regularly adding salt to food during cooking are risk factors to accelerated ageing among PLHIV aged 45+ on ART in Makindye. On the other hand, being confident about the current nutrition knowledge is protective against accelerated ageing among PLHIV aged 45+ on ART in Makindye.

We, therefore, recommend that Makindye division

administration should prepare and budget for a 6-month drive across the division to sensitize and train the PLHIV aged 45+ in their ART clinics on the nutritional risk factors to their accelerated ageing. The topics should include: Eating breakfast, the preference for half the plate being fruits/vegetables, including unsalted nuts and seeds in one's diet, and regularly adding salt to food during cooking, among others. Health facilities on the other hand should also conduct daily health education sessions and provide IEC materials so as to build the confidence about the current nutrition knowledge of the PLHIV aged 45+ on ART in Makindye ART clinics.

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