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ARTICLE

Nutrition risk and validation of an HIV disease-specific nutrition screening tool in Ghana

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Objectives: The objectives of this study were to assess the nutritional status and the most commonly reported nutrition-related factors contributing to nutritional risk in people living with HIV/AIDS (PLWHA) in Ghana and the specificity and sensitivity of the Rapid Nutrition Screening for HIV disease tool (RNS-H) in this population.
Design: A cross-sectional design was utilised. Patients were screened for nutritional status during a one-week period by clinic nurses using the RNS-H. Results were compared with a comprehensive nutritional assessment by a dietitian.
Setting: The research was conducted in a public health clinic at the University of Ghana Hospital, Legon.
Subjects Patients receiving care at the clinic were asked to participate.
Outcome measures: The nutritional screening and nutritional assessment both resulted in participants being assigned to one of three nutritional statuses: 'low risk', 'at risk' and 'high risk'. The association between the nutritional screening and nutritional assessment was measured.
Results: The results of the nutritional status assigned by the RNS-H and nutritional assessment were compared. A total of 51 patients participated. A high prevalence of nutritional risk based on the RNS-S (54.9%) was found with 33.3% of the sample being malnourished. The most common nutrition-related complications were food insecurity, poor appetite, weight loss and diarrhoea.
Conclusions: The RNS-H was found to have a strong specificity and sensitivity in a sample of Ghanaian PLWHA. Because of the nutritional risk and complexity of HIV in Ghana, nutritional screening using the RNS-H and nutrition care by a dietitian should be a standard of care.

Keywords: malnutrition, nutrition risk, nutrition screening, validity

Introduction

HIV continues to be a major global public health issue. According to the World Health Organization, an estimated 36.9 million people were living with the human immunodeficiency virus (HIV) worldwide in 2017.[1] While Africa overall has the highest prevalence of HIV among adults worldwide, the population HIV prevalence across West Africa varies substantially.[1] In Ghana, 1.7% of adults aged 15–49, or 310 000, live with HIV.[2]

The impact of HIV disease on nutritional status is profound. The classic presentation of HIV was wasting and undernutrition with the most common nutrition-related complications being diarrhoea, poor appetite, nausea and anaemia.[3] With the introduction of highly active antiretroviral therapy (HAART), undernutrition has become less prevalent and nutrition-related complications related to obesity and metabolic alterations have developed.[4] These complications predispose people living with HIV/AIDS (PLWHA) to an additional set of nutritional problems including cardiovascular disease, hypertension and diabetes.[5] As a result, people living with HIV/AIDS (PLWHA) experience a greater array of complex nutritional issues that continue to place them at higher nutritional risk. While the prevalence and types of nutrition-related complications are well documented in the United States,[4] few studies are available on the most common nutritional issues experienced by PLWHA in Ghana. The World Food Programme found 16% of the HIV-affected Ghanaian households were food insecure.[6] No evidence of routine nutritional screening for PLWHA is available in those living with HIV who are on antiretroviral therapy.[7]

The goals of nutrition intervention for PLWHA include treatment of conditions leading to undernutrition, maintenance of nutritional status, management of comorbid conditions such as obesity, diabetes and hyperlipidaemia, and management of nutrition-related side effects from antiviral therapy.[8] Early screening of nutritional risk in people with HIV disease is therefore essential. However, few nutrition screening tools have been developed for HIV-infected individuals and none have been validated for this population. Recently, a disease-specific nutrition screening tool was developed by registered dietitians in a US sample of 96 PLWHA. Analyses of the Rapid Nutrition Screening for HIV disease (RNS-H) tool showed a very high degree of relative validity (Kendall's tau = 0.973, $p < .0005$) and cross-cultural validity (Kendall's tau = 1.00, $p < 0.0005$).[9] The tool, however, has not been validated in other populations of PLWHA.

Due to the lack of a disease-specific, validated nutrition screening tool and the nutritional acuity of PLWHA, the objectives of this research were (1) to assess the nutritional status and most common nutrition-related complications experienced by PLWHA in Ghana and (2) to assess the specificity and sensitivity of the Rapid Nutrition Screening for HIV disease tool in this population.

Methods

The research was conducted at a public health clinic at the University of Ghana Hospital, Legon. A cross-sectional design was utilised. A convenience sample of all patients receiving care at the clinic was used. Patients were asked to participate while they waited to be seen by the clinic physician. Inclusion criteria included: (1) HIV positive, (2) receiving care in the clinic, and (3) aged 15 years and above. Exclusion criteria included: (1) not receiving antiretroviral therapy, or (2) an active opportunistic infection. Participants were screened for nutritional status by a clinic nurse and then received a comprehensive nutritional assessment by an advanced-practice dietitian.

Nutritional assessment

Patients were screened for nutritional status during a one-week period by a clinic nurse using the RNS-H. All nurses at the clinic ($n = 3$) were trained on how to use the RNS-H tool prior to the start of the research. The RNS-H tool has seven questions, which are listed in Table 1. Each item on the RNS-H tool has an assigned point value based on severity and contribution to nutritional risk. A RNS-H score of 0–3 is defined as 'low risk', 4–6 is defined as 'at risk' and 7–15 is defined as 'high risk'. Each participant also met on the same day as the nutrition screening with one of two registered dietitians who completed a comprehensive nutritional assessment guided by the Academy of Nutrition and Dietetics' Nutrition Care Process (NCP). NCP is a standardised process for providing nutritional care that was designed to improve the consistency and quality of individualised care for patients and the predictability of the patient outcomes.[9] The comprehensive nutritional assessment consisted of: (1) subjective nutrition-related data including appetite, intake, food access, weight history, bowel function, and chewing and swallowing ability; and (2) objective nutrition information including height, weight, medications and medical conditions. During the nutritional assessment, the registered dietitian also assessed the patient for malnutrition using the ASPEN/Academy of Nutrition and Dietetics Malnutrition Criteria (Table 2).[10,11] The six indicators were evaluated: (1) energy intake, (2) weight loss, (3) body fat (assessed orbital fat pads, triceps and biceps pinch), (4) muscle mass (assessed temple, shoulders, clavicle, scapula, interosseous), (5) fluid accumulation (assessed skin turgor and pitting oedema), and (6) grip strength (assessed hand grip). The ASPEN/Academy of Nutrition and Dietetics Malnutrition Criteria standards for moderate and severe were utilised.

Table 1: Rapid Nutrition Screening for HIV disease (RNS-H)[9,23]

1. Within the past 12 months I have worried whether my food would run out before I got money to buy more (1 point)
2. Within the past 12 months the food I bought just didn't last and I didn't have money to get more (1 point)
3. BMI*:
1. < 18.5 (3 points)
2. 18.5–24.9 (0 points)
3. 25–29.9 (1 point)
4. ≥ 30 (2 points)
4. I have been diagnosed with HIV within the past 6 months (3 points)
a. When diagnosed? _____
5. I have one or more of the following conditions: diabetes, heart disease, high blood pressure (2 points) Check all that apply:
_____ diabetes_____ heart disease _____ high blood pressure _____ lipodystrophy
6. I have lost more than 10 pounds over the past 6 months without trying (3 points)
7. I have one of the following: difficulty swallowing, nausea with vomiting, poor appetite or chronic diarrhoea (2 points). Check all that apply:
_____ difficulty swallowing _____ nausea with vomiting _____ poor appetite _____ chronic diarrhoea
0–3 points 1. Normal nutrition status 4–6 points 2. At nutrition risk 7–17 points 3. High nutrition risk

*BMI = (weight in pounds / (height in inches x height in inches)) x 703.

Usability testing

For usability testing, clinic nurses provided feedback on the design and ease of use of the screening tool.

Specificity and sensitivity

Analyses were conducted testing the validity of the nutrition screening tool. The nutritional screening and nutritional assessment both resulted in participants being assigned to one of three nutritional statuses: 'low risk', 'at risk' and 'high risk'. The dietitian's assessment was considered to be the standard for all statistical analyses. The registered dietitians and nurses were blind to the ratings of all others. To test for the validity of the screening tool, we measured the association between the dietitians' and nurses' ratings using the screening tool. Because both ratings were ordinal, we used Kendall's tau as the measure of association. Missing data were excluded using list-wise deletion. The alpha level for association was set at 0.05. Data were examined using SPSS (Version 25; IBM Corp, Armonk, NY, USA). The demographic data collected consisted of participant age and gender and were reported as percentages.

The study received institutional review approval (#1251716-1) from the University of North Florida and University of Ghana. Clients provided informed consent and those < 18 years of age provided assent and their caregiver provided consent. Quality was controlled for in the nutrition screening and nutritional assessment processes by using standardised tools and training the dietitians and nurses involved. Patients were seen in a private examination area and the dietitians have all completed training in research ethics. No identifiable information was collected to maintain anonymity.

Results

Nutritional assessment

One hundred per cent of clinic patients who met eligibility criteria were screened during the one-week period for a total of 51 patients. Some 71% of the clients were female ($n = 36$) and 29% were male ($n = 15$). Ages of the participants ranged from 15 to 75 years, with a mean age of 42.7 years. All patients seen were on antiretroviral therapy. Regarding nutritional status, 39.2% were 'low risk' while 26.4% were 'at risk' and 31.4% were at 'high risk' as classified by the results of the nutritional assessment. During the nutritional assessment, 12 women and 5 men, or 33.3% of the sample, met the ASPEN/Academy of Nutrition and Dietetics Malnutrition Criteria,[10,11] and were diagnosed as malnourished by the registered dietitians. As noted in Table 3, the most commonly reported nutrition-related factors contributing to nutritional risk were: (1) food insecurity (35.3%, $n = 18$), (2) poor appetite (33.3%, $n = 17$), (3) weight loss (27.5%, $n = 14$), (4) hypertension (15.7%, $n = 8$), and (5) diarrhoea (11.8%, $n = 6$).

Usability testing

The clinic nurses reported the RNS-H to be understandable and easy to use. They did offer suggestions on culturally appropriate

Table 2: Academy/ASPEN malnutrition criteria[10]

	Chronic illness		Acute illness	
Indicator	**Moderate**	**Severe**	**Moderate**	**Severe**
Energy intake	< 75% of energy needs for > 7 days	≤ 50% of energy needs for ≥ 5 days	< 75% of energy needs for ≥ 1 month	≤ 75% of energy needs for ≥ 1 month
Weight loss	1–2% 1 week 5% 1 month 7.5% 3 months	> 2% 1 week > 5% 1 month > 7.5% 3 months	5% 1 month 7.5% 3 months 10% 6 months 20% 1 year	> 5% 1 month > 7.5% 3 months > 10% 6 months >20% 1 year
Loss of subcutaneous fat	Mild	Moderate	Mild	Severe
Muscle mass	Mild	Moderate	Mild	Severe
Fluid accumulation	Mild	Moderate to severe	Mild	Severe
Grip strength	N/A	Measurably reduced	N/A	Measurably reduced

Table 3: Most common nutrition-related complications

Complication	Female ($n = 36$)	Male ($n = 15$)	Total
Food insecurity	13 (36.1%)	5 (33.3%)	18 (35.3%)
Poor appetite	12 (33.3%)	5 (33.3%)	17 (33.3%)
10+ pounds weight loss	10 (27.8%)	4 (26.7)	14 (27.5%)
Hypertension	5 (13.9%)	3 (20%)	8 (15.7%)
Diarrhoea	4 (11.1%)	2 (13.3%)	6 (11.8%)
Nausea/vomiting	4 (11.1%)	0 (0%)	4 (7.8%)
Dysphagia	3 (8.3%)	0 (0%)	3 (5.9%)
High cholesterol	1 (2.8%)	0 (0%)	1 (2%)
Coronary artery disease	0 (0%)	0 (0%)	0 (0%)
Diabetes mellitus	0 (0%)	0 (0%)	0 (0%)

wording for items such as dysphagia during their training with the tool. The suggestions were incorporated in the screening form before use with patients. The nurses reported that the screening took on average five minutes to complete, which they felt was feasible within their current workload.

Specificity and sensitivity

Nutritional status as measured by the screening tool and by the dietitian's assessment is listed in Table 4. No inter-observer differences were observed between clinic nurses. There was a high degree of association between nutritional risk status as measured by the RNS-H screen and the dietitian's complete nutritional assessment (Kendall's tau = 0.788, $p < 0.0005$). There was 86.2% agreement on 'low risk' status, 83.3% agreement on 'at risk' status, and 62.5% agreement on 'high-risk' status. In practical use, either a nutritional status of 'at risk' or 'high risk' on the RNS-H produces a referral for a complete nutritional assessment. Therefore, to measure sensitivity and specificity in the practical use of the screening tool, we collapsed the scores on the screen and the dietitian's assessment to 'Referral Needed' ('at risk' or 'high risk') on 'No Referral Needed' ('low risk'). On this measure, the screening tool and dietitian assessment were in concordance 90.2% of the time (46 of 51 observations). When the screening tool indicated case status as 'No Referral Needed' (23 of 51 observations), the dietitian assessment was in concordance 82.6% of the time (19 of 23 observations). When the screening tool indicated nutritional status as 'Referral Needed' (28 of 51 observations), the dietitian's assessment was in concordance 96.4% of the time (27 of 28 observations). Specificity of the screening tool was very good. However, sensitivity was lower than expected: 17.3% of cases where the screening assessments indicated 'No Referral Needed' were deemed to be either 'at risk' or 'high risk' by the dietitian's assessment.

Table 4: Nutrition status assigned by screening tool and dietitian assessment

Nutrition status	Female	Male	Total
Screening tool:			
Not at risk	16 (44.4%)	7 (46.7%)	23 (45.1%)
At risk	14 (38.9%)	4 (26.7%)	18 (35.3%)
At high risk	6 (16.7%)	4 (26.7%)	10 (19.6%)
Dietitian assessment:			
Not at risk	14 (38.9%)	6 (40.0%)	20 (39.2%)
At risk	11 (30.6%)	4 (26.7%)	15 (29.4%)
At high risk	11 (30.6%)	5 (33.3%)	16 (31.4%)

Differences between genders in the practical use of the RNS-H were minimal. In the 'Referral Needed' status, there was 90.9% concordance among women and 88.8% concordance among men. In the 'No Referral Needed' group, there was 87.5% concurrence among women and 85.7% concordance among men.

Discussion

Based on the results of this study, PLWHA in Ghana are at increased nutritional risk. The high prevalence of nutritional risk as measured by the RNS-H (54.9%) is consistent with 33.3% of the sample being diagnosed as malnourished. Nutrition-related complications showed more of a classical, or wasting-related, presentation with food insecurity, poor appetite, weight loss and diarrhoea most prevalent. The one metabolic-related complication seen was hypertension, which was prevalent in 15.7% of the sample. As all patients in the study were on antiretroviral therapy it was anticipated that more metabolic-related complications would be found. The research was conducted at a clinic in Accra, which is the biggest metropole in the country. This city is beginning to experience a nutrition transition,[12] which may also account for the development of a metabolic-related complication amidst the wasting-related complications. The nutritional issues among PLWHA in this sample appear to be more complex because of the greater range of nutrition complications experienced. This argues for nutrition screening and provision of medical nutrition therapy by a dietitian and therefore is the standard of care encouraged in the public health clinics. The prevalence of food insecurity (35.3%) was

consistent with other studies (48–52%) globally and in the United States (46%) in HIV disease but higher than the prevalence found by the World Food Programme.[4,6,13,14] In their analysis of food and nutrition assistance to HIV-infected populations in Ghana, Laar *et al*.[15] note that HIV and food insecurity are connected in a vicious cycle. While food insecurity can increase susceptibility to HIV exposure and infection, HIV in turn increases vulnerability to food insecurity.[16] Singer and Clair refer to this as syndemics: when two or more epidemics interact synergistically and, as a result of their interaction, contribute to an excess burden of disease.[17] In fact, recent studies have found that food insecurity is associated with poor antiretroviral effectiveness including lower CD-4 counts, higher HIV viral loads, greater acute care utilisation, and higher HIV/AIDS-related morbidity and mortality.[18–21] Additional studies have demonstrated that food insecurity in PLWHA is associated with suboptimal antiretroviral treatment adherence.[22] Therefore, both nutrition- and food-intervention programmes are critically needed to support health and disease management. Jones highlights a large number of nutrition screening tools available for general use but emphasises that the tools have been validated for use only in specific patient populations, by different professions, and validated using different techniques.[23] The RNS-H was developed specifically for HIV disease and found to have a high specificity and sensitivity for PLWHA in the United States. This study, however, found the RNS-H had a high specificity but lower sensitivity when used in a Ghanaian population of PLWHA. This may be due to the fact that the RNS-H was developed in the United States where the most common nutritional complications are metabolic-related (obesity and obesity-related diseases) while wasting-related complications are not as common. Differential weighting of items based on population characteristics may improve the specificity. Overall, though, there is evidence that the RNS-H has acceptable validity in this population and can serve as an effective tool for identifying PLWHA who need nutritional care. In this study, nurses utilised the screening tool and they reported that it was quick to administer and easy to use—characteristics highly desirable in a screening tool. Further, the nurses assisted with making the tool more culturally appropriate. The tool can potentially be used with the HIV/AIDS population across a variety of settings within Ghana. There are several strengths of this study. The RNS-H is the first HIV-specific nutrition screening tool that has been developed and the tool has now been shown to have specificity in the Ghanaian population of PLWHA. The RNS-H has been shown to be useful in a variety of practice settings. Limitations of this study include a small sample size, which may have limited the specificity analysis. The low number of participants may have affected the reliability of the specificity analysis as the 17.3% discordance reflects only three participants. The research was conducted in only one clinic, which could limit the generalizability. Future studies should use a larger number of participants to validate the tool for specific populations. Next steps are to re-weigh the RNS-H to better reflect the most common nutrition complications and re-test its specificity and sensitivity in Ghana. We also would like to use the results of this study to advocate for nutrition screening and provision of dietitian services to be required in the public health clinics.

Conclusion

This study demonstrates that PLWHA in Ghana are at high nutrition risk and many are malnourished. Complications contributing to nutritional risk are primarily wasting-related, but some metabolic-related complications are beginning to be seen. The RNS-H, a HIV-specific nutrition screening tool that has been validated in a US population of PLWHA, was found to have a strong specificity and sensitivity in a sample of Ghanaian PLWHA. Because of the nutritional risk and complexity of HIV in Ghana, nutritional screening using the RNS-H and nutrition care by a dietitian should be a standard of care.

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