Nutrition evaluation in HIV seropositive patients using the Malnutrition Universal Screening Tool and Subjective Global Assessment in Ibadan, Nigeria

[1]Folasire O.F*; [2]Adebayo A. & [3]Sanusi R.A.

[1]*Department of Human Nutrition, University of Ibadan & Department of Family Medicine, University College Hospital, Ibadan, Nigeria*

[2]*Department of Community Medicine, University of Ibadan, Nigeria*

[3]*Department of Human Nutrition, University of Ibadan, Nigeria*

**Corresponding author:yemisifolasire2011@gmail.com*

ABSTRACT

Background: *Early identification of nutritional risks in People Living With HIV/AIDS (PLWHA) in low-income settings depends onan awareness of the available and reliable tools.*

Objectives*:The study was designed to compare the nutritional status evaluation of PLWHA using the Malnutrition Universal Screening Tool (MUST) and Subjective Global Assessment (SGA) tool, and to also determine the cut-off values of MUST and SGA that corresponds to underweight with BMI (<18.5kg/m^2) as the gold standard.*

Methodology*: The study reviewed records of HIV seropositive patients between May and October 2008 at the antiretroviral clinic, University College Hospital, Ibadan, Nigeria. Clinical symptoms and anthropometric data of 120 PLWHA were extracted from the hospital records for nutritional evaluation by the BMI, MUST, and SGA tools. Descriptive and inferential statistics were employed in data analysis.Cut-off values for MUST and SGA tools in identifying underweight (BMI<18.5) were determined using Receiver Operation Curve (ROC) analysis.Level of significance was placed at p<0.05.*

Results*: Prevalence of underweight was 5.8%(BMI), 75.8% were at high risk of malnutrition (MUST score ≥2) while 42.3% had suspected and severe malnutrition (SGA B&C) respectively. There is a significant difference between MUST and SGA risk of malnutrition χ^2=17.331, p= 0.000. ROC curve for MUST was more accurate in identifying underweight compared with SGA (AUC=0.900, C.I=0.778 to 1.012, p=0.000 vs AUC=0.700, C.I=0.476 to 0.934, p=0.070). At a MUST score of 3.4 and SGA of 6.0, about 10% and 30% of the underweight respondents were not identified.*

Conclusion*: With the use of MUST and SGA tools, more PLWHA were at risk of malnutrition. Thus, combined use of MUST and SGA gives a better assessment than BMI.*

Key words: Nutritional assessment, MUST, SGA, PLWHA, Nutrition screening

INTRODUCTION

Individuals infected with the human immuno-deficiency virus (HIV) may be at nutritional risk at any point in their illness [1]. Severe malnutrition and weight loss, particularly loss of lean tissue, and delayed weight gain can further worsen morbidity and mortality[2]. The incidence of malnutrition amongst HIV seropositive patients has reduced in the Western world, on account of the use of highly active antiretroviral therapy (HAART)[1]. This trend is different from the picture observed in the developing countries where inadequate nutrient intake still contributes tremendously to weight loss in PLWHA[3].

The prevalence of malnutrition amongst PLWHA in developing settings of the world ranged from about 10.0% to about 77.0%, depending on the screening method and tools used in the assessment[4-8].With the use of body mass index (BMI<18.5kg/m^2), between 3.7% and 48.0% of PLWHA were reported to bemalnourished from Cuba, Ethiopia, China, Brazil and

Nigeria [9-13].The use of quick assessment tools in previous studies, reported malnutrition in PLWHA as ranging from 20% to 58.0%(SGA B&C) and 77% (MUST)[10,14].

Despite the use of highly active antiretroviral therapy, the issue of low BMI <18.5, persistent weight loss and wasting remains a concern. It has been documented that PLWHA may still be losing weight and become wasted after starting HAART, and this is generally regarded as a pointer to failure of treatment, non-adherence or drug resistance, and not often seen as a consequence of malnutrition in PLWHA[15].A low BMI at initiation or after commencement of HAART is a strong predictor of morbidity and mortality in both developing and developing countries, and a useful indicator of nutritional state [3,12,16]. It is evident that malnutrition and its problems in HIV/AIDS patients are complex and interwoven; no single recipe currently exists as solution either. The changes in the HIV positive patients' nutritional status thus need prompt recognition and to integrate appropriate nutritional care in comprehensive continuum of HIV care [10,11].

Unfortunately, most health care facilities in Sub-Saharan Africa involved in care of PLWHA, do not have a formal nutrition status screening protocol, resulting in more than half of the patients at risk of malnutrition in various settings not known and/or referred for intervention or treatment. Most facilities just monitor the weight and use weight changes in PLWHA as a proxy of nutritional status. Generally, the lack of a widely accepted malnutrition-screening tool and a consensus on definition of malnutrition is a factor that hinders both effective recognition and treatment[17,18]. Nevertheless, underweight individuals will continue to represent a significant proportion of patients who present for HIV care in Sub-Saharan Africa.The identification and correction of nutritional deficiencies in Sub-Saharan Africa is limited by inadequate diagnostic modalities and also the current focus on biochemical parameters (such as CD4 count) for evaluating treatment outcome are expensive, and competes for the inadequate health-care resources. Therefore, further studies on improved methods are needed to distinguish malnutrition with HIV-associated wasting (characterized by preferential skeletal muscle depletion and attendant decreased phosphate stores) from chronic insufficient food intake[3].

The Malnutrition Universal Screening Tool, (MUST) is one of the recommended tools by the European Society for Clinical Nutrition and Metabolism, for screening nutritional status in everyonethat comes in contact with healthcare services[18]. The Subjective Global Assessment (SGA) was first described in 1982 as a formalization of the process used by skilled clinicians to diagnosis protein-energy malnutrition[19]. These two tools are well researched in some cancers and chronic renal diseases but not quite well and only recently in PLWHA[20-23,10,9].Classical nutritional screening and assessment is not available/accessible in majority of clinical setting of Africa, complicated with the fact that nearly all nutritional parameters lack sensitivity and specificity; therefore, methods of identifying malnourished patients are not entirely satisfactory [24].The same picture is true in the contest of HIV positive patients. Previous studies on such asssessment tools like the MUST and SGA reported high sensitivity of MUST and low sensitivity ofthe modified form of the SGA(patient generated SGA) at identifying underweight [25,26,23].SGA has been reported to a have low sensitivitybut better specificity[20] because ideally the SGA is more of an assessment tool rather than pure screening tool compared with the MUST which is a screening tool.

Current consensus on definition of malnutrition, is a BMI<18.5kg/m^2 and unintentional weight loss (≥10% at anytime or ≥5% over last 3 months) [18].It is also emphasised that the use of BMI alone is not encouraged as it underestimates malnutrition, therefore should not be used on its own as a nutrition screening tool [10]. There is therefore a need to determine cut-off values of validated short nutritional screening and assessment tools (like MUST and SGA) that will correspond to the generally accepted norm for identifying malnutrition. Although, BMI<18.5 kg/m^2 cutoff value have been associated with increased mortality in PLWHA [12],it does not differentiate HIV-associated wasting from chronic insufficient food intake which are both seen in HIV/AIDS patients [27]. The current study thus evaluated nutritional status in a cohort of people living with HIVAIDS, using two quick tools; the MUST and SGA. It also determined the cut-off values of MUST and SGA that corresponds to underweight with BMI (<18.5kg/m^2) as the gold standard.

METHODOLOGY

Subjects and Methods: The study was a retrospective review of clinic records of 120 PLWHA, who were regular attendees of the AIDS PREVENTION INITIATIVE IN NIGERIA (APIN)-Plus Clinic, University College Hospital, Ibadan, Nigeria.Participants included patients with confirmed HIV seropositive status (by Western blot) 2) aged 18 years and abovehaving complete clinic records suitable for MUST and SGA evaluation. The PLWHA that were severely ill and needing admissions were excluded from the study. Ethical approvals for the study were obtained from the Principal Investigator of the APIN-Plus antiretroviral clinic, University College Hospital, Ibadan, and the Joint University of Ibadan (U.I) /University College Hospital (UCH) Ethical Board, Ibadan, Nigeria, approved the original study.[28]

Evaluation of Nutritional Status:

With the use of a symptom checklist, the records of history and physical examination findings by physicians during routine regular patients' visits to the clinic were extracted. Relevant information appropriate for nutritional status evaluation tools included weight, height, weight records over a 6 months period, gastrointestinal symptoms; (anorexia, nausea, vomiting, diarrhoea), duration of loss of appetite, and functionality assessment (degree of ambulation). The nutritional status evaluation was done with the Malnutrition Universal Screening Tool (MUST) and the Revised Subjective Global Assessment (SGA) [29-32].Body mass index (BMI) was calculated from weight (kg)/ height (m^2). Body fat percentage was calculated using the body fat formulae: Body Fat (BF) percentage = 1.20 * BMI + 0.23 * age - 10.8 *sex - 5.4[24].

MUST examines three independent measures; weight, unintentional weight loss and presence of acute disease. Unintentional weight loss can subjectively be assessed from history of clothing or wrist watches getting loose for patients and reduced food intake. Presence of acute disease can be assessed by history of nutritional intake or likelihood of no intake for more than five days. Each parameter is scored 0, 1, or 2. MUST score was calculated according to BAPEN recommendation[29]. Patients were classified as low-risk (score=0), moderate-risk (score=1) and high-risk (score ≥2)

The SGA is a questionnaire covering patient's history (weight loss, change in food intake, gastrointestinal symptoms, functional capacity and underlying disease) and physical examination (muscle wasting, subcutaneous fat loss, edema, ascites) and clinician's subjective assessment of patient's overall status. Patients were classified as follows; SGA-A =well nourished, SGA-B= moderately malnourished and SGA-C=severely malnourished. The classification is also based on some inclusion criteria: SGA-A: No weight loss in last six months, no muscle wasting or subcutaneous fat loss ± improvement in appetite. SGA-B: 5-10% weight loss in last six months, mild subcutaneous fat/muscle loss (prominent ribcage, muscle palpation), definite reduction in dietary intake (solids but reduced quantity, semi-solids).SGA-C: >10% weight loss or on-going, severe loss of subcutaneous fat, severe muscle wasting, severe reduction in dietary intake (intravenous fluids or nasogastric tube feeding). Some modifications made to the SGA tool include the duration of weight change and food intake since last visit (4 weeks interval was used, because, the clinic routinely review PLWHA medical records and measure patients' weightsmonthly, during the medication pick up visits). SGA score was calculated using features from the history and physical examination according to Detsky and colleagues [19, ,[31-34].To generate scores, each variable options was also ascribed points such that A= 1, B=2, C=3. For example, as regards weight changes in last 6 months;< 5% was ascribed 1 point, 5-10% was ascribed 2 points and> 10%was ascribed 3 points.For each component of the SGA, numerical values are awarded depending on the impact on nutritional status. Only SGA components with complete information common to all respondents were used to compute the overall SGA score. Percentage weight change in last six months was calculated from records of weight over six months period. For the BMI classification, cut-off points established by clinical guidelines were used (<18.5 kg/m^2 represents underweight, ≥18.5-24.9 kg/m^2: as normal, 25-29.9kg/m^2 as overweight and,≥30.0 kg/m^2as obese)[35].

Statistical Analysis

Data analysis was done with Statistical Package for Social Sciences (SPSS) version 16.0 , and Microsoft Excel for data analysis. Data collected was coded, entered, and cleanedaccording to established procedure. Categorical variables were reported as frequencies and percentages. The continuous variables were reported as mean (±standard deviation). Chi-square test was

used to compare differences between categorical variables and MUST or SGA categories. K statistics was done to determine agreement between the tools and Shrout's classification was used to interpret the k values as follows: 0-0.1, virtually none; 0.11-0.4, slight; 0.41-0.6, fair; 0.61-0.8, moderate; and 0.81-1.0, substantial [37]. ROC curves were used to measure the diagnostic accuracy of the MUST and SGA. Plots of sensitivity,

Table 1: Age, sex distribution, duration of HIV diagnosis and HAART status of HIV seropositive patients

Variable (N=120)	Frequency(n)	Percentage (%)
Sex Distribution		
Male	46	38.3
Female	74	61.7
Age group(years)		
20 – 29	19	15.8
30 – 39	52	43.3
40 – 49	35	29.2
50 and above	14	11.7
Mean Age (years): 38.0±9.0		
Duration ofDiagnosis (years)		
< 1	31	25.8
1 - 2	55	45.8
> 2	34	28.3
HAART status		
Not on HAART	18	15.0
On HAART	102	85.0
WHO Clinical stage		
Stage I	24	20.0
Stage II	22	18.3
Stage III	53	44.2
Stage IV	21	17.5
CD4 (cell/mm^3)		
< 200	19	15.8
200-350	34	28.3
>350	67	55.8

specificity, and positive predictive value from the ROC curve was used to determine the best cut-off points for MUST and SGA tools separately. The derived cut-off points for each toolwas used against BMI<18.5 as the gold standard to identify underweight. With a2 by 2 table, the sensitivity, specificity and positive predictive value of MUST and SGA at identifying underweight were calculated. Level of significancewas set at p<0.05.

Ethical Consideration:

The study was approved by the joint University of Ibadan/University College Hospital (UI/UCH) Ethical Review Board

RESULTS

The study evaluated nutritional status in 120 PLWHA (46 Males, 74 Females) who had complete clinic records for computation of the MUST, SGA, and BMI. The mean age of the respondents was 38.0 ± 9.0 years.Majority (43%) were aged 30-39 years, only 11.7% were aged 50 years and above. x Almost half (45.8%) of the respondents had been aware of their HIV status for 1-2 years. Majority (85%) were on HAART, mainly first-line therapy. Majority (44.2%) were in WHO clinical stage III, only 17.5% were in stage IV. More than half (55.8%) had CD4 count above 350 cells/mm^3, 28.3% had between 200 and 349 cells/mm^3 and only 15.8% had CD4 counts less than 200 cells/mm^3[Table 1].

Table 2 shows the mean weight,height and BMI of HIV seropositive patients which were 63.7 ± 1.1 kg, 1.6 ±0.1 m, and 24.2 ±3.8 kg/m^2 respectively. The CD4 count, percentage body fat; MUST and SGA scores had a mean of 376.9± 194.1 cells/mm^3,26.6± 7.2%, 2.7 ± 1.4 and 6.2± 3.8 respectively.

From Fig.1, the nutritional status evaluation by BMI reported 5.8% as underweight, 53.3% as normal, 34.2% as overweight and 6.7% as obese. With regards to MUST classification, above 75.8% were at high risk of malnutrition(MUST score ≥2),24.2% at lowrisk of malnutiriton (MUST score=1) and none was at no risk of malnutrition. There was a significant difference in respondents classification by MUST and by the BMI, Fisher= 8.788, p=0.032.

Using the SGA classification, about 12.5% had severe malnutrition (SGA-C), 31.0% had suspected or moderate malnutrition (SGA-B), and while more than half (56.7%) were not malnourished (SGA-A). There was a significant difference among these classes based on their BMI, Fisher =10.122, p=0.012

Table 3. There was a significant difference between the MUST and SGA classification of the nutritional status of the HIV positive patients, χ^2=17.331, p=0 .000. Also, there was a fair statistically significant difference in agreement between MUST and SGA tool (kappa =0.293, 95% C.I -1.079 to 1.665, p<0.001.

Table 2: Anthropometric characteristics, SGA, MUST scores of the HIV seropositive patients

Variable	Mean	SD	Min	Max
Mean Age (years)	38.0	9.0	20.0	67.0
Weight(kg)	63.7	1.1	36.0	106.0
Height (m)	1.6	0.1	1.5	1.9
BMI (kg/m2)	24.2	3.8	14.2	34.6
CD4count(cell/mm^3)	376.9	194.1	34.0	1136.0
Body Fat (%)	26.6	7.2	13.0	44.5
MUST score	2.7	1.4	1.0	7.0
SGA score	6.2	3.8	2.0	16.0

BMI: body mass index, CD4: helper T cells, %BF: percentage body fat, SGA: subjective global assessment, MUST: malnutrition universal screening tool.

Figure 1: Nutritional Status Evaluation by BMI, MUST and SGA

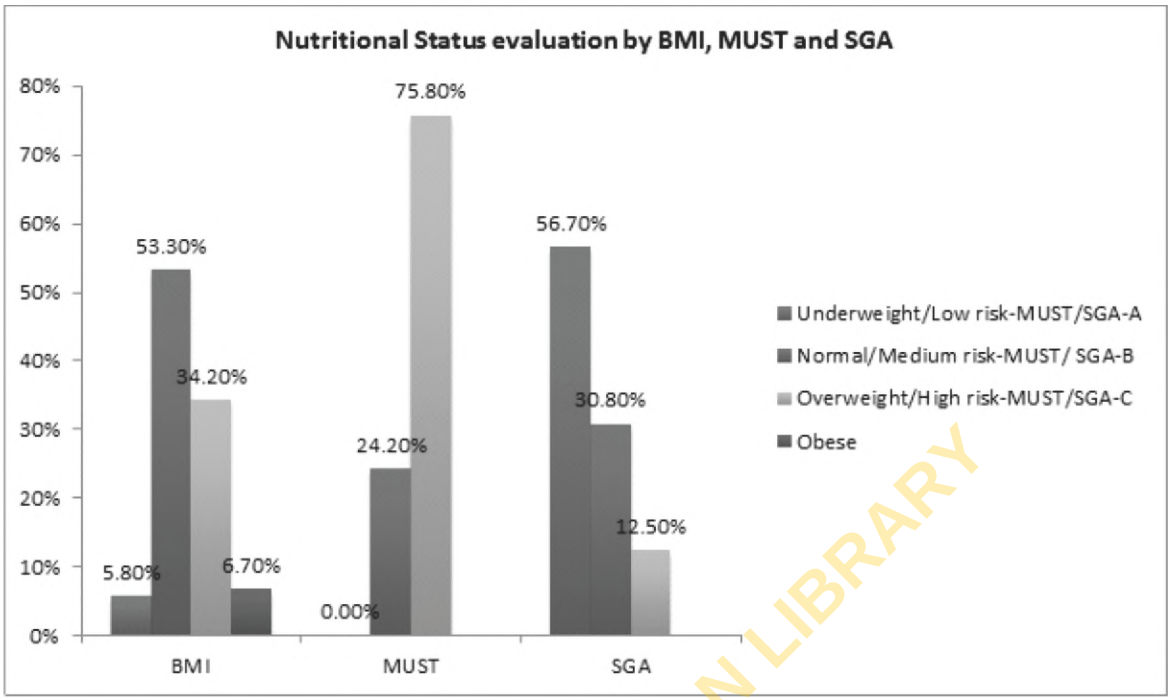


Table 3: Relationship between Nutritional status evaluation with MUSTand SGA

	MUST Medium risk n(%)	MUST High risk n(%)	TOTAL n(%)	χ^2	P
SGA A	26(21.7)	42(35.0)	68(56.7)	17.331	0 .000
SGA B	3(2.5)	34(28.3)	37(30.8)		
SGA C	0(0.0)	15(12.5)	15(12.5)		

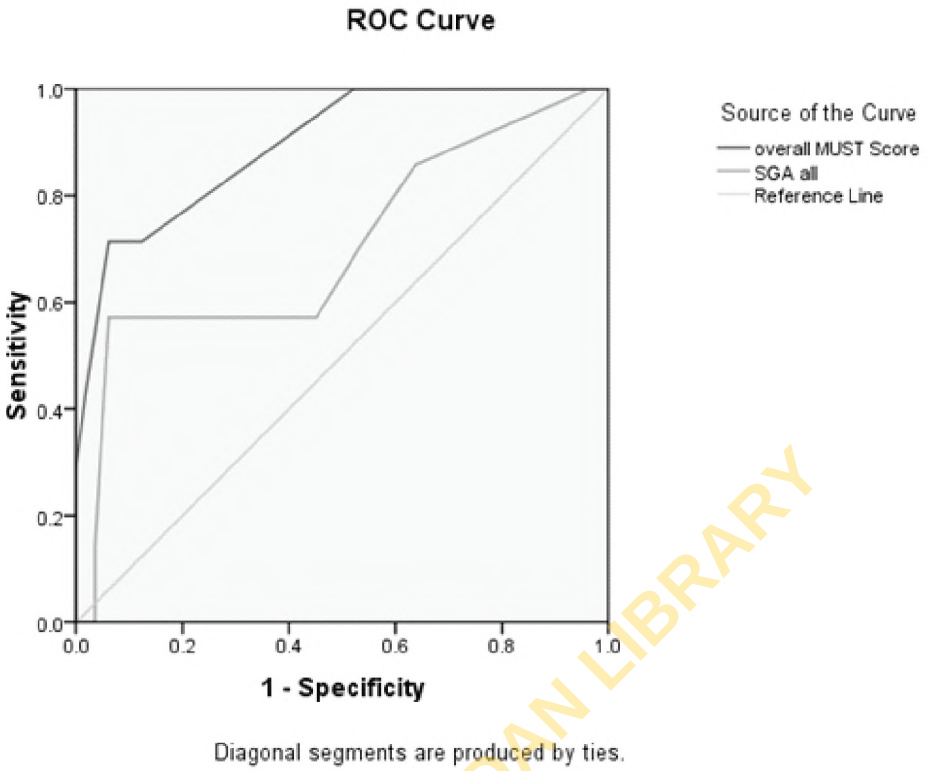
Kappa statistics =0.293, 95% C.I =-1.079 to 1.372, p=0.000

Fig. 2 shows the receiver operating characteristics (ROC) curve, the area under the curve (AUC) for MUST has better diagnostic accuracy compared to SGA, AUC 0.90; 95% C.I .78 to 1.01, p=0.00 compared to AUC 0.70; 95% C.I 0.47 to 0.93, p=0.70.

From fig. 3, MUST scores of 3.4 best predicts area under the curve of ROC (AUC = 0.90, 95% C.I=1.78 to 1.01, p=0.00). This score identified only 28.6% respondents that are underweight, i.e. sensitivity=28.6%. At this cut-off, its specificity is 12.4%, positive predictive value is 2.0%, negative predictive value is 73.7%, prevalence of underweight is 5.8%, and efficiency is 13.3%.

Fig. 4 reveals that SGA score of 6.0 best predicts the area under the curve of ROC (AUC= 0.70 95% C.I=0.47 to 0.93, p=0.70) identified 28.6% of respondents that are underweight, i.e. sensitivity=28.6%, specificity= 54.0%, positive predictive value= 3.7%, negative predictive value of 92.4%, prevalence of underweight =5.85 and efficiency of SGA =52.5%.

Fig 2: Receiver operating characteristic curves comparing accuracy of MUST and SGA as markers of underweight, N=120



AUC (MUST= 0.90, 95% C.I=1.78 to 1.01, p=0.00 vs. SGA=0.70 95% C.I=0.47 to 0.93, p=0.70)

Fig. 3: Determination of Cut-off value for MUST score identifying underweight (BMI<18.5)

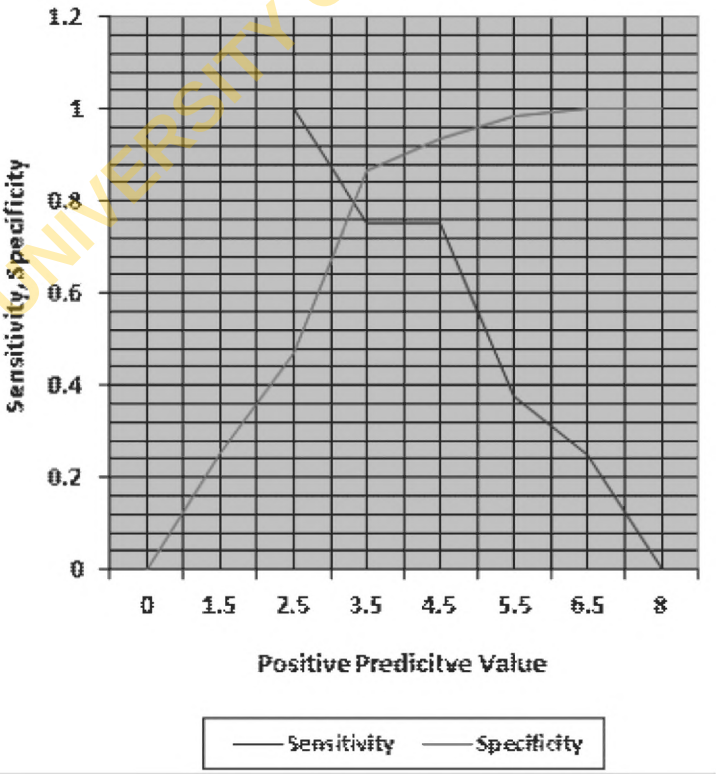
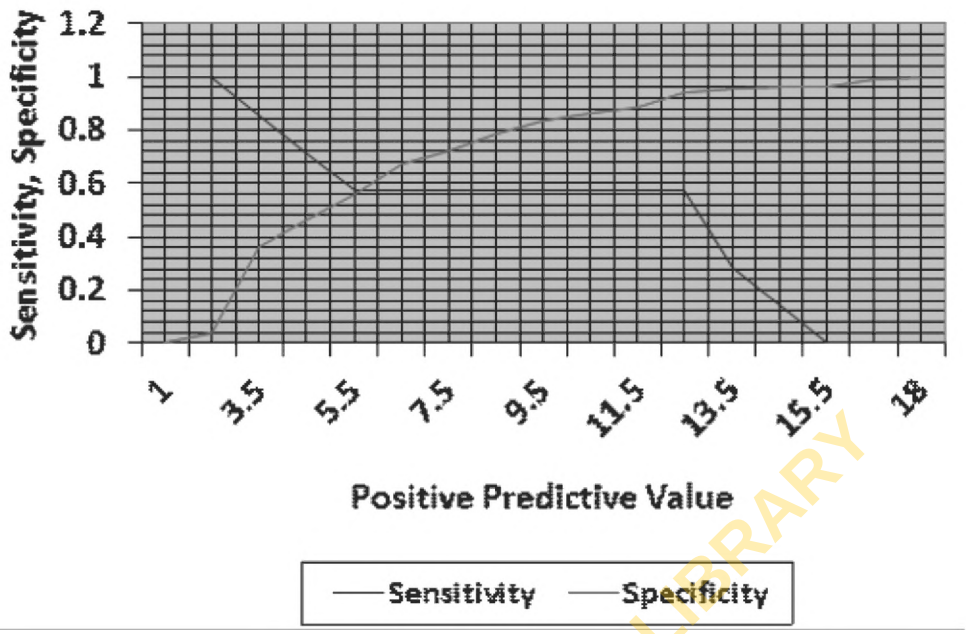


Fig. 4: Determination of Cut-off value for SGA score identifying underweight (BMI<18.5)



DISCUSSION

This study was conducted to evaluate the nutritional status of PLWHA using malnutrition universal screening tool (MUST) and subjective global assessment (SGA) tool.It also determined the cut-off values of MUST and SGA that corresponds to underweight with BMI(<18.5kg/m^2) as the gold standard.

In the study, the prevalence of HIV-related malnutrition (HIV patients with low body weight .i.e. underweight) in the cohort of PLWHA was 5.8%, which was lower than what some African studies reported [7,5,4,13,17], but similar to a report from the West Indie's population[38]. There was also co-existence of overweight (34.2%), obesity (6.7%) and underweight (5.8%) in the current study, thus providing more evidence for double burden of malnutrition in Africa as earlier reported[38],13]. More PLWHA were at risk of malnutrition using MUST and actually identified as malnourished by SGA, as similarly reported in China [17]. Also from the current study, BMI was significantly lower in those at higher risk of malnutrition (MUST score ≥2) or have moderate and severe malnutrition (SGA B & C) similar to previous reports [17],[18]. Also, there is a statistically significant difference between MUST and SGA evaluation of the respondents and only a fair agreement existed between the tools contrary to previous report on MUST and SGA[36]. This therefore emphasizes the need for combining nutritional screening or assessment tools in routine nutrition evaluation in PLWHA and other patients generally,thus, aiding prompt and appropriate therapies.

However, similar to previous studies, both MUST and SGA tools have low sensitivities, poor specificities, poor positive predictive values, poor negative predictive values compared to BMI in identifying underweight [7]. According to this study, the MUST tool have a better diagnostic accuracy compared with the SGA in identifying underweight because it has a significantly higher AUC representation, similar to a previous multicentre study in Spain, which detected nutritional risk in hospitalised patients. [36]. Also, similar to previous work on cut-off values, at a cut-off of 3.4 (MUST) and 6.0 (SGA), only about 10% of underweight PLWHA were not identified by MUST and about 30.0% were not identified by SGA[39].In the previous study,

optimal cut –off of 3.5 was reported for MUST inpatients with pulmonary tuberculosis in Japan. Hence, it is very important to put in mind the usefulness of different nutritional screening and/or assessment tools. Some are better as screening tools while some combine screening and assessment which come into consideration in diagnosis, planning, treatment and prognosis [6]. The MUST is considered more of a screening tool while, SGA is often used for both screening and nutritional assessment.Thus, the combination of different methods and tools in patient's evaluation is the ultimate because the methods are complementary. It is of note that majority of the respondents were on HAART, were in advanced stages of the disease and had CD4 count above 350 cell/mm^3, despite this, majority were at risk of malnutrition, and weight monitoring alone as currently practiced is insufficient in determining the nutritional status. Hence, more attentionneeds to be instituted for proper and acceptable measures of nutrition evaluation in these PLWHA because weight loss and BMI<18.5kg/m^2 alone may underestimate malnutrition [17].

A strength of the study is making comparison of evaluation of nutritional status by MUST and SGA tools with objective measures of nutritional status,the BMI<18.5 kg/m2 which recently has been approved as definition of malnutrition[19].Most studies only examined one nutritional assessment tool against another, or against length of hospital stay or mortality [5,[40],[36],18]. Also, the current study agrees with previous studies that suggested that short screening tools like MUST can be incorporated into electronic medical records in busy clinics, thereby solving the problem of manually calculating BMI and unintentional weight loss[18,[41].**Conclusion/Recommendation:**

The MUST tool was moreaccurate and sensitive in identifying underweight. The high proportion of PLWHA at high risk of malnutrition (MUST score≥2) emphasizes the need to have clinical nutritionists or dieticians on ground at clinics. In addition, there is need to incorporate the MUST tool in the electronically operated medical records for care of PLWHA. This will aid proper implementation of local treatment policy, improve and increase nutrient intake, monitor and review care plan for PLWHA.

Clinical relevance: Combination of MUST scores of 3.4 and SGA scores of 6.0 can conveniently be interpreted to indicate low BMI<18.5kg/m^2. Prospective studies to further confirm the clinical usefulness of MUST and SGA in monitoring nutritional status of PLWHA in Africa are necessary.

Acknowledgement: Authors appreciate the support of the APIN clinic staff, University College Hospital, Nigeria.

Conflicts of Interest: None

Reference.

1. Ockenga J, Grimble R, Jonkers-Schuitema C, Macallan D, Melchior J-C, Sauerwein HP, et al. (2006). ESPEN Guidelines on Enteral Nutrition: Wasting in HIV and other chronic infectious diseases. Clin Nutr. [cited 2014 Mar 30];25(2):319–29. Available from: http://www.ncbi.nlm.nih.gov/pubmed/16698147

2. Nerad J, Romeyn M, Silverman E, Allen-reid J, Dieterich D, Merchant J, et al. (2003). General Nutrition Management in Patients Infected with Human Immunodeficiency Virus. Clin Infect Dis.;36(Suppl 2):S52–62.

3. Koethe J.R, Heimburger D.C. (2010). Nutritional aspects of HIV-associated wasting in sub-Saharan Africa. Am J Clin Nutr.91(s):1138–42.

4. Uthman O.A (2008). Prevalence and pattern of HIV-related malnutrition among women in sub-Saharan Africa: a meta-analysis of demographic health surveys. BMC Public Health. [cited 2014 Apr 1];8:226. Available from: http://www.pubmedcentral.nih.gov/

5. Daniel M. (2013). Nutritional Status and Associated Factors Among Adult HIV/AIDS Clients in Felege Hiwot Referral Hospital, Bahir Dar, Ethiopia. Sci J Public Heal. [cited 2014 Apr 2];1(1):24. Available from: http://www.sciencepublishinggroup.com

6. Rasmussen H.H, Holst M, Kondrup J. (2010).Measuring nutritional risk in hospitals. Clin Epidemiol. [cited 2014 Mar 26];2:209–16. Available from: http://www.pubmedcentral.nih.gov/

7. Mokori A, Kabehenda M, Nabiryo C, Wamuyu M. (2011). Reliability of scored patient generated subjective global assessment for nutritional status among HIV infected adults in TASO, Kampala. Afr Health Sci.11(1):S86–92.

8. Bhowmik A, Ghugre P, Udipi S, Guha S.K. (2012). Nutritional Status and Quality of Life of Women with HIV /AIDS. Am J Infect Dis.8(1):13–8.

9. Linares Guerra E.M, Santana P.S, Carrilo F.O, Leon Sanchez M.A, Sanabria Negrin J.G, Acosta Nunez N, et al. (2013). Nutritional status of the persons living with HIV/AIDS ; its relationship with T CD4 + cells count. Nutr Hosp.28(6):2197–207.

10. Hu W, Jianlg H, Chen W, He S, Deng B, Wang W, et al. (2011). Malnutrition in hospitalized people living with HIV / AIDS : evidence from a cross-sectional study from. Asia Pac J Clin Nutr.20:544–50.

11. Hailemariam S, Bune G.T, Ayele H.T. (2013). Malnutrition : Prevalence and its associated factors in People living with HIV / AIDS , in Dilla University Referral Hospital. Arch Public Heal. Archives of Public Health;71(1):1. Available from: Archives of Public Health

12. Jesus P, Andrade T.B, Oliveira N.S, Nabity S.A, Andrade C.S, Ribeiro G.S. (2012). Prevalence and Characteristics Associated with Malnutrition at Hospitalization among Patients with Acquired Immunodeficiency Syndrome in Brazil. PLoS One. 7(11):e48717.

13. Bello T.K, Olayiwola I.O, Agbon C.O, Sokoya G.O. (2010).Assessment of BMI and Socio-demographic Status of the People Living with HIV/AIDS in Abeokuta, Nigeria. 123:123.

14 Obi S.N, Ifebunandu N.A, Onyebuchi A.K. (2010). Nutritional status of HIV-positive individuals on free HAART treatment in a developing nation.J Infect Dev Ctries.4(11):745–9.

15 Mangili A, Murman D.H, Zampini A.M, Wanke C.A. (2006). Nutrition and HIV Infection : Review of Weight Loss and Wasting in the Era of Highly Active Antiretroviral Therapy from the Nutrition for Healthy Living Cohort. HIV/AIDS CID. 42:836–42.

16 Ndekha M, van Oosterhout J.J.G, Saloojee H, Pettifor J, Manary M. (2009). Nutritional status of Malawian adults on antiretroviral therapy 1 year after supplementary feeding in the first 3 months of therapy. Trop Medicien Int Heal. 14(9):1059–63.

17 Hu W, Jiang H, Chen W, He S, Deng B, Wang W, et al. (2011). Malnutrition in hospitalized people living with HIV / AIDS : evidence from a cross-sectional study from. Asia Pac J Clin Nutr. 20:544–50.

18 Neelemaat F, Meijers J, Kruizenga H, van Ballegooijen H, van Bokhorst-de van der Schueren M. (2011). Comparison of five malnutrition screening tools in one hospital inpatient sample. J Clin Nurs. cited 2014 Apr 2];20(15-16):2144–52. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21535274

19 Cederholm T, Bosaeus I, Barazzoni R, Bauer J, Van Gossum A, Klek S, et al. (2015). Diagnostic criteria for malnutrition – An ESPEN consensus statement. Clin Nutr.34(3):335–40. Available from: http://linkinghub.elsevier.com/retrieve/pii/S0261561415000758

20 Detsky A, McLaughlin J, Baker J, Johnston N, Whittaker S, Mendelson R, et al. (1987). What is Subjective Global Assessment of Nutritional Status ? J Parenter Entera. 11(1):8–13.

21 Barbosa-Silva, M.C.G, de Barros G.D.A. (2002). Subjective global assessment: Part 2-Review of adaptations and their uses in various clinical specialties. Arch Gastroenterol. 39(4).

22 Isenring E, Bauer J, Capra S. (2003). The scored Patient-generated Subjective Global Assessment (PG-SGA) and its association with quality of life in ambulatory patients receiving radiotherapy. Eur J Clin Nutr. 57(2):305–9.

23 Koom W.S, Ahn S.Do, Song S.Y, Lee C.G, Moon S.H, Chie E.K, et al. (2012). Nutritional status of patients treated with radiotherapy as determined by subjective global assessment. Radiat Oncol J. 30(3):132–9.

24 Boléo-Tomé C, Monteiro-Grillo I, Camilo M, Ravasco P. (2012). Validation of the Malnutrition Universal Screening Tool (MUST) in cancer. Br J Nutr. 108(02):343–8.

25 Deurenberg P, Weststrate J.A, Seidell J.C. (1991). Body mass index as a measure of body
fatness : age- and sex- specific prediction formulas. Br J Nutr.65(2):2043597.

26 Yamada K, Furuya R, Takita T, Maruyama Y, Yamaguchi Y, Ohkawa S, et al. (2008). Simplified nutritional screening tools for patients on maintenance hemodialysis. Am J Clin Nutr. 87(1):106–13.

27 Van Venrooij L.M, Van Leeuwen P.A, Hopmans W, Borgmeijer-Hoelen M.M, de Vos R, De Mol B.A. (2011). Accuracy of Quick and Easy Undernutrition Screening Tools-Short Nutritional Assessment Questionnaire, Malnutrition Universal Screening Tool, and Modified Malnutrition Universal Screening Tool-in Patients Undergoing Cardiac Surgery. J Am Diet Assoc. 111(12):1924–30. .

28 Folasire O.F, Irabor A.E, Folasire A.M. (2012). Quality of life of People living with HIV and AIDS attending the Antiretroviral Clinic, University College Hospital, Nigeria. African J Prim Heal Care Fam Med. [cited 2014 Mar 22];4(1):1–8. Available from: http://www.phcfm.org/index.php/phcfm/article/view/294

29 BAPEN. (2003). The "MUST" explanatory booklet: A guide to the "Malnutrition Universal Screening Tool" ("MUST") for adults. British Association for Parental and Enteral Nutrition(BAPEN), Redditch.

30 NHS Trust Wirral community. (2006). Clinical protocol: The Malnutrition Universal Sc reening Tool (MUST).

31 Ruiz M, Kamerman L. (2010). Nutritional screening tools for HIV-infected patients : implications for elderly patients. J Int Assoc Physicians. 9(6):21138832.

32Tapiawala S, Vora H, Patel Z, Badve S, Shah B. (2006). Subjective Global Assessment of Nutritional Status of Patients with Chronic Renal Insufficiency and End Stage Renal Disease on Dialysis. J Assoc Physicians India. 54:923–6. Available from: www.japi.org

33 Steiber A.L, Kalantar-Zadeh K, Secker D, McCarthy M, Sehgal A, McCann L. (2004). Subjective Global Assessment in chronic kidney disease: A review. J Ren Nutr.[cited 2014 Mar 22];14(4):191–200. Available from:http://linkinghub.elsevier.com/retrieve/pii/S1051227604001396

34 NEMO Team. (2014). Subjective Global Assessment.A consensus document from Dietitian/ Nutritionists from the Nutrition Education Materials Online, "NEMO" team. [cited 2013 Oct 2]. Available from:http://www.health.qld.gov.au/masters/copyright.asp

35 Mueller C, Compher C, Ellen D.M. (2011). A.S.P.E.N. clinical guidelines: Nutrition screening, assessment, and intervention in adults. JPEN J Parenter Enteral Nutr. [cited 2014 Mar 30];35(1):16–24. Available from: http://www.ncbi.nlm.nih.gov/pubmed/21224430

36 Velasco C, Garcia E, Rodriguez V. (2010).Comparison of 4 Nutritional Screening Tools to Detect Nutritional Risk in Hospitalized Patients. A Multicentre Study. Eur J Clin Nutr. 1–25.

37 Sudfeld C.R, Isanaka S, Mugusi F.M, Aboud S, Wang M, Chalamilla G.E, et al. (2013). Weight change at 1 mo of antiretroviral therapy and its association with subsequent mortality , morbidity, and CD4 T cell reconstitution in a Tanzanian HIV-infected adult cohort. Amerian J Clin Nutr. (3):1278–87.

38 Burgin J, Nicholas S, Dalrymple N. (2008). The nutritional status of clinic attendees living with HIVAIDS in St Vincent and the Grenadines. West Indian Med J. 57(5):438–43.

39Miyata S, Tanaka M, Ihaku D. (2013). The prognostic significance of nutritional status using malnutrition universal screening tool in patients with pulmonary tuberculosis. Nutr J. [cited 2013 Nov 11];12(1):42. Available from: http://www.nutritionj.com/content/12/1/42

40 Stratton R.J, King C.L, Stroud M.A, Jackson A.A. (2006). " Malnutrition Universal Screening Tool " predicts mortality and length of hospital stay in acutely ill elderly. Br J Nutr. 95:325–30.

41 Young A.M, Kidston S, Banks M.D, Mudge A.M, Isenring E.A. (2013). . Malnutrition screening tools: Comparison against two validated nutrition assessment methods in older medical inpatients. Nutrition; 29(1):101–6. Available from: http://dx.doi.org/10.1016/j.nut.2012.04.007