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Health, Nutrition and Treatment Compliance of People Living with HIV/AIDS (PLWHA) at the Liberian Government Hospital in Buchanan, Grand Bassa County, Liberia

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Authors' contributions

This work was carried out in collaboration among all authors. Authors ATN and LSA contributed to the design and acquisition of data. Authors ATN, LSA, JPA, and KVM contributed to the data analysis and drafting of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To assess the nutritional and health status, and compliance with treatment and health services of adult people living with HIV/AIDS (PLWHA) attending Liberian Government Hospital (LGH).

Study Design: Cross-sectional study

Place and Duration of Study: LGH, Buchanan, Grand Bassa County, 2018

Methodology: The survey was conducted among 90 adults PLWHA.

Results: The majority had acute HIV infection, and tuberculosis and herpes zoster were the most contracted opportunistic infections. Although the majority had normal nutritional status, malnutrition was still observed especially among the women. Most had poor diet diversity and claimed to have

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faced challenges, mainly monetary concerns, while some experienced other traumatic events. A few also showed indications of self-harm. Moreover, they generally have a good health condition and medication adherence and demonstrated substantial knowledge about the disease and its treatment. Compliance was found to be associated with the health status of the participants, but not with their nutrition status, socio-economic and other characteristics.

Conclusion: The results provide an insight into the nutritional status and compliance of the adult PLWHA in Liberia. It is hoped that this study would be useful in crafting and enhancing existing intervention programs and policies promoting the better quality of life of adult PLWHA in the country.

Keywords: Nutritional status; compliance; health services; adults; HIV; acquired Immunodeficiency Syndrome.

1. INTRODUCTION

Human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) continue to be a major global public health issue, having claimed more than 35 million lives so far. In 2016 alone, 1 million people died from HIV/AIDS globally while it was estimated that 1.2 million deaths were averted due to treatment [1]. According to the World Health Organization (WHO), the African continent is the most affected region, with 25.6 million people living with HIV in 2016 which accounts for almost 2/3 of the global total of new HIV infections, with Liberia having a high prevalence. Among the 43,000 people living with HIV in Liberia, only 19% were accessing antiretroviral drugs (ARVs) although only 13% had suppressed viral loads based on estimation [2].

In this era of potent antiretroviral treatment (ART), malnutrition has been recognized as a significant problem and correlates directly to mortality for HIV patients [3]. Nutritional deficiencies begin early and often go unrecognized among people living with HIV/AIDS (PLWHA). In an earlier study, non-compliance to treatment was found to be significantly associated with nutritional factors and dietary patterns. Patients who have BMI lower than 18.5 kg/m² were found to have poor compliance with HIV treatment [4]. Further studies also show that patients with better nutritional status have better adherence to treatment [5]. Therefore, optimizing nutritional status is a key objective in the comprehensive management of HIV clients.

Compliance with treatment is an integral part of care protocols for PLWHA. Poor adherence to ART is associated with less effective treatment and increased morbidity and mortality of the patient [6]. A study on the compliance to treatment was already conducted in Africa [7] but

Liberia was not included. Likewise, the nutritional status of PLWHA has not yet been studied in the country.

Hence, for this study, the health, nutrition, and treatment compliance of adult PLWHA in Grand Bassa County, Liberia were investigated. Specifically, it assessed the health and nutritional status, and the dietary intake of the adult PLWHA at Liberia Government Hospital (LGH). It also described the health conditions and medication adherence of the adult PLWHA attending the hospital. Moreover, it analyzed the determinants of the treatment compliance of adult PLWHA.

2. METHODOLOGY

2.1 Study Design and Participants Selection

The study was a cross-sectional study involving adult PLWHA. Participants were selected from the patients attending the Liberian Government Hospital (LGH) in Buchanan, Grand Bassa County. This hospital was selected based on the high prevalence rate of HIV in the region and it is the only referral hospital that provides adequate care for PLWHA. There was a total of 270 adult PLWHA in the county, and 253 were attending the LGH. The sample size was calculated using the single population formula:

$$n = \frac{(Z_{\alpha/2})^2(\hat{p})(1 - \hat{p})}{\epsilon^2}$$

Based on the proportion of adult PLWHA in the hospital to country, and the 7% margin of error (ϵ) at the 95% confidence interval, the computed was 71. However, to increase the precision of the study, the sample size was rounded up to 90.

The participants of this study were randomly chosen among the adult PLWHA in the LGH.

2.2 Participants and Sampling

Participants of the study were randomly selected among adult PLWHA who were 18 years old and above. Informed consent was obtained from all participants.

2.3 Study Procedures and Variables

Data collection was conducted in 2018. A structured questionnaire was administered to the eligible participants through a face-to-face interview. The anthropometric parameters were measured using the hospital's equipment for taking weight and height (Beam balance scale) the dietary intake was collected through 24-hour food recall and questions on eating habits. Collected data consisted of participants' socio-economic and demographic profile, height, weight, hip and waist circumferences, dietary intake, and medication adherence. The participants' knowledge and psychological characteristics related to the disease as well as their challenges and negative experiences were also gathered.

On the other hand, secondary data from the hospital records were used and key informant interviews (KII) among attending health workers were conducted to describe the participants' health statuses, health conditions based on their viral load, and their treatment compliance. Treatment compliance indicates timeliness on the return date, practice routine medications, response to drugs, and use of preventive methods such as the use of condoms and other control.

2.4 Data Analysis

Descriptive analyses such as frequency, percentage, mean, and standard deviation were used to describe the socio-demographic and psychosocial profile, health status, nutritional status, and dietary intake of the PLWHA.

The health status of the participants was classified into three stages based on the WHO clinical staging system. Stage 1 was characterized to have acute HIV infection. This means that within 2 to 4 weeks after getting infected, the participant experienced a flu-like illness, which lasted for a few weeks. Stage 2 or clinical latency was characterized by HIV

inactivity or dormancy. This period is also called asymptomatic HIV infection or chronic HIV infection where HIV is still active but reproduces at extremely low levels. As this happens, the PLWHA begin to have symptoms as the virus levels increase in the body. The last stage is AIDS wherein the immune system is severely compromised that they get an increasing number of severe illnesses, called opportunistic illnesses.

On the other hand, the nutritional statuses of the participants were assessed based on their body mass index (BMI), waist circumference (WC), and waist-to-hip ratio (WHR). The BMI (calculated as weight in kilograms divided by the square of height in meters) was categorized using WHO criteria: underweight (<18.5 kg/m²), normal (18.5–24.9 kg/m²), overweight (25 to 29.9 kg/m²) and obesity (≥30 kg/m²). On the other hand, a WC > 94 cm in men and > 80 cm in women were used to define central obesity based on the African ethnicity of the study population. Lastly, the WHR was calculated as waist (cm)/hip (cm) circumferences). Central obesity of the participants was also defined as WHR > 0.90 in men and WHR > 0.85 in women. These cut-offs indicate increased risks of having a cardio-metabolic disease [8,9].

Data on the dietary intake of the participants was described based on their individual dietary diversity score (IDDS) and their eating habits. The IDDS was defined as the number of food groups consumed by the participants the previous 24 hours. The foods eaten by the participants were classified into nine food groups based on FAO [10]: 1) starchy staples, 2) dark leafy green vegetables, 3) other vitamin A-rich fruits and vegetables, 4) other fruits and vegetables, 5) organ meat, 6) meat and fish, 7) eggs 8) legumes, nuts, and seeds and 9) milk and dairy products. A computed IDDS of <4 was considered low dietary diversity scores, while medium if within 4-6, and high if within 6-9. Furthermore, the eating habits of the participants summarized by food avoidance, number of meals taken per day, preparation of daily meals, eating before medication, the timing of eating, doctor request in consuming specific food, specific meals consumed, level of appetite, the reason for eating in time, experienced changes in eating, eating when depressed, bored, or angry, and eating out of control.

Moreover, the data on the participants' conditions based on their viral load and medication adherence were described. A viral load of fewer

than 1000 copies was described as “very satisfactory”, virus load at 1000 copies as “satisfactory”, and virus load of more than 1000 copies as “unsatisfactory”. On the other hand, medication adherence was described based on how frequently a participant missed his/her medication. Participants who missed less than three doses of their monthly medication were classified as “good” medication adherence, five to eight as “fair”, and nine or more as “poor”. Descriptive analyses were also used to describe the participants’ knowledge about the treatment and the disease, psychosocial characteristics, and the challenges and traumatic events they have experienced.

Lastly, Chi-square, McNemar, and Anova were used to determine the relationship of demographic, socio-economic, and psychosocial characteristics, and IDDS to the treatment compliance of the participants. Significance was measured at a 95% confidence level. The data on this study were analyzed using the Statistical Package for Social Science (SPSS) version 12.

3. RESULTS AND DISCUSSION

3.1 Demographic Socio-economic and Psychosocial Profile

Results showed that the majority of the participants are female (88.8%), single (50.0%), and with no formal education (53.3%). About 98.9% of the participants were Christians. Most were unemployed (82.2%) and engaged in business (58.8%) with a monthly income ranging from 1,000-9999 LRD (27.7%). More than 80% of the participants also claimed that financial support came from business engagements.

3.2 Health and Nutrition Status and Dietary Intake

More than half of the participants had Stage 1 of the disease, while two in every 10 participants contracted opportunistic infections (OI). The most

common OIs among the participants were tuberculosis and herpes zoster (Table 1).

The majority of the participants had normal nutritional status. However, malnutrition was still observed in a sizable proportion of the participants, particularly overnutrition. About 21.1% of the participants were found to be overweight based on BMI, while 11.1% and 83.3% were at-risk of cardio-metabolic diseases based on their WC and WHR, respectively. The results also revealed that the prevalence of overweight and at-risk to cardiovascular diseases is greater among female than male participants (Table 2).

As for the diet quality, results showed that the mean average IDDS of the participants was 3.07 (SD = 1.31). None of the participants had high IDDS while the majority only had low IDDS (57.8%). All participants consumed food items under the *starchy staple food* group in the previous 24 hours. On the other hand, more than 90% of the participants ate food items under *other vitamin A-rich fruits & vegetables* food group in the previous 24 hours while three out of four consumed *meat and fish*. None of the participants consumed food items under the *other vitamin A-rich fruits & vegetables* and *organ meat* food groups (Table 3).

Furthermore, Table 4 summarizes the eating habits of the participants. The majority of the participants ate twice a day, prepared their food themselves, ate in the morning before taking their medication, had a good appetite, and cited not having financial means as the primary reason for not eating on time. One out of 10 claimed that they avoid food when taking medicine, while a quarter consumed specific meals during medication. More than a third of the participants also said that they made changes in their diet. These results indicate that health and nutrition interventions are needed to improve the nutrition, diet, and overall health of adult PLWHA.

Table 1. Health status of the adult PLWHA

Indicators	Frequency (n=90)	Percentage (%)
WHO clinical stages		
<i>One</i>	50	55.6
<i>Two</i>	35	38.9
<i>Three</i>	5	5.5
With opportunistic infections (OI)	15	16.7
Types of OIs		
<i>Tuberculosis</i>	5	33.3
<i>Herpes Zoster</i>	5	33.3
<i>Popular pruritic eruption</i>	3	20
<i>Pneumonia</i>	2	13.3

Table 2. Nutrition status of the adult PLWHA

Indicators	Male (n=10)		Female (n=80)		Total (n=90)	
	n	%	n	%	n	%
BMI						
<i>Underweight</i>	2	20.0	11	13.8	13	14.4
<i>Normal</i>	7	70.0	46	57.5	53	58.9
<i>Overweight</i>	1	10.0	18	22.5	19	21.1
<i>Obese</i>	0	0.0	5	6.3	5	5.6
WC						
<i>Normal</i>	10	100.0	70	87.5	80	88.9
<i>At Risk</i>	0	0.0	10	12.5	10	11.1
WHR						
<i>Normal</i>	7	70.0	8	10.0	15	16.7
<i>At Risk</i>	3	30.0	72	90.0	75	83.3

Table 3. The IDDS of the adult PLWHA

Indicators	Frequency (n=90)	Percentage (%)
	Food Groups	
<i>Starchy staples</i>	90	100
<i>Vitamin A-rich dark green leafy vegetables</i>	36	40
<i>Other vitamin A-rich fruits & vegetables</i>	83	92
<i>Other fruits & vegetables</i>	-	-
<i>Organ meat</i>	-	-
<i>Meat and fish</i>	71	78
<i>Eggs</i>	1	1.1
<i>Legumes, nuts, and seeds</i>	1	1.1
<i>Milk and milk products</i>	3	3.3
Dietary Diversity Score (DDS)		
<i>Low dietary diversity score (<4)</i>	52	57.8
<i>Medium dietary diversity score (4-6)</i>	38	42.2

3.3 Other Health-related Characteristics

Based on the data on participants' viral load, more than three-fourth had very satisfactory to satisfactory health conditions. Likewise, the majority of the participants have good overall medication adherence. However, it is good to note that most of them (82%) never skipped any medication, while those who missed taking medication is mostly due to travel (Table 5).

Moreover, Table 6 shows that the majority of the participants were knowledgeable about the ARV. In general, more than 90% of participants were aware of its mode of transmission and 71.1% were aware of its hereditary nature. More than 80% were also aware that they should bring partners and children for testing. It is good to note that majority (93%) are aware that safer sex is important to prevent re-infection and new transmission of HIV. In line with this, 50% of participants said that nurses provide condoms during visits. Further, the participants also shared

their experiences related to self-harm. Among the participants, only a small percentage have had suicide attempts (17.8%) and/or thoughts (14.4%) of harming themselves.

Furthermore, the participants had various challenges and negative experiences. The most common challenge faced by the participants was monetary concerns (77.8%), followed by health issues (38.9%), parent/child issues (22.2%), marital issues (11.1%), job issues (10%), abuse/neglect from family members (3.3%), and others (3.3%). They also had experienced traumatic events such as loss of a family member (61.1%), had a family member with illness (42.2%), housing loss (5.6%), and others (2.2%).

3.4 Determinants of Treatment Compliance

The results in Table 7 show that there is no significant relationship between the socio-

demographic and economic characteristics, psychosocial characteristics, and IDDS of the participants with compliance. These indicate that there was not enough evidence to differentiate the compliance of adult PLWHA considering these factors.

Concerning participants' overall health status, the study also determined the compliance of the participants according to nutritional status and stage of health status. Table 8 shows that patients with normal nutritional status have the best compliance to treatment and health services. Interestingly, over-nourished participants have better compliance compared with undernourished patients considering the absolute number of participants; undernourished had better compliance when the percentages of satisfactory and very satisfactory compliance were summed. The majority of undernourished had very satisfactory compliance (62%) while the

over-nourished had the highest percentage of unsatisfactory compliance (29%). For this data, the value of the test statistics (χ^2) is 4.28 with a *P*-value of 0.638, which is greater than the significance level of 0.05. These results indicate that the treatment compliance of the participants does not differ depending on their nutritional status.

In terms of HIV stage of health status, results show that those with the earliest stage of the illness had the best compliance status while those with the worst compliance were observed among those with the most advanced stage of the illness. For this data, the *P*-value of the test statistic is less than the significance level of 0.05. Thus, it is concluded that there is enough evidence to suggest an association between health status and compliance to health services (Table 9).

Table 4. Eating habits of the adult PLWHA

Indicators	Frequency (n=90)	Percentage (%)
Food avoidance while taking medications	9	10.0
Number of meals taken per day		
<i>Once</i>	23	25.5
<i>Twice</i>	47	52.2
<i>Thrice</i>	15	16.6
<i>Others</i>	5	5.5
Preparation of daily meals		
<i>Yourself</i>	69	76.6
<i>Family member</i>	7	7.7
<i>Others</i>	14	15.5
Eating before taking medication	14	15.5
Timing in eating		
<i>Morning</i>	54	71.0
<i>Afternoon</i>	13	17.7
<i>Evening</i>	8	10.5
<i>Night</i>	1	1.3
Doctor request in consuming specific food while taking medication	2	2.2
Specific meals consumed during medication	24	26.6
Level of appetite when taking medication		
<i>Good</i>	66	73.3
<i>Fair</i>	16	17.7
<i>Poor</i>	8	8.8
Reason(s) for not eating food in time		
<i>No money</i>	75	83.3
<i>Worrying about sickness</i>	8	8.8
<i>Cannot find the food to buy</i>	6	6.6
<i>Side effects of the drug</i>	1	1.1
Changes in eating	31	34.4
Eating when depressed, bored or angry	6	6.6
Eating out of control	6	6.6

Table 5. Health condition and medication adherence of the adult PLWHA

Indicators	Frequency (n=90)	Percentage (%)
Viral load		
<i>Very satisfactory</i>	42	46.6
<i>Satisfactory</i>	27	30
<i>Unsatisfactory</i>	21	23.3
Medication adherence		
<i>Good</i>	40	44.4
<i>Fair</i>	28	31.1
<i>Poor</i>	20	24.4
Last time missed any medication		
<i>Within the past 4 days</i>	2	2.2
<i>Within the past week</i>	11	12.2
<i>2-4 weeks ago</i>	3	3.3
<i>Never skipped</i>	74	82.2
Reason(s) in missing medication*		
<i>Traveling</i>	13	14.4
<i>Too busy</i>	3	3.3
<i>Others</i>	6	6.7

*multiple answers

Table 6. Knowledge and psycho-social characteristics of the adult PLWHA

Indicators	Frequency (n=90)	Percentage (%)
<i>Aware that ARV should be continuously taken</i>	90	100.0
<i>Aware that ARV should be taken daily</i>	90	100.0
<i>Aware that ARV is not true to cure HIV</i>	89	98.9
<i>Aware that ARV is associated with improved quality of life</i>	89	98.9
<i>A nurse showed samples of medication and asked to demonstrate which pills to take and when</i>	89	98.9
<i>Aware that safer sex is important to prevent re-infection and new transmission of HIV</i>	84	93.3
<i>Aware that HIV is a family disease</i>		
<i>Aware that ARV is associated with a side effect</i>	64	71.1
<i>Aware to bring your partner and children for testing</i>	60	66.7
<i>Close relative knows about your status</i>	57	81.4
<i>Nurses gave condoms upon visits</i>		
<i>Attempted to commit suicide or homicide</i>	46	51.1
<i>Currently have thoughts to harm themselves</i>	45	50.5
<i>Inflicted burns or other wounds to yourself</i>	16	17.8
<i>History of suicide in the family</i>	13	14.4
	6	6.6
	1	1.1

3.5 Discussion of the Findings

Results showed that most of the adult PLWHA in Grand Bassa County, Liberia had acute HIV infection, and tuberculosis and herpes zoster were the most common OIs contracted by those infected. Although the majority had normal nutritional status, malnutrition was still observed among the adult PLWHA. There was more overweight than underweight adult PLWHA making them at-risk for adverse cardiovascular and metabolic outcomes of obesity, particularly

the women. This pattern was also observed in a study in Zimbabwe wherein the majority of the HIV-positive adults had a normal BMI, while 10% had under-nutrition and 26.4% had overweight and obesity. It was also found that being overweight or obese was more likely in females [11]. Gaining weight is commonly considered an indicator of treatment success. However, appropriate interventions to address overnutrition among PLWHA are needed as mortality may increase due to non-communicable causes [12,13]. Routine screening is recommended to

PLWHA to facilitate early detection of the risk of over-nutrition [14].

Poor dietary diversity was also commonly observed among the adult PLWHA in this study. Undiversified food has always been a public health concern in developing countries [15] and was also found among adult HIV-positive patients in the sub-Saharan region [16]. This puts chronic patients like PLWHA at higher risks as consumption of low-quality and monotonous food can exacerbate the micronutrient and macronutrient deficiencies as their nutrient absorption and metabolism are already adversely affected by the disease [17]. Poor dietary habits such as frequent consumption of high-fat foods and low intake of fruits and vegetables have also been seen among HIV-positive patients in another study [18], and this type of diet is said to contribute to the high percentage of malnutrition in this group [19].

Moreover, the majority of the adult PLWHA cited economic constraints as the main reason for their poor eating habit. HIV infection and AIDS limit one's economic capacities due to reduced overall health and productivity and increased medical expenses [20]. This may also be the reason why most of the participants in this study only eat twice or once a day. Several of the adult PLWHA also claimed that they turn to food when they are depressed, angry, or bored, while some admitted inflicting harm to themselves and experienced different challenges and traumatic events in their lives. These findings highlight the need for appropriate interventions, such as improving food security and strengthening instrumental social support. These interventions are recommended as they may have synergistic beneficial effects on both mental health and HIV outcomes among PLWHA, particularly in resource-limited settings [21]. Clinical, community, and home-based psychosocial interventions may also help increase the quality of life of adult PLWHA [22].

The study also showed that there are high percentages of accurate knowledge on HIV/AIDS and its treatment among adult PLWHA. This result is promising as this is associated with a reduction in transmission risk behavior [23,24]. A previous study conducted in Kenya reported that unawareness of the vast majority of their HIV status posed a major barrier to HIV prevention, care and treatment efforts [25]. However, based on a recent study, the knowledge of status had been steadily increasing in the past decades across sub-Saharan Africa, which is crucial to reducing HIV incidence [26].

Some of the adult PLWHA claimed consuming specific food as prescribed by doctors, or meals during medication. Some also take medicine before taking the medicine. According to the WHO, attention to diet and nutrition must be improved to enhance ART acceptability, adherence, and effectiveness [27]. To date, a varied and healthy diet is still recommended to ensure micronutrient intakes at the recommended levels among PLWHA, as some micronutrient supplements, such as vitamin A, zinc, and iron, can produce adverse outcomes in HIV-infected populations. A review also revealed that there were inconsistencies in the evidence available regarding routine multiple micronutrient supplementation in adult PLWHA, although it was noted that this should not be a reason for denying micronutrient supplements for patients with specific deficiencies or whose diet is insufficient to meet the recommended daily allowance of vitamins and minerals [28]. Moreover, the recommendation regarding food intake depends on the patient's current ART regimen, e.g., a single-tablet regimen used as a first-line regimen should be taken on an empty stomach [29]. This information should be considered in providing nutritional counseling to an adult PLWHA.

Furthermore, the study showed that the adult PLWHA attending the LGH had generally satisfactory health conditions based on their viral load due to treatment. This result is promising as viral load suppression reduces HIV transmission [30,31]. The participants also showed good medication adherence. The main reason for missing treatment was travel. However, in a study among HIV-positive individuals in African countries, missed medication was linked to perceived HIV stigma. Perhaps, this may also be considered in encouraging medication adherence among PLWHA patients [32].

The treatment compliance was also found to be associated with their health status, with those in the earliest stage of the illness showed better timeliness on the return date, practice routine medications, response to drugs, and use of preventive methods such as the use of condoms and other control. This finding was also shown in studies in India [33], and other regions in sub-Saharan Africa such as Nigeria, Uganda, Zambia, and Tanzania wherein HIV-positive patients with better clinical outcomes had better adherence to treatment [34]. Moreover, in a meta-analysis on patient adherence and disease severity, it was found that patients who are severely ill may be at the greatest risk of non-

compliance to treatment [35]. However, there was also evidence showing that HIV-positive patients in the latter stage of the disease had better compliance to treatments, which may be due to their belief that complications will likely happen with non-compliance [36]. Hence, the finding of this study suggests that treatment adherence among adult PLWHA should be advocated particularly for patients with late-stage of HIV infection.

While the study showed an association of health status with treatment compliance, socio-economic and demographic characteristics did not. However, contrary to this study's findings, a significant association was found between socio-economic characteristics and compliance with health services in other literature [37]. On the other hand, similar findings with the study in terms of demographic characteristics were observed in a cross-sectional study where educational attainment was insignificantly associated with ART adherence [38]. Nevertheless, it is important to note that formal education plays a crucial role in understanding and communicating health information [39].

Hence, further research must be made to fully explore the association of socio-economic and demographic characteristics with compliance with health services. The lack of associations can also suggest that the sample population for this study may be homogenous.

Lastly, the study showed that adult PLWHA with normal nutritional status had the best treatment compliance although the association between the two variables was not established. Similar to the result, a study conducted in Ethiopia showed that PLWHA with normal BMI had the highest percentage of adherence to HIV treatment, while no association was observed between adherence to treatment and the nutritional status of the patients [40]. This result is contrary to a related study, where a positive association was observed between nutritional status and adherence to ART [4]. Perhaps, the association between these two variables will be established if there was a larger sample size and an equal number of participants of each group. Further study is recommended to ascertain the relationship of nutritional status to adherence of adult PLWHA with treatment.

Table 7. Association of the adult PLWHA’s socio-economic and other characteristics with treatment compliance

Variables	Treatment Compliance (P-value)
Demographic Characteristics	
<i>Level of Education</i>	0.18 (0.913)
<i>Marital Status</i>	0.73 (0.696)
Socio-economic characteristics	
<i>Source of income in the last 6 months</i>	5.03 (0.081)
<i>Average monthly income</i>	1.94 (0.380)
<i>Occupation</i>	0.57 (0.754)
Psycho-social characteristics	
<i>Awareness of ARV treatment and side effects</i>	1.09 (0.581)
<i>The tendency of causing self-harm</i>	2.68 (0.262)
<i>The general eating habit of participant</i>	2.00 (0.368)
<i>Food restriction and access</i>	2.88 (0.578)
Individual Diet Diversity Score	0.24 (0.886)

Table 8. Association of the adult PLWHA’s nutritional status with treatment compliance

BMI	Treatment Compliance				x ²	P-value
	Very Satisfactory n (%)	Satisfactory n (%)	Unsatisfactory n (%)	Total		
Undernourished	8 (61.5)	2 (15.4)	3 (23.1)	13 (14.4)	4.28	0.638
Normal	24 (45.3)	17 (32.1)	12 (22.6)	53 (58.8)		
Over-nourished	8 (33.3)	9 (37.5)	7 (29.2)	24 (26.7)		
Total	42 (46.7)	27 (30.0)	21 (23.3)	90 (100.0)		

Table 9. Association of the adult PLWHA's health status with treatment compliance

Health Status	Treatment Compliance			Total n (%)	McNemar Test
	Very Satisfactory n (%)	Satisfactory n (%)	Unsatisfactory n (%)		
Acute	28 (58.3)	19 (39.6)	1 (2.0)	48 (53.3)	0.001
Chronic	14 (38.9)	7 (19.4)	15 (41.7)	36 (40.0)	
Aids	0 (0.0)	1 (16.7)	5 (83.3)	6 (6.7)	

This study provides a picture of the nutrition and health situation of the adult PLWHA in Grand Bassa County, Liberia. It also provides an in-depth view of the factors that contribute to the HIV/AIDS treatment compliance of the adult PLWHA in the country. These analyses should be useful for the program planners and the

polycymakers in advocating improved quality of life, not only among PLWHA but for the population as a whole. The results can also help revitalize existing interventions and programs that are currently in place by incorporating psychosocial and food assistance components to ease the social and economic burdens that the PLWHA are afflicted with. Furthermore, the findings of this study could be used as a basis for crafting programs and policies to support financially constrained PLWHA in efforts to improve their dietary diversity, nutrition, and overall health.

As for the weaknesses of the study, the study gathered data on food consumption practices before taking medication. However, these practices were not confirmed vis-à-vis their current ART regimen as this information was not gathered. It would be interesting to know about the PLWHA's awareness of the correct ART regimen. Moreover, the focus of this study is the adult PLWHA and does not include other vulnerable groups such as pregnant and lactating HIV-infected women, adolescents living with HIV, HIV-infected infants and children, and HIV-exposed infants and children born to HIV-positive mothers. Perhaps, these topics could be investigated in future studies and should be all useful in formulating health messages for PLWHA.

4. CONCLUSION

Most of the adult PLWHA attending LGH had acute HIV infection, and tuberculosis and herpes zoster were the most common OIs contracted by those infected. Although the majority had normal nutritional status, malnutrition was still observed among the adult PLWHA. There was more

overweight than underweight adult PLWHA making them at-risk for cardiovascular diseases, particularly the women. Furthermore, poor dietary diversity was common among the adult PLWHA, while the majority only eats twice or once a day. Some also experienced food avoidance, changes in eating patterns, eating to suppress negative emotions, and skipping meals mainly due to financial constraints. Others claimed consuming specific food as prescribed by doctors, or specific meals during medication while some also take medicine before taking the medicine. The majority also claimed to have experienced challenges, mainly monetary concerns, and other traumatic events, while some admitted indications of self-harm. Moreover, the adult PLWHA attending the LGH generally had good medication adherence, health condition, and demonstrated substantial knowledge about the treatment. Treatment compliance was found to be associated with the health status of the participants, but not with their nutritional status, socio-economic and other characteristics.

The paper provides an insight into the nutritional status and compliance of the adult PLWHA in Liberia. It is hoped that this study would be useful in crafting and enhancing existing intervention programs and policies promoting the better quality of life of adult PLWHA in the country. However, there are still gaps in this area that need further investigation to better understand and promote proper nutrition and compliance with HIV treatment.

CONSENT

All the participants were asked to sign an informed consent stating that they willingly participated in the study.

ETHICAL APPROVAL

All authors hereby declare that all analyses have been examined and approved by the Liberian Government Hospital and been performed

following the ethical standards laid down in the 1964 Declaration of Helsinki.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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