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Nutritional Status of Adult Kala-azar Patients and Associated Factors in North West, Ethiopia

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Abstract

Introduction: Kala-azar is one of the most neglected tropical infectious diseases. Malnutrition and Kala-azar are serious problems of public health significance, and most often exist together. Even though kala-azar remained endemic in Ethiopia, explicit data on the magnitude and factors associated with nutritional status of kala-azar patients are scarce. The study aimed to assess nutritional status and associated factors among adult kala-azar patients who were admitted in Kala-azar treatment centers of Northwest Ethiopia.

Methods: Institution based cross- sectional study was conducted from February 06 to April 01, 2014. The study included 379 adult kala-azar patients from all health facilities, which provide Kala-azar treatment using consecutive sampling. Data were collected using face-to-face interviews. Anthropometric measurements were obtained from each patient. Clinical information extracted from patients' medical record. Data were entered to Epi Info software version 3.5.2 and analyzed using SPSS 20.0. Descriptive, bivariate and multivariate logistic regression was performed to assess predictors of adult under nutrition. Adjusted odds ratio with 95% confidence intervals and significance level at $p < 0.05$ was set.

Results: In this study, 379 patients were included with 99% response rate and majority of the patients were males (97.4%). The study showed that the magnitude of adult under nutrition was 74.1% (n=280). Patients with gastro intestinal disturbance and young adults were more likely to be undernourished.

Conclusion: Three in four of the kala-azar patients were undernourished. Age and gastro intestinal disturbance were predictors of undernutrition. Governmental and non-governmental organizations working on Kala-azar program should focus on deworming of clients, extensive health education on hygiene accompanied by nutritional support.

Keywords: Kala-azar; Undernutrition; Visceral Leishimaniasis (VL); Ethiopia

Abbreviations: AOR: Adjusted Odds Ratio; ART: Anti-Retroviral Therapy; BMI: Body Mass Index; CD4: Cluster of Differentiation 4; CI: Confidence Interval; COR: Crude Odds Ratio; GID: Gastro Intestinal Disturbance; IDDS: Individual Dietary Diversity Score; FANTA: Food and Nutrition Technical Assistance Project; FAO: Food and Agriculture Organization; FMOH: Federal Ministry of Health; HFIAS: Household Food Insecurity Access Scale; HIV: Human Immune Deficiency Virus; IQR: Inter Quartile Range; LPPD: Liter per Person per Day; MSF-H: Medicines Sans Frontiers–Holland; REC: Research Ethics Committee; SPSS: Statistical Package for Social Science; TB: Tuberculosis; VL: Visceral Leishimaniasis; WHO: World Health Organization

Introduction

Malnutrition and Kala-azar are serious public health problems. Globally around 30% of the population suffers from some form of malnutrition, one in every five people in the developing world is chronically undernourished, a total of 777 million individuals [1]. In Ethiopia, 27% of women and 37% of men suffers from acute form of malnutrition (Body Mass Index<18.5) [2]. There are several lines of evidences that PEM is a major determinant of both progression and severity of Visceral Leishimaniasis (VL) [3].

Under nutrition among adults imply proneness to illnesses which compromise immune system, this has serious implications. It could place enormous additional economic and social burdens. However malnutrition may not only reflect the effects of recurrent infection, but a combination of problems of food availability and increased energy demand due to increased physical activity resulting in seasonal changes in body weight in many adults [4].

Ethiopia is taking remarkable steps in addressing infection related malnutrition, by developing a National Nutrition Program [5]. Despite this, there is still limited documentation about adult under nutrition in Ethiopia, as most nutritional surveys reflecting nutrition are conducted in children. Also, little information exists on nutritional status of Kala-azar patients and what factors influence the nutritional status among this group. Therefore, this study aimed to assess the nutritional status and identify the associated factors of malnutrition among kala-azar patients. Assessing the prevalence and factors associated with malnutrition among kala-azar patients would be very important in designing appropriate strategies and develop intervention priorities to prevent nutritional problems of Kala-azar patients.

Methods

Study setting and sample

The study design was Institution based cross-sectional study in all health facilities that provide kala-azar treatment in North West Amhara and Tigray regional states of Ethiopia.

The study area comprises of North Gondar Zone of Amhara, North West and Western Zones of Tigray region, which is bordered on the west by Sudan and on the North by Tekeze River that separates Ethiopia from Eritrea. The North West low lands are one of Ethiopia's most fertile agricultural zones with large scale of farming of cash crops such as sesame, maize, cotton and sorghum. Since 1970, linked to an extensive program of agricultural development and the consequent increase in the influx of migrant workers, the number of Visceral Leishimaniasis (VL) cases has rapidly increased. According to the reports from Amhara Region, seasonal agricultural work attracts approximately 500,000 migrant laborers each year from non-endemic parts of Amhara, Tigray and neighboring regions. Data were collected from February 06 to April 01, 2014 through face-to-face interview of Kala-azar patients. The source and study populations were all Kala-azar patients who admitted in kala-azar treatment center in Northwest Ethiopia and All Kala-azar patients who were already admitted for less than three day or admitted during the study period in the health facilities respectively. All adult Kala-azar patients whose age is >19 years old were included in the study whereas pregnant women, patients with abdominal mass or ascites or patients who are bedridden were excluded from the study. Open epi software was used to calculate sample size using the single population proportion formula by assuming the estimated proportion of malnutrition among kala-azar patients from North Sudan (P)=62% [6], 5% degree of precision, 95% confidence level. Thus, considering a 5% non-response rate the final sample size becomes 383. All Kala-azar treatment centers from North West Ethiopia namely Gonder University Hospital, Suhul Hospital, Kahsay Abera Hospital, Metema Hospital, Addis Zemen Hospital and Abdurafi Kala-azar treatment center were included in the study. All patients who fulfill the inclusion criteria and visited the treatment centers during the study period were included in the study consecutively.

Measurements

The dependent variable (Adult nutritional status) of the patients was determined using Body Mass Index (BMI). An interview guided by pre-tested structured questionnaire was used to collect the socio demographic (age, sex, marital status, educational status, residence, employment and religion) Behavioral and environmental factors (tobacco use, alcohol consumption, drug abuse**,** water supply**,** bed net availability**,** housing condition and latrine availability). Information on comorbidity (gastro intestinal disturbance**,** Tuberculosis, Malaria, and HIV status, duration of illness, and type of Kala-azar) and Household Food Security, individual dietary diversity was also collected from each patient.

Data collection procedure

A pre tested questionnaire, 24 h dietary recall measurements at individual level, household food security questionnaire developed by FANTA [7] and anthropometric measurements were used as data collection tools. Secondary data were used from patient chart to assess the hemoglobin status of patients and admission weight was taken for those who were already admitted during data collection. Data was collected by twelve diploma Nurses working in the respective institutions. The questionnaire was initially prepared in English then translated in to local languages i.e., Amharic and Tigrigna by experts and back retranslated in to English for its consistency.

Anthropometric measurement

The Weight of the patients was recorded using beam balance scale to the nearest 0.1 kg and height was measured using calibrated Stadiometer to the nearest 0.1 cm. Patients were not wearing heavy clothes and shoes during measurement. Weighing scale was calibrated to zero before taking every measurement. BMI of the Kala-azar patients was calculated by dividing the weight (in kg) by height (in meters squared).

Data quality control

Measurement of height and weight were taken in duplicate on each patient. Continuous checkup of scales was carried out for their reliability. The data collection was supervised and every questionnaire was checked for completeness and logical consistency and made corrections on the spot on regular basis. A pretest was conducted on 10 patients from Abdu Rafi MSF-H kala-azar treatment center who were not included in the study. All data collectors were trained for two days on how to complete the questionnaire and obtain accurate data as well practical training of anthropometric measurement.

Operational definitions

VL (Kala-azar) patient: A person was considered as kala-azar patient when he or she has fever lasting for more than two weeks, splenomegaly and confirmed either serologically (positive RK39 or AT result) or parasitological (positive result from splenic aspiration or lymph node aspiration or bone marrow aspiration).

Nutritional status classification: The nutritional status of definition was using WHO [8]. The nutritional status was defined as severe, moderate, mild, normal, over weight and obese when the individual has BMI of <15.9 kg/m², 16-16.9 kg/m, 17-18.49 kg/m², 18.5-24.9 kg/m², 25-29.9 kg/m² and >30 kg/m² respectively.

Individual Dietary Diversity Score (IDDS): The individual dietary diversity scores was created by summing either the number of individual foods or food groups consumed over the past 24 h and it was classified based on the mean score: Diversified when IDDS greater than the mean score and non-diversified when IDDS less than the mean score [9].

Household Food Insecurity Access Scale (HFIAS): Household food insecurity access scale was developed from questionnaire consists of nine occurrence questions and follow-up "frequency-of-occurrence" question that represent a generally increasing level of severity of food insecurity (access). The score was classified as following:

- **Food secure:** It experiences none of the food insecurity (access) conditions or just experiences worry, but rarely.

- **Mildly food insecure**: Worries about not having enough food sometimes or often, and/or is unable to eat preferred foods, and/or eats a more monotonous diet than desired and/or some foods considered undesirable, but only rarely.

- **Moderately food insecure**: Sacrifices quality more frequently, by eating a monotonous diet or undesirable foods sometimes or often, and/or has started to cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes.

- **Severely food insecure**: It has graduated to cutting back on meal size or number of meals often, and/or experiences any of

the three most severe conditions (running out of food, going to bed hungry, or going a whole day and night without eating), even as infrequently as rarely [7].

Data processing and analysis: The data were checked for completeness and consistency. Data were entered and cleaned by running frequency of all variables using EPI info version 3.5.2 and exported to SPSS 20.0 statistical software for analysis. Descriptive statistics, frequency distribution for categorical data and appropriate measures of central tendency and variability for continuous data were calculated.

Variables with $p < 0.2$ during the bivariate analysis were considered as candidate variables to multivariable logistic regression for analysis to control for confounding variables. Adjusted Odds Ratio (AOR) with 95% confidence interval and significant level was set at $p < 0.05$.

Results

Socio-demographic characteristics of adult kala-azar patients

A total of 379 adult patients who were diagnosed to have Kala-azar participated in the study with 99% participation rate. The majority of the patients were males 369 (97.4%) and Orthodox Christians 98.2%. The median age of patients were 23 years (IQR: 20, 28) (Table 1).

Behavioural and environmental characteristics of Kala-azar patients

About 66% (n=251) and 44.6% (n=169) of the patients have their own house and toilet respectively. Among the patients 255(67.3%) reported they are current alcohol drinkers but only 5% were smokers (Table 2).

Household food insecurity and Individual dietary diversity

The study indicated that 307 of the participants were categorized in to three household food insecurity score categories. Out of them 276 (89.9%) were food secured, 10 (3.3%) and 21 (6.8%) had mild and moderate food insecurity, respectively. However, none of the participants had severe food insecurity.

The mean (SD) individual dietary diversity score of the patients was 5.5 ± 1.8. Out of the total participants, 48% of patients had a score less than 5.5. The study also indicated that magnitude of under nutrition among patients with IDDS >5.5(consumed diversified foods) and IDDS<5.5 (not consumed diversified foods) was 76.6% and 71.4%, respectively (Figure 1).

Nutritional status of Kala-azar patients

Among the 379 Kala-azar patients participated in this study 280 (74.1%) were malnourished with BMI<18.5 kg/m². Out of the malnourished 92 (24.3%), 64 (16.9%) and 125 (33%) had severe, moderate and mild malnutrition, respectively.

Majority of the patients were having kala-azar for the first time (97.4%), and 71.2% of the patients were sick for less than 8 weeks before admission. The prevalence of HIV was 6.3%. About 60% of HIV patients had relapse Kala-azar (Table 3).

Factors associated with adult under nutrition

Socio-demographic, behavioral characteristics, environment characteristics, comorbidities and individual dietary diversity variables were assessed for the presence of association with adult under nutrition (BMI<18.5).

The result of multivariable analysis show that age of the patient and gastro intestinal disturbance were associated with chronic energy deficiency.

The result indicate that patients whose ages 19-24 and 25-29 were 4 times more likely to be undernourished than patients >40 years old [AOR=3.9, 95% CI (1.51, 10.3)] and [AOR=4.0, 95% CI (1.42, 11.36)] respectively. Similarly, patients 30-34 years old were 3.5 times more likely to have to be malnourished as compared to patients whose age were >40 years [AOR=3.5, 95% CI (1.03,12.16)]. Patients who had gastro intestinal disturbance were 2.2 times more likely to be under nourished than those without gastrointestinal disturbance were [AOR=2.16, 95% CI (1.31, 3.58)] (Table 4).

Discussion

This study aimed to assess the nutritional status and its predictors among kala-azar patients during the dry season by involving all Kala-azar treatment centers from North West Ethiopia.

Variable (n=379)	Category	Frequency	Percent
Age	19-24	225	59.4
	25-29	81	21.4
	20-34	29	7.7
	35-39	19	5.0
	≥40	25	6.6
Sex	Male	369	97.4
	Female	10	2.6
Marital Status	Married	135	35.6
	Single	232	61.2
	Divorced/Separated	12	3.2
Religion	Orthodox	372	98.2
	Muslim	7	1.8
Education	Illiterate	149	39.3
	Read and Write	128	33.8
	Formal Education	102	26.9
Occupation	Farmer	280	73.9
	Daily laborer	63	16.6
	Student	36	9.5
Residence	Resident	266	70.2
	Migrant	87	23.0
	Settler	26	6.9

Table 1: Socio demographic characteristics of Kala-azar patients in North West Ethiopia, 2014.

Variable (n=379)	Category	Frequency	Percent
Bed net availability	Yes	198	52.2
	No	181	47.8
Main Source of Water	Pipe	135	35.6
	Surface Water	102	26.9
	Well	84	22.2
	Spring	56	14.8
	Other	2	0.5
Water Consumption L/P/D*	<20	270	96.8
	≥20	109	3.2
Toilet availability	Yes	169	44.6
	No	210	55.4
Housing condition	Private	251	66.2
	Rental	62	16.4
	Field	66	17.4
Currently drink alcohol	yes	255	67.3
	No	123	32.7

*L/P/D: Liter/Person/Day

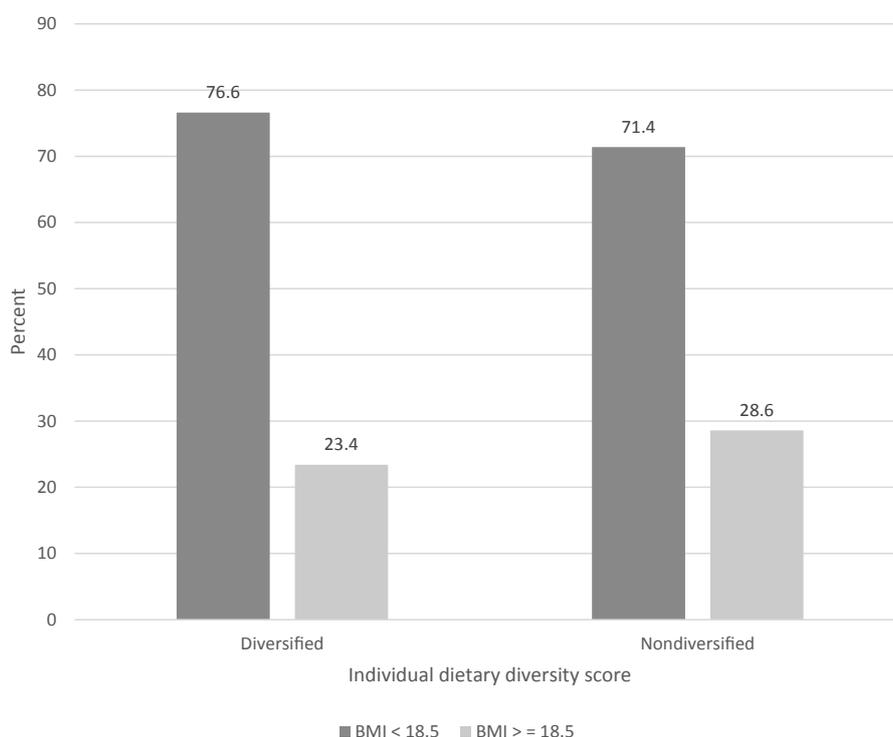**Table 2:** Behavioral and environmental characteristics of Kala-azar patients in North West Ethiopia, 2014.

Figure 1: Proportion of undernourished among diversified and non-diversified Kala-azar patients, North Western Ethiopia, 2014.

Variable (n=379)	Category	Undernutrition Yes	Undernutrition No	Frequency	Percent
GID	Yes	165	37	202	53.3
	No	116	61	177	46.7
Tuberculosis	Yes	24	2	26	6.9
	No	257	96	353	93.1
Malaria	Yes	206	75	281	74.1
	No	75	23	98	25.9
HIV	Yes	22	2	24	6.3
	No	259	96	355	93.7
Duration of illness	<8 weeks	198	72	270	71.2
	≥8 weeks	83	26	109	28.8
Type of Kala azar	Primary	274	95	369	97.4
	Relapse	7	3	10	2.6

GID: Gastro Intestinal Disturbance

Table 3: Nutritional status of Kala-azar patients with comorbidities, North West Ethiopia, 2014.

In this study the magnitude of malnutrition was 74.1% with mean BMI (±SD) 17.4 (± 1.87) kg/m^2.

The high magnitude of malnutrition among kala-azar patients was in agreement with the results reported from Nepal (71%), and Uganda (80%), but higher than a study conducted from North Sudan (61.9%) and India (60%) [6,10]. This could be explained by the inadequate infrastructure of the area, which could affect the socio economic status, and health coverage of the residents.

The magnitude of malnutrition was lower than the prevalence reported from Northwest Ethiopia which was 95.5% and south Sudan (92.6%) [6,11]. This could be because of the seasonal variation in which the research was conducted, people become more malnourished during rainy season, this is because people may experience hunger, increased

Variable	Undernutrition Yes	Undernutrition No	Crude OR (95% CI)	Adjusted OR (95% CI)
Age				
19-24	173	52	3.07 (1.32, 7.13)**	3.94 (1.50, 10.29)**
25-29	62	19	3.01 (1.179, 7.69)*	4.02 (1.42, 11.36)**
30-34	21	8	2.42 (0.782, 7.50)	3.54 (1.03, 12.16)*
35-39	12	7	1.58 (0.46, 5.35)	2.02 (0.53, 7.69)
≥40	13	12	1	1
Occupation				
Farmer	203	77	0.52 (0.21, 1.31)	0.51 0.19, 1.32)
Daily laborer	48	15	0.64 (0.22, 1.83)	0.52 (0.16, 1.61)
Student	30	6	1	1
GID				
Yes	165	37	2.34 (1.46, 3.76)***	2.16 (1.31, 3.58)**
No	116	61	1	1
TB				
Yes	24	2	4.48 (1.04, 19.32)*	4.49 (.909, 22.189)
No	257	96	1	1
HIV				
Yes	22	2	4.07 (0.94, 17.66)*	3.18 (0.65, 15.430)
No	259	96	1	1
Toilet				
Yes	119	50	1.41 (0.89, 2.24)	0.67 (0.41, 1.11)
No	162	48	1	1
Housing				
Private	182	69	0.58 (0.29, 1.16)	0.81 (0.38, 1.72)
Rental	45	17	0.58 (0.25, 1.36)	0.59 (0.24, 1.41)
Field	54	12	1	1

*P<0.05; **p<0.01; ***p<0.001. GID: Gastro Intestinal Disturbance

Table 4: Factors associated with adult under nutrition among Kala-azar patients in North West Ethiopia, 2014.

physical activity and diarrheal diseases, malaria, and respiratory tract infections are more prevalent during this season [12,13].

The proportion of the population with low BMIs that would define a public health problem is closely linked to available resources for correcting the problem, the stability of the environment, and government priorities, according to the WHO [8].

In this study it was established that 52% of the respondents had a high dietary diversity score (5.5 or more food groups) and 89.9% of the respondents were food secured. This study was conducted in the months of February to April, which is after a season of harvest and so the increased number IDDS and decreased HFIAS was not surprising. However, the high proportion of malnutrition among diversified and food secured, 76.6 and 75%, respectively could be attributed to other factors. But eating a diversity of foods is an internationally accepted recommendation for a healthy diet, and is associated with positive health outcomes such as reduced incidence of mortality [12]. Dietary diversity is therefore a key concept that should be promoted in managing the nutrition situation of Kala-azar patients.

Patients with gastro intestinal disturbance were 2.2 times more likely to be malnourished [AOR=2.16 (1.31, 3.58)]. Similar result was found from Gondar University Hospital; which showed that patients with Kala-azar who had one or more intestinal parasitic infection were three times more likely to be severely malnourished than patients with no intestinal parasites [AOR=3.01(2.20–5.11)] [11]. This indicates that GID (gastro intestinal disturbance) is related with malnutrition, which could be explained by the fact that GID affects nutritional status in several ways. The most important of these is that gastro intestinal parasitic infestations, bacterial and some other infections, especially if accompanied by fever, often leads to diarrhea, malabsorption, loss of appetite and therefore to reduced food intake, diversion of nutrients for the immune response, and urinary nitrogen loss, all of which lead to nutrient losses and further damage to defense mechanisms. Other infections commonly cause vomiting, with the same result [13].

However, still it is difficult to know, until longitudinal studies are undertaken, whether the high magnitude of chronic energy deficiency found in this study reflect the impact of pre-existing infection or whether the expected immunodeficiency from chronic energy deficiency makes these adults prone to suffer from infection.

In this research, it was observed that young adults were four times more likely to develop malnutrition [AOR=3.94 (1.50, 10.29)]. This contradicts with the fact that old adults are more likely to be malnourished than young adults. Even though, further study is important, this might be explained that young adults are prone to behavioral risk factors (smoking, alcohol use and chewing *khat*) which could make them susceptible to malnutrition.

There are some caveats to be considered while interpreting the results. The consecutive sampling might introduce bias in the selection of the subjects; the research did not assess the degree of malnutrition using body weight loss calculated by reference to the usual body weight. Besides, the study did not assure causality due to the nature of the design.

Conclusion

This study indicated that malnutrition was highly prevalent, nearly 2/3rd of Kala-azar patients were malnourished, out of them quarter of the participants were severely malnourished. Age and gastro intestinal disturbance were predictors of malnutrition among kala-azar patients in Northwest Ethiopia. Possibilities of universal deworming, nutritional support and extensive health education on hygiene should be a priority by governmental and non-governmental organizations on providing care for kala-azar patients. A further large scaled community level longitudinal research is recommended to explore predictors of malnutrition among Kala-azar patients. A due emphasis should also be given by the Federal Ministry of Health (FMoH) to include management of malnutrition in Kala-azar patients in the kala-azar care management guideline.

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from the Research Ethics Committee (REC) of, College of Health Sciences, Mekelle University. Permission letter were also granted from Amhara and Tigray Regional Health Bureau. Copies of the letters were given to the respective managers of the health facilities. Informed consent was obtained from individual patients but if they cannot read and write, fingerprints taken and a third party/caregiver was signing as a witness. All the information obtained from the patients was kept confidential.

Authors' Contributions

AH, AM and KH were involved in the design of study, data collection and analysis, and revised the manuscript. KB and AT carried out the analysis and drafted the manuscript. All authors read and approved the final manuscript.

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