

# Evaluation of the Quality of Nutritional Management of Tuberculosis Patients under Treatment in the Intensive Phase in Two Benin Health Districts

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**Abstract** Adequate nutrition is required for the effectiveness and adherence to medication among TB (Tuberculosis) patients. The purpose of the study was to evaluate the quality of nutritional management of TB patients under treatment in intensive phase in two health districts in Benin. This cross sectional and evaluative study was conducted from February 2<sup>nd</sup> to 20<sup>th</sup> July 2016 and included 36 tuberculosis TB patients (exhaustively selected) under treatment in intensive phase and twelve health professionals who provide care to TB patients identified by a reasoned choice. Data on nutritional management of TB patients were collected through interviews, observation and medical records exploitation. The quality of nutritional management for TB patients was assessed according to national and international guidelines. The median age of the 36 TB patients was 40 years and 97.2% (35) were new cases of tuberculosis. Among TB patients, 88.89% consumed less than required intake of fats and proteins. At base line, 66.67% had BMI <18.5. At the end of intensive phase treatment 44.44% showed BMI <18.5. The quality of nutritional management of TB patients was poor (score = 27.3%) characterized by and a fair component "input" (score = 55.6%), poor components "process" (score = 0%) and "results" (score = 20%). Interventions to improve the quality of nutritional care of TB patients under treatment in intensive phase in the two health districts are timely to improve effectiveness of drug treatment.

**Keywords** Evaluation, Quality, Nutritional Care, Tuberculosis, Benin

## 1. Introduction

According to the World Health Organization (WHO), nine million people have contracted tuberculosis and 1.5 million died in 2013 [1]. Among those nine million, a quarter was living in the African region. In Benin, the prevalence of TB

has stabilized around 40 cases per 100,000 inhabitants and 4092 cases were detected in 2015, with an increase of 3% compared to 2014. Among Tuberculosis patients, 5% are co-infected Tuberculosis / Human Immunodeficiency Virus (HIV). Twenty cases of Multi Drugs Resistance (MDR-TB) per year, with an increasing trend [2] are recorded. In Benin, the number of cases of TB patients in 2013 and 2014 was 3957 and 3977 with a lethal rate of 5% [3].

The TB treatment includes two phases, the intensive phase and the continuation phase. The intensive phase of TB treatment aims to eliminate bacilli, reduce the infectiousness of the patient two weeks later and even reduce bacilli resistance to TB medication. It is used for this purpose 4-5 drugs for 2 to 3 months [4].

The TB infection increases the metabolic requirements but reduces food intake. Nutritional deficiencies due to this infection can worsen the disease or delay recovery. [5]. TB infection usually leads to weight loss and thinness. Weight loss leads to malnutrition when food intake is inadequate for a long period. Then, an adequate nutrition is important for strengthening the immune system, the body's ability to fight against infection and an effective response to treatment [6].

In Benin, the nutritional management of TB patients is usually reasonable limited to the food distribution in the tuberculosis screening and treatment centers (TSTC). This situation could thus hamper the quality of nutritional care of TB patients in intensive phase. The objective of the study was to assess the quality of nutritional management of TB patients under treatment in intensive phase in the health districts of Lokossa and Aplahoué in Benin.

## 2. Materials and Methods

### 2.1. Setting

The study was carried out in the health zones of Lokossa in the Mono department and Aplahoué in Couffo department. Each health districts had two TSTCs. The

populations covered by these health districts were estimated to be 161444 in Lokossa and 408186 in Aplahoué in 2013 [7]. In these two health zones, TSTCs were integrated into the health service and managed by a nurse.

## 2.2. Study Design and Material

This was a cross-sectional and evaluative study. The study material consisted of:

- TB patients under treatment in intensive phase hospitalized or not during the study period.
- Health professionals who provide care to TB patients;
- Patient medical records, drug stock and foods stocks records and guides.

## 2.3. Sampling Method

The non-probabilistic sampling method was used to select all study materials. TB patients in intensive phase were exhaustively selected and health professionals were identified by the reasoned choice.

### 2.3.1. Inclusion Criteria

- TB patients under intensive phase treatment in hospital or not in one the TSTC in the two health zones during the study period.
- Health professionals involved in nutritional management of TB patients in the two health zones during the study period (for health workers).

### 2.3.2. Exclusion Criteria

- Patients who were unable to feed themselves orally.
- Health professionals with less than one month experience (at the time of the survey) in the nutritional management of TB patients in health centers services were concerned.

## 2.4. Study Variables

A Conceptual framework for evaluating the quality of nutritional management of tuberculosis patients in intensive-phase in the LA and ADD health zones was done.

The quality of nutritional management of tuberculosis patients in intensive-phase would only be ensured by the effective availability of inputs and their good management in the process. The results obtained during the take-over would be the image of the quality of the management.

Our hypothesis was that quality of nutritional management of intensive-phase tuberculosis patients in the Lokossa-Athieme and Aplahoué-Dogbo-Djakotomey health zones was insufficient. To Assess the quality of nutritional management of those TB patients in intensive phase and confirm or not our hypothesis, our objectives were to appreciate the availability and the functionality of the inputs of the nutritional management of intensive phase TB patient, to appreciate the process of nutritional management of

intensive-phase tuberculosis patients and to analyze the results of the nutritional management of intensive-phase tuberculosis patients.

The components of the quality of nutritional management of TB patients under treatment in the intensive phase were: “inputs”, “process” and “results”.

Inputs constitute the necessary resources for a good quality of the nutritional management of tuberculosis patients. Variables included in the component inputs were food availability, drugs availability, skilled health professional’s availability, availability of trained and supervised health professionals, guidelines of nutritional management of TB patients, availability of logistic logbook.

**Food:** in order to ensure proper feeding of tuberculosis patients, food must be available in sufficient quantity and in a good variety with at least seven groups. These foods are energy, construction and protection foods. They will ensure the quality of the nutritional care of TB patients;

**Medicines:** the permanent availability of the medicines required for the intensive phase will ensure the success of drug treatment. Medication can negatively affect absorption, metabolism and distribution of nutrients in the body anywhere. Therefore the intensive phase tuberculosis patients must have adequate and sufficient diet to adequately respond to these demands imposed by drugs. This interaction between food and medicines will therefore improve the quality of therapeutic and nutritional management of intensive phase TB patients;

**Technical materials:** the available technical and functional materials will make it possible to make a diagnosis of malnutrition in the tuberculosis patient;

**Nutrition management documents:** the documents will serve as a guide or reference for health professionals to ensure a good nutritional management of tuberculosis patients;

**Management documents:** these documents will ensure required and objectives information on tuberculosis patients in order to ensure the quality of the nutritional care of the patients.

Trained and supervised health professionals in nutrition to apply a correct nutritional management.

The process of nutritional management of tuberculosis patients is the implementation of the nutritional steps for a successful nutritional management of TB patients by the health professionals. Variables included in the components process were nutritional assessment, anthropometric Assessment, nutritional advice, nutrition Surveillance, nutritional monitoring, counseling, motivational and the nutritional education.

Qualified health professionals trained and supervised in food importance and nutrition will ensure the quality of nutritional management of patients through appropriate care and services. They needed to be able to do:

The nutritional status of the patient (food habits, time and quantity of meals, etc.);

Anthropometric assessment (taking weight, height, Middle Upper Arm Circumference; Body Mass Index etc.);

Adequate nutritional advices based on objective analysis of the situation;

Nutritional assessment and monitoring of food intake and anthropometric measurements;

Interpersonal communication that will take into account:

- Nutritional Counseling;
- Motivational interviewing;
- Education in nutrition for better feeding behavior of tuberculosis patients).

The results are the criteria that will help us assess the quality of this nutritional management. Variables included in the components results were weight gain, energy intake, Body Mass Index, patient satisfaction and application of nutritional advices. We were to appreciate the proportion of TB patients:

- who gained weight during the intensive treatment;
- with inadequate food intake in accordance with standards and balanced;
- according to changes in body mass index (BMI) classes: <16 (severe malnutrition); 16-18.5 (underweight); 18,5 to 24.9 (normal);  $\geq 25$  (overweight/obesity)
- satisfied with the nutritional management offered;
- with nutritional counseling and advices ;
- who consumed fruits and dairy products

## 2.5. Measurement of Variables

For the operational aspects of the variables, we adapted our rating scale and appreciation to the one proposed by Myriam Hubinon [8].

Predetermined scores were assigned to variables according to criteria met for their appreciation. The scores assigned to the different criteria of the variables varied from 1 (if the criteria was met), and 0 (if the criteria was not met). That appreciation concerned sub components as drugs and support protocol of TB which were irreplaceable and unavoidable with talking about TB. So if there were only one drug not met, or a TSTC without a protocol support of TB, the score would directly 0. For variables with more than one assessment criterion, the score assigned to the variable was 1 if more than 75% of the expected criteria were met and 0 if less than 75% of expected outcomes were observed. But to assess that information, we first of all calculated the presence of how many elements of the subcomponent corresponded to 75% and more. For example food availability was assessed in relation to the presence of seven food groups (Cereals tubers, fish-meat, fats, eggs, vegetables, fruits, dairy products), knowing that at least the recommended is seven groups of food and it wouldn't be easy to find all those seven. We did  $(7*75)/100$  to find how many groups could we consider as more 75% or more. We found 5 groups. So in a TSTC, if we found at least 5 groups of food, the score would be 1 because considered as 75% and more. That is how the

score was given to all the variables with more than one assessment. Also for example, technical materials were assessed in relation with the presence of three technical materials for nutritional purposes (scales, MUAC, height board). With that criteria, we did the same operation  $(3*75)/100$  and we found 2. So if in a TSTC, 2 technical materials were found, the score would be 1. For the health professionals, they were three per TSTC in charge of TB patients. Normally they were all supposed to be trained and supervised in nutrition as done in medical way. We also did  $(3*75)/100$  and found that at least 2 should be trained and supervised for us to give 1 as a score. Another example, for the sub component gain weight, we did  $(36*75)/100$  and found 26, so if 26 patients gained weight, the score given was 1. And finally, the percentage assigned to the component was calculated based on the ratio of the observed scores and the maximal expected scores in the four TSTCs. For example, in our study, we met 5 sub components of the component inputs at least average. So that mat the score 1. Although the score 9 was expected, we did  $(5/9)*100$  to see the percentage of the component. After that, the quality of each component was appreciated as follow:

- good if the total score is greater than or equal to 75% of the expected score;
- acceptable (fair) if the total score is between 50% and 75% of the expected score excluded;  
For example, the component inputs got  $(5/9)*100$  equal to 55, 55%
- bad (poor) if the total score is less than 50% of the expected score [8].  
For example, the component results, got  $(1/5)*100$  equal to 20%

The assessment of the sub components was based on national standards and international one like Benin's food guide, the care guide Tuberculosis, international documents on the nutritional care of people with TB [9, 10, and 11].

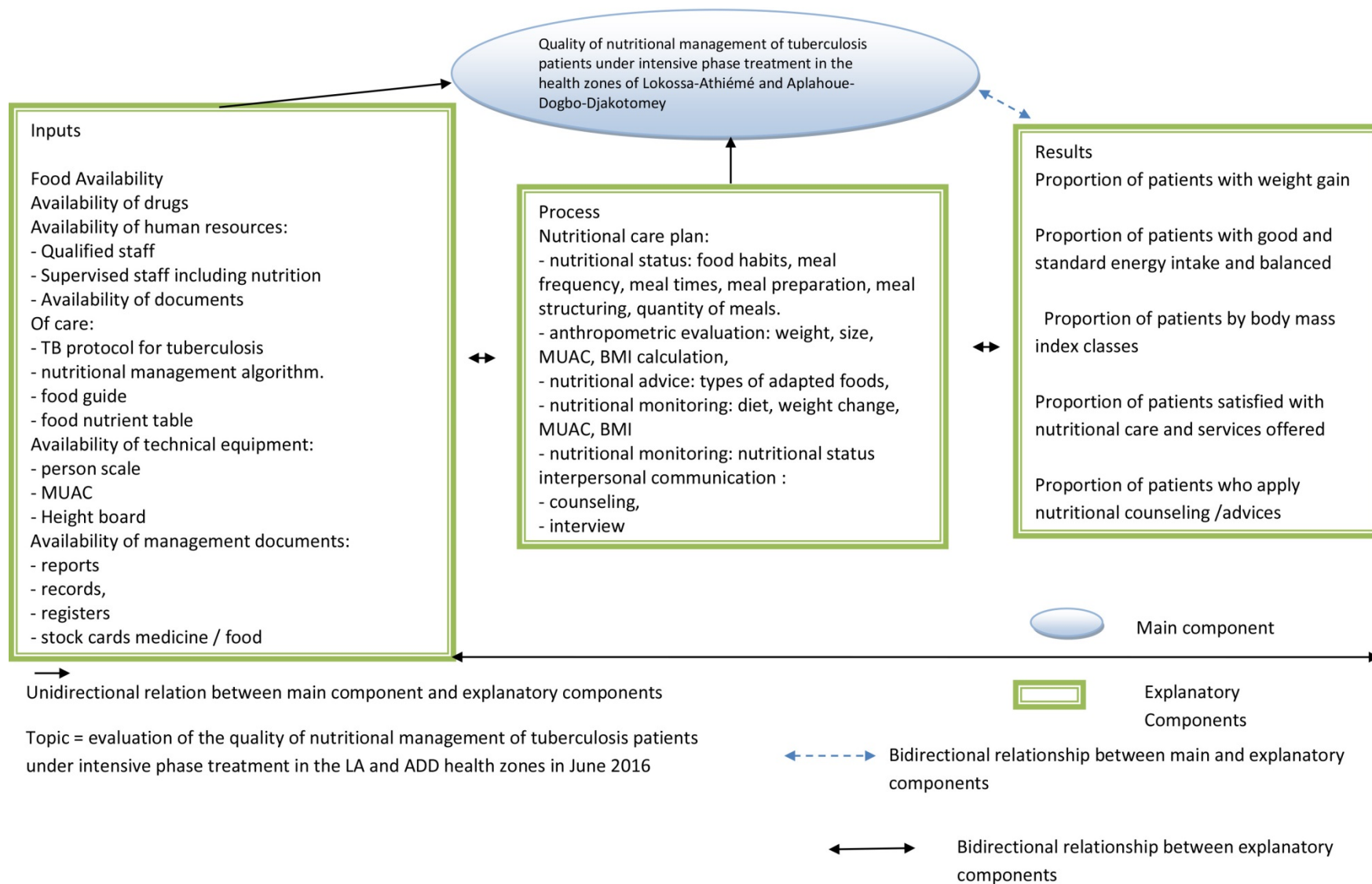
## 2.6. Data Collection

Observation checklists were used to collect data on availability of food, medicines, document management, technical materials, guidelines documents and records. The interview guides, questionnaires and observation checklist were used to collect data in skilled health professionals who provide care for TB patients and nutritional information of TB patients themselves. Data were collected by a student at the end of training in Master in Nutrition.

## 2.7. Ethical Considerations

Health professionals from the unit and all the TB patients were informed of the study objectives. Oral consent was obtained from each person before data collection. That consent claimed that participants are not at risk by refusing to participate in the survey or stopping their collaboration during the study.

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**Figure 1.** Conceptual framework for evaluating the quality of nutritional management of tuberculosis patients under intensive-phase in the LA and ADD health zones in June 2016

**2.8. Data Analysis**

Data were analyzed by STATA software (version 11.0). Those analyses were used especially for TB patients to assess our criteria in the results component.

For example, we used the 24-hour recall questionnaire to assess the patients' diet and nutritional information (two 24-hour recalls were made per patients); after Verification of missing data, elaboration, coding and adjustment by excel and 24h recall adjustment software, we used STATA, to calculate the proportion of TB patients with a good balanced in protein, carbohydrate and lipids intake, the proportion of TB patients fruits and dairy intake.

Also with information on height, weight at the beginning of the treatment, concerning TB patients, from reports, medical records, and our own anthropometric measurements (weight, height, MUAC), took to the TB patients during our study. We were able to calculate with STATA the proportion of TB patients with a normal BMI, MUAC, who gain weight and to see the evolution of those anthropometric measurements.

**3. Results**

**3.1. Characteristics of Participants**

Among the 36 TB patients under treatment in intensive phase who participated in the study, 18 (50%) were in the health zone of Lokossa. The median age of TB patients was 40 years and 97.2 were new TB cases, 97.2% had pulmonary tuberculosis and 94.4% were HIV-negative.

Concerning health professionals, the health professionals in charge of tuberculosis patients were 12 in our study, including three by TSTC. There were 4 doctors for a particular case of problem concerning TB patients and the 8 other nurses.

The heads of the TSTC were all nurses.

None of these health professionals had been trained on nutritional management. None of these health professionals had done nutritional assessment, prescribed nutritional advices, or had counseling or motivational counseling with their tuberculosis patients.

**3.2. Appreciation of the Components of the Nutritional Care of TB Patients under Treatment in Intensive Phase**

**3.2.1. Assessing the Availability of the Component "Inputs" of Nutritional Management**

Those inputs were drugs, food, qualification of health professionals, training and supervision and of health professionals, guidelines of nutritional management of TB patients and logistic logbook. The appreciation of the inputs showed that, the "Inputs" component of the nutritional management of intensive phase TB patients in LA and ADD was acceptable and the subcomponents of non-compliant inputs were all related to food and nutrition like food availability, availability of food materials, availability of trained and supervised nutrition staff.

Only four groups of food were seen instead of the five at least or the seven recommended in each TSTC

No food stuffs or document were present in one TSTC

No formed and supervised health professional in nutrition was notified in one TSTC.

The component "Inputs" was rated 5 points out of 9 (55.6%).The component "inputs" of the nutritional management of TB patients under treatment in intensive phase in the two health zones was fair. The summary of the scores obtained by elements included in the components "Inputs" in the health zones is shown in Table I below.

**3.2.2. Appreciation of the Component of the "Process"**

The components of that process were, nutritional assessment, anthropometric Assessment, nutritional advice, nutrition Surveillance, nutritional monitoring, counseling, glimpsed motivational and the nutritional education. The appreciation of the process showed that, the "Process" component of the LA and ADD health zones was poor.

Not even one of the steps in nutritional management was made in the four TSTCs.

The component "Process" was rated 0 out of 8 (0.0%) points. Thus, the assessment of the component "Process" of nutritional management of TB patients was poor. Table II summarizes the results obtained by the component "Process."

**Table 1.** Synthesis of BMIs of tuberculosis patients at the beginning and ending intensive phase treatment

Body Mass Index Class(kg/m <sup>2</sup> )	Base line %		End of intensive phase treatment	
	Absolute frequency	%	Absolute frequency	%
<16	1	2,78	4	11,11
16 -18,5	23	63,89	12	33,33
18,5- 24,9	11	30,56	19	52,78
≥ 24,9	1	2,78	1	2,78
Total	36	100	36	100

**Table 2.** Synthesis of the evolution of the body mass index of tuberculosis patients

Baseline body mass index (kg/m <sup>2</sup> )	Body mass index at the End of intensive phase treatment(kg/m <sup>2</sup> )			
	<18,5	18,5 - 24.9	≥ 25	Total
<18,5	15	9	0	24
18,5 -24.9	1	10	0	11
≥ 25	0	0	1	1
Total	16	19	1	36

### 3.2.3. Appreciation of the Component “Results”

The components of the results were, weight gain, energy intake, Body Mass Index, patient satisfaction and application of nutritional advices. The results showed that the subcomponents that did not meet the defined criteria were counseling, chronic energy deficit, weight gain and structuring in energy intake.

#### Changes in Body Mass Index of Tuberculosis Patients

At the admission, among our 36 patients, one patient (2.78%) had severe chronic energy deficit, 23 (63.89% moderate malnutrition) and one (2.78%) were obese.

At the end of our study, 4out of 36 patients, 11.11% were severely malnourished (severe chronic energy deficiency), 12 (33.33%) were moderately malnourished and 1(2.78%) was obese. This subcomponent was rated zero point.

Among the 36 patients in our study, 15 patients, or 41.66%, remained unchanged during our study. 1 patient, or 2.78%, had changed from normal BMI (18.5-24.9) to BMI <18, 5 (malnutrition), and 1 patient, 2.78%, had maintained his BMI ≥ 30 unchanged throughout the study.

#### Weight Gain

- General weight gain for all patients

In the study, 6 patients (16.67%) out of 36 maintained their weight unchanged; eight patients (22.22%) showed decreasing weight and only 22 patients (61.11%) increased their weight. The variation in weight loss in the eight patients ranged from one to 20 kg and that was of the gain ranged from 1 to 12 kg.

- Weight gain for patients who underwent 60 days of treatment

Of the 36 TB patients, 16 had completed their intensive phase. Of these 16, five (31.25%) showed weight gain ≥5% and 11 out of 16 (68.75%) had a weight gain <5%.

#### Macronutrients Intake

In our study, none of the 36 patients had unbalanced carbohydrate, lipid and protein intake.

**Table 3.** Synthesis of the energy input structuring of intensive-phase tuberculosis patients

Energy intake	Compliance	Frequency	Percentage (%)
Carbohydrate intake (45-65%)	Yes	3	8,33
	No	33	91,67
Protein intake (10-35%)	Yes	27	75
	No	9	25
Lipids intake (20-35%)	Yes	9	25
	No	27	75
Carbohydrate and lipids intake	Yes	3	8,33
	No	33	91,67
Carbohydrate and protein intake	Yes	0	0
	No	36	100
Lipids and protein intake	Yes	4	11,11
	No	32	88,89
Lipides, carbohydrate and protein intake	Yes	0	0
	No	36	100

#### Fruits and Dairy Product

Also concerning fruits, only 3 out36 or 8. 33 % patients told they took fruits during their treatment and only 1of them or 0.028% took a dairy product during the treatment.

The component score "Results" of the nutritional management of tuberculosis was 1 out of 5 (20%), and 32 patients (88.9%) were satisfied with the nutritional care. The component "results" was poor. The score of the component results will be summarized in Table III.

#### MUAC Results

12 or 33. 33% among our 36 TB patients had an abnormal brachial perimeter (<215). The lowest one was 140.

### 3.3. General Assessment of the Quality of Nutritional Care of TB Patients

The overall score of nutritional management of quality was (27.3%). The quality of nutritional care of TB patients under treatment in intensive phase in the health zones of Lokossa and Aplahoué was poor. Scores are summarized in Table IV below.

**Table I.** Scores of Component "inputs" of nutritional management of TB patients under treatment in intensive phase in two health zones, Benin, in 2016

Inputs	(%) Availability of inputs present in the TSTC	Score observed in the TSTC	Maximum score expected in the TSTC
Food	57	0	1
Drugs	100	1	1
Technical materials	66,7	1	1
TB management guidelines	100	1	1
Nutrition documents	00	0	1
Logistic logbook	100	1	1
Qualified health workers	100	1	1
Trained health workers	33,3	0	1
Workers supervised	33,3	0	1
Total	65,5	5	9

**Table II.** Scores of component "Process" of nutritional management of TB patients under treatment in intensive phase in two health zones, Benin, in 2016.

Activities	Implementation of activities	Score observed	Maximum score expected
Nutritional assessment	No	0	1
Anthropometric assessment	No	0	1
Nutritional advice	No	0	1
Nutritional surveillance	No	0	1
Nutritional monitoring	No	0	1
Counseling	No	0	1
Glimpsed motivational	No	0	1
Nutritional education	No	0	1
Total	-	0	8

**Table III.** Score of the component "results" of nutritional management of TB patients under treatment in intensive phase in two health areas, Benin, 2016

Variable	Frequency (%)	Observed score	Score waited
Weight gain	61,1	0	1
Balanced energy intake	0	0	1
Normal Body Mass Index	52,8	0	1
Patient Satisfaction	88,9	1	1
Application nutritional advices	0	0	1
	20	1	5

**Table IV.** Scores of overall nutritional management of TB patients under treatment in intensive phase in two health areas, Benin 2016

Components	observed Score	Score expected	Observed/expected (%)	Appreciation
Inputs	5	9	55,6	Acceptable
Process	0	8	0	Poor
Results	1	5	20	Poor
Quality of nutritional care	6	22	27,3	Poor

## 4. Discussion

The study evaluated the quality of nutritional care of TB patients under treatment in intensive phase in two health districts of Benin. The study showed that the quality of nutritional management of tuberculosis patients under treatment in the intensive phase was poor.

Food availability is required for a nutritional management

of TB patients under treatment in intensive phase. The results for "food availability" might be explained by the fact that all the seven food groups were not available. Furthermore, health professionals in charge of TB patients do not know the required food groups for a well-balanced diet. The result can also be due to the fact that health professionals ignored the consequences of an imbalance between food supply and drug treatment effectiveness in intensive phase. Indeed, a TB

patient has higher nutritional requirements than a normal individual. Therefore these need to increase nutrient requirement to cover all deficiencies. So a TB patient needs balance between energy intakes from macronutrients and even micronutrients. In the present study, it was found that the food provided for patients are generally cereals that were probably insufficient according to our results, since only three patients who had sufficient energy intake of carbohydrates. Indeed, TB patients received biweekly 3kg of rice, cassava flour, corn, beans, two bags of pasta shells 250g, two cans of evaporated milk 170g, two boxes of sardines, two tomatoes in boxes of 70 g and a liter of oil. Foods such as fruits, vegetables and meats, fish were deficient in their diet. Because fruits and vegetables contain nutrients strengthen the immune system. It is also known that fish and meat are involved in the reconstruction of tissues. According to some previous observational studies on the availability of food for TB patients, Depee et al. found a low incidence of TB in Denmark where the availability and consumption of milk products, vegetables, fruits and meats were very high [12]. All these deficiencies noted could explain the imbalance of energy intake observed in all patients in our study.

In addition to these shortcomings, it was noticed that no patient received micronutrients supplementation. While in a study by Kawai K et al, micronutrients supplementation improved the immune response of TB patients [13]. Another study, by Paton et al. had shown that many TB patients often suffer from malnutrition when the combination of drug and food supply is deficient [14, 15].

Despite all these shortcomings in the nutritional care, it was found that the majority of our patients were satisfied with the nutritional care. This satisfaction may be due to their lack of information concerning food required for their disease and nutritional requirements relating their disease.

Regarding the results obtained in relation with trained and supervised staff in nutrition, it was noticed that health professionals are trained and supervised only on some aspects of nutritional management (reception conditions, food storage and sorting of spoiled food) which generally ensure the availability of food for patients. But the training and supervision do not include the actual process of nutritional care. Health workers also ignore the existence and the importance of guidelines documents such as Benin's food guide, the algorithm of nutritional management of tuberculosis.

The adequate management of TB patients results in weight gain and improving the nutritional status of patients. A weight gain of less than 5% from the beginning to the end of the intensive phase, predicts relapse in patients who already have most often underweight at diagnosis [16]. The results of this study showed that the proportion gain of less than 5% of initial weight at diagnosis of tuberculosis at the end of the intensive phase differs from those reported by Khurram et al. in India. According to them, 52% of patients gained less than 5% of the initial weigh [17]. This difference of proportion can be explained rather by the sample size of this study at the

end of the intensive phase and in their case, the severity of food insecurity in patients and the early detection of the disease.

Finally, the nutritional management is a process that should be monitored up throughout treatment in intensive phase and even beyond this phase as the treatment of tuberculosis takes six months at least. Therefore it is important to involve patients in the nutritional management of communication strategies including counseling and motivational interviewing to enable them to improve their nutritional status even in their family after the end of the intensive phase. Khan et al. reported that after providing counseling for TB patients, the body mass index and nutritional status of patients were significantly improved [18].

## 5. Conclusions

The quality of nutritional management of TB patients under treatment in intensive phase in the health districts of Lokossa and Aplahouéin Benin was poor and it was characterized by an unbalanced diet, a component "input" acceptable and components "process" and "results" bad or poor. Our hypothesis was confirmed. Improving the quality of the nutritional care of TB patients under treatment in intensive phase in the health zones of Lokossa and Aplahoué is needed for more effectiveness of drug treatment.

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## Conflict of Interest

The authors declare no conflict of interest.

## Authors' Contributions

SEM, EMO and CSJ wrote the research protocol. SEM data collected under the supervision of EMO and CSJ. SEM, EMO and CSJ analyzed data. SEM and CSJ wrote the draft of the manuscript under the supervision of EMO. All authors contributed to the final revision of the manuscript.

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