Nutritional status of a leprosy patient in a referral hospital: case report

Estado nutricional de um paciente com hanseníase em um hospital de referência: relato de caso

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ABSTRACT
Leprosy is an infectious, communicable, and chronic disease caused by Mycobacterium leprae, which affects the skin and peripheral nerves. The inflammatory state of leprosy can be influenced by several environmental factors, and the nutritional status is considered one of the modulators of the immune response and a determinant of the risk and prognosis of the disease. Currently, there is little evidence on the relationship between eating habits and such nutritional status. The present study aimed to evaluate the correlation between nutritional status and its role in leprosy, and consequently, in leprosy reactions in a hospitalized patient. The research is a case report, where to perform data collection an interview was conducted during daily visits to the patient, in which a semi-structured form and food frequency questionnaire (FFQ) were applied, and information was collected from the electronic medical record, in the month of October 2021. The nutritional diagnosis indicated malnutrition, with slight loss of muscle mass and adipose tissue. The FFQ showed low food intake in all food groups, with deficiency in macro and micronutrients. Malnutrition affects the innate and adaptive immune response, which ends up compromising the body’s defenses to infectious agents. The lack of macro and micronutrients observed through FFQ is associated with increased inflammation and oxidative stress. Therefore, a balanced diet should be composed of foods from all food groups, becoming qualitatively and quantitatively appropriate to the eating habits. An adequate nutritional status becomes a powerful ally to aid in leprosy treatment since a variety of nutrients in balanced quantities combats malnutrition, strengthening the immune system and allowing an improvement in the quality of life of people with the disease.

Keywords: Leprosy, Nutrition, Food, Immunity.

RESUMO
A hanseníase é uma doença infecciosa, transmissível e de caráter crônico, causada pela Mycobacterium leprae, que acomete a pele e os nervos periféricos. O estado inflamatório da hanseníase pode ser influenciado por diversos fatores ambientais, sendo o estado nutricional considerado um dos moduladores da resposta imune e um determinante do risco e do prognóstico da doença. Atualmente há poucas evidências sobre a relação dos hábitos alimentares e o estado nutricional. O objetivo desse estudo foi avaliar a correlação entre o estado nutricional e seu papel na hanseníase, e consequentemente, nas reações hansênicas de um paciente hospitalizado. Trata-se de um relato de caso, onde para realização da coleta de dados foi realizada uma entrevista durante visita diária ao paciente, no qual foi aplicado uma ficha semiestruturada e o questionário de frequência alimentar (QFA), e coletado informações do prontuário eletrônico, no mês de outubro de 2021. O diagnóstico nutricional apontou
desnutrição, com perda leve de massa muscular e de tecido adiposo. O QFA demonstrou baixa ingestão alimentar em todos os grupos alimentares, com deficiência nos macro e micronutrientes. A desnutrição afeta a resposta imune inata e adaptativa, o que acaba comprometendo as defesas do organismo a agentes infecciosos. A carência de macro e micronutrientes observadas através do QFA tem associação com uma maior inflamação e estresse oxidativo. Diante disso uma alimentação balanceada deve ser composta por alimentos de todos os grupos alimentares, tornando-se qualitativamente e quantitativamente apropriados aos hábitos alimentares. Um estado nutricional adequado torna-se um potente aliado no auxílio do tratamento da hanseníase, visto que uma variedade de nutrientes em quantidades balanceadas combate a desnutrição, fortalecendo o sistema imunológico e permitindo uma melhora na qualidade de vida dos portadores da doença.

**Palavras-chave:** Hanseníase, Nutrição, Alimentação, Imunidade.

1 INTRODUCTION

Leprosy is an infectious, communicable, and chronic disease caused by *Mycobacterium leprae*, which affects the skin and peripheral nerves. It can also manifest as a systemic disease compromising joints, eyes, ganglions, and other organs (BRASIL, 2021).

In Brazil, leprosy is still considered a public health problem. In 2019, 27,864 new cases were notified in the country. The disease affects people of any sex or age, can show a slow and progressive evolution, and when not treated, can cause deformity and physical disability, many times irreversible (BRASIL, 2021).

In the course of the disease some patients may show acute inflammation and hypersensitivity reactions, and require specialized care in hospital units (BRASIL, 2016).

Several environmental factors may influence the inflammatory state in leprosy. In this sense, the nutritional status stands out. It is considered one of the modulators of the immune response and is an important determinant of the risk and prognosis of infectious diseases. This is, in turn, directly influenced by nutrition. Balanced nutrition has a direct relationship with immunity, in that the deficiency of nutrients affects immunological responses and compromises the organism's defense to infectious agents (SILVA and MIYAZAKI, 2012).

Currently there is little evidence on the eating habits and nutritional status relationship, as well as its role in the inflammatory process of hospitalized leprosy patients. The Food Frequency Questionnaire (FFQ) is a tool very used in nutritional epidemiology for investigating previous nutrition and that makes it possible to analyze the causal relationships between nutrition and disease or nutritional disturbance (GODOIS, LEITE and COELHO-RAVAGNANI, 2017).

Thus, the present study aimed to evaluate the correlation between nutritional status and its role in leprosy, and consequently, in the leprosy reactions of a hospitalized patient.
2 METHODOLOGY

The study is characterized as qualitative. The chosen approach was the case study, which sought to explore one single phenomenon in one single location, a patient with leprosy, at a referral hospital for this pathology. The case study, as a research strategy, is used in many situations for contributing with the knowledge one holds of individual, organizational, social, political, and groups phenomena (MEIRINHOS and OSÓRIO, 2016).

The study was developed at the Association for the Aid and Recovery of Leprosy Patients, São Julião Hospital, in a hospitalization unit named "Pousada dos Pássaros" (Inn of the Birds), located in Brazil's Central-West region. To perform data collection an interview was carried out during daily visits to the patient, in which a semi-structured form and food frequency questionnaire (FFQ) were applied, and information was collected from the electronic medical record, in the month of October 2021.

The semi-structured form was applied to collect information of the nutritional physical examination and anthropometric data. In turn, the electronic medical record contained secondary data, namely, social history and biochemical examinations (complete blood count, serum iron, transferrin, creatinine, urea, C-reactive protein, total proteins, albumin, total cholesterol and fractions).

Physical examination was performed in the evaluation of clinical signs in adipose tissue and muscle mass. The anthropometric evaluation included weight and height measurement by using anthropometric mechanical scale (Welmy®) for aid in calculating the Body Mass Index (BMI) and subsequent classification as per the World Health Organization (WHO). Calf Circumference (CC), Arm Circumference (AC), and Waist Circumference (WC) were measured using a 150-cm long and 0.5-mm variation inelastic tape of the Sanny® brand. Triceps Skinfold Thickness (TST) was measured using the Sanny® brand scientific adipometer, for subsequent calculation of the Arm Muscle Circumference (AMC). Values obtained for AC, TST, and AMC were classified according to Frisancho (1990); value obtained for WC was classified according to WHO (1998); and value obtained for CC was classified according to WHO (1995).

The dietary profile was assessed by applying the food frequency questionnaire (FFQ) method. For constructing the questionnaire, initially, a survey was carried out in the literature of the main micronutrients that leprosy patients have deficiency and/or depletion of in the organism and of importance for the immune system (SILVA and MIYAZAKI, 2012). The questionnaire was structured and applied by the study's researcher, using the printed form.
Thus, the foods were separated into seven groups with the respective quantity of foods in each group, namely, (1) rice, bread, pastry, manioc, and potato, composed of 14 foods; (2) legumes and vegetables with 19 foods; (3) fruits with 15 foods; (4) beans and oilseeds with eight foods; (5) meats and eggs with six foods; (6) milk, cheese, and yogurt with six foods; and (7) oils and fats with four foods. To obtain qualitative data and thus determine foods that served, subsequently, as the basis for the inquiry formulation, we grouped the foods according to the food composition table (PHILIPPI, 2016) and following the list of equivalents of portions (PHILIPPI, 2014). It is worth noting that for selecting foods, we considered, too, characteristics of the regional eating habit.

To indicate the frequency of consumption, codes were used, which are already established in the literature (MOTTA et al., 2021). The codes correspond to N (none) and 1-2-3-4-5-6-7-8-9-10 refers to the number of times the food was consumed. The letters D (daily), W (weekly), M (monthly), and A (annual) indicate the food consumption frequency.

The FFQ data were assessed per group, considering the total quantity of food versus the percentage of the number of times the food was consumed daily, weekly, or monthly. Results obtained were correlated with recommendations of Guia Alimentar da População Brasileira (2014).

The research was developed respecting ethical aspects, in accordance with norms of Resolution n. 466 of the National Health Council (BRASIL, 2018), and was approved by the hospital’s Research Commission and by the Research Ethics Committee of UFMS through the opinion 4,567,642. The participant was invited to participate in the study, received information about the aims and procedures of the research, and accepted to participate by signing the Informed Consent Form (ICF).

3 RESULTS
3.1 DESCRIPTION OF THE CASE

Patient J. B. P., 67 years old, male, from the city of Rio Verde (MS), rural worker, and with some primary education. In treatment for dimorphic lepromatous leprosy with polychemotherapy (PCT), he was admitted to the Pousada dos Pássaros hospitalization unit on 27 September 2021, after consultation at the outpatient clinic for leprosy of São Julião Hospital, due to a leprosy reaction of the Erythema Nodosum Leprosum (ENL) type, which spread over the trunk and upper limbs, also showing fever episodes (38°C) and hyporexia. The patient did not have a history of alcoholism, tobacco addiction and other comorbidities, and was admitted conscious, oriented, and ambulating.
3.2 NUTRITIONAL ANAMNESIS

In the anthropometric evaluation the patient showed current weight of 66 kg, 1.60m height, and 25.78 kg/m² BMI, being classified as eutrophic. The AC was 27 centimeters, corresponding to 86.81% of adequacy (mild malnutrition), TST of 8.6 millimeters, corresponding to 67.71% of adequacy (severe malnutrition), AMC of 24.29 centimeters, resulting in 85.52% of adequacy (mild malnutrition), CC of 32 centimeters, revealing a slight loss of muscle mass, WC of 89 centimeters (adequate).

In the physical examination the patient showed slight reduction of the buccal fat pad, slight reduction in bilateral temporal muscles, slight reduction of the adipose tissue and muscle mass in upper and lower limbs bilaterally, and dry skin. In the biochemical evaluation the patient showed changed parameters for blood count (red blood cells), C-reactive protein, transferrin, and HDL cholesterol, as presented in Table 1. It is worth stressing that the reference values follow standards established by São Julião Hospital’s (SJH) laboratory.

<table>
<thead>
<tr>
<th>Examination</th>
<th>Results</th>
<th>Reference value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin</td>
<td>10.3 g/dL*</td>
<td>12.8 to 17.8 g/dL</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>32.9%</td>
<td>40 to 54%</td>
</tr>
<tr>
<td>Red blood cells</td>
<td>3.89 million/mm</td>
<td>4.5 to 6.1 million/mm</td>
</tr>
<tr>
<td>C-Reactive Protein</td>
<td>17.6 g/dL**</td>
<td>&lt; 5 g/dL</td>
</tr>
<tr>
<td>Creatinine</td>
<td>1.0 mg/dL**</td>
<td>0.70 to 1.50 mg/dL</td>
</tr>
<tr>
<td>Urea</td>
<td>21.6 mg/dL.</td>
<td>&lt; 55 mg/dL</td>
</tr>
<tr>
<td>Total proteins</td>
<td>7.4 g/dL</td>
<td>5.7 to 8.2 g/dL</td>
</tr>
<tr>
<td>Albumin</td>
<td>3.4 g/dL</td>
<td>3.2 to 4.8 g/dL</td>
</tr>
<tr>
<td>Iron</td>
<td>51.9 mcg/dL.***</td>
<td>35 to 150 mcg/dL</td>
</tr>
<tr>
<td>Transferrin</td>
<td>185 mg/dL</td>
<td>215 to 365 mg/dL</td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>143 mg/dL</td>
<td>&lt; 200 mg/dL</td>
</tr>
<tr>
<td>HDL</td>
<td>31.4 mg/dL</td>
<td>≥ 40 mg/dL</td>
</tr>
</tbody>
</table>

Note: *g/dL: grams per deciliter; **mg/dL: milligrams per deciliter; ***mcg/dL: microgram per deciliter

Source: São Julião Hospital Laboratory, 2021

The nutritional diagnosis, from the results of this assessment, was malnutrition, with slight loss of muscle mass and adipose tissue.

3.3 FOOD FREQUENCY QUESTIONNAIRE (FFQ)

After the FFQ application, it was observed that in the rice, bread, pastry, potato and manioc group, there was the absence of consumption of four foods (28.57%). Furthermore, the consumption of food once or twice daily was 7.14%, while the monthly consumption was 35.71%.

In the vegetables and legumes group there was absence in the consumption of 13 foods representing 68.42%, while the daily consumption represented 15.78%. Regarding the fruits...
group, only two foods are consumed daily (13.33%); about 60% are not consumed. In the bean and oilseeds group, 62.5% of the foods are not consumed. It is worth stressing that the patient is not in the habit of consuming beans daily, rather, the consumption is monthly (25%). The meat and eggs group result evidenced that 33.33% of the foods are consumed daily, yet 50% of the foods in the group are not consumed.

The milk, cheese and yogurt group had the highest percentage for no food inserted in the eating habit (83.33%) and only 16.66% of the foods were consumed daily. Oils and fats showed 50% for daily consumption and 50% for no consumption.

The food consumption assessment carried out evidenced that between the food groups, the foods consumed daily had higher percentage when compared to weekly and monthly consumption, except in the group of rice, bread, pastry, potato, and manioc. We highlight that the absence/no consumption of food had the highest percentage in all food groups, being more significant in the group of milk, cheese and yogurt, followed by vegetables and legumes, beans and oilseeds, and of fruits, as detailed in Table 2.

<table>
<thead>
<tr>
<th>Food Group</th>
<th>None</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice, bread, pastry, potato, and manioc.</td>
<td>4 (28.57%)</td>
<td>1 (7.14%)</td>
<td>1 (7.14%)</td>
<td>5 (35.71%)</td>
</tr>
<tr>
<td>Vegetables and legumes</td>
<td>13 (68.42%)</td>
<td>3 (15.78%)</td>
<td>1 (5.26%)</td>
<td>1 (5.26%)</td>
</tr>
<tr>
<td>Fruits</td>
<td>9 (60%)</td>
<td>2 (13.33%)</td>
<td>1 (6.66%)</td>
<td>1 (6.66%)</td>
</tr>
<tr>
<td>Beans and oilseeds</td>
<td>5 (62.5%)</td>
<td>-</td>
<td>1 (12.5%)</td>
<td>-</td>
</tr>
<tr>
<td>Meats and eggs</td>
<td>3 (50%)</td>
<td>2 (33.33%)</td>
<td>-</td>
<td>1 (16.66%)</td>
</tr>
<tr>
<td>Milk, cheese, and yoghurt</td>
<td>5 (83.33%)</td>
<td>1 (16.66%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Oils and fats</td>
<td>2 (50%)</td>
<td>2 (50%)</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: author of the research
4 DISCUSSION

Nutrition has gained momentum as an important ally in healthcare, both in prevention and in disease control. Yet, there are few studies evaluating nutritional status in people carriers of leprosy, and consequently, no specific diet or nutrients reported relative to the disease, directly. Food and nutrition are considered basic principles for health promotion and protection, and this enables improving nutritional status, immunity, and accordingly, the quality of life of these patients (SILVA and MIYAZAI, 2012).

The assessment of nutritional status aims to identify nutritional disorders and promotes an adequate intervention so that it can aid in recovering and/or maintaining the individual’s health (KAMIMURA et al., 2014).

The biochemical examinations pointed out reduced parameters for red cells in the complete blood count, which is indicative of anemia of chronic disease. This condition is associated with situations of inflammation and/or chronic and acute infections (OLIVEIRA et al., 2019). Transferrin also proved to be low and may be associated with anemia or the inflammation and infection caused by leprosy (KAMIMURA et al., 2014). The increased C-reactive protein can indicate the infectious process and inflammatory state of the disease (OLIVEIRA et al., 2012). The HDL cholesterol also responsible for the inhibition of inflammatory and antioxidant activity in the organism was reduced (CALIXTO-LIMA, GUEDES and REIS, 2012). Findings of transferrin and HDL cholesterol have a direct relationship with the food quality deficit observed in FFQ.

Malnutrition affects the innate and adaptive immune response, which ends up compromising the organism’s defense to infectious agents (SILVA and MIYAZAKI, 2012). Previous study suggested that the host’s impaired immune response against bacteria causing leprosy as a result of insufficient nutritional intake is the possible cause of this condition (OKTARIA et al, 2018). Thus, it is possible to observe that the patient has a nutrient-deficient diet, evidencing the malnutrition. The dearth of macro and micronutrients observed via FFQ has an association with greater inflammation and oxidative stress (IDDIR et al, 2020).

Foods as rice, bread, pastry, potato, and manioc are rich in carbohydrates and vitamin B1; vegetables, legumes, and fruits are rich in vitamin C, folate, potassium, calcium, and magnesium; beans and oilseeds are rich in proteins, selenium, manganese, and phosphorus; meats and eggs are rich in proteins, vitamins B6, B12, niacin, biotin, iron, zinc, and copper; milk, cheese, and yogurt are rich in proteins, vitamin A, D, B12, and calcium; oils and fats are rich in lipids and vitamins E and K (PHILIPPI, 2014).
A healthy diet should include foods that become adequate qualitatively and quantitatively, to food habits, foods from all food groups, and prepared in a manner to preserve the nutritive value and sensorial appearances (SILVA and MIYAZAI, 2012).

Carbohydrates should provide from 55% to 65% of the Total Energy Value of our daily nutrition, 45% to 55% of which complex carbohydrates and 10% simple sugars. Between 25% and 30% should come from lipids. The protein supply should be from 10% to 15% of the food energy value (BRUSCHI, LABRÊA and EIDT, 2011). Vitamins and minerals should be present in the diet because they provide an adequate immune response (IDDIR et al, 2020).

The food quality in individuals with leprosy is associated with eating habits, physical health condition, knowledge on nutrition, and with the socio-economic situation, therefore there is a need that these patients receive nutritional care, so as to promote adequate nutrition and the prevention of comorbidities, ensuring the promotion of health and food safety (BRUSCHI, LABRÊA and EIDT, 2011).

5 CONCLUSION

The patient’s malnutrition status reflected how much the food, and consequently food nutrients need to be added in the diet, given the unbalance between intake and need for nutrients, and the impact of nutritional deficiencies can impair immunological responses.

Adequate nutritional status becomes a powerful ally in aiding the treatment of leprosy, as well as preventing and/or treating leprosy reactions, given that the variety of nutrients in balanced quantities combats malnutrition, strengthening the immune system and allowing an improvement in the quality of life of disease carriers.
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