Tópicos em Nutrição e Tecnologia de Alimentos 2

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APRESENTAÇÃO

O *e-book* Tópicos em Nutrição e Tecnologia de Alimentos vol. 2 traz 26 artigos científicos na área de Nutrição e Tecnologia de Alimentos, abordando assuntos como desenvolvimento e análise sensorial de alimentos, composição físico-química e avaliação microbiológica de produtos, avalição nutricional de cardápios, desperdício alimentar em unidades de alimentação coletiva, estado nutricional e comportamento alimentar de pacientes, marketing na nutrição, gastronomia aliada ao turismo, entre outros diversos temas.

Diante da leitura dos artigos que compõem esse *e-book* o leitor conseguirá integrar a Nutrição e Tecnologia de Alimentos, além de atualizar-se com temas de suma importância e relevância.

Desejamos a todos uma excelente leitura!

Vanessa Bordin Viera
Natiéli Piovesan

SUMÁRIO

CAPÍTULO 25

REPERCUSSIONS OF THE NUTRITIONAL STATUS OF PEOPLE LIVING WITH HIV/AIDS

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ABSTRACT: Currently, AIDS tends to become a chronic disease, due to the highly effective drugs against the virus, and to the change in the quality of life and daily habits of the carriers, especially concerning food. However, even with the state of the favorable to HIV maintenance in the human organism, there is the possibility of development of changes in the physiological state. The individual with HIV/Aids, even after starting treatment with highly potent antiretroviral therapy, may develop lipodystrophic syndrome, and consequently, facial lipoatrophy, which has become epidemic, negatively interfering in the patient's quality of life. The patient may also present with viral and fungal infections, which are common oral manifestations of HIV and can cause limitations in nutrient intake, resulting in weight loss and compromised nutritional status. Thus, the purpose of this chapter is to discuss the general and oral repercussions regarding the nutrition of individuals living with HIV/Aids.

KEYWORDS: HIV; Aids; Nutrition; Oral Diagnostic

INTRODUCTION

Currently, Aids (Acquired Immunodeficiency Syndrome) tends to be a manageable disease. It is possible to recognize and treat the pictures associated with the infection itself and the adverse effects of the antiretrovirals. Even before the diagnosis of HIV (Human Immunodeficiency Virus) and Aids, constitutional signs are usually present, such as weight loss, diarrhea, lymphadenopathy, night sweats, vomiting, fever, prostatitis, adynamia, bacterial infections, candidiasis, pulmonary

tuberculosis, cerebral toxoplasmosis, carcinomas, and many other symptoms that impose changes on the patient's physical and psychological lifestyles.

The individual with HIV/Aids, even after initiation of treatment with highly potent antiretroviral therapy, may develop lipodystrophic syndrome and, consequently, facial lipoatrophy, which has become epidemic, interfering negatively in the patient's quality of life.

Viral and fungal infections are common oral manifestations of HIV and can cause limitations in nutrient intake, resulting in weight loss and compromised nutritional status. In general, these infections end up compromising even more the immune response and pre-existing malnutrition, as well as gastrointestinal disturbances due to HIV itself. Candidiasis of the tongue, palate, or esophagus can cause great discomfort and make chewing, sucking, and swallowing painful.

Oropharyngeal fungal infections can also cause burning, hypersensitivity in the mouth, and dysphagia, compromising food intake. In addition to its direct influence on nutritional status, it is important to highlight the clinical importance of oral candidiasis, which is considered from the beginning of the Aids cycle to the present day as an important marker of Aids progression, and may also predict increased immunosuppression of patients, failure of Highly Active Antiretroviral Therapy (HAART), or even lack of adherence to the recommended treatments. The oral route is preferred by the multidisciplinary team; when the nutritional need of macro and micronutrients cannot be obtained wholly or partially, enteral and/or parenteral nutritional therapy may supplement or even replace oral intake. It is indicated in the correction of severe malnourished patients, especially in cases where there are oral or esophageal lesions, until the patient is able to maintain adequate oral intake. Parenteral nutrition therapy should be provided when oral and/or enteral nutrition is not tolerated in sufficient quantity to meet the nutritional needs of the patient.

The lipodystrophy syndrome (LS) in HIV/Aids patients is characterized by redistribution of body fat and metabolic abnormalities. Physically, lipoatrophy is observed in peripheral areas, and lipohypertrophy, in central areas, thus causing morphological changes in the human body. Scientific research suggests that the percentage of individuals with lipodystrophy can range from 6 to 69% among HIV-positive patients on antiretroviral therapy (ART) for at least one year. In the face region, lipodystrophy is characterized by the loss of fat, especially in malar (fat and/or Bichat´s fat pad) and pre-temporal areas. These changes have a great psychological impact, because they have a similar appearance in patients at the beginning of Aids, practically revealing the diagnosis, which most patients wish to keep confidential. Comparative studies between the volume deficit in the face due to aging caused by changes in soft tissues and the loss of fat that occurs in HIV-associated lipoatrophy suggest that it is smaller in aging than that observed in people with lipoatrophy. However, with advances in the treatment of Aids and the reduction of morbidity and mortality, consequently there has been an increase in life expectancy and, increasingly, we will have the combination of these

two factors (aging and lipoatrophy) directly interfering in the facial contours of HIV/Aids patients. At the present moment there is a certain tendency of Aids to become a disease in stage of chronification, and the use of antiretrovirals can accelerate the development of facial lipoatrophy, influencing the quality of life of those who develop it. Nutritional balance is crucial to help minimize these effects.

In many cases, facial filling alone does not solve the facial alteration; sometimes the oral health conditions of patients end up being unfavorable due to the lack of dental replacement, lost prematurely, or even due to the immunosuppression caused by HIV virus, or even for periodontal diseases, evidenced abruptly as opportunistic manifestations related to Aids. Considering that facial lipoatrophy is a process that can significantly alter the image of people, which may reflect directly on the question of their identity, the Dentist has a relevant role in mitigating anatomical alterations such as wrinkling and facial depression caused by lipoatrophy and/or loss of dental elements.

ACQUIRED IMMUNODEFICIENCY SYNDROME

In 1981, the Centers for Disease Control (CDC), an institution responsible for epidemiological surveillance in the United States, reported five cases of pneumonia caused by *Pneumocystis carinii*, now called *Pneumocystis jirovesii*, in previously healthy young men who have sex with men. Later, they reported on the epidemic of Aids, reporting, this time, an outbreak of Kaposi's sarcoma and *Pneumocystis carinii* pneumonia among the same population of New York and Los Angeles, later concluding that it is an infectious disease. The first indication that AIDS was caused by a retrovirus occurred in 1983, when a virus with a reverse transcriptase activity was isolated and described as human immunodeficiency virus type 1 (HIV-1). Soon afterwards, in 1986, another retrovirus was isolated and called human immunodeficiency virus type 2 (HIV-2). Thereafter, the means of transmission of Aids became known even before its etiologic agent was identified through epidemiological investigation, and the community of homosexuals and injecting drug users were identified as a risk group. Over the years, a new trend has occurred with the generalization of the disease to the entire population. Sexual practices have been identified as important avenues of HIV transmission since the earliest research on the disease. Another form of HIV transmission was the perinatal or vertical transmission, which may occur intrauterine, during labor, or through breastfeeding. The vertical transmission rate varies from 15 to 35% in the absence of antiretroviral therapy, but the transmission of HIV through the blood, whether by sharing syringes for injecting drug use, in turn, has become a very present path. From the development of increasingly sensitive serological tests for HIV detection greatly reduced the risk of transfusion of contaminated blood. Transplants, dialysis, and other hospital procedures, such as artificial insemination, are described as forms of HIV transmission. Testing for the presence of the virus has become a key element in the definition of cases since 1985, and in 1993, the CDC included HIV-

infected persons with CD4+ cell counts below 200 cel/mm^3 of blood, expanding the pre-existing list of diseases indicative of Aids. The case definition developed by the CDC has been adopted and modified by several countries around the world (BRASIL, 2009; TRAN, 2012).

Aspects of HIV infection as well as the functioning of the human immune system began to be elucidated in the 90s, and the integration of the viral genome into infected cells, especially T cells, is evidenced as the cause of major changes in host cell gene expression, leading to the depletion of these cells as well as of the non-infected ones. Patients, as a rule, present a progressive decrease in the function and number of helper T cells, accompanied by hypergammaglobulinemia, being a determinant factor in the imbalance in the cytokine network in infected patients, making it a determinant factor, at least in part, by the immunological changes that lead to Aids. Viral infection also causes changes in non-immunological homeostasis, with consequences on the immune process, such as elevation in the substance P level, which in turn increases HIV expression in monocytes. Changes in basic cellular processes, such as the cycle of cell regulation are present, resulting in premature programmed cell death. At least three major cell populations are infected with HIV: helper or CD4+ T lymphocytes, monocytes, and macrophages. Most viral replication occurs on CD4+ lymphocytes, peripheral blood, or lymphoid tissue. In summary, HIV infection is characterized by a selective depletion of CD4+ lymphocytes. Plasma levels of HIV-1 ribonucleic acid (RNA) and CD4+ lymphocyte count are the most important variables that determine the rate of disease progression. In the absence of treatment, the duration of seroconversion until the development of Aids revolves around 10 years. Some patients are rapidly progressing to the development of Aids over a period of 3 to 5 years, but long-term non-progressors, about 1% of those infected, may have normal CD4+ counts and low viral loads for more than 10 to 20 years. In the absence of treatment, survival after the clinically defined diagnosis of Aids is extremely doubtful, and disease is likely to progress in a short period of time (CDC, 2015; KOETHE et al., 2016; AIROLDI; ZACARELLI, 2010; KOSMISKI 2011; RAJSHREE et al., 2015).

The exact number of HIV-infected people in the world is still unknown, because there are failures or even lack of notifications, even though it is mandatory.In poorer countries, this data is omitted and impaired, with no parameters to really know the epidemiology. The World Health Organization (WHO) and the United Nations Programs on HIV/Aids (UNAIDS) estimate that in 2018 around 40 million people were living with HIV/Aids worldwide, and that 16,000 new infections occur daily.

Although initially concentrated in a group of men who have sex with men, the epidemic was expansive and reached injecting drug users and the entire general population, with an increase in the number of infected women, mainly of childbearing age, with vertical transmission occurring. Since the 90's, a transition of the epidemiological profile was verified, resulting in heterosexualization, feminization, pauperization, and internalization of the epidemic. At the present moment there is a marked increase in

the two age groups of the population: in young people who are starting their sexual activities and in the elderly people above 60 years of age, according to the WHO, mainly due to unprotected sexual activities.

HIGHLY ACTIVY ANTIRETROVIRAL THERAPY

The natural history course of HIV infection has been significantly modified since 1996 with the advent of antiretroviral therapy (ART), which delays the evolution of infection even to the final stage, where Aids-defining manifestations appear. Together with prevention campaigns, antiretrovirals (ARVs) have contributed to the stabilization of the progress of this epidemic in Brazil and in the world, reflecting the reduction of Aids incidence and the reduction of the mortality rate in recent years. According to the WHO, there is 42% coverage of ARV use among those infected with HIV worldwide.

ART currently includes drugs that are divided into classes: nucleotide analogue reverse transcriptase inhibitors (NRTIs), which act on the reverse transcriptase enzyme by incorporating the DNA strand that the virus creates, making this chain defective and preventing the virus from reproducing itself; non-nucleotide reverse transcriptase inhibitors (NNRTIs), which directly block the action of the enzyme, its multiplication, and the development of infestation in the body; protease inhibitors (PIs) evidenced as an important drug, but also an important villain in the onset of lipodystrophic syndrome, which prevent the production of new copies of HIV-infected cells, fusion inhibitors (FI), integrase inhibitors, and the CCR5 inhibitors, which prevent virus from entering the cell. To combat HIV, it is necessary to use at least three drugs of different classes, and most patients receive three to four antiretroviral drugs. However, many drugs cannot be used together because they interact with each other, potentiating the toxic effects or inhibiting their action. The use of regimens containing combination of three antiretroviral drugs outweighed the emergence of viral resistance easily observed with the use of monotherapy or double therapy containing nucleoside reverse transcriptase inhibitors. The combination regimen of three antiretroviral agents containing protease inhibitors has been named HAART in the United States, and popularly “cocktail” treatment in Brazil. With the advent of ART, scientific evidence shows the impossibility of complete elimination of HIV in the body, causing AIDS patients to use antiretrovirals throughout their lives. The criteria adopted for the initiation of therapy are based on the patient’s clinical status, CD4+ lymphocyte counts, and viral load, which are extremely important factors in the adequate choice of the various therapeutic regimens available, as well as for monitoring the therapeutic outcome, which aims to reduce viral load to levels below 50 copies of RNA/ml, as measured by the polymerase chain reaction (PCR) technique (BRASIL, 2009; TRAN, 2012; BALDERSON et al., 2013; DANCHECK et al., 2005; PRIBAN, 2011).

There is a well-established relationship between the number of circulating

CD4+ lymphocytes and the susceptibility to infection. In addition to diseases caused by immunosuppression, the HIV virus can cause disease due to direct damage to certain organs or immune processes. Numerous studies have shown that response to high potency combination antiretroviral therapy, as measured by CD4+ counts and HIV viral load, is associated with decreased disease progression and incidence of lethality. These studies also demonstrated that the greatest reductions in viral load are associated with improved clinical outcome. Knowledge of viral dynamics and the emergence of laboratory methods capable of measuring the amount of virus circulating in plasma (viral load) as well as CD4+ lymphocyte counts have made it possible to monitor reliably and objectively the evolution and treatment of HIV infection. Successful treatment of infected patients depends on intervention with antiretroviral agents, and specific therapeutic and prophylactic modalities that will avoid direct damage to the organs by HIV itself and will not allow or decrease the immune decline, and will reduce the likelihood that opportunistic infections and neoplasms produce morbidity and mortality. Brazil is one of the first countries to adopt significant health policies to improve care for people living with HIV/Aids, coupled with universal and free access of the population to medicines used to treat Aids. These drugs slow down the development of Aids and enable higher quality of the patient because they act to reduce viral load and reconstitute the immune system. The introduction of antiretroviral therapy as it is known today has led to an increase in the survival of seropositive HIV patients, but it is also related to the advent of new and important problems, such as the redistribution of body fat and the metabolic abnormalities - the so-called lipodystrophic syndrome, which are among the most prevalent and worrying side effects of ART (BRASIL, 2009; BEATA et al., 2015; FALCO et al., 2012).

LIPODYSTROPHY ASSOCIATED WITH HIV/AIDS

Since 1996, a number of new anatomical and metabolic changes have begun to be described in patients with HIV/Aids, particularly those using highly effective antiretroviral therapy. Patients began to exhibit atrophy of peripheral fat as well as accumulation of central fat, and at the same time it was noted that redistribution of body fat was accompanied by insulin resistance and various abnormalities in serum lipids. These changes were described below as lipodystrophy and/or lipodystrophic syndrome of HIV (SLHIV). The first morphological signs of SLHIV were described about 2 years after the introduction of protease inhibitors (PIs). However, the introduction of PIs coincides with the inclusion of a second nucleoside analogue reverse transcriptase inhibitor, stavudine. Initially, SLHIV was referred to as “Crixbelly” because the first cases of redistribution of body fat were observed after the use of Crixivan R (indinavir), a class IP medication. The association between the use of indinavir and the redistribution of body fat was described in 1998, using computed tomography, demonstrating the increase of visceral fat in these individuals. With the advent of new IPs, evidence has

been found that redistribution of body fat was not a unique effect of indinavir, and this denomination was abandoned. Several synonyms are currently used for SLHIV, such as body fat redistribution syndrome, metabolic syndrome associated with antiretroviral therapy or, more recently, dyslipidemic lipodystrophy associated with HIV and HAART. The first perceived bodily changes were the accumulation of fat in the abdominal region and in the back of the neck, the so-called gibas. Other anatomical changes include lipoatrophy of the face and upper and lower limbs, and prominence of superficial veins, orfat accumulation in the abdomen, cervical region, and breasts. Metabolic changes include lipid changes and abnormalities in glucose homeostasis. Metabolic changes may or may not be associated with anatomical changes, and lipid abnormalities found in SLHIV are increased serum triglycerides (TGC) and/or total cholesterol at the expense of low-density lipoproteins or low-density lipoproteins (LDL), with a tendency to decrease the levels of high-density lipoproteins or high-density lipoproteins (HDL). Hypertriglyceridemia is mainly due to high rates of de novo lipogenesis and delayed clearance of TGCs in the postprandial period. Studies also revealed that a significantly increased proportion of patients on PI had elevated serum levels of apolipoproteins B and E, possibly due to their increased synthesis, which could be related to the manifestation of hyperlipidemia or the so-called plurimetabolic syndrome. Glucose abnormalities may be manifested as glucose intolerance, peripheral insulin resistance, or diabetes mellitus (DM).The mechanisms of action by which ARV, such as protease inhibitors, cause insulin resistance are the reduction of uptake of insulin-mediated glucose in skeletal muscle and adipocytes, interfering with GLUT-4 transmembrane glucose transporters, as well as the effect on steroid regulatory element binding protein-1c (SREBP-1) transcription factor, affecting glucose metabolism by producing imperfect expressions of peroxisome proliferator-activated gamma receptor (PPAR-gamma). A lactic acidosis occurs in the syndrome.Itis mainly caused by nucleoside analog reverse transcriptase inhibitors, and secondary to mitochondrial dysfunction due to the inhibition of mitochondrial deoxyribonucleic acid (DNA) polymerase by this class of drugs. The establishment of lactic acidosis and slow and symptoms is not specific. It is now known that loss of bone mineral density is a component of the same syndrome, and avascular necrosis has been considered a complication of SLHIV, since hyperlipidemia and HIV infection itself are known risk factors for osteonecrosis of the femoral head, and metabolic changes are associated with an increased risk of cardiovascular events. Hyperinsulinemia associated with insulin resistance and recognized risk factor in non-HIV infected patients may contribute to the increased risk of acute myocardial infarction in patients receiving ARV. Thus, HIV-positive patients with a significantly higher prevalence of high levels of fasting and triglyceride glycemia and low levels of HDL cholesterol have an increased risk of atherosclerosis, coronary disease, and diabetes mellitus. Among the anatomical alterations of fat redistribution, three groups are identified:lipoatrophy, lipohypertrophy, and mixed forms. Lipoatrophy and lipohypertrophy may occur independently or may occur together in the same patient.

In lipohypertrophy, central or localized fat accumulation occurs. Fat accumulation can occur in the abdomen, cervical region, back, breasts, and other localized sites. The increase of the volume of the breasts, in the female sex, is basically due to the fatty component, without obligatory association with the glandular hypertrophy. In the male sex, gynecomastia (glandular hypertrophy) or pseudo-gynecomastia (fat accumulation) may occur. In lipoatrophy, there is a peripheral loss of subcutaneous tissue, resulting in thinning of the upper and lower limbs; the skin becomes thinner and allows visualization, almost anatomically, of muscle clusters and superficial blood vessels. The heterogenicity of findings in HIV-associated lipodystrophy may reflect the existence of more than one syndrome (BROWMIK et al., 2012; AKINBORO et al., 2014; CANAVARRO et al., 2011, CHATTERJEE et al., 2010; FRAZÃO et al., 2014; ANABWANI; NAVARIO, 2015; GUADAMUZ et al., 2012; RAY et al., 2007; THOMPSON-PAUL et al., 2015; THUPPAL et al., 2017; TÓTHOVA et al., 2014).

Appropriate treatment proposals for patients with facial lipoatrophy:

1. Switch the medication: In patients receiving HIV treatment with ARVs such as Zidovudine or Stavudine, it is recommended toexchange for a nucleoside analog such as Abacavir, and in patients using Protease Inhibitor,it is recommended to evaluate its replacement with an Integrase Inhibitor such as Dolutegravir;

2. Dietary Changes: Low Fat and Carbohydrate Diet;

3. Drug treatment with: Metformin, Glycations and/or Recombinant human leptina;

4. Hormonal treatment: use of supplements and hormones should be evaluated carefully because of the risk of drug interaction and increased risk of hepatites;

5. Cosmetic treatments: Facial reconstruction with free flaps or silicone; liposuction. Lipectomy to remove excess fat; fillings with methacrylate; and use of mouth prostheses to fill the spaces of the lost dental elements or even to the edentulous ones, evidences a considerable improvement of the conditions of deformities caused by the facial lipoatrophy, reducing the losses, and sinking of the facial region of the patient (BRASIL, 2009; AKINBORO et al., 2017; MIZIARA et al., 2005).

DIAGNOSTIC

The most used method to determine a case of lipodystrophy includes the subjective description of changes in body fat, and some diagnostic criteria are proposed, such as blind face, depressed temples, sunken eyes, prominent zygomatic arch, emaciated aspect, prominent non-varicose veins in the arms and legs, loss of skin folds, and loss of contour and fat in the gluteal region. Fat accumulation is categorized into five areas, such as: increased abdominal circumference, pectoral enlargement, accumulation of dorso-cervical fat, accumulation of facial fat, and the presence of lipomas. Methods for fat assessment and monitoring include patient testimonials, clinical evaluations,

anthropometric measurements, and imaging tests. The lack of standard values regarding fat in the general population and the heterogeneity of the clinical manifestations of lipodystrophy make diagnosis even more difficult, and some methods have been used, such as anthropometry, bioimpedance, DEXA, computed tomography, magnetic resonance imaging, and ultrasonography. Anthropometry and impedanciometry cannot measure regional fat, but the use of ultrasoundbecomes important and promising because it is simple, non-invasive, and low cost (BRASIL, 2009; AKINBORO et al., 2017; MIZIARA et al., 2005).

Identification of the disorganization of adipose tissue in HIV patients and changes in tissue architecture seem to appear earlier, because face anatomy, patient age, and skin quality interfere with how the subcutaneous fat is perceived externally. The objective measures of facial fat are even more difficult to obtain than body fat measurements. The diagnosis of lipoatrophy is often based on patient perception and clinical assessment, which has shown a good correlation. It is very difficult to evaluate the prevalence of SLHIV, because the picture is composed of several changes in the body morphology, be they by: atrophy, hypotrophy, or hypertrophy, which may be present together or isolated, making it more difficult to fit the patients in groups (BRASIL, 2009; COPPINI; JESUS, 2011; NUNES et al., 2014; FUKUDA et al., 2013; SO, 2014).

NUTRITION IN HIVE/AIDS PATIENTS

The great evolution that has occurred in recent years in the medical treatment of HIV/Aids, especially in relation to HAART, has guaranteed a significant increase in the survival of individuals with HIV-Aids. On the other hand, there is evidence that the long-term use of HAART, particularly protease inhibitors, has a significant impact on the nutritional status of the patient. Before the HAART-era, weight loss and malnutrition, as a result of opportunistic infections were the major nutritional problems. Currently, weight gain, fat redistribution, and obesity are new nutritional problems that individuals with HIV/Aids using HAART have been reported, especially with regard to the redistribution of body fat in central regions of the body, such as the trunk, abdomen, and dorsum-cervical region. The change in body composition is estimated to be approximately 83% among people using protease inhibitors, and this type of alteration is associated with cardiovascular diseases, glucose intolerance, and diabetes mellitus, and a decrease in bone mineral density (SILVA et al., 2010; COPPINI; JESUS, 2011; MDA et al., 2010; SHEDLIN et al., 2013; MOREIRA et al., 2013).

People at the present time evidence expectations of living longer and better, and it has never been more important to think about improvements in the quality of life of these patients. Nutrition plays a prominent role in immunological strengthening, reducing disease risk, and this much desired improvement in quality of people living with HIV. Through the approach of a nutritionist, it is possible to perform an early nutritional

assessment, using weight, height, BMI, bioimpedanciometry, skin folds, biochemical tests, and food anamnesis (TÓTHOVA et al., 2014; MOREIRA et al., 2013; OGALHA et al. 2011; OZHAN et al., 2011).

The nutritional care for immunosuppressed patients plays a fundamental role in the adequate clinical evolution, minimizing the worsening of the condition, mainly due to the fact that these characteristic alterations of the syndrome interfere in both humoral and cellular immunity, impairing the whole defense of the individual. The frequent changes in individuals with Aids prevent the adequate supply or assimilation of nutrients by the body, and that results in loss and deterioration of their nutritional status. The control of nutritional therapy is a process used to modify the behaviors related to weight and feeding, and it has two quite distinct phases, the first being educational and the second experimental (RAJSHEE et al., 2015; FEROZE et al., 2011; RUUTEL et al., 2009).

The educational phase aims at collecting and transmitting information about the patient's food history, establishing a relationship of collaboration, and defining relevant concepts about food.

The experimental phase has more therapeutic goals, which include separating behaviors related to food and weight from feelings and psychological issues; to increase food behavior changes; to increase or decrease weight gradually; and to guide the maintenance of adequate weight (SILVA et al., 2010; FALCO et al., 2012; COPPINI; JESUS, 2011).

Some nutritional management is important because it directly influences the overall health of people living with HIV/Aids, namely:

- Glucose Metabolism - Diets for changes in glucose metabolism should be specific for the reduction of simple carbohydrate intake, giving preference to complex carbohydrates;
- Protein metabolism - In the case of kidney changes, strict control of dietary protein intake should be performed according to the individual needs of each patient;
- Lipid Metabolism - For health maintenance, a healthy diet is an indispensable help in the control of fat mass loss and muscle mass formation. High cholesterol and triglycerides indicate that eating habits should be modified.

In some cases, diet alone does not produce results, and medication intervention and constant and scheduled physical activities are required. The effectiveness of the treatment of people living with HIV/Aids and the ability of the multidisciplinary team professionals to engage them in their recovery and adaptation to the new lifestyle are increasingly perceived. In this context, considering the role of nutrition as protection or risk factor for the appearance of comorbidities, dietary counseling emerges as an integrated action to the other actions of the multidisciplinary team. Once again we emphasize the importance of good interdisciplinary relationship, conduction of treatments, and the promotion of people's health. The introduction of antiretroviral

treatment (ARVs) modified the nutritional profile of people living with HIV/Aids and, consequently, if on the one hand, the success of HAART led to a reduction in morbidity and mortality, on the other hand, the association with side effects of therapy, such as dyslipidemia and hyperglycemia, was observed. Nutrition plays an important role in the cycle between malnutrition and HIV, since by improving the nutritional status of people, it can help stop the cycle and prevent disease progression. So, it is important to enjoy a variety of foods, perform physical activities to build and maintain muscle mass, and feed on starchy foods, as they provide energy and fiber. It is also important to eat vegetables and fruits daily, not forgetting to keep and control foods by the most varied colors possible ("to eat the rainbow"); to eat grains, as they are low cost and high in protein and fiber; and to drink low-fat dairy products, as they are a source of calcium for bones and teeth. Fish, chicken, lean meat, or eggs can be consumed daily - these offer the protein that is needed for a healthy immune system and for muscle maintenance and building. One should also drink plenty of water, consume sugar and sugar-rich foods and beverages in moderation, and use salt and salt-rich foods in moderation. People living with HIV are prone to heart disease, especially when taking ARVs that have a side effect of raising blood cholesterol levels (CDC, 2015; KOSMISKI, 2011; FALCO, 2012; OGALHA et al., 2011; OZHAN et al., 2010).

Poor appetite, nausea, vomiting, and diarrhea, which are the main symptoms, can make all the difference negatively to HIV patients who are struggling to meet their nutritional needs, and they should exercise utmost caution in controlling their constitutional signs and symptoms improving their general condition at that time. Vitamin and mineral deficiency is common in people infected with HIV, and it is attributed to malabsorption and changes in the mechanism of the immune and metabolic system. At this time, physical activities supply the needs such as morning sunbathing. If necessary, the patient should use controlled doses of the missing vitamins for replacement. All of these problems of malabsorption and increased energy and nutritional needs can lead to rapid weight loss. This loss of weight, especially of muscle proteins, causes high fatigue, in addition to reducing the capacity of the immune system to fight against other infections and many diseases (RASJSHEE et al., 2015; GUERRA; PORBÉN, 2015; CHATERJEE et al., 2010; SUZANNE, 2010).

There are important indicators of changes in constitutional signals, being them:

- Weight Loss: to prevent or reverse malnutrition, it is necessary to have a balanced diet. Protein-rich foods, such as meats, dairy foods, and legumes help rebuild muscles and stimulate the immune system, weakened by HIV. In addition, consumption of healthy fats also promotes weight gain;
- Appetite loss: changes caused by medication or even nausea may cause a decrease or loss of appetite. In this case, it is important to eat small and frequent meals, since the body can better tolerate this form of food. One should also prefer foods that are more easily accepted, such as boiled potatoes, rice, chicken, yogurt, and oats;

- Diarrhea: some types of medication can trigger diarrhea, so one should avoid milk and dairy products and high-fat foods. It is necessary to avoid foods rich in insoluble fibers and to prefer soluble fibers. To prevent dehydration, one should drink enough liquid.

People with Aids and a weakened immune system are at a higher risk of developing foodborne diseases, and it is important to follow the basic hygiene, precautionary, and food safety guidelines (SILVA et al., 2010; FALCO, 2012; RAY et al., 2007).

The consumption of functional foods evidences positive results in the immunological response and in the prevention of metabolic alterations resulting from antiretroviral therapy. Omega-3 fatty acids found in fish, seaweed, and flaxseed, and omega-6 fatty acids, found in vegetable oils, positively interfere with blood coagulation, inflammatory process control, and improvement of lean body mass. Allicin, alline, and dialyne sulphide, found in garlic have a hypotensive, fibrinolytic, anticoagulant, and cholesterol lowering function. Probiotics and prebiotics improve the intestinal macrobiota, cholesterol levels, and the immune system. Malnutrition is one of the complications of Aids, and is of great significance for the prognosis of the evolution of the disease, as it compromises immune function, causes damage to the metabolism, reduces the response to therapies, and causes progressive weakness, leading to a decrease in survival and compromising the quality of life of the patients. In addition, attention to the problems of malnutrition is of paramount importance, as there is a significant relationship between the time of death and the degree of depletion of body cellular mass. Several mechanisms may be related to the occurrence of malnutrition in AIDS patients, such as: low caloric and protein intake, metabolic alterations, diarrhea, opportunistic infections, neurological changes, psychological factors, drug-nutrient interaction, and deficiency of vitamins A, C, B12, and B6, and of minerals such as zinc and selenium. In addition, malnutrition may be a sign of risk to immune functions, as the virus causes a change in basal metabolism, increasing the demand for nutrients to maintain the body's nutritional status. Malnutrition associated with vitamin and mineral deficiency has a synergistic effect on the infection and, because it causes immunological changes, it contributes to the increased severity and progression of the disease in individuals with AIDS. Micronutrient deficiency is frequent in HIV-positive individuals, and this affects the immune system as well as the progression of the disease. However, with the elimination of malnutrition, the evolutionary potential of the disease becomes slower and less aggravating, leading to an increase in the life expectancy of the AIDS patient. With the evolution of the treatment with HAART, a significant reduction in the occurrence of opportunistic infections and improvement of the nutritional status can be observed. Currently, with the therapeutic effects of HAART, recommended for symptomatic and asymptomatic HIV virus patients with CD4+ T lymphocyte counts less than or equal to 350 cel/mm^3, a decrease in the incidence of malnutrition and opportunistic infections, control of viral load, and an improvement of the morbidity-mortality profile and quality of life of the patients can be observed. On the other hand, it can be observed that the use of this therapy can develop

side effects such as weight gain, poor fat redistribution, obesity, hypercholesterolemia, hypertriglyceridemia, and alterations in glucose metabolism. Nutritional status and inadequate eating habits may play important roles in the development of AIDS, as inadequate nutrition affects not only health as a whole but also quality of life and response to treatment. Therefore, the nutritional intervention in the Aids patient has been recommended because the nutritional consequences are related to the evolution of HIV infection. Preventive nutritional treatment can help reduce the frequency and severity of infections. A healthy, balanced, and adequate diet aims to improve nutritional status, prevent or reverse malnutrition, provide adequate levels of nutrients, and reduce symptoms of malabsorption and the side effects of antiretroviral therapy. In this way, it improves the nutritional and evolutionary framework of the disease, besides promoting improvement of the quality of life of the patient (RAJSHEE et al., 2015; BALDERSON et al., 2013; PRIBAN, 2011; BEATA et al., 2015; BROWMIK et al., 2012; SILVA et al., 2010; COPPINI; JESUS, 2011).

Patients taking antiretroviral drugs should pay particular attention to changes in their body. The treatment of these physical changes deserves specific and individualized care. Anthropometric evaluation is an essential resource for the periodic determination of nutritional status and possible changes in weight and lean mass. It should be performed at the time of diagnosis of HIV infection, with annual or semi-annual follow-up in the asymptomatic patient, and around two to six times a year in the symptomatic patient. The most used measures to determine the nutritional status of people living with HIV/Aids are: weight, height, triceps skin fold, and the circumference of the arm, waist, hip, and breasts. According to the WHO, obesity is the abnormal or excessive accumulation of fat. Abdominal obesity or android obesity, that is, increased adipose tissue in the abdominal region, is considered a risk factor for several morbidities, representing a different risk when compared to other forms of body fat distribution. Obesity is generally estimated by the Body Mass Index (BMI), calculated by dividing the weight by the squared height. In addition to the BMI, it is relevant to consider the distribution of body fat. The excessive accumulation of the fat in the abdominal region is related to the deposition of adipose tissue in the viscera, and visceral obesity is more strongly linked to cardiovascular risk factors as: hyperglycemia; elevation of serum triglyceride, apolipoprotein B, and low density lipoprotein (LDL) levels; and decrease in high-density lipoprotein (HDL) levels. One of the factors responsible for the success of thetherapy of people with HIV is their nutritional status; so, full initial nutritional assessment including anthropometric, biochemical, and dietary patterns should be part of multidisciplinary care planning.

- Anthropometric markers: the BMI is calculated as the ratio between the weight in kilograms and the square of the height in meters (kg/m^2). The body weight is evaluated through a scale with precision in grams. Body height was measured using a tape measure fixed to the wall with a precision of

0.1cm. Low weight was defined as BMI<18.5, and overweight was defined as BMI>25kg/m^2. Waist circumference (WC) was used as an indicator of abdominal obesity. The WC was measured using anthropometric fiberglass tape with an accuracy of 0.1cm. Abdominal obesity was defined from cut-off points due to increased risk of metabolic complications due to the deposition of fat in the abdomen: CC> 102 for men and > 88 cm for women;

- Immunodeficiency markers: the number of CD4+ T lymphocytes (cel/mm^3) is used as an immunodeficiency marker, along with a history of antiretroviral medication, including time of use, in months, of protease inhibitors. Normally, three categories are established by number of CD4+ T lymphocytes to be observed, namely:<200, 201 to 349, and> 350 cel/mm^3.

Nutritional Assessment (NA) shows isolated or global deficiencies of nutrients and allows the classification of individuals at levels of nutritional status serving as a valuable tool for the determination of clinical or dietary therapy, in order to try to correct the observed deficit. Attention to the problems of malnutrition is of paramount importance because the time of death is more accurately related to the degree of depletion of Body Cell Mass (BCM) than to any specific basal infection. The type of nutritional counseling, the complexity of the evaluation, and the degree of intervention should vary with the individual's disease stage. In the early stage of Aids there is a decrease in BCM and an increase in extracellular water (ECW), without weight loss. At the intermediate stage, the BCM decreases more, the ECW increases, and weight loss occurs. In the late stage, the rates of BCM and ECW loss increase further, body fat decreases, and severe weight loss occurs, characteristics that worsen in the presence of acute infections (Table 1). Regressive analyzes of body weight loss, BCM, and albumin, regardless of CD4+ cell counts, are predictors of death in Aids, and progression of the disease with a greater predisposition to acute illnesses and frequent hospitalizations. Every patient should be thoroughly evaluated to determine their nutritional status considering the disease stage (DANCHECK et al., 2005; SILVA et al., 2010; FALCO 2012; NUNES et al., 2014; MOREIRA et al., 2013; SUZANNE, 2010).

Phase	CD4	Features
Initial	Abouve 500 cel/ mm³	> in energy expenditure and <in the body stock of vitamin B and folate
Intermediary	Betwen 220 and 500 cel/mm³	Association with nutritional deficiencies of vit. B, folate, zinc and selenium > infections
Late	Below 200 cel/mm³	> risk for severe and intractable weight loss, with malnutrition and chronic fatigue and acute infections

Table 1 - Aspects observed in the stages of the disease

The simple measurement of body weight minimizes the loss of BCM due to the relative extracellular expansion of water, and the disease stage should be considered as it is a key factor in the efficacy of nutritional therapy. The assessment

of the nutritional status is currently based on anthropometric and biological indices. Anthropometric indices include total body weight, height, body composition, and fat and protein ratios, as well as the determination of total body potassium, normalized by height and age (important determinant of BCM). Biological indices comprise the rates of certain plasma proteins (albumin, transferrin, and retinol binding protein), as well as the excretion of urinary 3-methylhistidine. Immunocompetence is an index that allows an objective approximation of malnutrition and correlates it with morbidity and mortality in patients with Aids (BRASIL, 2009; COPPINI; JESUS, 2011; NUNES et al., 2014).

The clinical examination should evaluate the general condition, muscle strength, and skinfold measurements, allowing to classify malnutrition as mild, moderate, or severe. The dosages of albumin, calcium, phosphorus, magnesium, vitamin B, folate, vitamin D and zinc (Table 2)

Weight	Nutritional Status
< or = 5% of current weight	without malnutrition
Between 5% and 10% of the current weight	moderate malnutritional
Between 10% and 20% of the current weight	Intermediar malnutritional
> than 20% of the current weight	severe malnutritional

Table 2 - Classification of malnutrition according to weight loss

There are a number of body mass methods available in clinical practice for HIV/Aids patients, which have the following advantages and disadvantages:

- Measure of skinfolds: easily developed with portable equipment, with possibility of error and variability in measurement among observers, requiring careful training and standardization;
- Bioimpedance analysis: easily developed with portable and low cost equipment. It is used to calculate BCM, but results may be affected by hydration, caffeine, alcohol, physical activity prior to measurement, and are not yet validated with the use of HAART;
- Dual Energy X-ray Absorptiometry (DEXA): a non-invasive method with a minimum amount of radiation. It is considered the best tool for assessing body composition, but it is expensive, results can be affected by hydration and calcification, and regional measures are not standardized;
- Whole body plethysmography: a densitometry method in which body volume is measured in a closed chamber. However, it is complex and costly;
- Computed tomography and magnetic resonance imaging of the abdomen, thigh, or whole body have been used. However, each one presents risks such as radiation and claustrophobia, and can only be analyzed by trained specialists. They require expensive equipment, and normal values are not

established for visceral adiposity;

- Complete blood count, electrolyte assay, liver function test (OGT and TGF), renal function test by determination of serum urea and creatinine, serum proteins (albumin, transferrin, and total proteins) and assessment of gastrointestinal integrity through occult blood and parasitological examination of feces are usually included. The parameters to be monitored and their frequency should be considered in relation to the disease stage, general clinical condition, and drug regimen.

Weight loss and low serum albumin levels are indicative of increased risk of morbidity and mortality in AIDS patients, and the frequency of complications increases rapidly when serum albumin levels are below 3.0 mg/dl. In near-death patients there is progressive depletion of body mass, assessed by total body potassium content, with an approximate level of 54% of normal. The progressive loss of body weight is related to death, reaching up to 66% of the usual body weight (AIROLDI; ZACARELLI, 2010; BALDERSON et al., 2013; PRIBAN 2011; SILVA et al., 2010; GUERRA; PÓRBEN, 2015; CANAVARRO; PEREIRA, 2011; THOMPSON-PAUL et al., 2015; NUNES et al., 2014; SO, 2014).

CONCLUSION

The deterioration of nutritional status in HIV-infected patients is complicated by the changes associated with the disease in the gastrointestinal structure and function, as well as by the adverse effects of antiretroviral drugs. Total serum proteins may be increased as a result of hyperimmunoglobulinemia by activation of B cells. Albumin may also be influenced by non-nutritional factors such as intravenous fluids, renal or hepatic failure, or acute phase response to injury. A low cholesterol level (below 100mg/dl) is indicative of consumptive syndrome or wasting

In view of the above, it can be concluded that the nutritional control of individuals living with HIV/AIDS is of great importance, because it is directly related to the quality of life, both physiologically and socially. In addition, the oral health team plays an important role in this process, and the insertion of the dentist surgeon in the day-to-day care of the HIV/AIDS patient contributes to the general reestablishment of health and control of their basic alteration.

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ÍNDICE REMISSIVO

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