



Nutritional Behavior and Quantitative and Qualitative Dietary Balance in Nasopharyngeal Carcinoma Patients

Mariem Ben Jemaa¹, Fatma Mhamdi², Hanen Falleh¹, Riadh Ksouri¹ and Raja Serairi Beji^{1,3*}

¹Laboratoire des Plantes Aromatiques et Médicinales, Centre de Biotechnologie de Borj Cedria, Hammam-lif, Tunisie

²Université Mahmoud El Materi, rue Bourguine, Montplaisir, Tunis, Tunisie

³École Supérieure des Sciences et Techniques de la Santé de Tunis. Tunisie

*Corresponding Author: Raja Serairi Beji, Laboratoire des Plantes Aromatiques et Médicinales, Centre de Biotechnologie de Borj Cedria, Hammam-lif, Tunisie.

Received: December 20, 2021

Published: January 24, 2022

© All rights are reserved by Raja Serairi Beji, et al.

Abstract

This manuscript was focused on the nutritional behavior of nasopharyngeal carcinoma patients and the assessment of their quantitative and qualitative dietary balance in order to evaluate the role of dietary factors in patient healing process. The first part of the study was devoted to a retrospective cross-sectional survey involving 50 patients diagnosed with nasopharyngeal carcinoma in order to investigate their nutritional behavior. The interview identified the patient gender, age, family situation, ethnicity, career, family and personal ancestors, swallowing difficulties, and the date of diagnosis. After that, the anthropometric profile of questioned patients was drawn via their size, weight and their Body Mass Index (BMI) measurements. In addition, their brachial circumference, their tricipital cutan fold and their brachial muscle circumference were evaluated. Finally, blood samples of investigated patient were used for Albuminemia, Reactive Protein C (RPC), Superoxyde Dismutase (SOD) and for the Glutathion peroxydase measurements. Obtained results demonstrated that the questioned population was formed of 68% men and the average age was 55 years. Moreover, 77,6% of questioned patient declared their new diagnosis and 33 patients had difficulty to swallow. Considering the anthropometric profile of questioned patients, results highlighted that 70% of the studied population had a normal BMI, 26% were in overweight, and just 2% had grade 1 malnutrition. Gathered results suggested that the average of brachial circumference, tricipital cutan fold and muscle circumference were 19,86; 11,63 and 16,23, respectively. Blood biological analysis demonstrated that all the studied sample were in an inflammatory phase, 90% have hypoalbuminemia, 72,4% showed a decrease in the enzymatic activity of the Superoxyde Dismutase and the Glutathion peroxydase. In conclusion, gathered results present an interesting data basis for therapists in order to avoid malnutrition and its consequences for nasopharyngeal carcinoma patients.

Keywords: Nutritional Behavior; Dietary Balance; Nasopharyngeal Carcinoma

Introduction

Cancer is seen as a major public health issue in a number of countries around the world [1]. The majority of tumors are formed from a single cell that has been transformed into a cancer initiating cell (cancer stem cell) capable of proliferating and forming tumors *in vivo*. In the United States, at least 1 665 540 new cancer cases were detected in 2014, with an estimated 585 720 deaths [1].

According to estimates, the global cancer epidemic reached 18,1 million new cases and 9,6 million deaths in 2018 [2].

According to epidemiological studies, accounts for almost half of all new cancer cases and more than half of all cancer-related deaths happen from Asia whereas Europe accounts for 23,4% of all cancer cases and 20,3% of cancer-related deaths worldwide [2]. USA ac-

count for 21,0% of global incidence and 14,4% of global mortality [2]. In comparison to other regions of the world, Asia and Africa have higher rates of cancer deaths (57,3% and 7,3%, respectively) than incidence cases (48,4% and 5,8%, respectively) [2].

In terms of incidence, the malignancies of the mouth, the colon-rectum, and the uterus in women are the three most common types of cancer, and they rank first, second, and fifth in terms of mortality [2].

In the world, one in every five men and women will develop cancer at some point in their lives, and one in every ten men and women will succumb to the disease [2].

The nasopharyngeal carcinoma (NPC), also known as cavum cancer, is a kind of cancer found in the ORL spheroid. It is distinguished by an unusual and unequal geographic distribution.

The NPC is uncommon in western countries (incidence less than 1 per 100,000), and it is endemic in the Mediterranean Basin, the Maghreb, and particularly the Asian South-East. In Hong Kong, the male mortality rate is 20,2 per 100,000, while the female mortality rate is 7,8 per 100,000. The incidence ranges from 3 to 7 per 100 000 in intermediate frequency zones such as the Maghreb and the Mediterranean hinterland.

In Tunisia, 19 446 new cases of cancer were discovered in 2020, with 11 855 deaths. The new cases are divided into 10 473 cases for men and 8 973 cases for women. The five most common malignancies in Tunisia are those of the mouth, the prostate, the colon-rectum, the vessie, and the prostate. The NPC accounts for 1.8% of all cases detected, with a score of 16 out of 35 [3]. The number of deaths reported by the NPC is estimated to be 218 out of 342 cases, with a score of 14 out of 35 [4].

The treatment of cancer in children and adolescents is mostly focused on radiotherapy, which is more or less associated with chemotherapy [5]. Chemotherapy can cause nausea and vomiting, which can lead to malnutrition and a reduction in the whole body's ability to function.

The patient's dietary dietis influenced by irradiation of the head and neck, thorax, and belly. Radiation therapy can cause a radial mucositis, which is followed by a discomfort, hyposialia, and a change or loss of taste [6]. The combination of these effects leads to a decrease in the patient's ability to take food and a decrease in the

patient's ability to digest and assimilate nutrients, which will disrupt the patient's nutritional balance [7]. Malnutrition is a common consequence of cancer and its treatments, with prevalence ranging from 30 to 80% depending on the kind of cancer, patient, and measurement tools. Malnutrition is rarely diagnosed and treated since it is mistakenly thought to be a component of the disease's progression. A mismatch between nutritional needs and nutritional supplies causes proteino-energetic malnutrition. This imbalance is even more important in the case of cancer, because the pathology, investigations, and treatments increase energy needs while the intakes are in decrease.

Furthermore, the oxidant stress is defined by a change in the redox cellular homeostasis. It is caused by an increase in the generation of oxygen-reactive species or a decrease in antioxidant defense capacities. The superoxyde dismutase and glutathione peroxidase enzymes ensure that ERO-induced chain reactions are neutralized. Oxidative stress contributes to the acceleration of cellular aging and the encouragement of oncogenic processes. An early nutritional risk assessment can detect the presence of, and/or the risk of developing, or worsening, proteino-energetic deficiency. There are numerous tools for detecting nutritional risk. Their use is not always made due to a lack of resources or a disregard for their best interests.

Our research focuses on a specific type of cancer called nasopharyngeal carcinoma in order to answer two questions: What role do dietary factors play, and how is the subject's eating behavior measured both qualitatively and quantitatively? What is the antioxidant profile of the patients?

Materiel and Methods

Study population patients

It is a retrospective cross-sectional study involving 50 patients diagnosed with cavum carcinoma. They are divided into 34 men and 16 women. From February 16 to March 12, 2021, patients visited the Institut Salah Azaiez's ORL, external consultation, radiotherapy, and chemotherapy services.

Inclusion criteria

Our research considers any patient diagnosed with cavum cancer who is between the ages of 20 and 30 years old and is treated at Institute Salah Azaiez's ORL, external consultation, radiotherapy, or chemotherapy service.

Exclusion criteria

Patients who are being treated for another ORL pathology, as well as patients who are unwilling to cooperate, are excluded from our study.

General interview

The purpose of the interview is to identify the patient, including his or her gender, age, family situation, ethnicity, career, family and personal ancestors, swallowing difficulties, and the date of diagnosis, as well as his or her daily habits.

Biological assessment

Albuminemia

We dosed albuminemia to all of our patients for a biological assessment of their nutritional status. It is a plasma protein produced in the liver [8] with a daily dose of 35 - 52g/day for a healthy person [9]. The measurement of this protein is commonly used in the diagnosis of malnutrition [10].

Reactive protein c (RPC).

The RPC is a hepatic protein (produced in liver). During an inflammatory phase, it is secreted in the blood during an inflammatory phase [11]. Its normal value should be less than 5mg/l.

Superoxyde dismutase (SOD).

SOD is an antioxidant enzyme that circulates in the bloodstream [12]. It is classified as the first line of defense against reactive oxygen species [13]. Its usual value is 785 - 1570 UI/G HB.

Peroxydase of glutathion

The GPx enzyme is an antioxidant enzyme with a renal and hepatic origin.

Usual value = 20 - 56 UI/g Hb for men and 26 - 58 UI/g Hb for women.

Anthropometric measurements

Size measurement

The subject must keep his feet flat and his talons against the plaque. It is measured in centimeters.

Weight measurements

The subject must remain standing without assistance, stationary in the center of the plateau, with the body's weight distributed

evenly between the two slightly asymmetrical feet. It is necessary to remove shoes and clothing. The balance used is a TECHWOOD TPP-811 model. The weight is estimated to be around 100g.

Body mass index

The BODY MASS INDEX, or BMI, is defined by the "weight/size²" ratio, expressed in kg/m². The purpose of the BMI is to assess the patient's corpulence.

Brachiale circumference measure

This measurement is taken at the level of the hands, halfway between the acromion and the olecranon [14]. The standard CB measurements are 28cm for men and 22,2cm for women.

Measurement of tricipital cutan fold

The tricipital cutan fold is measured with a skin crease clamp [15]. The take is done at the level of the right arm, halfway between the acromion and the olecranon [14].

Brachial muscle circumference

Calculated using the following formula: BMC = (0.314*TCF) - BC [14].

Food survey

We chose to combine two methods to have a better understanding of the nutritional contributions of the patients we recruited on a qualitative and quantitative level: a 24-hour recall and a frequency recall. To reduce the possibility of bias, we conducted all of the food surveys ourselves. The patients described the portions taken using common measurements: a little plate, a medium plate, a soup spoon, a large glass. The collected data was then translated using the computer application "BILNUT" to calculate journal nutrient amounts in macronutrients and micronutrients. In fact, the report ensures: - total caloric intake; - diary entries for proteins, carbohydrates, and lipids; - nutrient intake: cholesterol, iron, magnesium, zinc, folates, vitamin B1, vitamin C, vitamin E, calcium, fibers, and water.

Results

Population general characteristics

Our population consists of 50 individuals, with 34 men and 16 women.

The average age of the population studied was 55 years old, with a maximum of 80 years old and a minimum of 31 years old.

The majority of the people in our study (77,6%) are newly diagnosed, while nearly a quarter of the people (22,4%) are already sick. Depending on the results, the received treatment varies from one group to the next. In fact, 70% of the population is undergoing adjuvant chemotherapy, 18% is undergoing concurrent chemo-radiotherapy, and 12% is undergoing radiotherapy alone. Thirty-three of the fifty people interviewed had difficulty to swallow.

Sample life habit

Taken meal frequency

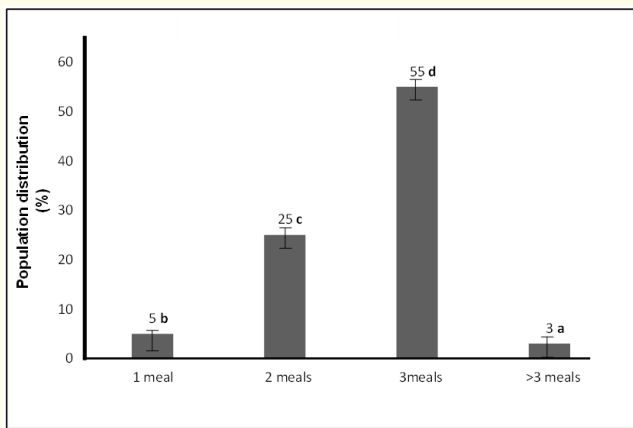


Figure 1: Population distribution based on the number of taken meals.

As seen in figure 1, the majority of the panelist (55%) eat three meals per day. Only two meals are required for the fourth of the population.

Quantity of consumed water

Figure 2 depicts the results relating to the patients consumed water amount. We found that just 20% of the people polled drink more than 2 liters of water per day, the one-third drink between 1.5 and 2 liters per day. The rest (45%) drink less than a 1.5 L of water every day.

Salty food consumption

The results shown in figure 3 show that salted foods (olives, pepperon, vegetables, Kadid, etc.) are consumed by 55% of our sample, whereas 45% do not consume this type of food.

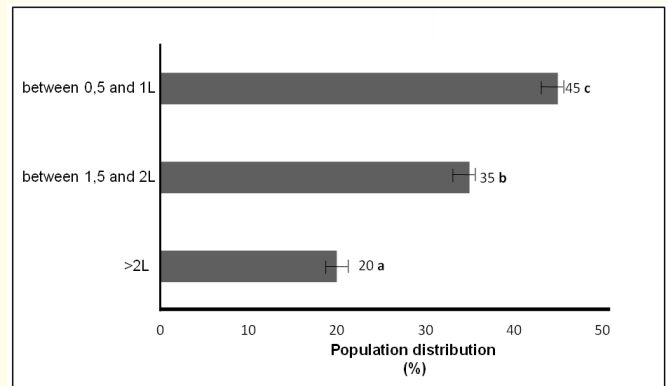


Figure 2: Distribution of the sample according to the taken water amount per day.

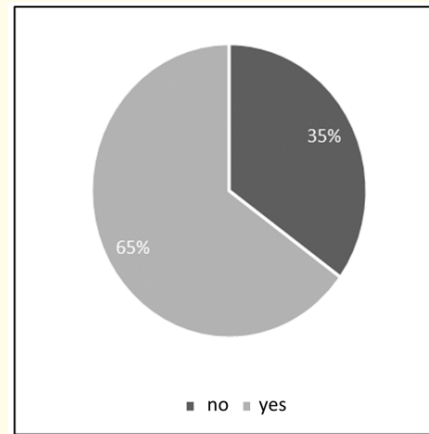


Figure 3: Distribution of the sample according to the salty food consumption.

Red meat consumption

The majority of the sample (90%) declares that they consume red meat 1 to 2 times per week, whereas the remaining 10% consume it 3 to 5 times per week (Figure 4).

Tobacco consumption

According to figure 5, 55% of the sample consume Tobacco, with an average of 19 persons.

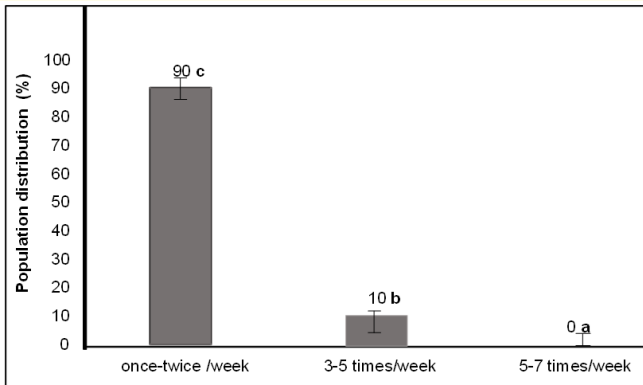


Figure 4: Distribution of the sample according to the red meat consumption.

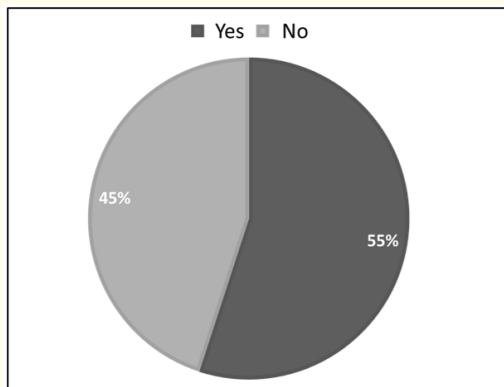


Figure 5: Distribution of the sample according to Tobacco consumption.

Anthropometric profil

weight, sizeandbmi

Table 1 shows the studied population distribution based on their current BMI.

According to the findings, 70% of the studied population has a normal BMI, 26% is in overweight, and just 2% has grade 1 malnutrition.

Brachiale circumference measure

Table 2 shows the studied population distribution based on their current brachial circumference measurement, measurement of tricipitalcutan fold and their brachial muscle circumference.

	BMI	Patients
Malnutrition	Malnutritiongrade 5	0
	Malnutritiongrade 4	0
	Malnutritiongrade 3	0
	Malnutritiongrade 2	0
	Malnutritiongrade 1	1 (2%)
Normal BMI	Normal BMI	35 (70%)
Obesity	Overweight	13 (26,%)
	Obesityclass I	1 (2%)
	Obesityclass II	0
	Obesityclass III	0

Table 1: Distribution of the sample according to their actual BMI.

Table 2 shows that the average brachial circumference is 19,86 ± 2,19 cm, and the average tricipitalcutan fold is 11,63 ± 3,11 cm. The average muscle circumference is 16,23 ± 2,23 cm.

	Mean ± Standard Deviation	Population
BC (cm)	19,86 ± 2,19	28 (93%)
TCF (cm)	11,63 ± 3,11	24 (80%)
BMC (cm)	16,23 ± 2,23	29 (97%)

Table 2: Studied population distribution based on their current measurement of brachial circumference, tricipitalcutan fold and muscle circumference.

Biological parameters

Table 3 shows the averages of C reactive Protein content, albuminemia, superoxide dismutase, and glutathione peroxidase in the studied population.

According to table 3, all the studied sample is in an inflammatory phase (CRP > 100 mg/L).

The majority of the panelist (90%) have hypoalbuminemia, with an average of 26,93 ± 3,8g/L.

The majority (72,4%) of the sample included in our study show a decrease in the enzymatic activity of the Superoxyde disseminated, as well as a decrease in the activity of Glutathione peroxidase.

	Mean ± Standard Deviation
CRP (mg/L)	139,6 ± 126,57
SOD (UI/G HB)	438,3 ± 162,35
GPx (UI/G HB)	22,1 ± 7,93
Albuminemia (g/L)	26,93 ± 3,8

Table 3: C reactive Protein content, albuminemia, superoxide dismutase, and glutathione peroxidase in the studied population.

Sample nutritionnel profiling

Energy and macronutrients input

Table 4 summarizes the energy and the macronutrient intakes of the studied sample.

The bilnut treatment of the participant dietary questionnaires reveals a caloric deficiency when compared to recommended needs. Furthermore, the protein intake is far lower than nutritionist recommendations.

	ANC*	Spontaneousintake
Daily calorie intake(kcal)	W : 2200	1352,2
	M : 2500	
Daily ProteinIntake(%ANC)	12 - 15	10
Daily glucidicIntake (% ANC)	50 - 55	55
Daily FatIntake (%ANC)	30 - 35	35

Table 4: Mean measurements of Energy and macronutrients input.

*ANC: Nutritional intakes recommended by ANSES.

Micronutrient input

Table 5 summarizes the micronutrient input of the patient sample.

The findings in table 5 show that the population’s average vitamin C, vitamin B9, and vitamin E intakes are below the recommended levels for their age group.

Discussion

Population general characteristics

The findings of our study show that the male gender has a 70% to 30% advantage over the female gender. These findings are in

Micronutriments	ANC*	Spontaneousintake
Vitamin c daily intake (mg)	90	52,45
Vitamin B9 daily intake (µg)	250	90,8
Vitamin E daily intake (mg)	10	5,88
Irondaily intake (mg)	F : 7	7,63
	H : 6	

TABLE 5: Micronutrientmean input.

*ANC: Nutritional intakes recommended by ANSES.

agreement with those published by ANNE., *et al.* who point to a male predominance in cavum cancer.

Our population’s average age is 51 years old, with a range of 31 to 80 years old. These findings are similar to those of another study conducted in the United States, which found that the average age of onset of cavum cancer is above 50 years old.

We have 70% of the population doing chimiotherapy, 18% undergoing concurrent chimio-radiotherapy, and the remaining 12% undergoing radiotherapy. The most promising approach to treating cavum cancer is to get a chimiotherapy treatment followed by a concurrent chimio-radiotherapy treatment. Furthermore, in recent decades, advances in understanding of the therapeutic use of ionizing radiation and radiobiologic research have allowed radiotherapy to improve its efficacy (in terms of tumor cure) while lowering its toxicities dramatically. The research is continuing in order to improve the biological specificity of therapeutic irradiations and, as a result, the therapeutic index (effectiveness/toxicity ratio).

The act of deglutition is a physiological process that allows food, liquids, or saliva to pass through the oral cavity until it reaches the stomach while protecting the upper airways. This act necessitates the coordination and synchronization of all organs of the aerodigestive system *via* a complicated neurologic control. Deglutition has serious consequences for one’s quality of life when it is altered. On the one hand, problems have functional consequences up to the point where the prognosis is critical: the patient is no longer able to provide the nutrients necessary for his or her health, and these deviations invariably affect respiratory function in the case of faulty routes. On the other hand, they intrude into the patient’s psychological and social lives since deglutition helps to turn eating into a pleasurable and social experience that is strongly linked to emotional needs. This function is disrupted in the context of malignancies of the upper gastrointestinal tract.

At fact, the only presence of a tumor alters the anatomy of the involved organs significantly, putting the entire deglutition procedure in jeopardy [16]. In our community, 66% say they have trouble digesting food, which has an impact on their dietary intake. In these cases, a multidisciplinary team consisting of an oncologist, an ORL, an orthopaedic surgeon, and a nutritionist must work together to improve the patient's daily life while avoiding the negative consequences that may result.

Studied population lifestyles

Our sample consists of 50 patients. 55% say they eat three meals every day, 25% say they only eat two, and five% say they only eat one. These changes in food intake frequencies may result in difficulties with deglutition on one hand, as well as anorexia caused by the pathology and treatments on the other. The liquid consumption is also altered in the studied population. In fact, only around a quarter of the people polled drink more than 2 liters of water per day, while the rest drink between 1.5 and 2 liters. The rest drink less than a liter of water every day. These contributions are insufficient and do not meet the recommended needs. Comparable results have been published in the literature [17].

The NPC's etiology implicates three types of factors: the viral factor, as a result of its long-term association with the Epstein-Barr virus, genetic factors, and environmental factors, such as a traditional way of life associated with a monotonous, limited-variety diet based on traditional preservation products. In fact, many commonly consumed foods by high-risk groups contain carcinogenic or genotoxic components that can alter the ADN by causing tumors or directly affecting epithelial cells, such as nitrosamines found in dried meats and fish that harm rhino-pharyngeal epithelial cells. The consumption of salted foods such as Kadid (dried meat), Harissa, and variants was validated by 65% of the population polled in this study.

Poirier, *et al.* [18] published similar findings, confirming that the consumption of foods containing carcinogenic components (N-nitroso pyrrolidine and dimethyl-nitrosamines) is a common factor among groups at high risk of NPC. Nitrosamines have been detected in the toukليا, keddidi, and hrissa. Furthermore, the presence of potential mycotoxines in saumured vegetables and couscous has been demonstrated out. In fact, aflatoxine is a mycotoxin that plays a major role in the genesis of early-stage liver cancer.

Another common factor is the consumption of red meat. In fact, 90% of our sample consumes red meat only once or twice each week. This frequency could be explained by a lack of financial resources to purchase meats whose prices are continuing to rise.

Several ethnic groups have described the link between the NPC and tobacco, but no clear findings about the link between tobacco use and the NPC have been reached. This link was investigated in our study, as it has been in some other studies that linked the increased risk of NPC development with smoking status. The consumption of tobacco would be a risk factor for the NPC of type I (squamous cell cancer). As a result, only the different types of nasopharyngitis are clearly linked to a high level of tobacco consumption in the United States.

A strong dose-response relationship between cigarette smoking and the risk of nasopharyngeal carcinoma has also been discovered. However, the nitrosamines found in tobacco, along with many other chemical products, are known carcinogens with a cytotoxic and mutagenic potential role in the etiology of not only NPC, but also a variety of other cancers (cancers of the esophagus, stomach, gallbladder and liver) [20].

Anthropometric profile

Malnutrition can be defined as a short-term or long-term state in which one experiences a nutritional imbalance associated with an inflammatory activity that results in a change in body composition (reduced muscle and fat mass).

In our study, 70 of the subjects had a normal IMC, 26 were overweight, and only two were malnourished, contradicting the findings of Pressoir, *et al.* [21] who found that 23 of the cancer patients treated in French cancer treatment centers were severely malnourished. This distribution is based solely on weight and size measurements, which could explain the discrepancy in the results.

These results are discussed differently when other parameters are used. In fact, the results of brachial circumference measures show that 93% of the subjects are malnourished. Even better, when the PTC is added, the percentage of people who are malnourished rises to 97%. This percentage is significantly higher than that reported by Hébuterne [22] who claims that the prevalence of malnutrition, all malignancies combined, is in the range of 40%. Another study conducted by Righini, *et al.* [23] found that up to 88%

of patients treated for cancer of the upper gastrointestinal tract suffer from malnutrition. Malnutrition is present in 92% of cases of pancreatic cancer, 90% of cases of esophageal cancer, 70% of cases of colon cancer, 63% of cases of breast cancer, 55% of cases of prostate cancer, and 49% of cases of bladder cancer.

Biological parameters

Remembering that a healthy person's albumine level ranges between 35 and 52grams per day, and that 90% of our sample has hypoalbuminemia. Our findings outperform those of Irungu., *et al.* [24] who discovered that only 23,3 people have hypoalbuminemia. This decrease is directly proportional to the patients' morbidity and mortality [24].

In the same vein, Silvio A., *et al.* [25] conducted a study that yielded results similar to ours. In fact, 82% of their population had hypoalbuminemia, with an average of 18,17g/L.

The measurement of C Reactive Protein is usually linked to albumin dosage. The results confirm the link between chronic inflammatory problems and neoplasia once more.

In the case of oxidative stress, Brandon Griess., *et al.* [26] have noted that oxygen reactive species are increasingly recognized as important determinants of cell signaling, and that a precise balance of their levels is required for effective cell function. Our findings show a decrease in SOD enzymatic activity, which is consistent with Jine Li., *et al.* [27] analysis, which found an increase in SOD activity in patients with cavum cancer.

In terms of GPx, our findings, which show that 72 has a lower activity, contradict those of Laribi., *et al.* [28] who claim that plas-matic GPx activity is significantly higher in NPC patients than in healthy people.

Sample's nutritional profil

As previously discussed, cancer patients are generally malnourished, and malnutrition is caused by a mismatch between the subject's resources and needs.

The majority of our sample (90%) has energy intakes that are below the recommendations for their age and gender. VADS irradiation can cause dysphagia due to a change in odor and taste, as well as a decrease in salivary secretions depending on the irradiated territories. These several factors may result in complete aphagy

and, as a result, malnutrition. The calculated energy input in our study population is less than 1 500 kcal/d, further complicating patient nutritional status.

Another study conducted by Fetni [29] on gastrointestinal cancer found that the average energy intake of patients is 1796,34 kcal/day, compared to 1352,2 34 kcal/day in our sample. When we look at the quantities of carbohydrates, fats, and proteins provided by the subjects' diets, we see a clear imbalance that only serves to accelerate the onset of malnutrition.

This deficiency in supply also affects micronutrients such as vitamin C, vitamin B9, vitamin E, and iron.

All of these findings support the need for immediate and appropriate nutritional care for our patients.

Conclusion

Nasopharyngeal cancer, like all cancers, is a serious health problem that usually develops in conjunction with an underlying nutritional imbalance, increasing the risk of morbidity and mortality. Our research focused on this type of cancer, which is becoming more common in Tunisia, as well as the need of providing appropriate nutritional care to NPC patients.

Our group of 50 patients showed signs of malnutrition, which was detected using biological tests, anthropometric measurements, and food surveys. This qualitative and quantitative imbalance in energy and vitamin intake further complicates the patients' already precarious position. In fact, the oxydative stress enzymes have been activated, making them much more vulnerable.

Based on our findings, we believe that the treatment of cavum cancer (chemotherapy and radiotherapy) as well as the location of the tumor (behind the nasal fosses, at the top of the pharynx, and beneath the base of the crane) are the primary causes of our population's nutritional deficiency. As a result, we must insist on nutritional evaluation in oncology services and medical centers specializing in chemotherapy/radiotherapy in order to avoid malnutrition and its consequences.

Bibliography

1. Rebecca Siegel., *et al.* "Cancer Statistics 64 (2014): 9-29
2. OMS, Communiqué De Presse N° 263; "Dernières données mondiales sur le cancer: le fardeau du cancer atteint 18,1 million de nouveaux cas et 9,6 million de décès par cancer en 2018" (2018).

3. Ma B and Chan A. "Recent perspectives in the role of chemotherapy in the management of advanced nasopharyngeal carcinoma". *Bulletin du Cancer* 103 (2005): 22-31.
4. Mathilde Beurrier. "Dietetique et nutrition chez le patient atteint de cancer: importance de la prise en charge et rôle du pharmacien d'officine (2016): 1-81.
5. Ed John. "LE suivi du patient cancéreux" Dialogue ville-hôpital. *Formation Médicale Continue* 110.
6. Favier. "Le stress oxydant: intérêt conceptuel et expérimental dans la Compréhension des mécanismes des maladies et potentiel thérapeutique". *L'actualité Clinique* (2003): 108-115.
7. Jean-louisvincent, et al. "Albumin administration in the acute-ly ill: what is new and where next?" Juillet (2014).
8. Comlan Jules Gninkoun. "Statut Des Marqueurs Du Stress Oxydatif au Service De Medecine Interne Et D'endocrinologie De L'hospital Du Mali" (2019): 45-51.
9. Zhiyingzhang, Suzette I., et al. "Evaluation of blood biomarkers associated with risk of malnutrition in older adults. A Systematic Review and Meta-Analysis" *Nutrients* 9.8 (2017): 829.
10. Del giudice M and Gangestad SW. "Rethinking IL-6 and CRP: why they are more than inflammatory biomarkers, and why it matters". *Brain, Behavior and Immunity* 70 (2018): 61-75
11. Bruno Baudin. "Doser les enzymes du stress oxydant, oui ou non?" *Revue Francophone des Laboratoires* 522 (2020): 62-65.
12. He L., et al. "Antioxydants Maintain Cellular Redox Homeostasis by Elimination of Reactive oxygen Species". *Cellular Physiology and Biochemistry* 44.2 (2017): 532-553.
13. Medhioub M., et al. "Evaluation de l'état nutritionnel chez les cirrhotiques". *La Revue de Médecine Interne* 38 (2017): A142
14. Kouassi K., et al. "Prevalence of protein-energy undernutrition evaluated by the measurement of triceps skinfold thickness and mid-arm muscle circumference of 103 adults with cirrhosis of the liver hospitalized in the department of hepatology and gastroenterology of the Lomé Campus University Hospital (Togo)". *Medecine et sante tropicales* 24.2 (2014): 208-213.
15. Calmels P and Woisard V. "Indication de la Rééducation en cancérologie. Fascicule" 4: les déficiences liées aux cancers des voies aéro-digestives supérieures (VADS) (2014).
16. Fondation contre le Cancer". Alimentation des personnes atteintes de cancer" (2014).
17. S Poirier, et al. "Volatile Nitrosamine Levels and Genotoxicity of Food Samples After Nitrosation from High-Risk Areas for Nasopharyngeal Carcinoma Before And after nitrosation". *International Journal of Cancer* 44 (2015): 1088-1094.
18. Stefaan De Sme. "Viande et Cancer: unpoint de vue". *Viandes AND Produits Carnés* (2018): 34-35.
19. Zhenshi Xu., et al. "Cancer mortality attributable to cigarette smoking in 2005, 2010 and 2015 in Qingdao, China". *PLoS One* (2018): 1-11.
20. Mark L Dreher. "Whole Fruits and Fruit Fiber Emerging Health Effects". *Nutrient* 10.12 (2018): 1833.
21. M Pressoir, et al. "Prevalence, risk factors and clinical implications of malnutrition in French Comprehensive Cancer Centres". *British Journal of Cancer* 102 (2010): 966-971.
22. Righini C., et al. "Évaluation du statut nutritionnel, lors du diagnostic, des patients traités pour un cancer des voies aérodigestives supérieures (VADS)". *Annales françaises d'Oto-rhinolaryngologie et de Pathologie Cervico-faciale* 130.1 (2013): 8-14.
23. Righini CA., et al. "Assessment of nutritional status at the time of diagnosis in patients treated for head and neck cancer". *European Annals of Otorhinolaryngology, Head and Neck Diseases* 130.1 (2013): 8-14.
24. Irungu., et al. "Prevalence and Predictors of Malnutrition in Nasopharyngeal Carcinoma". *Clinical Medicine Insight: Ear, Nose and Throat* 8 (2015): 19-22.
25. Silvio A., et al. "Hypoalbuminemia in Critically Ill Patients with Cancer: Incidence and Mortality". *American Journal of Hospice and Palliative Care* 28.4 (2011): 253-257.
26. Griess B., et al. "Extracellular superoxide dismutase and its role in cancer". *Free Radical Biology and Medicine* 112 (2017): 464-479.
27. Jine Li., et al. "Evaluation and Monitoring of Superoxide Dismutase (SOD) Activity and its Clinical Significance in Gastric Cancer: A Systematic Review and Meta-Analysis". *Medical Science Monitor* 25 (2019): 2032-204.
28. Laribi., et al. "Human glutathione peroxidase codon 198 variant increases nasopharyngeal carcinoma risk and progression". *European Archives of Oto-Rhino-Laryngology* (2021): 1-8.

29. Fetni Samira. "Le cancer du sein dans une population de femmes de l'Est algérien: facteurs de risque hormonaux, anthropométriques, du stress oxydant et des habitudes alimentaires". *Algerian Journal of Health Sciences* (2020): S9-S22.

Assets from publication with us

- Prompt Acknowledgement after receiving the article
- Thorough Double blinded peer review
- Rapid Publication
- Issue of Publication Certificate
- High visibility of your Published work

Website: www.actascientific.com/

Submit Article: www.actascientific.com/submission.php

Email us: editor@actascientific.com

Contact us: +91 9182824667