



# Seafood allergy: main challenges in their diet and solutions developed by students of the nutrition and gastronomy course

*Alergia a frutos do mar: principais desafios na alimentação e soluções desenvolvidas por alunos do curso de nutrição e gastronomia*

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## ABSTRACT

Food allergy is characterized by an adverse reaction to a given food, involving an immunological mechanism. One of the most common allergies currently found is seafood allergy, which is based on hypersensitivity to animals in this group. The objective of this research is to identify the challenges exposed in the feeding of seafood allergies and formulate solutions for this population based on nutritionally substitute foods. Being carried out in 3 stages, initial investigation, construction of concepts and planning of an action with nutritional guidance. According to the difficulties encountered in feeding this portion of the population, different preparations were carried out, with nutrients such as: omega-3, proteins, B vitamins, zinc, iron, potassium, magnesium, iodine and selenium. Which are also found in seafood. In order to avoid possible cross-contamination and ensure their nutritional intake in substitute foods. It was possible to conclude that seafood allergies do not present a significant interference in their quality of life, having a small nutritional impact, since through food there are other sources, requiring only some care on a daily basis due to the consequences of possible contamination.

**Keywords:** Food hypersensitivity, seafood, allergens, substitute nutrients.

## RESUMO

A alergia alimentar caracteriza-se por uma reação adversa a um determinado alimento, envolvendo um mecanismo imunológico. Uma das alergias mais comuns encontradas atualmente é a alergia a frutos do mar, a qual se baseia em uma hipersensibilidade a animais desse grupo. O objetivo desta pesquisa é identificar os desafios expostos na alimentação de alérgicos a frutos do mar e formular soluções para essa população baseadas em alimentos nutricionalmente substitutos. Sendo realizado em três etapas: investigação inicial, construção de conceitos e planejamento de uma ação com orientações nutricionais. De acordo com as dificuldades encontradas na alimentação dessa parcela populacional, realizaram-se diferentes preparações, com nutrientes como ômega-3, proteínas, vitaminas do complexo B, zinco, ferro, potássio, magnésio, iodo e selênio, os quais também são encontrados nos frutos do mar, a fim de evitar possíveis contaminações cruzadas e garantir seu aporte nutricional em alimentos substitutos. Foi possível concluir que os alérgicos aos frutos do mar não apresentam uma interferência significativa em sua qualidade de vida, tendo um impacto nutricional pequeno, visto que por meio da alimentação existem outras fontes, necessitando somente de alguns cuidados no dia a dia em virtude das consequências de uma possível contaminação.

**Descritores:** Hipersensibilidade alimentar, frutos do mar, alérgenos, nutrientes substitutos.

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## Introduction

Food allergies are an atypical response of the body, involving the immune system, which identifies innocuous foods as if they were aggressors, which would cause harm to the body. The severity of allergic reactions varies for each individual, ranging from a mild reaction to a severe anaphylactic reaction, which can be fatal, developing within a few minutes or up to two hours after ingestion.<sup>1,2</sup>

Food allergy (FA) can be mediated by Immunoglobulins E (IgE), which is the most common, symptoms are immediate with the possibility of an anaphylactic reaction; it may also be non-IgE-mediated, i.e. mediated by cells, or by both IgE and cells.<sup>3</sup>

Clinical manifestations can occur in different ways, depending on the tissue affected. They range from cutaneous manifestations such as hives, eczema, tingling sensation in the oral cavity, itching, edema, respiratory problems, cardiovascular problems such as decreased blood pressure, loss of consciousness, gastrointestinal problems such as vomiting, diarrhea, abdominal pain, to anaphylactic reactions. Clinical manifestations of anaphylaxis can be mild, moderate or severe, with the potential to be fatal.<sup>4</sup>

The allergens that cause food allergy are usually glycoproteins that are relatively resistant to digestion and the cooking process. The most common foods are: milk, eggs, wheat, nuts, peanuts, fish, seafood and seeds.<sup>1-5</sup>

To present an allergic reaction, the individual must have had some contact with the food previously, which leads to sensitization (formation of antibodies without a clinical reaction). In certain situations this contact does not happen through ingestion. This sensitization can occur through skin contact (examples: products that contain food proteins in their composition) or even through breast milk. In the case of seafood, they can be ingested several times before triggering allergic responses, whereas other foods, such as milk and eggs, generally do not require a prolonged exposure time to present adverse reactions.<sup>6</sup>

Seafood is one of the foods that most cause food allergies.<sup>7</sup> Among them, we can mention shellfish, which are divided into crustaceans such as lobster, crabs, crabs and shrimp, and molluscs, such as oysters, mussels, snails, octopus and squid.<sup>2</sup> Tropomyosin is the reactive protein in seafood that causes an aversion to these foods, with a 75% risk of clinical reactivity, that is, reactions that occur even if

certain proteins do not belong to the same taxonomic classification, and there may be similar amino acid sequence.<sup>8</sup>

Recent studies indicate that 15% of individuals with a seafood allergy may react to vapors and fumes produced during the cooking process. This is because, during cooking, seafood releases proteins called amines, which can cause allergic reactions in the respiratory tract.<sup>8</sup>

The increase in the prevalence of allergic diseases is on the rise and affects both children and adults, and it is reported that 25% of the world population suffers from the problem, 1 to 2% of adults and 5 to 7% of children.<sup>9</sup>

Regarding the diagnosis, the patient undergoes a careful evaluation, which is characterized by the clinical history associated with physical examination data, and may be complemented by allergic tests. These tests can be in vitro or in vivo. In in vivo tests, the methods used are the immediate hypersensitivity skin test (or Prick test), and the oral provocation test, which are the gold standard for diagnosis. In vitro tests measure specific serum IgE.<sup>8</sup>

Currently, allergen avoidance becomes the only available and effective treatment, as there is still no cure. Consequently, exclusion diets must be carried out, and emergency treatments in case of accidental ingestion. Therefore, it is extremely important to ensure that nutrient intake is not compromised, ensuring the consumption of nutritionally equivalent foods.<sup>2-10</sup>

As a result of these assumptions, the objective of this research, through the extension project, is to identify the challenges exposed in the diet of those allergic to seafood and formulate solutions for this population based on nutritionally substitute foods.

## Materials and methods

Based on the discipline of Single Health and Food, an extension project was carried out by students of the Nutrition and Gastronomy course at Universidade Positivo, together with the assistance and supervision of the professors.

Allergies, intolerances and dietary restrictions were presented by the professors as a general topic at the beginning of the development of the studies, each group should choose one of them and delve into the subject.

Therefore, the present study will be developed according to the allergy to seafood, being exposed

to challenges and solutions for those with this hypersensitivity.

The research carried out for a better understanding of the subject was divided into stages, namely: initial investigation, construction of concepts and planning of an action.

In the first stage, initial investigation, an initial analysis was sought with the following descriptors: *hypersensitivity, seafood, food allergy, allergens, food and crustaceans*. With a deeper knowledge of the subject, the students developed a structured interview with a script with the doctor and coordinator of the Scientific Department of Food Allergy at ASBAI – Brazilian Association of Allergy and Immunology (Annex 1).

The second stage, construction of concepts, was based on a grouping of information obtained from the database and the interview. With this, more detailed definitions were obtained about the disease and responses to the difficulties encountered on a daily basis by those allergic to seafood.

Finally, the third stage, planning an action, resulted in the preparation of recipes (Figures 1-5) that can contribute mainly in the nutritional area, focusing on nutrients (omega-3, protein, B vitamins, zinc, iron, potassium, magnesium, iodine and selenium) that make up seafood, but in other preparations that can be ingested without any risk. Nutritional guidelines were also developed for individuals who have this allergy, based on the results of all the steps described.

## Results and discussion

According to the specialist interviewed, after being diagnosed, it is essential that the allergic person is instructed about the foods he should consume to ensure adequate nutritional intake, especially when fish and seafood are the basis of food, as in coastal regions. Reading labels should also be considered, making it essential for allergy sufferers, given that according to RDC N° 26/2015, the presentation of allergens on food labels is mandatory.<sup>11</sup>

According to the expert, cross-contamination occurs when food allergens are accidentally transferred from one food to another, this can occur in any stage of food production: preparation, packaging, storage and distribution, whether in home-cooking or when food is prepared in cafeterias and restaurants. Thus, for some allergic patients, a small amount of

the food may be enough to cause reactions. In a domestic environment, to avoid undesirable contacts, those who handle food should always wash their hands between preparations, sanitize surfaces and household utensils.<sup>2</sup> The interviewee reports that to cook, clean water and new oil should always be used, avoiding reuses of the same. It is also recommended that the drying of the utensils be done in the open air, avoiding the use of cloth. And, if the allergic person does not know how the food was prepared, the ideal would be to avoid consumption, so as not to have a possible allergic crisis. Thus, treatment consists of eliminating contact, inhalation or consumption of the food involved.<sup>12</sup>

Seafood has omega 3 as its main source. As a result, replacement options for obtaining omega 3 include flaxseeds, seaweeds and oilseeds. Other nutrients, also present in seafood, such as protein, B vitamins, zinc, iron, potassium, magnesium, iodine and selenium can be found in meat, eggs, fruits, nuts and dark green vegetables.<sup>13</sup>

For individuals who need EPA – eicosapentaenoic acid and DHA – docosahexaenoic acid (types of omega 3 from fish oil) supplementation, the option to replace supplements is those from seaweed, explains the interviewee. Studies indicate that DHA can, for example, be obtained from the consumption of seafood, such as fish, crustaceans and, for allergy sufferers, algae, since these foods are the main source of polyunsaturated fatty acids (PUFAs) omega 3,<sup>14</sup> which have several benefits, such as cardiovascular health care, more specifically with eicosapentaenoic acid.<sup>15</sup>

Eating meals outside the home can be risky, due to the possible cross-contamination and the existence of the allergen in the preparation, which can lead to an unexpected allergic reaction.<sup>10</sup> With this, one of the challenges and difficulties among those who are allergic to fruits of the sea is the fact that the allergic person may be afraid to eat in certain places. With this, it was sought through other nutrient preparations to substitute seafood.

Five preparations were made in total, with the following nutritional sources: omega-3, proteins, B vitamins, zinc, iron, potassium, magnesium, iodine and selenium, being arranged in preparations that can be attributed to breakfast, morning snack, lunch, afternoon coffee and dinner.

The first preparation (omelet with eggs, banana with grated cashews and whole milk) served as a

breakfast option and was developed with a focus on the following nutrients: selenium, iodine, and magnesium. In it, practicality was observed in the preparation, in addition to being easy to reach for the affordable price (Figure 1).

The nutrients chosen in this preparation were based on the interviewee's report, in which she explains that the nutrients most committed to the seafood exclusion diet include iodine, which in turn helps protect against the toxic effects of radioactive materials, prevents goiter, stimulates the production of thyroid gland hormones, burns excess fat and protects skin, hair and nails.<sup>16</sup> The source of iodine in this preparation is whole milk, with a daily recommendation of 130 µg for adults. Pregnant women, however, need to consume 220 µg/day. The ideal amount of iodine for infants is 90-135 µg daily.<sup>17</sup> However, seafood also has selenium in its composition, which stands out for its participation in the synthesis of thyroid hormones, its antioxidant action and the aid to enzymes that depend on it to function well.<sup>16</sup> Its main source is cashew nuts, and its daily food intake for adults in Brazil is 34 µg/day.<sup>17</sup> Finally, magnesium is necessary for the body's hormonal activity and for the contraction and relaxation of muscles, including the heart.<sup>16</sup> Indication of daily consumption of magnesium for adult men and women is 260 mg, 220 mg/day for pregnant women, and 36 to 53 mg/day for infants. Its source is offered in this preparation through milk.<sup>17</sup>

As a morning snack, the option given was an avocado cream with flaxseed and banana, rich in omega 3 and potassium (Figure 2).

According to a study, fish have the advantage of provide polyunsaturated fatty acids and omega 3 and 6, essential for health.<sup>18</sup> In view of this statement, it was decided to make a preparation rich in this nutrient (omega 3), which presents cardiovascular benefits for human health.<sup>13</sup> The minimum recommendation for adequate daily intake of this nutrient is 250 mg/day of EPA + DHA in adults,<sup>19</sup> in addition to potassium, an important contributor to the metabolism and synthesis of proteins and glycogen that can be found in seafood and fruits such as bananas, used in this preparation<sup>16</sup>, adequate for adults is 3,500 mg/day.<sup>17</sup>

For lunch, a dish based on roasted pork loin with creamed spinach and roasted potatoes and carrots was prepared (Figure 3). This dish is mainly rich in protein, iron and B vitamins, especially vitamin B2 (riboflavin), which it acts in the formation of red blood cells, and B12 (cobalamin), which guarantees cellular

metabolism, especially cells of the gastrointestinal tract, bone marrow and nervous tissue.<sup>20</sup> Given that, it is exposed that Meat and fish are good sources of vitamin B12.<sup>21</sup> The daily recommendation for Cobalamin is 1.5-2.4 µg for adults and 0.7-1.2 µg for children.<sup>22</sup> In the case of Riboflavin, consumption of 1.1-1.6 mg/day is recommended for adults and 0.4-0.6 mg/day for children.<sup>17</sup>

For the afternoon snack, a preparation focused on zinc was carried out. For its accomplishment, the following inputs were used: wholemeal bread, Minas cheese, egg yolk and black tea. Zinc, in turn, has several benefits, including the antioxidant defense, growth, development, essential for protein structures and increase, complement and stimulant to the resistance of the immune system. Shellfish, oysters, red meat, liver, offal, eggs, nuts and pulses are considered the best sources of zinc.<sup>20</sup> Its daily intake for adults is 7 mg/day, daily consumption for infants should be 2.8-4.1 mg/day, and for pregnant women 11 mg/day<sup>17</sup>(Figure 4).

For dinner, there was a recipe with practical and affordable food: liver fillet, butter, broccoli, carrots and brown rice, with the main focus on animal protein and iron, making it a very nutritious meal, rich in nutrients necessary for the proper functioning of the body<sup>23</sup> (Figure 5). The Iron is recognized by the transport of oxygen to all cells,<sup>16</sup> its source in this recipe is identified through the liver, and its daily requirement for adults is 14 mg, for infants the daily value is 0.27-9 mg, and for pregnant women should have an intake of 27 mg/day.<sup>17</sup> In the case of protein, its recommended daily intake is 10 to 15 percent of the total amount of the diet.<sup>24</sup> It, in turn, performs the functions of transporting substances through the blood, formation of tissues, enzymes, hormones, neurotransmitters and antibodies, participate in the acid-base balance, maintain the ideal fluid balance in body tissues, act as a source of energy in the Krebs cycle and are responsible for muscle contraction.<sup>25</sup> The protein sources that best serve to these characteristics are those of animal origin: meat, eggs, milk and dairy products.<sup>26,27</sup> In view of this, comes the choice of replacing the seafood with another meat, in the case of this preparation, the liver.

In view of the above, the nutritional guidelines collected according to the interview and the databases reveal that for the allergic person to live better with this hypersensitivity, he should avoid eating seafood, in addition to the care to be taken when eating outside from home, due to cross-

contamination that can occur on frying pans, utensils and surfaces during preparation. The substitute sources mentioned above characterize the ease of feeding correctly with nutrients present in seafood, but in other preparations, resulting in obtaining the daily recommendations of each nutrient.

### Final considerations

According to the study presented through the extension project, it is concluded that food allergies, especially seafood, have some challenges related to food. With the research history and the interview

carried out, it was possible to materialize and identify ways to help this audience, presenting nutritionally balanced, tasty preparations, with micro and macronutrients substitutes for seafood, and also accessible to the most diverse economic classes.

Thus, it becomes evident that those allergic to seafood do not have a significant nutritional interference in their quality of life, since through food there are other sources of the main nutrients of this group. However, this is an allergy that has no cure, and must be treated, avoiding the ingestion of the allergen and all possible situations of cross contamination.

### Annex 1

Structured interview with script with the doctor and coordinator of the Scientific Department of Food Allergy at ASBAI – Brazilian Association of Allergy and Immunology

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- 1. One of the impasses encountered by those allergic to seafood would be the difficulty in finding a place where cross-contamination does not occur, since many of them use, for example, the same oil in frying. For this reason, the person may feel insecure about eating outside and they choose to make their own food. In your point of view, what would be the solution for these cases?**

Dr.: Cross-contact occurs when food allergens are accidentally transferred from one food to another. This can occur in any of the stages of food production: preparation, packaging, storage and distribution, both in the home environment and in cafeterias and restaurants.

For some allergic patients, a small amount of the food may be enough to cause reactions. In a domestic environment, to avoid unwanted contact, those who handle food should always wash their hands between preparing different foods and sanitizing surfaces and household items. For cooking you should always use clean water and new oil. It is also recommended that the utensils be dried outdoors, avoiding the use of cloth.

When you do not know how the food was prepared, avoid consumption. Although there are studies that try to define for each allergen what would be the minimum dose capable of inducing an allergic reaction, this varies from individual to individual and even within the same individual depending on the clinical condition.

- 2. Seafood is a great source of B vitamins and minerals. However, those allergic to such foods end up not being able to ingest certain supplements, such as omega 3. What would be the solution to avoid any type of nutritional deficiency?**

Dr.: The nutrients most committed to the seafood exclusion diet are omega 3 and iodine. Substitute options for obtaining omega 3 include flaxseeds and oilseeds. Seaweeds are also good sources of omega 3.

Iodine is added to iodized table salt. Seaweed, milk and eggs are other sources of iodine.

Other nutrients, also present in seafood, such as protein and vitamin B12, can be easily obtained from other foods of animal origin, such as meat and eggs.

For individuals who need EPA and DHA supplementation (types of omega 3 from fish oil), the option to replace supplements is from seaweed (vegan supplement).

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**Annex 1 (continuation)**

Structured interview with script with the doctor and coordinator of the Scientific Department of Food Allergy at ASBAI – Brazilian Association of Allergy and Immunology

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**3. When diagnosed with seafood allergy, in addition to the person not being able to eat these foods, what other precautions should be taken?**

Dr.: It is essential that the patient is oriented about the foods he should consume to ensure adequate nutritional intake, especially when fish and seafood are the basis of food, as in coastal regions. In the fish-restricted diet, supplementation of plant-based omega-3 fatty acids should be considered.

Careful reading of labels should also be performed. For example, Worcestershire sauce may contain anchovy and should not be consumed by patients who are allergic to fish.

**4. For more severe allergic reactions, including anaphylaxis, what are the precautions in the treatment? And in which situations is the adrenaline pen prescribed?**

Dr.: Anaphylaxis is a serious, potentially life-threatening reaction that requires emergency treatment. Emergency treatment plans for anaphylaxis, describing signs and symptoms of allergic reactions and indications for the use of emergency medications, should be provided to the patient. Prescriptions for self-injecting adrenaline and training on how the devices should be used should be made available to all anaphylactic patients. Constant reviews of the guidelines and training must be carried out.

In the case of shellfish allergies, autoinjector adrenaline should always be prescribed for the potential severity of the reactions. It is the most important drug in the treatment of anaphylaxis and should be administered promptly whenever necessary.

**5. For a person who loves seafood but ends up becoming allergic over time, the difficulties encountered are the most diverse, since they are not able to taste the flavor and texture of such foods. In your opinion, are there foods that can replace these sensory properties that seafood brings?**

Dr.: The characteristic flavor and texture of seafood are not found in fresh foods from other food groups, unfortunately. Individuals with a seafood allergy are rarely allergic to all seafood. For example, people with a fish allergy may be tolerant of shellfish, and similarly, those who are allergic to crustaceans may tolerate fish. Professional guidance is needed to determine which foods are safe for each individual.

**6. As many patients would like to be able to consume seafood again, is there any specific way for them to acquire tolerance again?**

Dr.: So far, avoiding the shellfish allergen is the only treatment available. Research in crustacean immunotherapy has focused on the development of hypoallergenic variants of tropomyosin. No clinical trials of crustacean immunotherapy have been described so far.

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### Datasheet

**Recipe name:**

Two-egg omelet with a drizzle of olive oil. Glass of whole milk.  
Sliced banana with grated cashews on top.

**Utensils and equipment:**

frying pan, knife, cup, cup, fork,  
spatula, scale and plate.

**Time:** 10 min**Serves:**

1 meal

Ingredients	Amount in homemade measure	Amount in grams or milliliters	Cost BRL
Medium eggs	2 units	65 g	0.80
Medium banana	2 units	75 g	0.89
Cashew nut	4 units	2.5 g	0.90
Glass of milk	1 cup	250 mL	0.82
Salt	2 pinches	1 g	0.10

**Preparation:**

1. Beat eggs and salt until smooth. Then pour into the hot skillet.
2. Cut the bananas and grate or chop the chestnuts over them.
3. Pour a medium glass (250 mL) of milk.

**Total yield grams:** 538 g**Yield serving grams:** 538 g

#### Nutritional information

CHO (g)	PTN (g)	LIP (g)	Fiber (g)	Ca (mg)	Fe (mg)	Na (mg)	Selenium (µg)	Iodine (µg)	Magnesium (mg)
1.28	14.35	27.64	0	57.72	1.37	0	42.24	72	11.58
34.26	1.64	0.5	3.9	7.5	0.39	0	1.5	3	40.5
2.62	1.22	3.71	0.24	3.6	0.48	0	1.87	9	20.8
11.31	8.05	8.13	0	282.62	0.08	0	9.26	40	20.8
0	0	0	0	0	0	461.2	0	0	0
<b>Total g</b>	<b>Total g</b>	<b>Total g</b>	<b>Total g</b>	<b>Total mg</b>	<b>Total mg</b>	<b>Total mg</b>	<b>Total µg</b>	<b>Total µg</b>	<b>Total mg</b>
49.46	25.26	39.97	4.14	351.44	2.31	461.2	12.45	11.8	1,083.6
<b>Kcal</b>	<b>Kcal</b>	<b>Kcal</b>							
197.84	101.04	359.73							
<b>Total caloric value:</b> 644 Kcal					<b>Serving size:</b> 644 Kcal				
<b>Total cost:</b> BRL 3,51					<b>Portion cost:</b> BRL 3,51				

**Figure 1**

First preparation

Datasheet									
<b>Recipe name:</b> Avocado cream with flaxseed.									
<b>Utensils and equipment:</b> blender, knife, spoon, juicer, measuring cup, bowl and scale.			<b>Time:</b> 10 min						
Ingredients	Amount in homemade measure		Amount in grams or milliliters		Cost BRL				
Medium avocado	1 unit		400 g		5.98				
Medium or large banana	1 unit		150 g		0.50				
Lemon juice	½ unit		15 mL		0.30				
Glass of water	½ cup		100 mL		0.40				
Linseed	2 tablespoons		18 g		0.50				
Wholemeal toast	3 units		20 g		0.78				
<b>Preparation:</b> <ol style="list-style-type: none"> <li>1. Blend the avocado, banana and lemon juice in a blender.</li> <li>2. Gradually pour in the water, whisking constantly, until smooth.</li> <li>3. Pour into a bowl and sprinkle with the flaxseed.</li> <li>4. Serve chilled on toast.</li> </ol>									
<b>Total yield grams:</b> 500 g (cream)					<b>Yield serving grams:</b> 25 g (of the cream with the toast)				
Nutritional information									
CHO (g)	PTN (g)	LIP (g)	Fiber (g)	Ca (mg)	Fe (mg)	Na (mg)	Monoun-saturated fat (g)	Polyun-saturated fat (g)	Potassium (mg)
30.15	6.20	41.98	31.57	39.58	1.03	0	21.5	7	1,031.28
30.30	1.29	0.22	1.37	3.74	0.26	0	0	0	295.23
0.84	0.04	0.01	0.04	1.4	0.01	0.2	0	0	11.7
7.80	2.54	5.81	6.03	38.07	0.85	1.56	1.28	0.76	156.47
14.67	2.67	0.67	1.33	0	6.07	83.33	0	0	0
Total g	Total g	Total g	Total g	Total mg	Total mg	Total mg	Total g	Total g	Total mg
83.76	12.74	48.69	40.34	82.79	8.22	84.89	22.78	7.76	1,494.68
Kcal	Kcal	Kcal							
335.04	50.96	438.21							
<b>Total caloric value:</b> 760 Kcal					<b>Serving size:</b> 28 Kcal				
<b>Total cost:</b> BRL 8.46					<b>Portion cost:</b> BRL 0.31				
<b>Comments:</b> for a tastier result, the avocado must be very ripe. If you prefer, add a small amount of brown sugar.									

**Figure 2**  
 Second preparation

### Datasheet

**Recipe name:**

Roasted pork loin with potatoes and carrots with spinach cream.

**Utensils and equipment:**

blender, knife, spoon, juicer, measuring cup, bowl, baking sheet, pan, silicone spatula, grater, sieve, scale, ladle, foil and scale.

**Time:** 2h40min

**Serves:**  
10 servings



Ingredients	Amount in homemade measure	Amount in grams or milliliters	Cost BRL
Pork loin	1 piece	1.5 kg	40.30
Big potatoes	5 units	1.1 kg	2.98
Big carrots	3 units	795 g	1.58
Water	2 ½ cups	500 mL	0.00
Orange juice	1 cup	200 mL	2.00
Olive oil	½ cup	100ml	5.50
Medium onion	1 unit	100 g	0.40
Head of garlic	1 unit	50 g	1.00
Salt (to taste)	2 ½ heaped tablespoons	50 g	0.09
Rosemary (to taste)	2 pinches	2 g	0.78
Black pepper (to taste)	2 pinches	5 g	0.65
Spinach	1 pack	100 g	3.00
Parmesan	1 cup	200 g	19.00
Flour	½ tablespoon	50 g	0.18
Butter	½ tablespoon	50 g	2.60
Milk	5 cups	1 L	3.10

**Preparation:***Roasted pork loin*

- Mix the orange juice, olive oil, onion, garlic, pepper, salt and water in a blender.
- With the help of a knife, make holes in the loin so that the seasoning can penetrate the piece.
- Place the loin piece inside a plastic bag and add the sauce.
- Leave to marinate for 24 hours.
- After marinating, cut the potatoes and carrots into large pieces and season with a drizzle of olive oil, salt and rosemary.
- Transfer the marinated loin to a roasting pan, add the potatoes and 5 ladles of marinade sauce.
- Cover the piece with aluminum foil (shiny side down), and bake for 2 hours at 200 °C.
- After 2 hours, remove the aluminum foil from the loin and leave it in the oven until the loin and vegetables are golden brown.
- While the loin and vegetables are browning, water the loin so it is juicy.
- After removing from the oven, set aside while you prepare the spinach cream.

*Spinach cream*

- Start by separating the spinach leaves and grating the Parmesan cheese.
- In a pan, add butter and spinach leaves to the edge of the pan, remove and set aside when the leaves are wilted.
- In another pan, add 50 g of butter and sift 50 g of flour, mix until you smell popcorn, then add the milk and mix until it becomes a cream.
- Then turn off the heat and add pepper, salt and cheese, mix until everything is homogeneous and add the spinach.
- Finally, serve with the loin and vegetables.

**Total yield grams:** 3,900 g

**Yield serving grams:** 390 g

**Figure 3**

Third preparation

Nutritional information							
CHO (g)	PTN (g)	LIP (g)	Fiber (g)	Ca (mg)	Fe (mg)	Na (mg)	B-complex vitamins: vitamin B2 (mg)
0	536	96	1.7	296.7	6.9	583.8	1.05
131.3	12.8	0	14.7	38.7	2.1	25.2	0
60.9	10.5	1.4	25.7	179.2	1.4	26.5	0
15.1	1.5	0.1	0	14.7	0	0	0
0	0	12	0	1	0.6	2	0
9	1.1	0.1	1.7	23	0.2	4	0
12	3.5	0.1	2.4	6.8	0.4	2.7	0
0	0	0	0	12	0.1	19.37	0
2.6	2.86	0.2	2.2	97.5	0.4	17.1	16.1
3.3	71.1	67.1	0.5	1,983.9	1.1	3,688.2	0
37.6	4.9	0.7	1.2	8.9	0.5	0.4	0
0.05	0.45	81	0	24	0	11	0
50	30	20	0	1.150	0	690	2.4
<b>Total g</b>	<b>Total g</b>	<b>Total g</b>	<b>Total g</b>	<b>Total mg</b>	<b>Total mg</b>	<b>Total mg</b>	<b>Total mg</b>
321.65	674.71	278.6	50.1	3,836.4	13.2	5,070.27	19.55
<b>Kcal</b>	<b>Kcal</b>	<b>Kcal</b>					
1,286.6	2,698.84	2,507.4					
<b>Total caloric value:</b> 7,221.1 Kcal				<b>Serving size:</b> 722.11 Kcal			
<b>Total cost:</b> BRL 83.16				<b>Portion cost:</b> BRL 8.24			

Figure 3 (continuation)

Third preparation

Datasheet							
<p><b>Recipe name:</b> Wholemeal bread with white cheese and yolk and black tea.</p>							
<p><b>Utensils and equipment:</b> frying pan, knife, spoon, cup, plate and scale.</p>		<p><b>Time:</b> 15 min</p> <p><b>Serves:</b> 1 portion</p>					
Ingredients	Amount in homemade measure	Amount in grams or milliliters	Cost BRL				
Wholemeal bread	2 slices	44 g	0.88				
Fresh Minas cheese	2 slices	40 g	1.71				
Chicken egg yolk	2 units	42 g	0.80				
Black tea	1 cup	165 mL	0.33				
<p><b>Preparation:</b></p> <ol style="list-style-type: none"> <li>1. Fry the egg yolk in a non-stick skillet.</li> <li>2. Put the hot water in the cup and add the tea.</li> <li>3. Add the cheese slices to the wholemeal bread and right after the yolk.</li> <li>4. Serve.</li> </ol>							
<b>Total yield grams:</b> 291 g				<b>Yield serving grams:</b> 291 g			
Nutritional information							
CHO (g)	PTN (g)	LIP (g)	Fiber (g)	Ca (mg)	Fe (mg)	Na (mg)	Zinc (mg)
20.63	4.13	0	2.75	105.88	0.92	233.75	0
1.16	5.68	7.24	0	579	0	0	0
0.75	7.06	12.98	0	57.54	1.48	18.06	1.31
0	0	0	0	0	0	0	0
Total g	Total g	Total g	Total g	Total mg	Total mg	Total mg	Total mg
22.54	16.87	20.22	2.75	742.42	18.98	251.81	1.31
Kcal	Kcal	Kcal					
90.16	67.48	181.98					
<b>Total caloric value:</b> 339.62 Kcal				<b>Serving size:</b> 339.62 Kcal			
<b>Total cost:</b> R\$ 3.72				<b>Portion cost:</b> R\$ 3.72			

**Figure 4**  
Fourth preparation

Datasheet									
<b>Recipe name:</b> Liver with carrots and broccoli in butter and rice.									
<b>Utensils and equipment:</b> knife, scales, plate, spoon, pots, stove and skillet.									
Ingredients		Amount in homemade measure		Amount in grams or milliliters		Cost BRL			
Bull's liver		1 slice		120 g		1.91			
Braised carrots		4 tablespoons		60 g		0.45			
Braised broccoli		1 cup tea		80 g		0.44			
Cooked rice		3 tablespoons		100 g		0.58			
Butter without salt		1 teaspoon		8 g		0.41			
<b>Preparation:</b> 1. Cook the rice. 2. Grill the liver fillet. 3. Saute carrots and broccoli in butter. 4. Place on plate and serve.									
Total yield grams: 360 g					Yield serving grams: 360 g				
Nutritional information									
CHO (g)	PTN (g)	LIP (g)	Fiber (g)	Ca (mg)	Fe (mg)	Na (mg)	Monoun-saturated fat (g)	Polyun-saturated fat (g)	Vitamin A (µg)
5.04	35.83	10.81	0	6.67	6.95	98.63	2.64	1.32	17,488.8
4.78	0.44	1.90	1.75	17.46	0.2	33.76	0.42	1.09	0
5.74	1.90	2.66	2.64	32	0.54	32.8	0.58	1.49	0
25.47	2.32	1.18	0.49	12.43	1.37	275.87	0.29	0.62	0
0	0.07	6.49	0	1.88	0.01	0.88	1.95	0.24	60.32
Total g	Total g	Total g	Total g	Total mg	Total mg	Total mg	Total g	Total g	Total µg
41.03	40.56	23.04	4.88	70.44	9.07	441.94	5.88	4.76	17,549.12
Kcal	Kcal	Kcal							
164.12	162.24	207.36							
Total caloric value: 533.72 Kcal					Serving size: 533.72 Kcal				
Total cost: BRL 3.79					Portion cost: BRL 3.79				

**Figure 5**  
Fifth preparation

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