Nutritional analysis of noodles with and without the additional of *Pereskia aculeata*

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Abstract

Pereskia aculeata Mill. is a cactaceous, popularly known as ora-pro-nobis, considered a native and non-endemic vegetables besides being rich in protein, fiber, iron and calcium, among others. This work aimed to study the chemical composition of noodles prepared with the incorporation of dry leaves flour, stems and fresh leaves of *Pereskia aculeata,* to identify and quantify the nutrients and minerals present. Four recipes were tested: traditional noodles with flour; noodles with incorporating flour from dried leaves; noodles with leaves flour incorporation + stem; noodles with incorporation of fresh leaves. The following analyzes were carried out in a completely randomized design with three replications, and data expressed in percentage in wet and dry basis (g 100g-1): moisture, ash, protein, fiber, lipids, total carbohydrates, total caloric value and minerals. Among the tested recipes, it was concluded that the noodles with incorporating flour dried leaves of Pereskia aculeata showed the best moisture, ash, lipids, proteins, fibers and lower total caloric values. Furthermore, it showed the best results for all analyzed minerals, thus the better nutritional quality.

Keywords: Ora-pro-nobis. Pasta. Bromatological analysis. Nutrition.

Resumo

Análise nutricional de macarrão talharim com e sem a adição de Pereskia aculeata
Pereskia aculeata Mill. é uma cactácea, popularmente conhecida como carne de pobre, considerada uma PANC não endêmica além de ser rica em proteínas, fibras, ferro, cálcio, dentre outros. Este trabalho objetivou estudar a composição bromatológica de macarrão talharim elaborado com a incorporação de farinha de folhas secas, caules e folhas frescas de *Pereskia aculeata*, visando identificar e quantificar os nutrientes e minerais presentes. Foram testadas quatro receitas: macarrão talharim tradicional com farinha de trigo; macarrão talharim com incorporação de farinha de folhas secas; macarrão talharim com incorporação de farinha de folhas+caule secos; macarrão talharim com incorporação de folhas frescas de Pereskia aculeata. Foram realizadas as seguintes análises, num delineamento inteiramente casualizado, em três repetições, e seus dados expressos em porcentagem em base seca (g 100g^{-1}): umidade, cinzas, proteínas, fibras, lipídeos, carboidratos totais, valor calórico total e minerais. Dentre as receitas testadas, concluiu-se que o macarrão talharim com incorporação de 60 g de farinha de folhas secas de *Pereskia aculeata* foi o que apresentou os melhores teores de umidade, cinzas, lipídeos, proteínas, fibras e menores valores calóricos totais. Além disso, apresentou os melhores resultados para todos os minerais analisados, sendo assim o de melhor qualidade nutricional. O resumo traduzido deve ser inserido neste espaço. O resumo tra- duzido deve ser inserido neste espaço.

Palavras-chave: Ora-pro-nobis. Massa. Análise bromatológica. Nutrição.

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Introduction

Malnutrition is characterized as a pathological condition due to lack of energy and proteins, in various proportions (CHAGAS et al., 2013). One of the alternatives to reduce malnutrition, is proper nutrition, providing the body with daily basic nutritional needs (BURITY et al., 2010). However, this is not always possible due to different family incomes and information and culture levels of the individuals (RIBEIRO et al., 2014).

Expansion of food use of unconventional food plants (UFP), such as *Pereskia aculeata*, directs an increasing modification in the relation between humans and food, which includes the introduction of healthier and more nutritious food in the population diet (RIBEIRO et al., 2014).

Pereskia aculeata, popularly know as carne de pobre (poor people meat), is from the cactaceae family, considered a non-endemic vegetable, in other words, it does not suffer interference of men to be cultivated in a certain place (QUEIROZ et al., 2015).

The species is used in human nutrition and has been used in several recipes, specially after being shown in a television program on May 2013 (Terra de Minas of Rede Globo TV station) (ALMEIDA; CORRËA, 2012). In addition, in a study carried out with residents of São Gonçalo do Abaete (MG), the species was mentioned by 91.67% of the participants as an ingredient for broths, by 16.67% for raw salads and by 8.33% for soups (ALMEIDA; CORRËA, 2012). It is also used as a medicine and considered as a nutritional supplement, since it is rich in proteins, fibers, iron and calcium, among other minerals (QUEIROZ et al., 2015), classified as a species with characteristics of a functional food with protective and medicinal properties (SILVA JÚNIOR et al., 2010).

It is also recommended for use in the daily diet, and can be used either in its raw and processed form (ROSA et al., 2011). Its leaves are edible and have mucilage, and can be consumed as broths and soups, as a flour to be incorporated in preparations of pies, pasta, cookies, breads and cakes, granting a high protein content (OLIVEIRA et al., 2015). It is believed that potential consumption of the species in the daily diet is extremely important, since besides contributing with nutrients supply for a healthy diet, it provides the interest in increasing its cultivation throughout the country (RIBEIRO et al., 2014).

Despite its importance, the consumption of *Pereskia aculeata* is still low and therefore there is the need to adopt measures to increase it. One of those measures is to encourage the use of foods with low quality and quantity of proteins and nutrients, but which are part of Brazilian market basket, such as pasta.

The lack of information by the population about the nutritional value of *Pereskia aculeata*, as well as its preparation method and a good difusion of potential gastronomic recipes that can be prepared, causes a limitation in its consumption (ROCHA et al., 2008).

Therefore, in order to offer a recommendation of the use of a food product with higher nutritional quality which is accessible to most part of the population, the objective of studying the bromatological composition of noodles prepared with leaves and stems flour, as well as fresh leaves of *Pereskia aculeata*, arose aiming to identify and quantify nutrients and minerals present in these foods.

Material and Methods

The vegetative material of *Pereskia aculeata* was collected in Curitiba-PR, at coordinates of 25°38'29.28" South latitude and 49°29'61.47" West longitude. According to Köppen classification, the region climate is type Cfb, that is to say, it is a climate characterized by humid temperature, with the average temperature of the warmest month above 10°C, with mild Summers and frequent frosts during Winter, with a tendency of rain concentration in Summer months, but without a defined dry season. Dry samples of the species were deposited in the herbarium of Universidade Federal do Paraná (UFPR) receiving classification UPCB 75848.

Leaves and stems of *Pereskia aculeata* were collected with the purpose of preparing the flour to be used in food processing. The plant material was properly washed with a triple wash in distilled water and put in a greenhouse at 60°C for 24 hours. Subsequently, it was ground and stored in a freezer at -20°C for further food production, except the fresh leaves. For the production of 100 g of flour it was necessary 1 kg of leaves of *Pereskia aculeata*.

For the preparation of noodles dough four recipes were tested, namely: noodles without addition of *Pereskia aculeata* flour (traditional pasta) (MT); noodles with the incorporation of dry leaves flour (MFS);

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noodles with the incorporation of dry leaves+stems flour (MFCS); noodles with the incorporation of fresh leaves (MFF) of *Pereskia aculeata*. In the preparation of the dough were used ingredients as wheat flour, durum wheat semolina and eggs, obtained in commercial establishments in the city of Curitiba (PR), with the ingredients proportion described in Table 1.

Table 1 - Ingredients used in formulations of traditional pasta (MT), pasta with dry leaves flour (MFS), pasta with dry leaves+stems flour (MFCS) and pasta with fresh leaves (MFF) of *Pereskia aculeata*, Curitiba (PR), 2015

Ingredients		MT	MFS	MFCS	MFF
		Quantity			
Wheat flour	g	200	140	140	190
Semolina	g	200	200	200	200
Eggs	g	180	180	180	180
Pereskia aculeata	g	-	60	60	10

The bromatological analysis were conducted in the Laboratório de Produtos Florestais Não Madeiráveis da Embrapa Florestas (Embrapa Florestas Laboratory of Non-woody Forest Products), located in Colombo-PR, and performed in accordance with the Metodologias Oficiais do Instituto Adolfo Lutz (Official Methodologies of Adolfo Lutz Institute) (BRASIL, 2008). The data were expressed in a percentage of humid basis (water content of a food) and of dry basis (determined by the greenhouse method up to constant weight). The analysis were performed three times, so that each data corresponded to the average of three repetitions.

As for nutritional composition, except for composition of total food fibers and total carbohydrates, the others (moisture, ashes, lipids and proteins) were performed three times according to the official methodology of Instituto Adolfo Lutz (IAL, 2008). The moisture of samples was determined in about 5 g of sample, which remained in a greenhouse for 12 hours at a temperature of 105°C. The percentage value of moisture was obtained by multiplying the mass loss (g) of the sample by 100 and dividing the result by the sample mass (g). Ashes, representing the total minerals, were determined by calcination of approximately 2 g of sample in the muffle at 550°C for three hours. The percentual value of ashes was obtained by multiplying the mass (g) of the sample ash by 100 and dividing the result by the sample mass (g).

The lipids were determined in 1.5 g of the sample using ethyl ether as an extracting solvent for a six-hour period, in Soxhlet Extractor. The ethereal extract obtained was put in a greenhouse set at 70°C for one hour to remove residues from the sovent, followed by cooling in a dry environment, and subsequently weighted. The lipid content was calculated by multiplying the lipids mass by 100, and the result was divided by the sample mass (g). The total proteins were obtained in 0.5 g of sample by the micro Kjedahl method, which quantifies the total nitrogen content of the sample. The proteins percentage was calculated by multiplying the total nitrogen percentage by the conversion factor 6.25.

Dietary fibers were determined by the enzymatic-gravimetric method with 1 g, consisting of hydrolyzing the starch to obtain protein by the use of the enzymes protease, alfa-amilase stable at heat and amiloglucosidase (glucoamylase).

The total caloric value, in kcal, was determined considering the conversion factor 4.0 for proteins and carbohydrates and 9.0 for lipids. Minerals, macronutrients and micronutrients were determined by Laboratório de Química e Fertilidade do Solo (Laboratoty of Chemistry and Soil Fertility), of Universidade Federal do Paraná (Federal University of Paraná), in Curitiba-PR.

Results and Discussion

The doughs of noodles prepared with *Pereskia aculeata* present a greenish tone, caused by the characteristic color of the used parts of the plant, full of chlorophyll pigments.

The data of centesimal composition of noodles on a dry basis revealed that the variable lipid did not present a significant difference, whereas the other variables ashes, proteins and fibers presented a significant difference at a level of 1% of probability (Table 2).

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Table 2 - Percentage of ashes, lipids, fibers, total carbohydrates (CT) and total caloric value (VCT - kcal 100 g-1) of pasta doughs with and without addition of *Pereskia aculeata* flour of fresh leaves, Curitiba (PR), 2015.

	MT[a]	MFS[b]	MFCS[c]	MFF[d]	Variation Coefficient (%)
DRY BASIS					
Ashes (%)	1.70 b	4.07 a	2.08 b	0.90 c	8.46
Lipids (%)	2.33 a	2.89 a	3.06 a	2.92 a	21.01
Proteins (%)	10.12 a	10.71 a	9.86 ab	8.86 b	3.89
Fibers (%)	6.77 b	13.94 a	15.41 a	3.47 b	12.96
CT (%)	79.08	68.39	69.59	83.85	
VCT (kcal 100 g^{-1})	377.77	342.41	345.34	397.12	
	MT	MFS	MFCS	MFF	Variation Coefficient (%)
MOIST BASIS					
Ashes (%)	1.20 b	2.61 a	1.36 b	0.59 c	8.62
Lipids (%)	1.65 a	1.85 a	2.00 a	2.06 a	21.55
Proteins (%)	7.18 a	6.87 ab	6.44 bc	6.09 c	3.91
Fibers (%)	4.80 b	8.95 a	10.06 a	2.39 b	12.81
CT (%)	56.09	43.87	45.43	57.61	
VCT (kcal 100 g^{-1})	268.00	219.70	225.55	272.91	

Measures followed by the same letter on the line do not differ statistically at 5% level of significance. MT[a]= traditional noodles; MFS[b]= noodles prepared with substitution of 30% of wheat flour for 30% of dry leaves flour of *Pereskia aculeata*; MFCS[c]= noodles prepared with substitution of 30% of wheat flour for 30% of dry leaves+stems flour of *Pereskia aculeata*; MFF[d]= noodles prepared with fresh leaves of *Pereskia aculeata*.

The determination of moisture is one of the most important measures used in food analysis, since it is related to its stability, quality and composition. In addition, it can affect the packaging, storage and processing of the product (IZIDORO et al., 2008).

The noodles prepared with dry leaves flour of *Pereskia aculeata* presented a higher moisture content of 35.82%, while the traditional noodles had the lowest moisture content of 29.05% and, the noodles prepared with dry leaves+stems flour and the noodles prepared with fresh leaves presented 34.68% and 31,26%, respectively.

The water content increased when using *Pereskia aculeata* in pasta doughs. This can be related to the fact that the moisture content of its leaves is approximately of 86.81%, a higher value than the moisture content found in commercial wheat flour, of 10.60% (MARTINEVSKI, 2011; NEPA-UNICAMP, 2011).

As in this study, Rocha et al. (2008) studied noodles dough with addition of 2% of godseffiana dry leaves flour and also found a higher moist content in the pasta when using *Pereskia aculeata* (10.47%) when compared to traditional pasta (9.93%).

Regarding the ashes content, this indicates the content of mineral salts present in a certain food after the burning of the organic matter such as iron, sodium, potassium, magnesium and phorphorus (CECCHI, 2007; IAL, 2008).

According to Brazilian table of food composition, raw wheat pasta with eggs contains about 0.50% of ashes, which is lower than the analyzed pasta doughs. This shows that the pasta doughs of this study have a higher quantity of minerals in their composition. The noodles prepared with dry leaves flour was the one that presented the highest content of 4.07%, and the lowest content was found in noodles prepared with fresh leaves (0.90%) (Table 2).

Supporting the results of this study, noodles also presented the highest ash content for the one made with dry leaves flour of *Pereskia aculeata* (5.84%) when compared to the traditional (2.88%) (ROCHA *et al.*, 2008).

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The lipid content is variable according to the type of each food, but fruits and leafy vegetables are among food with the lowst contents (0.1-1.2% of the fresh composition) (AUED-PIMENTEL; ZENEBON, 2009). The noodles doughs present a variation of 2.33% (traditional noodles) up to 3.06% (noodles prepared with dry leaves+stems flour). These results show that the low lipid concentration is a positive aspect, since it means that pasta doughs of this study can be used in hypocaloric and lipid-restricted diets (ROCHA *et al.,* 2008).

Supporting the results of the present study, traditional noodles and the noodles prepared with 2% of dry leaves flour of *Pereskia aculeata* presented similar values of lipids of 1.65% up to 2.06%, respectively (ROCHA *et al.*, 2008).

Regarding to proteins, it is known that diets with a higher proportion of proteins and lower proportions of carbohydrates promote a greater weight loss, greater reduction of body fat and less loss of lean mass (LAYMANN et al., 2005). Therefore, noodles doughs presented satisfactory results regarding to proteins when compared to the table of food composition for raw pasta with eggs, which is 10.30 g (NEPA-UNICAMP, 2011). The noodles prepared with dry leaves flour was numerically higher with 10.71%, but it did not differ from traditional noodles (10.12%) and from the one prepared with dry leaves+stems flour (9.86%).

In other studies with noodles with and without addition of leaves flour of *Pereskia aculeata*, the higher protein content was found in the pasta prepared with 2% of leaves flour (17.21%) of *Pereskia aculeata* (ROCHA *et al.*, 2008). This protein difference found in this work in relation to the one found by Rocha *et.al.* (2008) can be related to the types and/or formulations of ingredients used for the dough preparation.

According to Brazilian National Health Surveillance Agency (ANVISA, 2005), an adult should have daily intake of approximately 50 g of proteins, and a food is considered rich in proteins when it provides, in a 100 g portion of the food, approximately 20% of proteins. Therefore, considering the analyzed results, traditional noodles and the ones prepared with *Pereskia aculeata* can not be classified as a food rich in proteins. However, it can be seen that there was an increase of 5.83% for noodles prepared with dry leaves flour in relation to traditional noodles.

Food fibers act as markers of the general state of human health and colon, due to increase in softness and volume of fecal matter, mainly providing reduction of cholesterol (VAN DOKKUM, 2008). Normally, population low fiber consumption is associated with the occurrence of constipation and weight gain (VITOLO *et al.*, 2007).

According to the Brazilian Ministry of Health, the daily recommendation of fiber intake is 25 g day^{-1} (ANVISA, 2005); therefore, the daily consumption of 100 g of noodles added with dry leaves+stems flour would correspond to approximately 61.64% of the daily recommendation.

A food can be considered rich in fibers if it presents a minimum of 6% for solids of the product (ANVISA, 2005). Therefore, noodles with fresh leaves can not be considered a good source of fibers. On the other hand, noodles prepared with dry leaves flour and the one prepared with dry leaves+stems flour of *Pereskia aculeata* added a higher fiber nutritional value, with an increae of 105.91% and 127.62%, respectivaly, when compared to traditional noodles.

Validating the results of this work, Rocha *et al.* (2008) when studying noodles with dry leaves flour of *Pereskia aculeata*, also obtained a significant increase of approximately 119.05% in relation to conventional pasta.

Regarding to the total caloric value, it was observed that noodles doughs presented a total caloric value between 342.41 kcal 100 g^{-1} and 397.12 kcal 100 g^{-1}. This means that in a normal diet of 2000 Kcal, about 100 g of noodles would meet 17.12% up to 19.86% of the daily needs.

In general, consumption of food with lower caloric value is better for human health and obesity control (ALMEIDA *et al.*, 2014). In the face of this importace, the consumption of noodles prepared with dry leaves flour (342.41 kcal 100 g^{-1}) and noodles prepared with dry leaves+stems flour (345.34 kcal 100 g^{-1}) would be better when comparing to traditional noodles (377.77 kcal 100 g^{-1}).

As for carbohydrates content, noodles doughs presented values between 68.39% (noodles prepared with dry leaves flour) and 83.85% (noodles prepared with fresh leaves). The minimum quantity of carbohydrates necessary to provide glucose to brain cells is estimated in 130 g a day^{-1} for men and women over 19 years old (ANVISA, 2005). Therefore, consumption of 100 g of traditional noodles would supply 60.85% and noodles prepared with dry leaves flour, leaves+dry strem flour and the one prepared with fresh leaves would supply 52.61%, 53.53% and 64.50%, respectively.

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UFPs are known to be rich in minerals and, usually their contents are significantly higher than in domesticated plants, exerting important functions in human organism. Besides that, despite their importance, their contents in foods, as well as their availability and effects of different forms of culinary preparation are still little known (KINUPP; BARROS, 2008).

In this work, the highest contents of minerals, of both macro and micronutrients, were found in noodles prepared with dry leaves flour of *Pereskia aculeata* (Table 3).

Table 3 - Contents of minerals phosphorus (P), sodium (Na), potassium (K), magnesium (Mg), calcium (Ca), copper (Cu), iron (Fe), manganese (Mn) and zinc (Zn) of natural cupcakes (CN), cupcakes with leaves flour (CF), cupcakes with leaves+strem flour (CFC), cupcakes with fresh leaves (CFR) of *Pereskia aculeata*, Curitiba (PR), 2015.

Minerals		MT[a]	MFS[b]	MFCS[c]	MFF[d]	Variation Coefficient (%)
P		2.13 c	2.78 a	2.57 ab	2.21 bc	6.43
Na		0.55 c	0.90 a	0.77 b	0.49 c	7.19
K	g kg^{-1}	1.79 c	14.30 a	8.66 b	2.10 c	7.34
Mg		0.26 c	2.26 a	0.94 b	0.29 c	7.13
Ca		0.21 c	8.20 a	3.98 b	0.15 c	5.44
Cu		10.37 c	12.21 bc	18.49 ab	20.59 a	18.54
Fe	mg kg^{-1}	60.14 c	203.32 a	105.58 b	88.62 bc	12.56
Mn		15.68 c	32.67 a	19.71 bc	21.74 b	7.33
Zn		15.64 b	22.88 a	19.04 ab	17.14b	10.95

Means followed by the same letter on the line (lower case) do not differ statistically at 5% level of significance by Tukey Test. MT[a]= traditional noodles; MFS[b]= noodles prepared with substitution of 30% of wheat flour for 30% of dry leaves flour of *Pereskia aculeata*; MFCS[c]= noodles prepared with substitution of 30% of wheat flour for 30% of dry leaves+stems flour of *Pereskia aculeata*; MFF[d]= noodles prepared with fresh leaves of *Pereskia aculeata*.

The average daily recommendation of some minerals by Dietary Reference Intakes for men and women between 9 and 70 years old is 1,160 mg of calcium; 975 mg of phosphorus; 9.5 mg of iron and 13 mg iron for men and women, respectivaly; 360 mg of magnesium for men and 300 mg for women; 830 mg of copper; 2 mg of manganese; 9.5 mg of zinc to men and 8.5 mg for women; 1.3 mg of sodium; 4.6 mg potassium (ANVISA, 2005).

The consumption of noodles made with dry leaves flour of *Pereskia aculeata* in the approximate quantity of 100 g a day^{-1} would meet the calcium need in 14.14%; 35.07% of phosphorus; 4.67% of iron for men and 6.39% for women; 15.92% and 13.67% of magnesium for men and women, respectively; 6.12% of manganese; 41.52% and 37.15% of zinc for men and women, respectively; 0.14% of sodium and finally 0.03 % of potassium (Table 3).

When analyzing the mineral phosphorus, noodles prepared with dry leaves flour of *Pereskia aculeata* (2.78 g kg^{-1}) did not differed only from noodles prepared with dry leaves+stems (2.57 g kg^{-1}). It is worth to highlight that the nutritional orientation of phosphorus intake is quite delicate. In addition, its low availability in plant-derived foods is related to the way it is present in foods (GONÇALVES *et al.*, 2007).

Regarding sodium content, it is known that foods with lower content are better suited for a healthy eating, since sodium is a constituent of salt and a great concern for public health since it is directly related to development of hypertension, cardiovascular disease and kidney disease (ANVISA, 2005). For this reason, noodles prepared with fresh leaves of *Pereskia aculeata* would be the best for consumption, since it has the lowest content of 0.49 g Kg^{-1}. However, noodles prepared with dry leaves flour of *Pereskia aculeata*, despite of showing a higher sodium content of 0.90 g kg^{-1}, which is considered as low, the results of foods processed in this work can be considered satisfactory.

Referring to potassium, it is considered a necessary mineral for the metabolism of carbohydrates and its dietary supplementation can be performed from a diet rich in foods with high content of potassium, in

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addition to being associated with reduction of cardiovascular condition (PEREIRA *et al.*, 2005). Due to that, consumption of foods with a high content of potassium is important; thus, noodles prepared with dry leaves flour would be more suitable, since it presents a higher content of potassium (14.30 g Kg^{-1}) when compared to traditional noodles (1.79 g Kg^{-1}).

As for calcium, the highest contents were found in noodles prepared with dry leaves flour (8.20 g kg^{-1}) and the lowest contents were found in traditional noodles and in noodles prepared with fresh leaves, 0.21 g kg^{-1} and 0.15 g kg^{-1}, respectively. It is worth to highlight that calcium is an essential nutrient for several biological functions, and its low consumption is associated with chronic diseases as osteoporosis, colon cancer, arterial hypertension and obesity (PEREIRA *et al.*, 2009). The highest contents of calcium found in this work were found.

About copper, it is known that it is a blood constituent and it is well distributed in foods, and its deficency is ery rare in humans. Thus, only dietary intake is enough to prevent its deficiency (KOURY; DONANGELO, 2007). Therefore, only 0.9 mg of dry leaves flour of *Pereskia aculeata* would meet the recommended needs, since the daily consumption is 900 μg (ANVISA, 2005). According to the results found, noodles prepared with fresh leaves (20.59%) did not differ only from noodles prepared with dry leaves+stems flour (18.49%).

Regarding the iron, its deficiency is the most common in the world. It develops in many stages, including its most intransigent form, anemia, being considered the most prevalent nutritional deficiency in population groups that have a high demand for iron, as children and women of reproductive age (ASSUNÇÃO; SANTOS, 2007).

Iron levels of analyzed food were higher in noodles prepared with dry leaves flour of *Pereskia aculeata* of 203.32 mg kg^{-1}. When comparing levels of iron in foods with 100 g of dry matter described in Brazilian Food Composition Table, it can be highlighted that iron content of the foods analyzed in this work is considered to be great: traditional noodles of 60.14 mg and taglerini prepared with *Pereskia aculeata* on an average of 132.51 mg, since several foods popularly referred as iron sources have lower values, such as: raw (1.43 mg) and cooked (2.13 mg) suggar-beet, fried kale (2.70 mg), fried spinach (4.48 mg), grilled beef liver (12.89 mg), raw chickpea (6.16 mg), raw lentil (7.91 mg) and several types of raw beans (black-eyed peas: 5.84 mg; black beans: 7.64 mg; purple beans: 7.89 mg and chilli beans: 9.30 mg) (SILVA; PINTO, 2006; NEPA-UNICAMP, 2011).

As for manganese, it is an essential element to mankind, playing an important role in the process of bone and tissue formation, reproductive functions and metabolism of carbohydrates and lipids (NEVES *et al.*, 2009). Therefore, the ideal would be to consume noodles prepared with dry leaves flour of *Pereskia aculeata*, since it obtained a higher content when compared with other pasta, of 32.67 mg kg^{-1}.

Regarding to zinc, despite of its physiological importance in the maintenance of several processes in human body, little has been done to counteract its deficiency, and its greater need among children, due to growth phase (SANTOS *et.al.*, 2007; SIQUEIRA *et.al.*, 2007; SILVA *et.al.*, 2010). This is why noodles prepared with dry leaves flour and dry leaves+stems flour of *Pereskia aculeata* would be better suited, since they present the highest values of zinc of 22.88 and 19.04 mg kg^{-1}.

Conclusion

Under conditions of performance of this work, among the studied preparations of noodles, it was possible to conclude that noodles prepared with a substitution of 30% of wheat flour for 30% of dry leaves flour of *Pereskia aculeata* was the one which presented the best ashes, lipids, proteins and fiber contents, also presenting the lowest total caloric values and the best results for the minerals phosphorus, sodium, potassium, magnesium, calcium, iron, manganese and zinc. Due to this great nutritional quality, noodles prepared with a substitution of 30% of wheat flour for 30% of dry leaves flour of *Pereskia aculeata* is the best suited for human consumption.

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