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Nutritional Composition of *Pithecellobium dulce*, Guamuchil Aril

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Abstract: Determining the nutrient content of easily accessible food can allow us to maximize its use in rural populations. *Phitecellobium dulce* is abundant in large rural areas of southeast Mexico. Using proximate analyses, we find that the aril of *P. dulce* contains low moisture content (17.167%) compared to the dry matter (82.832%), as well as high content in carbohydrates (69.092%), which is the major nutritional component. Proteins represent a 9.33% and crude fat, ash and crude fiber percentages were in the range of 1.1 and 1.6%. Significant differences were found in the carbohydrates content when compared on dry basis to on wet basis, although in both cases the same tendency to high values was observed. For crude protein, values were significantly higher on dry basis compared to wet basis and for crude fat content, ash and crude fiber not significant differences were found. We recommend processing and consumption of aril in dry basis for a more efficient use of this food. These results suggest that *P. dulce* aril could be utilized as a nutritious and affordable food alternative in rural areas.

Key words: *Pithecellobium dulce*, bromatology, food properties, food alternative

INTRODUCTION

Guamuchil, *Pithecellobium dulce* (Roxb.) Benth., considered a resource with multiple uses (Monroy and Colin, 2004), is a medium size fast growing evergreen tree that belongs to the Fabaceae family, subfamily Memosoideae, native to the American tropics. Generally it is distributed in semi-arid regions of dry deciduous forest.

It has been successfully planted in areas with a 4-5 months dry season; thus, it is considered a heat and drought resistance species (Parrotta, 1991). Guamuchil uses are varied; among them, it can be mentioned timber-yielding, fertilizer, forage, shade, medicinal, live fence and edible (Parrotta, 1991; Zamora *et al*., 2001; Monroy and Colin, 2004; Berdonces, 2010; Pinto-Ruiz *et al*., 2010) as well as the usage of its extracts as insecticide (Perez-Pacheco *et al*., 2004), fungicide (Bautista-Banos *et al*., 2003), antioxidant and α-amylase and α-glucosidase inhibitor (Pio-Leon *et al*., 2013).

The tree produces fruit that mature 3 to 4 months after bloom. Fruit are linear, curve or rolled up dehiscent pods, measuring up to 20 cm long and 10 to 15 mm wide, with constrictions between seeds, short hairs and white and fleshy arils covering the seeds. In general, each pod contains 5 to 10 shiny black bean-shaped seeds, each one measuring around 1 cm long (Parrotta, 1991). There are documents that report harvesting and consumption practices by the Mixtecs in Guerrero's mountains, indicating that they benefit from the consumption of the aril and the seed and the usage of different parts of the tree (Casas and Caballero, 1995). Aril is fleshy and sweet, originates from the raphe, funiculus, hilum or from the chalaza and covers the seed partially or completely (Gonzalez *et al*., 2007).

Attraction of animals for seed dispersal is one of its ecological benefits and human consumption is among its nutritional and economic benefits (Olivares-Perez *et al*., 2011). There is the knowledge for identification of fruit with different flavors for consumption; in some regions of Mexico, for example, in Guerrero's mountains, there are sweet and bitter fruits and only the sweet fruit is harvested for consumption (Casas and Caballero, 1995). Nutritional analysis of the seeds aril allow the

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Table 1: Nutritional content percentage in wet and dry basis of *P. dulce*

	Wet basis			Dry basis	
	Content (%)	S.D.		Content (%)	S.D.
Moisture	17.1678	0	Crude protein	11.2656	0.413
Dry matter	82.8321	0	Crude fat	1.9966	1.734
Crude protein	9.3315	0.342	Ash	1.3333	0.577
Crude fat	1.6538	1.437	Crude fiber	1.9914	0.453
Ash	1.1044	0.478	Carbohydrates	83.4129	1.908
Crude fiber	1.6384	0.358			
Carbohydrates	69.0926	1.580			

S.D: Standard deviation

population to know the properties of a seasonal alternative food. This information can be used as an advantage to promote the beneficial effects for consumer's health which gain importance in regions with high degree of marginalization, as it is case for the region studied (Sedesol, 2013). Therefore the objective of this research was to know the nutritional properties of Guamuchil aril of the seed using proximate analyses.

MATERIALS AND METHODS

Biological material: Seeds were harvested in Tepecoacuilco de Trujano, municipality located in San Juan Tetelcingo, Guerrero, Mexico. Seeds were transported in paper bags to the laboratory and the specimen for the herbarium was prepared with the reference number IMSSM 15729.

Laboratory tests: In the laboratory, aril was separated from the seeds and dried at room temperature for 30 days. The following determinations were carried out using the dry material: (a) dry and wet matter, (b) total ash and organic matter, © ether extract or crude fat (AOAC, 1975), total nitrogen (macro-Kjeldhal method) and crude protein, (e) crude fiber (Weende method with modifications) and (f) nitrogen free ether extract (carbohydrates) (Weende method). The values obtained were analyzed using t-test for independent samples.

RESULTS

Bromatological analysis show a low moisture percentage (17.167%) compared to the dry matter (82.832%). Nutritional determinations revealed that *P. dulce* aril have high content of carbohydrates in both wet and dry basis (69.092 and 83.4%, respectively) standing out as the major nutritional component (Table 1). Proteins also represent an important aril component with a 9.331% on wet basis and 11.3 on dry basis. Crude fat, ash and crude fiber contents show percentages in the range 1.1 and 1.6% on wet basis and 1.3 and 1.99 on dry basis.

Regarding the carbohydrates content, significant differences were found between dry basis and wet basis analysis (Table 1) ($t = -10.01$; $p = 0.0006$), although in both cases high values were observed. With respect to crude protein, values were significantly higher on dry basis compared to wet basis analysis ($t = -6.25$; $p = 0.003$) and no significant differences were detected for crude fat, ash and crude fiber ($t = -0.26$; $p = 0.80$; $t = -0.53$; $p = 0.62$; $t = -1.05$; $p = 0.35$, respectively).

DISCUSSION

Regarding crude fiber content, values were lower than previous reports (5.83-6.12%) (Pio-Leon *et al*., 2013). These differences might be due to the environmental conditions of the harvesting site, Pio-Leon *et al*. (2013) worked with material collected in Culiacan, Sinaloa, while fruit collected in Tepecuacuilco de Trujano, Guerrero, was used for the analysis of the present study. As already mentioned by these authors, geographical and environmental factors may affect composition and biological activity of *P. dulce* fruit.

The carbohydrates content in *P. dulce* is higher than in other legumes species like *Leucaena esculenta* (red guaje), *Leucaena leucocephala* (green guaje) and *Tamarindus indica* (38-68%), which had higher carbohydrates levels than soybean, pea, broad bean and red kidney bean (Bhat and Karim, 2009; Roman-Cortes *et al*., 2014).

It has been reported that *P. dulce* aril has a high content of vitamin C (79.7-82.2 mg 100/g fresh weight), pectins (9.4% on dry basis and 2% in fresh basis), phenolic compounds (from 27 to 60%) and organic acids (15%) (1.8). Based on the results obtained in the present study, aril consumption might represent an alternative food resource for marginalized regions such as Tepecoacuilco de Trujano, Guerrero, since its high carbohydrates content represent a rapid source of immediate energy. On the other hand, the high content of vitamin C can provide diverse health benefits to the consumer, its antioxidant effect is only one of them (Traber and Stevens, 2011).

It should be pointed out that protein content and carbohydrates was higher on dry basis than in fresh tissue which may suggest a possibility for drying the fruit for consumption. This, besides allowing a different kind of consumption of the product for the population, might represent an incentive for promoting products elaboration that could support the economy of the inhabitants of the locality.

Conclusion: Bromatological analysis of *P. dulce* show that its consumption may represent a favorable food alternative for the inhabitants of the community of San Juan Tetelcingo, Guerrero, since it has a high content of proteins and carbohydrates and therefore, it can complement their diet and provide health benefits to a Mexican marginalized community. Based on the results obtained in the present study, it would be important to promote elaboration of a food product from *P. dulce* that were accessible to the population.

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