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Iron from Jenipapo (*Genipa Americana L.*) is Bioavailable. Study in Rats

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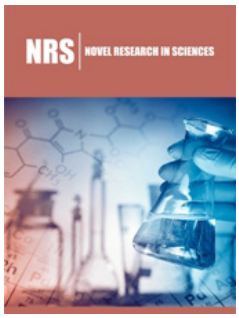

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Introduction

The jenipapeiro belongs to the Rubiaceae family, having a wide geographic distribution. In Brazil, it ranges from the border with Guyana and Marajó to São Paulo and Mato Grosso. Outside Brazil, its distribution is also vast, extending from Mexico to the Antilles [1]. The fruiting period, an interval that goes from the appearance of young fruits to maturity, complete dehiscence or the fall of indehiscent fruits, varies greatly from species to species [2]. It can be seen that the jenipapeiro, a typical species of riparian forest, concentrates its fruiting during the flood season and that its great representation on the banks of rivers suggests that the seeds can also be dispersed by water [3]. Considering that with the period of floods (December to February) there is an increase in density and a decrease in buoyancy, it is assumed that this phase corresponds to the beginning of the process of fixation of the fruits in the soil. With the decrease in rainfall, the flood waters return to the riverbed, when most of the fruits are ripe [4].

The fruits are of the sub-globose berry type, 8 to 10cm long and 6 to 7cm in diameter, soft, brown or yellowish-brown, membranous, thin and wrinkled skin and up to 8.5cm in diameter [5]. The pulp is sweet, with a characteristic and pronounced "flavor" [6], and is usually consumed in the form of jams, candied drinks, ice cream, soft drinks, liquor and wine [1]. Trees between 15 and 20 years old produce an average of 400 to 600 fruits per year [7], where their fruits are used empirically by the population to fight anemia [8]. The search in popular medicine for natural sources for the treatment of non-communicable diseases, including anemia, has been intensified in recent decades, as it is a public health problem [9].

Iron deficiency anemia has increased in recent decades and affects approximately two billion people worldwide [9]. It stands out as the main nutritional deficiency, given its magnitude and the deleterious effects on the individual's health, representing considerable harm to health, with associated reduced work capacity, apathy, persistent fatigue, shortness of breath, palpitations, headaches, dizziness and irritability [10]. Among the biological segments most vulnerable to the problem are women in the reproductive period, particularly during pregnancy, and children in the first years of life [4,11,12]. In Brazil, there is no national information on the extent and geographic distribution of the prevalence of iron deficiency anemia, but specific studies indicate that anemia is a public health problem in view of its magnitude in our country [13]. Studies have shown a tendency for the problem to worsen, as the prevalence of anemia in preschool children rose from 35.6% in 1984/85 [14] to 46.9% in 1995/96 [13], in the city of São Paulo/Brazil; and from 19.3% in 1981/82 to 36.4% in 1992 in the state of Paraíba/Brazil [15]. Anemia results from the interaction of multiple etiological factors. Among them, one of the most important causes is the deficient intake of iron, especially in the heme form, due to the low consumption of foods of animal origin and/or low bioavailability [16,17].

Iron can be presented in two forms in the diet, non-heme and heme. Non-heme, which is more present in plant foods, has variable bioavailability, around 1 to 15% [18], as it depends on the individual's reserves of this element, around 50mg/kg of body weight in men and 40mg/kg in adult women and several factors that interfere with its bioavailability [19]. Heme iron, present in foods of animal origin, is highly bioavailable, around 15 to 40% of absorption [18]. Therefore, there is a need for a full assessment of the individual's diet, considering that not all the iron contained in foods is bioavailable [10].

The term bioavailability began to be used in the field of nutrition, based on the knowledge that the mere presence of the nutrient in the ingested food did not guarantee its use by the body [20]. Bioavailability was then defined as the fraction of any nutrient ingested that has the potential to meet physiological demands in target tissues [21], with the primary purpose of correlating the amount of nutrients or other substances present in the food with the individual's health status [10].

In order to minimize and/or control nutritional iron deficiency, one of the strategies is the exploration of natural, regional, low-cost resources with great nutritional potential, such as genipap [7]. To assess iron bioavailability, the method of depletion and repletion of hemoglobin in rats was used. During the depletion period, during lactation, the rats (Rattus novergicus) and their offspring received a casein-based feed, free of iron in the saline mixture, and the offspring, when weaned, continued to receive the same feed for another seven days [22-27]. At the same time, there was a control group in which rats and offspring received commercial feed. In the 14-day repletion period, male rats (n=32) were distributed into four groups with eight rats each. Group I received AIN-93 ration, having Jenipapo as iron source; Group II received AIN-93 ration in the same proportions of iron as genipap; Group III received AIN-93 diet without addition of iron in the saline mixture; and Group IV received rations in accordance with AIN-93. The hemoglobin concentration and weight of the rats were evaluated weekly [28]. The physicochemical composition revealed that dehydrated genipap is a hypocaloric source with iron concentration in the order of 1.5mg%. At the end of the depletion period, the mean hemoglobin concentration of the rats was 6.53±0.02 g/dL, demonstrating that the model used induced anemia in the rats. At the end of the repletion period, rats from different groups gained weight, which reflects their adequate feed intake. The hemoglobin of rats in group I showed recovery as much as in group II [29-32]. Based on the results, it is concluded that genipap is a fruit with low concentrations of lipids, proteins and iron, however, it is bioavailable, having recovered hemoglobin from anemic rats. Considering that genipap is empirically used to combat anemia, the present study aimed to evaluate the bioavailability of iron from dehydrated genipap considering iron deficiency anemia as a public health problem in the Amazon region, the minimal iron content was shown to be bioavailable under the conditions in which the experiment was carried out. preliminarily the mouse as an experimental model [33-35].

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