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## EFFECTS OF THE USE OF ORA PRO NOBIS (*PERESKIA ACULETA* MILLER) ON HUMAN HEALTH

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### ABSTRACT

Some studies have shown that Ora-Pro-Nobis (OPN) (*Pereskiaaculeata* Miller) can be an alternative that can be used to prevent or treat risk factors for cardiovascular risk and malnutrition. For these reasons, this paper aims to review the effects of OPN on human health. This descriptive review was built from studies published in the PUBMED and Scielo databases. OPN is a cheap source of energy and is consumed by low-income communities as a source of nutrients. In folk medicine, the leaves of OPN are used against cancer, kidney disorders, wounds and inflammations on the skin (atopic dermatitis), emollients, laxatives, hypertension, diabetes, rheumatism, headaches, hemorrhoids, gastritis, and ulcer. The leaves can be found in sweet and savory dishes and are rich in amino acids (mainly tryptophan), proteins, fibers (approximately 39.0%), minerals (calcium, magnesium, manganese, and zinc), vitamins A, C, and folic acid. It exhibits antioxidant, anti-inflammatory, and antinociceptive actions. The studies found in the literature search showed that OPN could reduce body weight, lead to increased satiety, can improve glycemic and lipid profile. Moreover, it can also improve kidney functions and help in malnutrition. Due to the properties of OPN, we suggest the population can use it as a source of numerous essential nutrients for the homeostasis of the organism. It can also be used to control body weight, blood glucose, and dyslipidemia that are risk factors to the development of cardiovascular diseases. Moreover, it can also be used to reduce malnutrition in the poor population.

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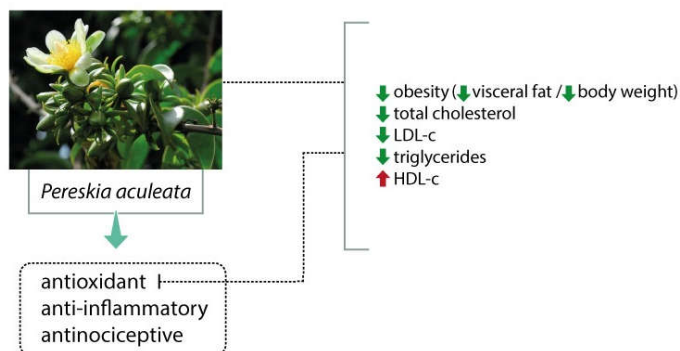
### INTRODUCTION

Currently, there has been a substantial increase in the prevalence of obesity, diabetes, and Metabolic Syndrome (MS), which are the main risk factors for the occurrence of cardiovascular diseases (CVD). This increase in incidence is directly related to lifestyle, with an increase in foods with a high content of sugars and fats and a reduction in physical exercises (Dabbaghpour; Javaherian; Attarabashi Moghadam, 2020; Wan; YU; Chin; Barrett *et al.*, 2020). CVD are among the leading causes of death in the world. It is estimated that 31% of the causes of death in the globe are due to these diseases and that, in 2030, the

prevalence reaches about 23.6 million people (Walli-Attai; JOSEPH; Rosengren; Chow *et al.*, 2020; Wang; XU; Zhang; Chen *et al.*, 2020). On the other hand, malnutrition is also considered an important problem in many countries around the world. It can affect all age groups in low-income populations, drawing attention mainly to children and the elderly (Choudhury; Raihan; Ahmed; Islam *et al.*, 2020; Ghimire; Aryal; Gupta; Sapkota, 2020). Due to the facts mentioned, the plant of Brazilian origin and popularly known as OPN (*Pereskiaaculeata* Miller), can be an alternative that can be used in the prevention or treatment of risk factors for CVD and malnutrition (De Souza; Barbalho; Guiguer; Araújo *et al.*, 2015). OPN belongs to the

family Cactaceae and subfamily Pereskioideae. It adapts easily in diverse environments, being found between the northeast and south regions (Bahia and the Rio Grande do Sul, mainly in sandy and rocky coastal plains (low altitudes), being possible to find it also in the south of the USA (Barbalho; Guiguer É; Marinelli; Do Santos Bueno *et al.*, 2016). Some studies show that this plant has anti-inflammatory, antioxidant, and antimicrobial (gram-positive and gram-negative bacteria) activities (De Souza; Barbalho; Guiguer; Araújo *et al.*, 2015). Figure 1 shows some aspects of OPN on human health.

Given the above, the aim of this paper is to perform a review of the effects of OPN on human health.



**Figure 1. Effects of *Pereskia aculeata* (OPN) in human health. LDL-c: Low Density Lipoprotein; HDL-c: High Density Lipoprotein.**

## METHODOLOGY

This descriptive review was built from studies published in the PUBMED and Scielo databases. We do not restrict publication time. The descriptors used were: *Pereskia*, Ora-Pro-Nobis, health effects.

## RESULTS AND DISCUSSION

Table 1 shows the studies that evaluated the effects of species of *Pereskia* (*Pereskia aculeata* and *Pereskia grandifolia*) in humans and animal models. These studies showed that OPN can reduce body weight, increase satiety, and improve glycemic and lipid profiles. Moreover, it can also improve kidney functions.

**Chronic-degenerative diseases:** Obesity is a risk factor associated with insulin resistance (hyperglycemia), glucose intolerance, dyslipidemia, and hypertension, and these conditions are associated with CVD. Studies show that, in addition to the mortality rate in the last decades due to MS having increased dramatically, adults with elevated Body Mass Index (BMI) present a high rate of developing diabetes (DM) (Castañeda; Gabani; Choi; Nguyen *et al.*, 2019; Fan, 2017). The increase in adipose tissue resulting from obesity causes hyperplasia and hypertrophy of adipose tissue cells. Consequently, they can lead to the dysfunction of this tissue, which is related to the development of metabolic disorders and increased cardiovascular risk. Besides, it is also associated with increased cell death and inflammation, leading to pro-inflammatory cytokines that have harmful systemic effects. Thus, visceral obesity is characterized by presenting itself as a low-grade inflammatory state and is directly associated with an increased cardiovascular risk. (Landecheo; Tuero; Valentí; Bilbao *et al.*, 2019; Leocádio; Oriá; Crespo-LOPEZ; Alvarez-Leite, 2019). Hyperglycemia, which is inherent to resistance to the action of insulin and DM itself, is also related to the increase in inflammatory and oxidative processes that aggravate systemic damage to the body and can lead to myocardial infarction, angina pectoris, stroke, peripheral arterial disease, and congestive heart failure (Aguiar; Duarte; Carvalho, 2019) (Berbudi; Rahmadika; Tjahjadi; Ruslami, 2020). The increase in blood lipids also potentiates the atherosclerosis process in diabetic or non-diabetic individuals, in addition to those who are overweight or obese (Moura, 2019) (Schütt;

Müller-Wieland; Marx, 2019). According to the American Heart Association (AHA) and American Diabetes Association (ADA), the prevention of CVD should be on controlling blood pressure, blood glucose, plasma lipid levels, physical activity, and smoking cessation. Therefore, lifestyle changes are fundamental for preventing and treating CVD, which are the leading causes of death in the modern world (Heinicke; Halle, 2020).

***A Pereskia aculeata* (OPN):** OPN has spiny branches and fleshy and mucilaginous leaves. These are non-toxic to the body and provide several nutrients, such as arabinogalactane, amino acids (mainly tryptophan), proteins, fibers (approximately 39.0%), minerals (calcium, magnesium, manganese, and zinc), vitamins A, C, and folic acid. Because it is native to South America, it adapts at low altitudes, that is, between the northeast and south regions (Bahia and the Rio Grande do Sul, with a greater focus on sandy and rocky coastal plains). It is worth noting that it is also possible to find it in the south of the USA, where it receives the popular names of leaf cactus and currant (Barbalho; Guiguer É; Marinelli; Do Santos Bueno *et al.*, 2016), (Souza; Caputo; Inchausti De Barros; Fratianni *et al.*, 2016). The juicy leaves of OPN, in protein values, are superior to other vegetables commonly consumed, such as beans, corn, or cabbage. In addition to the leaf being highly nutritious, it also has ethnopharmacological relevance. It is rich in phenolic compounds (flavonoids) and carotenoids, rutin, isomers of di-tert-butylphenol, tryptamine, mescaline, petunidine as main constituents, hordenine, abrina, quercetin, naphthalene, sennosides, anthraquinone, acetophenones, and xanthenes. These compounds may exhibit antioxidant, anti-inflammatory, and antinociceptive properties (Barbalho; Guiguer É; Marinelli; Do Santos Bueno *et al.*, 2016), (Garcia, J. A.; Corrêa, R. C.; Barros, L.; Pereira, C. *et al.*, 2019). Also, studies are showing that heat treatments impair the OPN leaf's total dietary fiber and mineral content. However, wet cooking does not affect the contents of these two compounds in the leaf. The temperature rise reduces digestive protease inhibition and increases the retention of antinutrients (tannin and oxalic acid). Furthermore, interactions between different solutions (Na and sucrose) with OPN mucilage cause changes in viscosity (Amaral; Junqueira; TAVARES; Oliveira *et al.*, 2019); (Silveira; Picinin; Cirillo; Freire *et al.*, 2020). Given the beneficial characteristics of *Pereskia aculeata*, it is worth checking the benefits of food consumption on human health.

**Effects of OPN on human health:** Due to the functional properties of OPN, and once it is a cheap source of energy, this plant is consumed by low-income communities. Its leaves can be found in sweet and savory dishes, mainly in Minas Gerais' mining regions, such as in salads, soups, omelets, and pies. In addition, the flour produced by its leaves can be an enriching element in the preparation of bread, cakes, and pasta, and mucilage can replace eggs, being a good option for those who have restrictions or food allergies. Its fruits, on the other hand, can participate in the manufacture of juices, jellies, mousses, and liquors (Garcia, J. A.; Corrêa, R. C.; Barros, L.; Pereira, C. *et al.*, 2019); (De Souza; Barbalho; Guiguer; Araújo *et al.*, 2015). In addition to its use in food, OPN is also widely used in folk medicine for several treatments since it has no liver toxicity signs. It can be used as adjuvant therapy for conditions such as cancer, kidney disorders, wounds and inflammations on the skin (atopic dermatitis), emollients, laxative, hypertension, DM, rheumatism, headaches, hemorrhoids, gastritis, and ulcer (De Almeida; Simão; Corrêa; De Barros Fernandes *et al.*, 2016; Garcia, J. A. A.; Corrêa, R. C. G.; Barros, L.; Pereira, C. *et al.*, 2019); (Pinto; Cassini-Vieira; Souza-Fagundes; Barcelos *et al.*, 2016).

Moreover, due to its anti-inflammatory activity, it can be considered to treat acute and chronic dermatitis, wound healing, antinociceptive, antioxidant, and antimicrobial activities. For these reasons, OPN may be a potential natural drug for antiproliferative activity against cancer cell lines (leukemia, neuroblastoma, and cancer breast cancer) since there are reports of cytotoxicity against HL60 and MCF-7 (Garcia, J. A. A.; Corrêa, R. C. G.; Barros, L.; Pereira, C. *et al.*, 2019); (Kazama;

Table 1. Effects of species of the genus *Pereskia* in humans and animal models.

Reference	Model	Intervention (how OPN was used to be administered)	Main results	Main conclusions
Vieira et al, 2020	Prospective, double-blinded, randomized clinical trial with 24 ♀, 20-60y and fat percentage above 25%.	For 6 weeks, the group treated with <i>Pereskiaaculeata</i> drink, and the control group received the same drink without the plant. Each participant was submitted to anthropometric assessments and a questionnaire related to gastrointestinal symptoms.	The beverage with OPN reduced body weight, waist circumference, and body fat. It also increased satiety, reduced eructation, and constipation significantly.	OPN flour drink reduces body weight and improves symptoms of eructation.
Vieira et al {Vieira, 2019 #963}	Randomized, cross-over intervention performed with 24♂, 20-50y, with BMI between 25 - 35kg/m <sup>2</sup> .	The protocol followed: pre-intervention, week 0; first 6-week intervention (one serving of <i>Pereskiaaculeata</i> cookie), weeks 1-6; 2 weeks washout; second 6-week intervention, weeks 9-14. Half of the participants received biscuits prepared with OPN flour in the first intervention and biscuits without OPN in the second intervention. The other individuals received the cookie without OPN in the first and in the second intervention.	The consumption of the biscuit, prepared with OPN flour, resulted in improved intestinal health with the maintenance of high adherence of <i>L. casei</i> to the intestinal cells. It also improved the patients' anthropometric profile and biochemical parameters.	The use of OPN can assist in the functioning of the gastrointestinal system and assist in the treatment of obesity.
Barbalho et al, 2016	Male Wistar rats.	The animals were separated into two experimental groups (n = 10 per group): G1 (control) and G2, treated with a diet supplemented with OPN for 40 days.	The use of OPN flour resulted in improved intestinal motility, reduced lipid profile, and visceral fat, in addition to increased HDL-c levels.	The consumption of OPN flour is related to benefits in the biochemical profile and intestinal motility.
Almeida et al, 2015	Male Wistar rats.	The animals were divided into C (control) and CH (high-calorie diet group) that received a diet supplemented with condensed milk for 10 weeks. The animals in the CH group were divided and received flour from <i>Pereskia grandifolia</i> (10% and 5%) for 4 weeks.	<i>Pereskia grandifolia</i> flour at 10% had an efficacy three times greater than that of 5% in reducing body weight, Lee index, and reducing the deposition of fat droplets in hepatocytes.	<i>Pereskia grandifolia</i> can be useful in the treatment of obesity and metabolic disorders.
Kazama et al, 2012	Male and female Wistar rats (180-200g).	The animals were separated into nine groups for the acute study (single dose) of <i>Pereskia grandifolia</i> and another three groups for the continuous study (repeated dose of 7 days). The rats received an oral dose of 5 mL/100 g : INFPG (125, 250 and 500 mg / kg); HEPG (3, 10, 30 and 100 mg / kg) or HCTZ (10 mg / kg). For 7 days, different groups of rats were subjected to oral gavage administration of HEPG (30 mg/kg) or HCTZ (10 mg/kg). Urine was collected every 24h for evaluations.	<i>Pereskia grandifolia</i> used as a diuretic agent, and its acute and prolonged aquaretic effect may involve inhibiting AVP release. HEPG can present compounds responsible for the reported activities without signs of toxicity and can act as an adjuvant in some kidney diseases and AVP secretion.	The use of OPN as a diuretic agent and its aquaretic effect can assist in some kidney diseases and AVP secretion disorders without showing signs of toxicity.

AVP: arginine-vasopressin; BMI: body mass index; HEPG: *Pereskia grandifolia* hydroethanol extract; INFPG: oral administration of the *Pereskia grandifolia* infusion; MAP: mean arterial pressure; OPN: Ora-Pro-Nobis.

Uchida; Canzi; De Souza *et al.*, 2012);(Pinto NDE; Duque; Pacheco; Mendes Rde *et al.*, 2015). The compoundrutin, found in the leaves of OPN, has several pharmacological uses, such as antimicrobial (slows or inhibits the growth of pathogenic microorganisms and toxin producers in food) and antifungal agent (Garcia, J. A.; Corrêa, R. C.; Barros, L.; Pereira, C. *et al.*, 2019); (Pinto NDE; Duque; PACHECO; Mendes RDE *et al.*, 2015). Due to the high levels of antioxidants such as Vitamin C and carotenoids, and fibers, OPN can be used to prevent chronic-degenerative diseases such as obesity, DM, Metabolic Syndrome, and CVD. Some authors have shown that, after daily consumption of OPN flour in the diet, patients showed improvement in intestinal motility, which is

associated with a reduction in visceral fat, BMI, blood glucose, and triglyceride levels. Moreover, participants of this study reported satiety control and presented increased HDL-c levels(Barbalho; Guiguer É; Marinelli; DO Santos Bueno *et al.*, 2016);Takeiti et al, 2009;(Vieira; GRANCIERI; Martino; César *et al.*, 2020) Vieira *et al.*, 2020).

## CONCLUSION

Due to the properties of OPN, we suggest the population can use it as a source of numerous essential nutrients for the homeostasis of the organism. It can also be used to control body weight, blood

glucose, and dyslipidemia that are risk factors to the development of cardiovascular diseases. Moreover, it can also be used to reduce malnutrition in the poor population.

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