

# The effect of the *Stevia rebaudiana* Morita II on the warts caused by fowl pox in *Meleagris gallopavo* as model study

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## ABSTRACT

**Objective:** to evaluate the effect of leaves of *Stevia rebaudiana* Morita II on swelling caused by fowl pox in backyard turkeys of the *Meleagris gallopavo* species.

**Design/methodology/approach:** Different percentages of ground stevia leaves (5.5, 15, 20 and 25%) combined with ground corn were evaluated and the reduction of avian pox in turkeys was evaluated.

**Results:** The diet with 5% stevia leaves with corn was the most accepted combination by the turkeys; it also leads to immunomodulation to eliminate avian pox in a period of 30 days.

**Limitations on study/implications:** One of the main limitations is the production of stevia matter, however, due to the required amount, it has the possibility of being applied in the feeding of these animals, this study has applications in animal health and food safety in turkeys.

**Findings/conclusions:** The use of stevia in combination with corn could represent a natural alternative for the treatment of fowl pox and be profitable enough to prevent the death of turkeys.

**Keywords:** fowl pox, turkey, *Stevia rebaudiana*, Morita II.

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## INTRODUCTION

Backyard breeding is a common activity in indigenous communities worldwide. In Mexico rural communities, this activity is mainly focused on the production of poultry and pigs, although cattle, sheep, goats and rabbits also be found (Elkashef *et al.*, 2016; González Ortiz *et al.*, 2014; Nelson, 1998). Animals breeding in this fashion is mainly focused on feeding them with products and by-products obtained from the same site, milpa and kitchen waste. No veterinary intervention is common in backyard breeding, only including cultural practices as feeding with citric products and medicinal herbs (Nelson, 1998).

Domestication of the turkey (*Meleagris gallopavo* Linn) by the Mesoamerican civilizations allowed the development of an incipient poultry farming before the arrival of European civilizations. Currently, backyard turkeys are raised by women, who use broken corn, soaked tortilla and vegetable waste to feed them. For families dedicated to raising this species, it serves mainly as a source of food (García-Flores & Guzmán-Gómez, 2016; González Ortiz *et al.*, 2014).

The breeding of *Meleagris gallopavo*, in the center and south of Yucatan is carried out in 86% by country Mayan women who manage a backyard production system, and who also feed their turkeys with commercial feed; whole corn and kitchen waste. It is known that corn kernels and their nixtamalization are used to feed backyard turkeys in some communities in southern Yucatán (Domínguez May *et al.*, 2021). For producers, this activity generates an additional income (Canul *et al.*, 2011). However, backyard turkeys are frequently sickened by fowl pox, and most producers do not use pharmacological treatments to control this disease (Canul *et al.*, 2011).

Fowl pox is a disease caused by the Avipoxvirus virus, it infects several species of wild and domestic birds worldwide. This virus causes respiratory problems and lesions in the integumentary system of birds. Fowl pox dry form produces skin warts or scabs (mainly on un-feathered parts of the body). The diphtheritic form shows cankers in the mouth, oesophagus or trachea. Other symptoms include blindness, feed refusal, lowered egg production, facial swelling (Umar *et al.*, 2021). Although worldwide the economic losses of commercial birds have been reduced by immunization programs against the virus, fowl pox continues to prevail on the planet (Bertalmio *et al.*, 2017).

Medicinal plants are a source of bioactive compounds used to treat diseases all around the world (Fallah Huseini *et al.*, 2006; Rafieian-Kopaei *et al.*, 2013). *Stevia rebaudiana* Bertoni is considered one of the species that provides suitable sweeteners since they do not generate calories (Haida & Hakiman, 2020). Moreover, it is a very interesting medicinal plant because it is used in the treatment of various diseases such as diabetes, hypertension, inflammation and cancer. In a study carried out in rats, it was shown that steviosides from *S. rebaudiana* improved the response of the immune system, increasing phagocytic activity and proliferation of B cells and T cells (Sehar *et al.*, 2008). Furthermore, a study in broiler chickens showed a positive effect of *S. rebaudiana* based sweetener included in bird diet on body weight gain and immune response to New castle virus vaccination (Molina *et al.*, 2021). Therefore, the use of *S. rebaudiana* as a food supplement could be of great help in the treatment of smallpox in backyard turkeys of rural communities.

The objective in this research was to evaluate the effect of leaves of *Stevia rebaudiana* Morita II on swelling caused by fowl pox in backyard turkeys of the *Meleagris gallopavo* species.

## **MATERIAL AND METHODS**

### **Survey of people who domesticate the species *Meleagris gallopavo***

We applied a closed-response, multiple-choice survey with 12 items applied to 42 inhabitants of the communities of Cankab and Xohuayan, in Southern Yucatan. Survey was applied to families that raise backyard turkeys of the *Meleagris gallopavo* species.

The survey was divided into two sections: socioeconomic aspects and poultry raising practices. For the application of the surveys, home visits were made, collecting the opinion of the inhabitants verbally. Due to the high proportion of Mayan-speaking inhabitants, a Spanish-Mayan translator was required for adequate communication with the respondents.

The data collected were processed in the IBM SPSS<sup>®</sup> statistical package using a descriptive approach to identify the frequencies and percentages of responses.

### Preparation of the materials

*S. rebaudiana* Morita II plants were grown in a greenhouse of Instituto Tecnológico Superior del Sur de Yucatan (ITSSY), in the community of Oxcutzcab, Yucatan, Mexico. Leaves from three-month old plants were sun dried and ground with a blender. *Zea mays* grains were obtained from local market and ground with a manual grain mill. Ground material were storage in sealed bags until use (Figure 1). Corn and stevia mixtures were prepared in different proportions, as described in Table 1. The feed mix was offered on demand to backyard-raised adult turkeys. The acceptance of the food was evaluated every day by the owner.



**Figure 1.** Feed generated with *Stevia rebaudiana* Morita II and *Zea mays*. A) Three-month old stevia plants. B) Dried leaves of stevia plants. C) *Zea mays* grains (corn). D) Mixture of ground Morita II leaves and ground corn kernels.

**Table 1.** Evaluated percentages of ground leaves of *Stevia rebaudiana* Morita II.

Ingredients of the food product	Serving (%)			
	1st test	2nd test	3rd test	4th test
Ground Stevia	25	20	15	5.5
Ground corn	75	80	85	94.5

### Evaluation of fowl pox symptoms in turkeys feed with modified diets

In total 30 turkeys were evaluated, 15 with fowl pox symptoms and 15 without symptoms. Presence of skin warts and scabs (characteristic symptoms of fowl pox) was evaluated every day after the start of treatment. Control turkeys fed only grounded corn were set.

### RESULTS AND DISCUSSION

Of the 42 people surveyed, 13 are from the Cankab community, and 29 from Xohuayan. The majority are women with 61.9% (26) and 38.1% (16) are men, with 72.58% being married. The elementary education level is the majority with 42.8% (18), while only 19% (8) have studies at the primary school level.

All of surveyed inhabitants includes corn in growth and fattening diets for backyard-raised turkeys, either in the form of ground grains, dough or nixtamalized tortillas. Additionally, 83.3% includes also commercial balanced food from CAMPIPAVO Brand and 16.7% add vegetable residues (Figure 2).

### Effect of stevia-enriched diets on fowl pox symptoms in turkeys

Turkeys included in this study did not consume enriched diets with high proportions of stevia leaves (Table 2). Only a poor acceptance was observed with 15% stevia leaves, while the food with 6.5% stevia was consumed in a similar way to the control diets.

On the other hand, a change in the coloration of dermal warts was observed after the third day of consumption of diets with stevia. After 15 days, the warts began to decrease in size and fall off. After 30 days of consumption, no obvious symptoms of fowl pox were observed in all turkeys fed stevia and corn (Figure 3A-D).

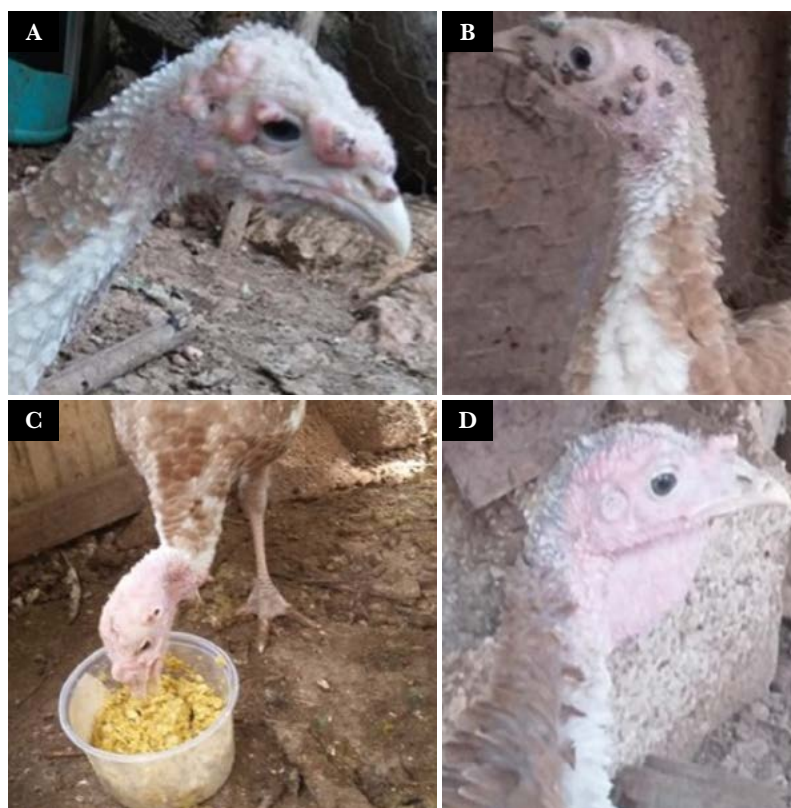


**Figure 2.** raising backyard turkeys. A) Turkeys in a wire mesh cage without a roof. B) Turkeys in a cage with a roof. C) Turkeys before being fed. D) Girl feeding turkeys. E) Turkeys eating nixtamalized corn mixed with CAMPI brand (commercial food). F) Mix of nixtamalized corn and commercial food.

**Table 2.** Consumption response of the ground leaves of Morita II in combination with ground corn.

25 g in 75 g of ground corn	–
20 g in 80 g of ground corn	–
15 g in 85 g of ground corn	+
5.5 g in 94.5 g of ground corn	+++

(–) Negative; (+) poor; (++) good; (+++) same as control.



**Figure 3.** Effect of *Stevia rebaudiana* Morita II against fowl pox. A) Color change of some bumps on the third day; B) Change of color to brown of most of the bumps, approximately after two weeks; C) Turkey eating the food product in the fourth week of treatment. D) Total removal of bumps on the turkey's skin, after 30 days of treatment.

The results suggest that *Stevia rebaudiana* Morita II leaves could have immunomodulatory activity, as observed by Sehar and coworkers (2008) on mice fed stevioside from *S. rebaudiana* Bertoni (Sehar *et al.*, 2008) In the same way, *S. rebaudiana* based sweetener included in broiler chicken diets showed an increase on body weight gain and immune response to New castle virus vaccination (Molina *et al.*, 2021).

A more detailed study would require several biometric tests on the turkeys before and after eating, in order to see the levels of leukocytes in the blood, which indicate the presence of an infection (López Farré & Macaya Miguel, 2009; Salvador-Reyes *et al.*, 2014). With this experiment, the antimicrobial and antiviral properties of the *S. rebaudiana* Morita II leaves could be demonstrated.

## CONCLUSIONS

For the turkeys could consume the product derived from the combination of *Stevia rebaudiana* Morita II with corn, the maximum percentage of ground leaves had to be 5.5%, this is due to the degree of sweetness of the Morita II leaves. The sick turkeys that consumed this mixture had positive effects, their warts were dried and reduced, and after 30 days of treatment scabs disappeared.

The consumption of *Stevia rebaudiana* Morita II as a food supplement could be a good alternative in the treatment of fowl pox. The high cost of synthetic drugs for the treatment of fowl pox has caused many poultry farmers of the Cankab and Xohuayán communities to be affected in the raising of turkeys of the species *Meleagris gallopavo*. Turkeys that are infected with bird flu often die because poultry farmers do not have enough financial resources to pay for the costs of the medicines or because they do not know natural remedies. The use of this plant as a natural medicine could be a good option, since its production is economic; therefore, it may be a very promising alternative to improve the response of the immune system of *Meleagris gallopavo* against the fowl pox. With this ecologic alternative, losses of specimens of this species could be avoided.

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