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Comparative effectiveness of extract and powder of *Spondias mombin* leaves on milk production of Djallonke ewes and weight growth of theirs lambs in southern Benin

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ABSTRACT: This study was conducted in Republic of Benin to compare the effectiveness of two forms (powder and extract leaves) of *Spondias mombin* on the milk production of the Djallonke ewes as well as weight gains of theirs lambs. The experimental part involved 18 lactating ewes divided into three homogeneous groups of 6 animals each that received orally and separately powder and extract of leaves of *Spondias mombin*. The results of experimental study showed that powder of leaves of *S. Mombin* improved significantly the milk production of ewes (707.94 ± 24.34 VS 650.30 ± 26.37 and 647.18 ± 50.77) and weight gain of lambs (ADG: 112.67 g/day VS 90.67g/day and 89.47g/day). The extract of leaves of *S. Mombin* had less effect on milk production or on the growth of lambs compared to the powder group, but had more effect compared to the control group. Treatments based on *S. Mombin* had no effect on the variation of body weight of ewes during lactation ($p>0.05$). Also, the leaves of *Spondias mombin* had no significant effect on ph, dry matter content, ash content, protein and milk fat ($p > 0.05$). The powder of *S. Mombin* can be a best source of plant drug to increase the milk production on african livestock for malnutrition reduction.

KEYWORDS: Djallonké sheep, galactogenic plants, *Spondias mombin,* ethnoveterinary, Republic of Benin.

1 INTRODUCTION

Traditional medicine consists of using medicinal plants to protect and restore health. These medicinal plants contain inherent active ingredients to cure disease or relieve pain [1]. Around the world and throughout history, women have used certain herbs to enhance their milk supply. Most of these herbs have not been scientifically evaluated but their traditional use, suggests safety and some efficacy. In Africa, phytomedicine has been in existence for hundreds of years ago ever before the colonial administration and is still in use today with about 80% of the population depending on herbal medicine for its primary health care delivery [2]. *Spondias mombin* is a medicinal plant whose leaves are used in the treatment of various diseases. They are used in the treatment of dystocia and retained placenta by its contractile properties of uterine muscle [3]. During lactation, this medicinal plant was used to stimulate the production of milk. In Benin, [4] identified several galactogenic plants among which were *Spondias mombin.* However, the lactogenic potential of this traditional plant have been underestimated. This is how, [5] and [6] tested the lactogenic effect of the fresh leaves of *S. Mombin* on lactating ewes. Up to now, this old practice has not yet found a consistent application in veterinary medicine to date.

This study aims to compare the lactogenic activity of powder and extract of leaves of *Spondias mombin* to choose the most effective form of leaves to increase milk production in sheep Djallonke to get a better lamb growth.

2 MATERIALS AND METHODS

2.1 STUDY ENVIRONMENT

This study was conducted on the Sheep Research Center of Faculty of Agronomy Sciences. The Sheep Research Center of Faculty of Agronomy Sciences is located in the University of Abomey-Calavi in the town of Abomey Calavi near Cotonou. The climate is of guinean type with two dry seasons (from November up to Match, July to September) and two rainy.

2.2 POWDER OBTAINMENT

The fresh leaves of *S. Mombin* are harvested, dried in the room at 22 ° C and then processed into powder using electric grinder. The dose of powder of plant (23.5g/ewe/day) administered is based on the quantity of leaves (100 g of fresh leaves) used by traditional healers in treatment the milk production deficiencies [5].

2.3 PREPARATION OF EXTRACTS

The fresh leaves of *S. Mombin* are harvested, dried in the laboratory at 22 ° C and then processed into powder. 60g of powder was soaked in 500ml of alcohol for 24hrs at room temperature with occasional stirring. The content was filtered and evaporated to dryness in a water bath at 78°C. The extract was collected and stored in the refrigerator at 4°C until required for use.

2.4 MANAGEMENT OF ANIMALS

The Djallonke ewes of a lambing rank of 4, body weight ranging from 16.8 ± 1.35 kg were used in this trial that lasted four months. They were regularly vaccinated against the small ruminant plague and treated against ectoparasites and gastro-intestinal strongyles. After parturition, 18 Djallonke ewes in lactation were selected and randomly divided into 3 groups of 6 animals each. During the first three days of lactation, each ewe receives the fresh leaves and the powder of leaves early in the morning before leaving for grazing.

- **Group Control:** without treatment
- **Group Powder:** received 23.5 g of powder of *S. Mombin* 'leaves per ewe per day for the first three days of lactation.
- **Group extract:** received 1.06 g of extract of *S. Mombin* 'leaves per ewe per day for the first three days of lactation.

The animals were conducted on artificial or improved pasture consisting of *C1 Panicum maximum, Brachiaria ruziziensis, Andropogon gayanus, Aeschynomene histrix* and *Cajanus cajan* from 11 AM to 17 PM (for 6h).The ewes received extra cotton oil cake protein of 300 g per day and per animal. Occasionally by-products such as corn, rice straw and groundnut hum were given to them. They also received mineral supplements in the form of licks and water *ad libitum* throughout the test period.

2.5 DATA COLLECTION

For three months, milk production of ewes was estimated once every two weeks using a weigh suckle weigh (WSW) method (WSW: weighing before and after suckling). The lambs were isolated from their mothers at 18 h pm. The next morning, the lambs were weighed and then returned to their mothers and allowed to feed for 1 h. After feeding, the lambs were reweighed anew. The lambs were then left to the pens and the ewes were then sent to pasture. Back from the pasture, the WSW method was used again to assess the amount of milk suckled by the lamb during the day. The sum of the first and second daily milk suckled gave an estimate of the amount of milk suckled per day per lamb and the total milk production of individual lactations was calculated from birth to weaning.

The body weight of lambs was followed by weighing. The birth weight of lambs was recorded. Every two weeks, the lambs were weighed before feeding in the morning. Average daily gain (ADG) of lambs was calculated to compare the growth of lambs between groups. The body weight of ewes was also measured once a month.

2.6 STATISTICAL ANALYZES

The means and standard errors of the means of milk production, prolactin level as well as those of ADG were determined. Statistical analysis of the differences between mean values obtained for treatments was performed using Minitab. Data were

subjected to one way analysis of variance (ANOVA) followed by Tukey- Kramer multiple comparison test. In all cases, p values <0.05 were regarded as statistical significance.

3 RESULTS

3.1 MILK PRODUCTION

From the first week up to the fifth week of lactation, the lactation curves (Fig 1) showed that ewes that received the powder of leaves of *S. Mombin* produced more milk than control and extract groups. From the fifth week to the end of lactation, the daily milk production is similar in all groups (Fig 1). This is evident on the lactation table of three groups (Table1). The daily and total milk production, the daily milk production of the third week lactation were significantly higher (p <0.05) in the ewes of Group powder than control and extract groups. Likewise, these parameters were similar in the extract group and control group. The daily milk production of the ninth week lactation was not different between all three groups (p >0.05).

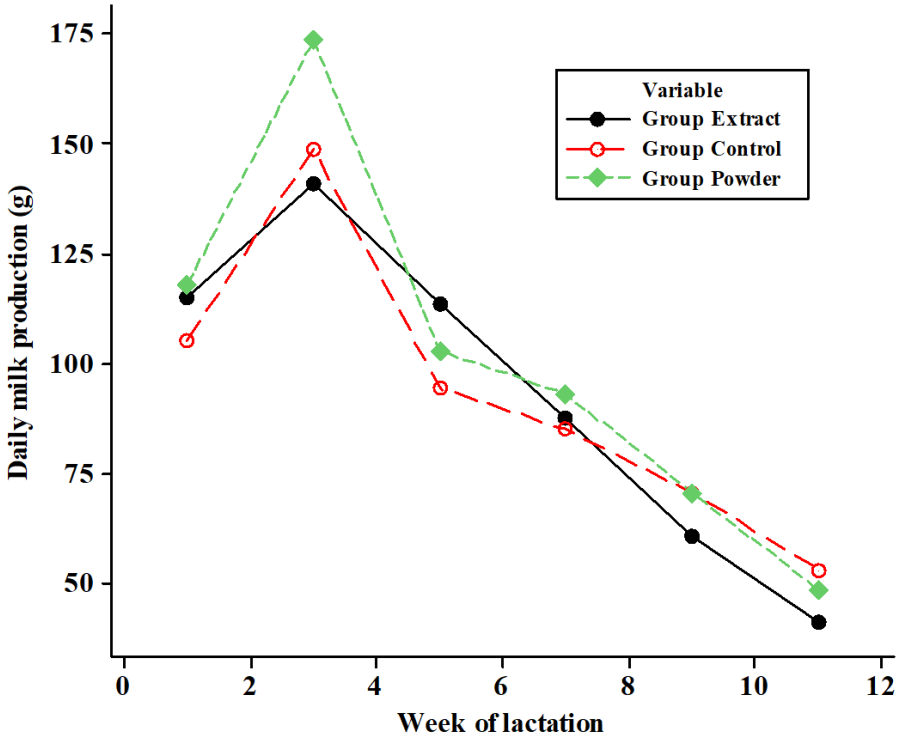

Fig. 1. Daily milk production according to week of lactation and treatment

Table 1. Milk production (g) (Mean ± Standard deviation)

Milk Production (g)	Group Powder	Group Control	Group Extract
Third week	173.59 ± 13.67 **b**	148.80 ± 7.78 **a**	134.02 ± 19.53 **a**
Ninth week	70.662 ± 10.466 **a**	70.652 ± 9.175 **a**	60.662 ± 4.246 **a**
Average daily milk	101.14 ± 3.48 **b**	92.90 ± 3.77 **a**	89.97 ± 7.25 **a**
Total	707.94 ± 24.34 **b**	650.30 ± 26.37 **a**	647.18 ± 50.77**a**

a, b, c = Means with different superscript letters on the same row differ significantly (p < 0.05).

3.2 WEIGHT PERFORMANCE

The body weight of lambs increased gradually during the first half and was virtually identical in all groups (Figure 2). After the first three weeks, this increase became higher in the powder group than the control group. The analysis of variance (Table

2) showed that average daily gain (ADG) of the lambs in 30 - 45 days, 45 - 60 days, 60 - 75 days, 75 - 90 days were not different between all the three groups ($p > 0.05$). The ADG of the lambs in 0 - 15 days, 15 - 30 days were significantly higher in the powder and extract groups compared to the Control group ($p<0.05$). The trend of curve of ewe's body weight does not show the effect of the treatments on the body weight of ewe (Fig 3).

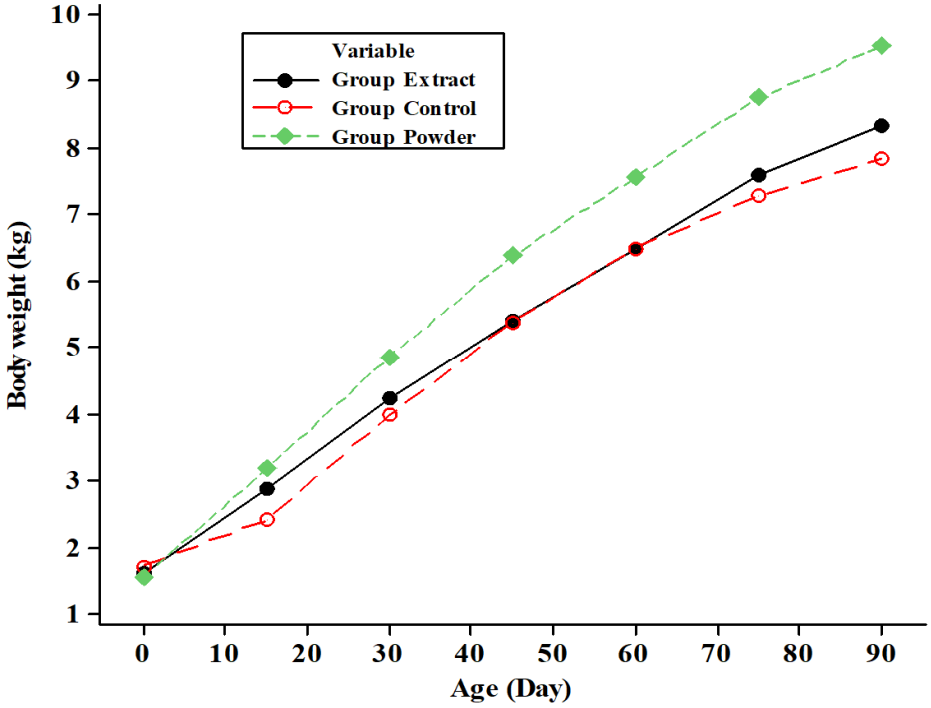

Fig. 2. Lamb body weight according to age and treatments

Table 2. Average Daily body weight Gain (ADG) (Mean ± Standard deviation)

ADG (g/day)	Group Extract	Group Control	Group Powder
ADG 0 - 15 days	83.33 ± 10.54 **b**	46.00 ± 25.76 **a**	107.73 ± 10.81**b**
ADG 15 - 30 days	96.67 ± 16.41 **b**	89.47 ± 15.10 **a**	112.67 ± 13.82 **b**
ADG 30 - 45 days	87.13 ± 6.44 **a**	89.20 ± 8.24 **a**	101.33 ± 8.03 **b**
ADG 45 - 60 days	70.40 ± 5.13 **a**	74.00 ± 8.30 **a**	79.07 ± 7.81 **b**
ADG 60 - 75 days	74.66 ± 6.05 **a**	52.00 ± 12.60 **a**	79.33 ± 6.41 **b**
ADG 75 - 90 days	48.66 ± 5.57 **a**	37.33 ± 5.96 **a**	51.33 ± 5.57 **b**

*a, b, c = Means with different superscript letters on the same row differ significantly. * P < 0.05*

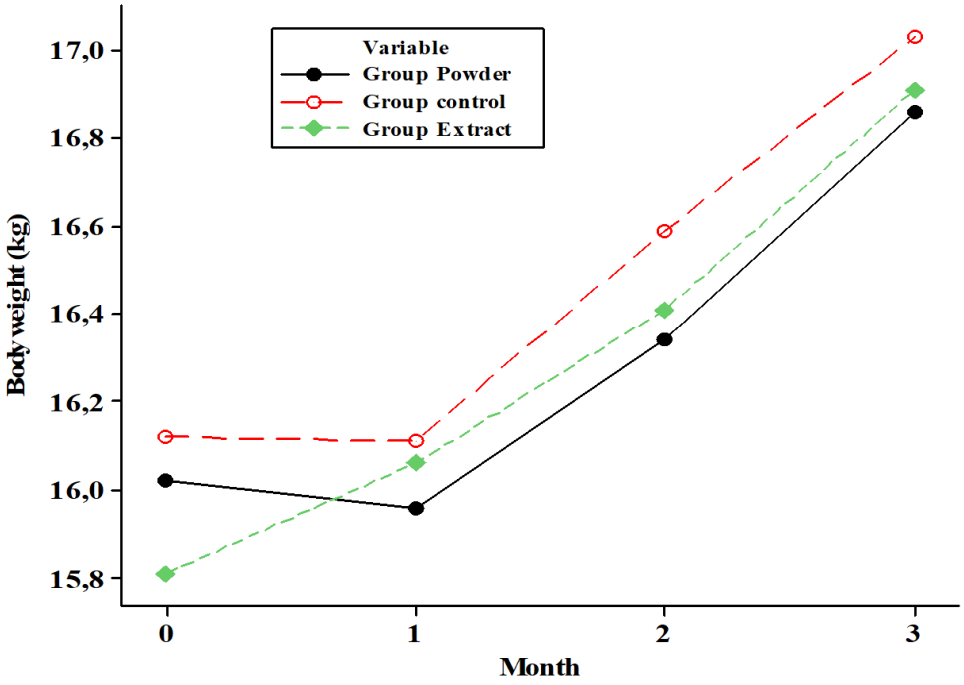

Fig. 3. Ewe body weight according to age and treatments

3.3 MILK PHYSICO-CHEMICAL COMPOSITION

The ph of milk showed no difference in the three groups making it statistically insignificant ($p > 0.05$) (Table 3). Likewise, the total solid, ash content, protein and fat were not significantly different between the groups ($p > 0.05$) (Table 3).

Table 3. Milk physico-chemical composition (Mean ± Standard deviation)

Variables	Group Extract	Group Control	Group Powder
Ph	6.94 ± 0.06 a	6.93 ± 0.04 a	6.91 ± 0.05a
Total Solid TS (%)	15.63 ± 0.16 a	15.54 ± 0.23 a	15.33 ± 0.27 a
Ash content (%TS)	2.07 ± 0.02 a	2.05 ± 0.06 a	2.08 ± 0.10 a
Protein (%TS)	5.17 ± 0.02 a	5.19 ± 0.05 a	5.25 ± 0.15 a
Fat (%TS)	6.22 ± 0.11 a	6.20 ± 0.15 a	6.19 ± 0.22 a

a, b, c = Means with different superscript letters on the same row differ significantly ($p < 0.05$).

4 DISCUSSION

In this study, extract and powder of leaves of *Spondias mombin* were investigated for its activity on milk production. The results obtained on milk production indicate that the powder of leaves of *Spondias mombin* significantly stimulated milk production in treated ewes compared to control and extract groups. The ewes from the powder group produced more milk than ewes of other Control and Extract groups. The better production of milk by the groups treated with the *Spondias mombin* could be due to the action of the lactogenic activity from the leaves of *S. Mombin*. The phytochemicals present in leaves of Spondias mombin could be responsible for their biologic activities. Tannins have been reported to increase milk production [7]. The presence of steroidal saponins and sapogenins constituents contributes in the lactogenic effect of Asparagus racemosus and Hibiscus Sabdariffa L [8] and [9].The lactogenic activity of the leaves of *S. Mombin* could be related its ability to stimulate the secretion of hormones that promote milk synthesis [10] especially the prolactin [11]. Prolactin plays a major role in the induction of milk secretion [11] and also appears to be involved in the growth of the mammary gland. Prolactin is a polypeptide hormone that is synthesized in and secreted from specialized cells of the anterior pituitary gland, the lactotrophs [12]. It has many separate biological activities and plays multiple roles in reproduction other than lactation. This increase of

milk production in lactating ewe was assumed due to the increase of cells proliferation in their mammary gland after interference of MTLF. Galactagogues have a profound effect on the mammary secretory cells proliferation which is used as an indicator of lactogenic activity.

The difference of milk production between powder group and extract group could be due to nutritive composition of the leaves plant that can vary according to the leave forms. The extraction caused a loss of nutrients from the leaves.

The lambs of the groups Powder had the best weight performance. Also, the best average daily gain was observed with these lambs compared to the Control and extract groups. This was due to the greater milk production of the ewes. Indeed, for lambs unable to take solid foods, breast milk is the only source of nutrients [13] and their growth depends on its consumption [13].

The ph of the milk in the three groups is similar. The chemical constituents are identical in the three groups and are statistically insignificant. These results are similar to those reported by [15] in an assay where the soybeans were replaced by horse bean in the feed of ewes. The protein content of milk obtained in this study is similar to the one of [16]: 5.17 - 5.25% in WAD ewes. [17] obtained slightly higher values from fat (7.08%) and protein (6.12%) in WAD ewes. This difference could be explained by feeding regimes, ration components and forage, grain ratios that affected milk composition.

5 CONCLUSION

The effectiveness test of powder leaves of *Spondias mombin* on the Djallonke ewes milk production showed the positive effect of powder of leaves on milk production on the one hand and on the other hand its positive effect on the weight gains of lambs. As a matter of fact, interesting increases in milk production and body weight of lambs belonging to the powder group that received the powder of leaves of *S. Mombin* were observed with the Djallonke sheep. The extract of leaves of *S. Mombin* had less effect on milk production or on the growth of lambs compared to the powder group.

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