Original Research Article

Effects of *Ficus capensis* leaves aqueous extracts (lactogenic medicinal plants) on NMRI mice milk secretion

.

ABSTRACT

Introduction

Ficus capensis is a plant used in traditional medicine to stimulate lactation in women and animals in Africa. However, the effects of their extracts on the mammary gland are poorly documented. The objective of the study was to evaluate the effects of *Ficus* aqueous extracts on NMRI mice milk secretion.

Methodology

This was an experimental animal study using virgin female NMRI mice aged eight to nine weeks. The mice were grouped into for groups of eight mice each. Each group received one of the following products: distilled water, Galactogil™, sulpiride, aqueous extracts (AE) of *Ficus capensis* leaves. Data were analysed and processed using Microsoft Excel 2016 and Stata MP 16 with P ≤ .05 as the significance threshold.

Results

Arborescence of the galactophorous ducts was more developed in the sulpiride lot. Galactogil™, and *Ficus capensis* leaves extracts treated groups showed almost equivalent arborescence with a higher tendency than the distilled water. With histological haematin-eosin staining, the ratio of galactophorous ducts containing secretions to total ducts was higher in the groups of *Ficus capensis* AE treated group than distilled water (P = .0001). Galactogil™, sulpiride and the group of *Ficus capensis* extracts each had higher levels of beta-casein in mammary tissue and average prolactinemia than distilled water (P < .01). Mammary tissue stained by immunohistochemistry with anti-prolactin receptor antibodies showed more intensely labelled mammary glands in the sulpiride and *Ficus capensis* extracts groups. There was no statistically significant difference between average progesteronemia among the different groups.

Conclusion

Ficus capensis leaves AE administered to virgin female NMRI mice show mammogenic effects. The extracts were able to increase the nutritional quality produced, as evidenced by the increase in protein secretion.

Lenovo
2024-04-03 13:08:08

F. capensis and italic

Lenovo
2024-04-03 13:09:44

AE of F. capensis leaves

Keywords: mammary gland, histology, Ficus capensis, milk secretion, mouse

INTRODUCTION

For the first six months after birth, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) recommend that mothers exclusively breastfeed their babies [1]. In Africa, 80% of children are breastfed. However, in Burkina Faso, only 40% to 50% of children are exclusively breastfed, despite the recommended practice of exclusive breastfeeding [2]. Conventional medicine uses sulpiride and Galactogil™ to stimulate lactation. However, sulpiride has side effects for both mothers and breast-fed babies [3]. In Burkina Faso, dairy products and conventional medicines are not readily available to everyone

due to their limited availability and high cost. For this reason, some African people turn to traditional medicine, using plant extracts to boost lactation. Many ethnopharmacological studies have reported that extracts from various plants are used throughout Africa as lactogens [4–11]. Among the plants used to stimulate lactation, Ficus capensis is listed [12–14]. *Ficus capensis* Thunb. is a member of the Moraceae family and is known as «womsèèga» in the Mooré language (Burkina Faso). This study was initiated to contribute to the promotion of breastfeeding and, at the same time, to the promotion of traditional medicine. The World Health Organization (WHO) recommends the inclusion of traditional medicine in the health policies of its Member States [15]. The aim of this study was to evaluate the effects of *Ficus capensis* extracts on milk secretion in mice.

MATERIAL AND METHODS

Ficus capensis leaves were collected at Sapouy, 102 km south of Ouagadougou (Burkina Faso) and were identified as such in the national herbarium under numb extractionwas carried out after maceration. The amount of total flavonoids determined by the Dowd method adapted by Arvouet-Grand and al [16]. were estimated by the method of Singleton and al [17]. The reference produ Galactogil™ and distilled water. The study of the effects of the extracts on t was carried out on pubescent and virgin NMRI (Naval Medical Research In eight to ten weeks and weighed 27g to 35g. The NMRI mice were obtaine ZERBO University's animal house at Ouagadougou. The university's anim ethics committee approved the experimental protocol under number CE-U product was administered to a group of eight mice for eight days, following was initiated after applying the Whiten effect to synchronize the mice's estr

Lenovo
2024-04-03 13:13:15

Total polyphenols
Aqueous extract (AE) of F. capensis leaves
vs
2024-04-03 13:12:08

Female mice used
et. al or not
al experimentation
KZ/2023-11. Each
Table I. Gavage
ous cycles [18,19].

Table I: dosages of gavaged products

Products	Dosages
Distilled water	0,3 ml at 8AM, 1PM and 6PM
Galactogil™	50 mg/ Kg body weight (BW) at 8AM, 1PM and 6PM
Sulpiride	2 mg/kg BW at 8AM and 6PM
AE of *Ficus capensis* leaves	500mg/kg BW at 8AM, 1PM and 6PM

At the end of the treatment, the mice were euthanised under general anaesthesia using ketamine/lidocaine for tissue and organ removal. Mice were euthanised one hour after the last gavage. One abdominal mammary gland was used for the “whole mount” technique [20–22]. The second mammary gland was fixed in 10% formalin for standard histological examination and immunohistochemistry. Immunohistochemistry focused on prola mammary tissue using a Biorbyt antibody anti-PRLR kit orb 389311 lot thoracic mammary glands were used for ELISA determination of beta-cas tissue using a Biorbyt orb565466-lot FT6316 Mouse CSN2 ELISA kit. P were determined using a mouse prolactin ELISA kit Biorbyt orb4 Progesteronemia was determined using a mouse progesterone ELISA kit B lot I2524.

Lenovo
2024-04-03 13:13:38
---
check space
in levels in breast
olactinemia levels
09008-lot T6793.
orbyt orb1669464-

Statistical analysis

Data were processed using Microsoft Word, Microsoft Excel and Stata 16 MP. Comparisons of means were made using Student's t-test. The significance level was set at $P \leq .05$.

RESULTS

Phytochemical studies

The phytochemical compounds found in the extracts were flavonoids, tanins, polyphenols and quinones. The total flavonoid content was 1.16 ± 0.05 mg quercetin equivalent (QE)/g extract. The total polyphenol content was 0.51±0.05 mg ascorbic acid equivalent/g extract. The antioxidant power of the aqueous extracts of *Ficus capensis* leaves wa quercetin. The 50% inhibition concentration of α- diphenyl -β-picrylhydr 6.17±0.05 µg/ml for quercetin and 10.32±0.21 µg/ml for aqueous extracts leaves.

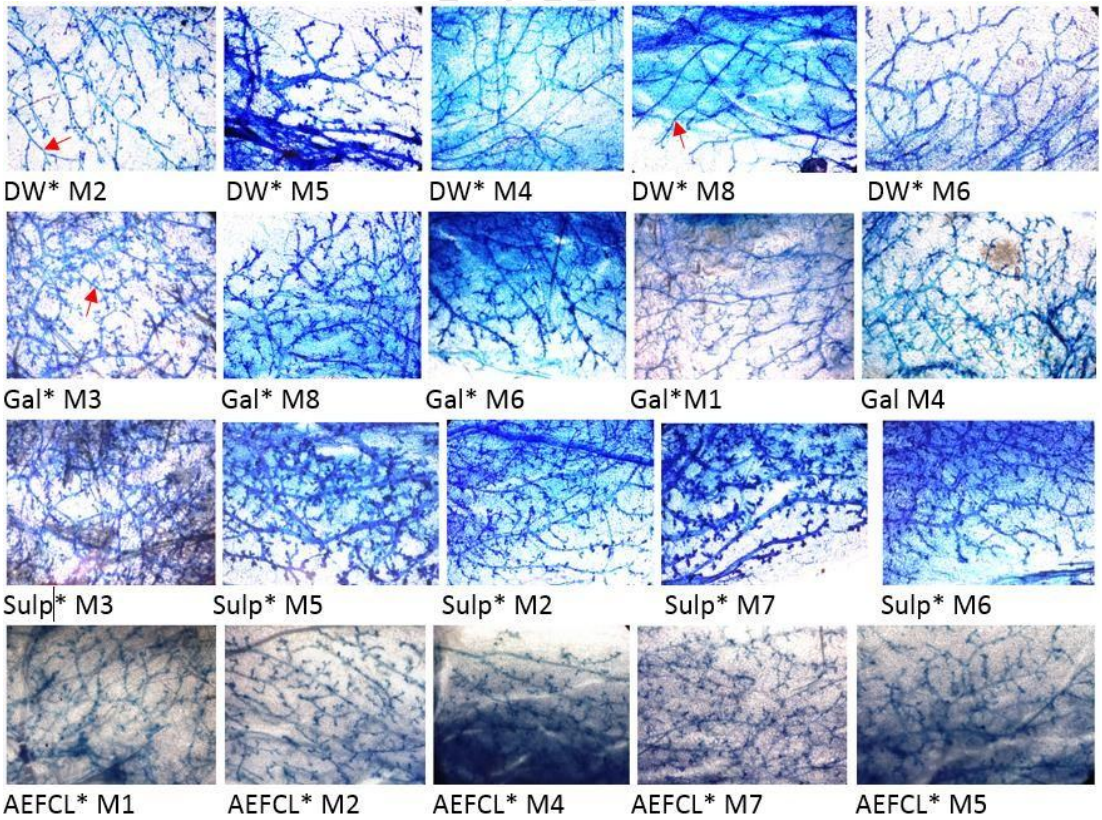
Lenovo
Lenovo
2024-04-03 13:14:36
---
check this alpha and beta using symbol

Evaluation of the effects of plant extracts on the mammary gland

The average relative weight of the abdominal mammary gland (g/100 g PC) was 0.78±0.11, 0.86±0.13, 0.9±0.3 and 0.83±0.05 for the distilled water, Galactogil™, sulpiride and *Ficus capensis* EA groups, respectively. There were no statistically significant differences between the groups (P > .27).

Ductal tree arborescence

Figure 1 illustrates the most common types of ductal tree in each group. Mice from the sulpiride group showed the most developed arborescence with more appendages and branches. The Galactogil™ and aqueous extracts of *Ficus capensis* leaves groups showed almost equivalent arborescence with a higher tendency than the distilled water group.



*DW : distilled water ; Gal : Galactogil™ ; Sulp : sulpiride ; AEFCF: aqueous extract of *Ficus capensis* leaves; red arrow : galactophorous duct

Figure 1: galactophorus ductal tree arborescence of mice in the four groups

Lenovo
2024-04-03 13:15:21

Galactophorus ...

Ratio of ducts with secretions compared to total ducts

Figure 2 shows the average ratio of ducts with secretions in relation to the total number of ducts per lot. The four highest ratio, in descending order, were those of the sulpiride, *Ficus capensis* fruit and leaf EHE and Galactogil™ groups.

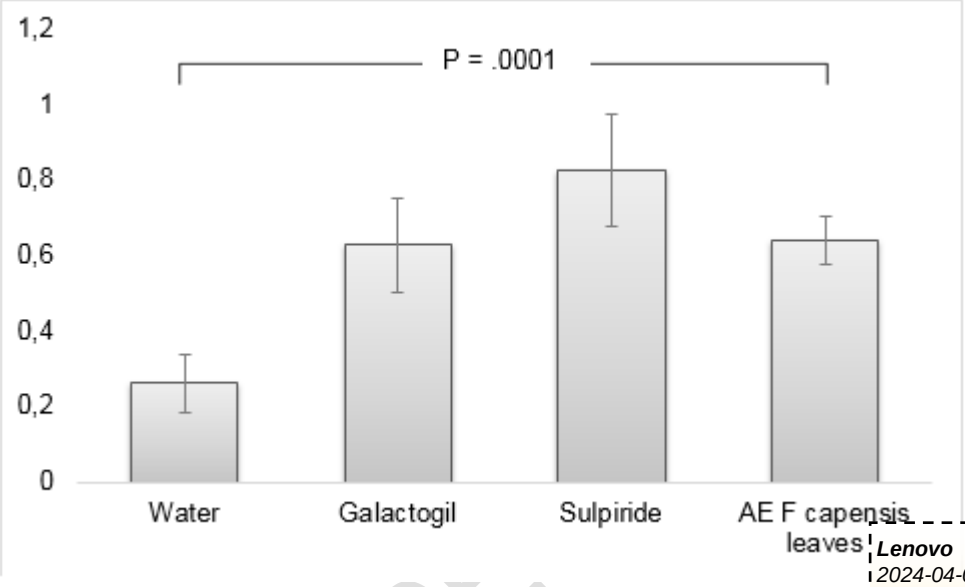


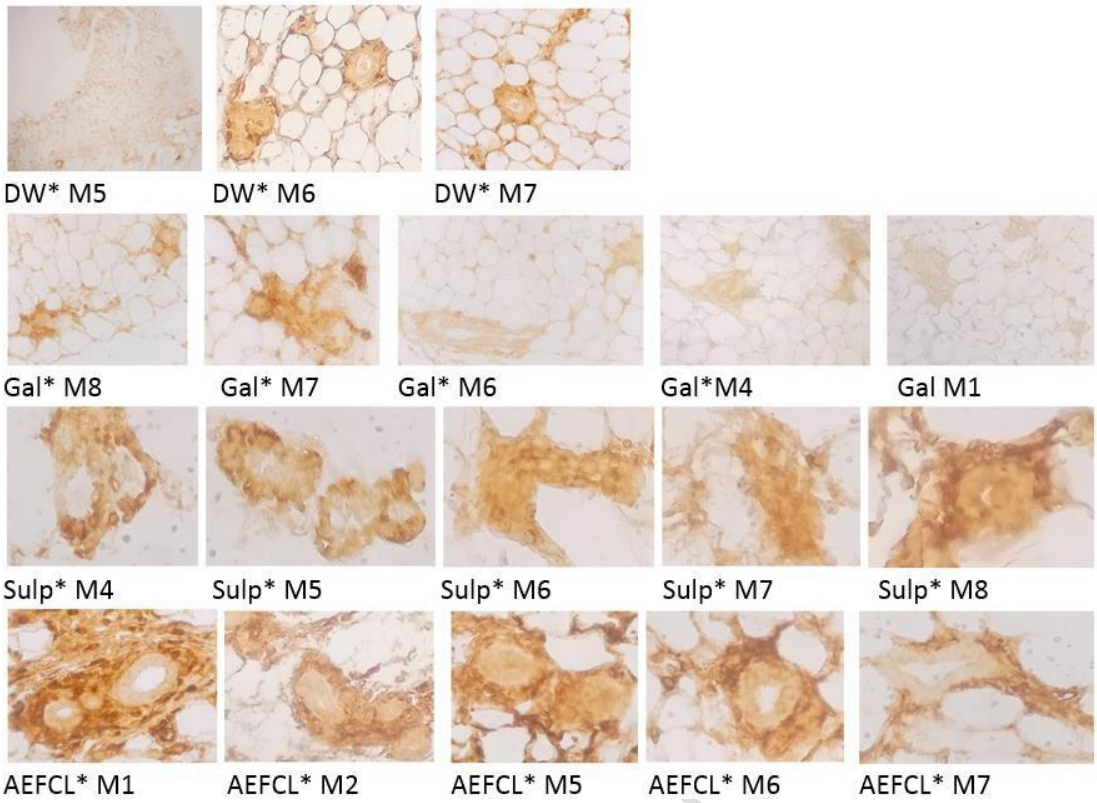
Figure 2: average ratio of ducts with secretion to total ducts per group

Lenovo
2024-04-03 13:17:31

Please adjust the Figure 2 (non using eg of figure). And correct (AE of F. capensis (italic) leaves)

Immunohistochemical marking of breast tissue with anti-prolactin receptor antibody (anti PRLR)

Figure 3 shows immunohistochemical marking of breast tissue with anti-prolactin receptor antibody. The figures reported here are those of the most labelled mammary glands in the different groups. The groups in which the glands were most intensely labelled were those of sulpiride and aqueous extracts of Ficus *capensis leaves*.



*DW : distilled water ; Gal : Galactogil™ ; Sulp : sulpiride ; AEFCF: aqueous extract of Ficus capensis leaves

Figure 3: immunohistochemical marking of breast tissue with anti-prolactin receptor antibody

Beta casein concentration in breast tissue

The average concentration of beta-casein in breast tissue is shown in Figure 4. The distilled water group had a lower concentration than the other three groups (P < .02).

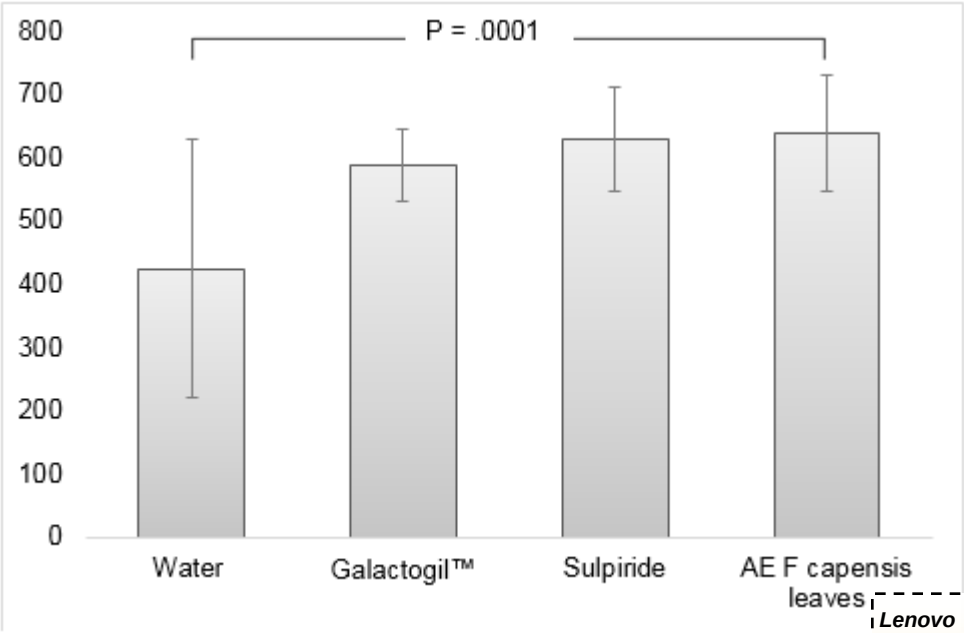


Figure 4: average concentration of beta-casein in mammary tissue of different groups of mice

Lenovo
2024-04-03 13:18:11
---
correct as following Figure 3.

Prolactinemia

Figure 5 shows the average prolactinemia for each group. The groups of mice fed with the different extracts and the positive control groups had higher average prolactinemia levels than the negative control group.

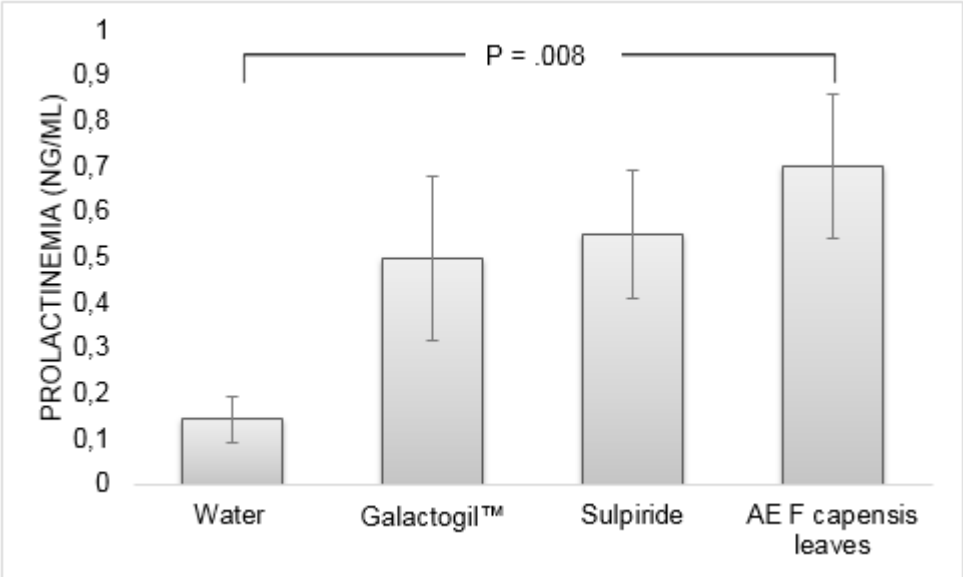


Figure 5: average prolactinemia in different groups of mice

Progesteronemia

The average progesteronemia was 334.028±96,89 pg/ml, 277.69±99,69 pg/ml, 294.55±131,09 pg/ml and 304.04±81,1 pg/ml for the distilled water, galactogil™, sulpiride and *Ficus capensis* EA groups, respectively. There were no statistically significant differences between groups (P > .2 in all cases).

Discussion
Arborisation of the galactophorous ducts

When examining the arborisation of the galactophorous ducts, the mice in the sulpiride group had the most developed arborisation with more appendages and ramifications. These appendages were alveoli, alveolar buds and/or terminal buds. Sulpiride is known to be mammogenic, possibly due to prolactin [23–25]. Sulpiride was also given to our mice at a lactogenic dose. This may favour this mammogenic effect more than the *Ficus capensis* extracts. It has been reported that in the post-pubertal period, the entire fat pad is occupied by galactophorous ducts, even tertiary ones, with only a few terminal end buds [26,27]. Most of the mice gavaged with distilled water showed fewer appendages on whole mount images. Aqueous extracts of *Ficus capensis* had more mammogenic effects than distilled water, and therefore more than the hormones of the simple oestrous cycle in mice. Considering the hormone levels measured in this study, the progesteronemia of the different groups of mice did not show any statistically significant differences. This could be due to the synchronisation of estrous cycles by the Whiten effect. The effects observed on the mammary glands of the groups of *Ficus capensis* aqueous extracts might be attributed to this effect. The aqueous extracts of *Ficus capensis* might also mediate prolactin for their mammogenic effects, as the mice in their groups have higher prolactinemia levels than those in the distilled water group. (Fig. 5).

Mammary secretion

Some of the ducts observed on the histological sections contained eosinophilic material, one of the characteristics of a secretory product. These secretion products were found in varying proportions in all histological sections. It is accepted that secretions are present in the galactophorous at all stages of the oestrous cycle [28–30]. This basal secretion is due to hormonal stimulation of the cycle, but remains low. The ratio of ducts containing secretion to the total ducts gives a better indication of the intensity of secretion in the gland histologically. In this study, the positive control mice showed higher proportions than the neutral control, confirming the lactogenic properties of sulpiride and Galactogil™. In this sense, our aqueous extracts, which also showed higher proportions than the distilled water group, would then show histological evidence of prosecretory effects. The histological assessment of secretion was combined in our study with assays of beta-casein in breast tissue. These assays make it possible to verify and confirm the histological results in the context of whether or not there is an increase in milk secretion [12]. Both the extract and positive control groups showed more beta-casein in mammary tissue than the distilled water group. Combining the observations on histological sections and the results of the biochemical assays, the extracts increased the secretion of milk proteins in mouse mammary tissue. At doses of 500 mg/kg body weight, this increase in milk secretion was significant (Fig. 4). Concentrations might be considered low and this might be related to the fact that stimuli to significantly increase the amount of milk produced would require a physiological state similar to that of lactation and/or pregnancy [26,31]. Also, the doses used for positive controls were those used in humans, where sulpiride and Galactogil™ pharmacological parameters may differ from those observed in mice. Humans differ from animals in the expression and activity of drug metabolizing enzymes [32–34]. It is also accepted that milky secretions present in the galactophorous ducts may be phagocytosed or reabsorbed into epithelial and/or connective tissue [31,35,36]. In the present study, the increase in secretion was associated with an overexpression of prolactin receptors in certain groups of mice analyzed immunohistochemically in the mammary glands. These were essentially groups of aqueous extracts of *Ficus capensis* and sulpiride (Fig. 3). The increase in milk secretion was also associated with increased prolactin concentrations in the blood samples. The increase in tissue concentrations of mammary gland beta-caseins suggests that the extracts tested are not only lactogenic but may also modulate the quality of milk secretion. Milk protein concentration is an important parameter in neonatal nutrition. In this study, the group of mice gavaged with aqueous extracts of *Ficus capensis* leaves showed an increase in the density of the galactophorous duct network and an increase in the secretion of beta-caseins. These effects could be due to direct effects of the extracts on the mammary gland and/or via pituitary and ovarian hormones. The fact that aqueous extracts of *Ficus capensis* leaves and fruit overexpressed prolactin receptors leads us to at least conclude that the said extracts pass via prolactin to ensure their lactogenic effects [24,37–39]. However, the *Ficus capensis* extracts used contained bioactive compounds such as polyphenols, flavonoids and tanins. These compounds are thought to act on the secretory function of the mammary gland, either by increasing prolactinemia, blood levels of ovarian hormones, or by increasing blood flow in the mammary gland [40]. Some flavonoids are thought to increase prolactin secretion and possess anti-inflammatory and antioxidatives properties, which are also known to improve lactation [41–43]. Some tannins have lactogenic properties [44–48]. Lactogenic properties are also attributed to certain polyphenols [46,49–51]. Prolactin synthesis has been reported to be increased by some polyphenols [42].

CONCLUSION

This study was conducted with the aim to contribute to the promotion of breastfeeding by testing the lactogenic properties of Ficus capensis extracts. By measuring beta-caseins in mammary tissue, groups of mice treated with these extracts showed higher levels than those treated with distilled water. The increase in protein secretion is evidence that the extracts are able to improve the nutritional quality of the milk produced, although this does not rule out the possibility of phytochemicals passing into the milk. The phytochemicals found in the extracts might explain the lactogenic and mammogenics effects.

REFERENCES

1. WHO/UNICEF. Discussion paper The extension of the 2025 Maternal, Infant and Young Child nutrition targets to 2030. 2021. 12 p.

2. Somé AMT. The challenge of adopting exclusive breastfeeding in Burkina Faso. Public health. 2020; HS1(S1):113‑ 22.

3. Academy of Breastfeeding Medicine. Protocol No. 9: Use of galactogens for the induction or increase of milk secretion. Breastfeed Med 2011. 2011;6(1):41‑ 6.

4. Zénabou A, Cyrille B, Adenile A, Akouedegni G, Mensah G, Joseph D, et al. Factors influencing the effectiveness of galactogenic recipes in Borgou cows reared in a real environment in Benin. Ethnobotany Research and Applications. Feb 2, 2021; 21:1-18.

5. Curasson, M.G. VU. West African plants considered by the natives as galactologists. Bulletin of zootechnical services and epizootics of the A.O.F., 1, 1, 13 - 16. 1938.

6. Adepo Y A, Bolou G E-K, Akoa E E F. Effect on breast development and phytochemical analysis of two lactogenic plants from the traditional Ivorian pharmacopoeia: Euphorbia hirta L. and Secamone afzelii (Roem. &Schult.). International Journal of Biological and Chemical Sciences. 2017;11(4):1872‑ 7.

7. Baggnian I, Abdou L, Yameogo J T, Moussa I, Adam T. Ethnobotanical study of medicinal plants sold in the markets of central-west Niger. Journal of Applied Biosciences. 2018;13392‑ 403.

8. Arbonnier M. Trees, shrubs and lianas of West Africa. Quae Editions; 2019. 778 p.

9. PROTA/CTA Foundation. Plant resources of tropical Africa: medicinal plants 2., Netherlands, 2013. 418p [Internet]. [Quoted May 22, 2023]. Available at: https://uses.plantnet-project.org/fr/Ficus_sur_(PROTA)

10. Deleke Koko I K E, Djego J, Hounzangbe-Adote M S, Sinsin B. Ethnobotanical study of galactogenic and emmenagogue plants used in the riparian areas of the Pendjari Hunting Zone. Int. J. Biol. Chem. Sci (2010); 3(6): 1226-1237.

11. Salifou C F A, Kassa K S, Ahounou S G, Moussa H, Dotché I O, Agbozo J M, Issifou M T and Youssao I A K 2017. Lactogenic plants for cattle and their preparation methods in traditional livestock farming in Benin. Livestock Research for Rural Development [Internet]. 2017;29(Article #25). Available at: http://www.lrrd.org/lrrd29/2/sali29025.html

12. Sawadogo Laya. Contribution to the study of medicinal plants and traditional African pharmacopoeia: Case of lactogenic plants. Doctorate of Sciences thesis. Francois-Rabelais University of Tours; 1993. :141p.

13. Esievo K, Onuche A, Fatokun O, Kunle O. Ficus capensis Thumb. (Moraceae): Review of Its Ethnomedicinal Uses, Pharmacological Activities and Phytochemical Constituents. Archives of Current Research International. Feb 21, 2018; 12:1–7.

14. Ouédraogo RA, Ouédraogo RA, Tindano B, Bayala B, Lamien/Sanou A. The use of Ficus capensis Thunb (Moraceae) in African traditional medicine against female infertility and hypogalactia: literature review. International Journal of Medicinal Plants Research. 2023;12(10):001‑ 8.

15.WHO. Traditional medicine strategy: 2014-2023. 2013. 76 p.

16. Arvouet-Grand A, Vennat B, Pourrat A, Legret P. [Standardization of propolis extract and identification of principal constituents]. J Pharm Belg. 1994;49(6):462‑ 8.

17. Singleton VL, Orthofer R, Lamuela-Raventós RM. [14] Analysis of total phenols and other oxidation substrates and antioxidants by means of folin-ciocalteu reagent. In: Methods in Enzymology [Internet]. Academic Press; 1999 [cited Feb 4, 2024]. p. 152‑ 78. (Oxidants and Antioxidants Part A; vol. 299). Available at: https://www.sciencedirect.com/science/article/pii/S0076687999990171

18. Jemiolo B, Harvey S, Novotny M. Promotion of the Whitten effect in female mice by synthetic analogs of male urinary constituents. Proceedings of the National Academy of Sciences. June 1986;83(12):4576‑ 9.

19. Gangrade BK, Dominic CJ. Studies of the Male-Originating Pheromones Involved in the Whitten Effect and Bruce Effect in Mice. Biology of Reproduction. August 1, 1984;31(1):89-96.

20. Tucker HA. Quantitative Estimates of Mammary Growth During Various Physiological States: A Review. Journal of Dairy Science. Sep 1987;70(9):1958‑ 66.

21. Rooney BL, Rooney BP, Muralidaran V, Wang W, Furth PA. Mouse Mammary Gland Whole Mount Density Assessment across Different Morphologies Using a Bifurcated Program for Image Processing. The American Journal of Pathology. Oct 2022;192(10):1407‑ 17.

22. de Assis, S, Warri A, Cruz M I, Hilakivi-Clarke L. Changes in Mammary Gland Morphology and Breast Cancer Risk in Rats. J. Vis. Exp. 2010;1-4.

23. Brisken C, O'Malley B. Hormone Action in the Mammary Gland. Cold Spring Harb Perspect Biol. Dec 2010;2(12): a003178.

24. Camarillo I, Thordarson G, Moffat J, Van Horn K, Binart N, Kelly P, et al. Prolactin receptor expression in the epithelia and stroma of the rat mammary gland. Journal of Endocrinology. 1 Oct 2001;171(1):85-95.

25. Porter JC. Hormonal Regulation of Breast Development and Activity. Journal of Investigative Dermatology. 1 juill 1974;63(1):85‑ 92.

26. Cardiff RD, Jindal S, Treuting PM, Going JJ, Gusterson B, Thompson HJ. Mammary Gland. In: Comparative Anatomy and Histology [Internet]. Elsevier; 2018 [cité 28 sept 2023]. p. 487‑ 509. Disponible sur : https://linkinghub.elsevier.com/retrieve/pii/B9780128029008000233

27. Cole HA, Parkes AS. The mammary gland of the mouse, during the œstrous cycle, pregnancy and lactation. Proceedings of the Royal Society of London Series B, Containing Papers of a Biological Character. janv 1997;114(787):136‑ 61.

28. Robinson GW, McKnight RA, Smith GH, Hennighausen L. Mammary epithelial cells undergo secretory differentiation in cycling virgins but require pregnancy for the establishment of terminal differentiation. Development. juill 1995;121(7):2079‑ 90.

29. Kanazawa T, Kohmoto K. Immunochemical Demonstration of αs1- and β-Casein in Mouse Mammary Glands at Early Stages of Pregnancy. J Histochem Cytochem. 1 févr 2002;50(2):257‑ 64.

30. Schedin P, Mitrenga T, Kaeck M. Estrous Cycle Regulation of Mammary Epithelial Cell Proliferation, Differentiation, and Death in the Sprague-Dawley Rat: A Model for Investigating the Role of Estrous Cycling in Mammary Carcinogenesis. J Mammary Gland Biol Neoplasia. 1 avr 2000;5(2):211‑ 25.

31. Richert MM, Schwertfeger KL, Ryder JW, Anderson SM. An Atlas of Mouse Mammary Gland Development. J Mammary Gland Biol Neoplasia. 1 avr 2000;5(2):227‑ 41.

32. Uehara S, Murayama N, Higuchi Y, Yoneda N, Yamazaki H, Suemizu H. Comparison of mouse and human cytochrome P450 mediated-drug metabolising activities in hepatic and extrahepatic microsomes. Xenobiotica. mars 2022;52(3):229‑ 39.

33. Indorf P, Patzak A, Lichtenberger FB. Drug metabolism in animal models and humans: Translational aspects and chances for individual therapy. Acta Physiologica. 2021;233(4):e13734.

34. Martignoni M, Groothuis GMM, de Kanter R. Species differences between mouse, rat, dog, monkey and human CYP-mediated drug metabolism, inhibition and induction. Expert Opin Drug Metab Toxicol. déc 2006 ;2(6) :875‑ 94.

35. Girardie Josiane. Histo-cytomorphologie de la glande mammaire de la souris C3H et de trois autres rongeurs. Zeitschrift fiir Zellforschung. 1968; 87:478‑ 503.

36. Shamay A, Shapiro F, Mabjeesh S, Silanikove N. Casein-derived phosphopeptides disrupt tight junction integrity, and precipitously dry up milk secretion in goats. Life sciences. 1 mai 2002; 70:2707‑ 19.

37. Bera TK, Hwang S, Swanson SM, Guzman RC, Edery M, Nandi S. In situ localization of prolactin receptor message in the mammary glands of pituitaryisografted mice. Mol Cell Biochem. 1994;132(2):145‑ 9.

38. Bole-Feysot C, Goffin V, Edery M, Binart N, Kelly PA. Prolactin (PRL) and its receptor: actions, signal transduction pathways and phenotypes observed in PRL receptor knockout mice. Endocr Rev. juin 1998;19(3):225‑ 68.

39. Harris J, Stanford PM, Oakes SR, Ormandy CJ. Prolactin and the prolactin receptor: new targets of an old hormone. Ann Med. 2004;36(6):414‑ 25.

40. Dietz BM, Hajirahimkhan A, Dunlap TL, Bolton JL. Botanicals and Their Bioactive Phytochemicals for Women's Health. Pharmacol Rev. oct 2016;68(4):1026‑ 73.

41. Olagaray KE, Bradford BJ. Plant flavonoids to improve productivity of ruminants – A review. Animal Feed Science and Technology. 1 mai 2019; 251:21‑ 36.

42. Budiono B, Pertami SB, Kasiati, Arifah SN, Atho'illah MF. Lactogenic effect of Polyscias scutellaria extract to maintain postpartum prolactin and oxytocin in lactating rats. J Ayurveda Integr Med. 2023;14(2):1‑ 9.

43. Yu S, Li L, Zhao H, Zhang S, Tu Y, Liu M, et al. Dietary citrus flavonoid extract improves lactational performance through modulating rumen microbiome and metabolites in dairy cows. Food & Function. 2023;14(1):94‑ 111.

44. Dey A, De PS. Influence of Condensed Tannins from Ficus bengalensis Leaves on Feed Utilization, Milk Production and Antioxidant Status of Crossbred Cows. Asian-Australas J Anim Sci. mars 2014;27(3):342‑ 8.

45. Dschaak CM, Williams CM, Holt MS, Eun JS, Young AJ, Min BR. Effects of supplementing condensed tannin extract on intake, digestion, ruminal fermentation, and milk production of lactating dairy cows1. Journal of Dairy Science. 1 mai 2011;94(5):2508‑ 19.

46. Kuswaningrum O, Suwandono A, Ariyanti I, Hadisaputro S, Suhartono S. The impact of consuming Amaranthus spinosus L extract on prolactin level and breast milk production in postpartum mothers. Belitung Nursing Journal. 30 oct 2017;3(5):541‑ 7.

47. Aguerre MJ, Duval B, Powell JM, Vadas PA, Wattiaux MA. Effects of feeding a quebracho–chestnut tannin extract on lactating cow performance and nitrogen utilization efficiency. Journal of Dairy Science. 1 mars 2020;103(3):2264‑ 71.

48. Wang Y, Douglas GB, Waghorn GC, Barry TN, Foote AG. Effect of condensed tannins in Lotus corniculatus upon lactation performance in ewes. The Journal of Agricultural Science. mai 1996;126(3):353‑ 62.

49. Cutrim CS, Cortez MAS. A review on polyphenols: Classification, beneficial effects and their application in dairy products. International Journal of Dairy Technology. 2018;71(3):564‑ 78.

50. Pujiastuti SE, Salsabila DIB, Anwar MC. Potential of Moringa Leaf Cookies to Increast Breastmilk Production in Postpartum Mothers. Open Access Macedonian Journal of Medical Sciences. 2022;10(T8):207‑ 10.

51. Widyawaty ED, Fajrin DH, Lestari YD, Permatasari P, Happy TA. Effect of lembayung leaf (Vigna sinensis L.) on increased breast milk production in women breastfeeding 0-6 months' infants. Pal Arch's Journal of Archaeology of Egypt / Egyptology. 1 déc 2020;17(6):10084‑ 91.