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FOODS WHICH INCREASE LACTATION. EFFECT OF ALHUCEMA (*ACHILLEA MILLEFOLIUM*) ON MILK PRODUCTION USING A RABBIT MODEL

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ABSTRACT

A rabbit model was used to determine any increase in milk yield produced by including plants commonly used as galactogogues in Guatemala in feed given to lactating does. Surveys were carried out on Guatemalan women in order to determine which plant product is used by mothers to encourage abundant breast milk, and include such a product in the study. On this basis, alhucema (Achillea millefolium) was chosen.

Milk production data for 30 New Zealand White 5-month old does was recorded for 19 days, from day 3 to day 21 of lactation. Does were divided in 2 groups; 15 were fed regular rabbit feed, and 15 were fed feed to which 5% alhucema flour had been added.

The method used was weight-lactation-weight (6), and the changes in doe weight were used to estimate milk yield. At the end of the study, it was found that the differences in milk production between the groups were significant; (α = 0.0193)

These results indicate that alhucema does indeed have a galactogogic effect, confirming the widespread belief expressed by those surveyed; this study may contribute to solving agalactia or insufficient milk yield in rabbits and other species in which succesful lactation is an important factor in later offspring development.

BACKGROUND

During recent years, renewed attention has been given to the significant nutritional importance of lactation by mothers on the growth and development of the newborn during the first few months of life (4). As is well known, lactation provides many advantages. Mother's milk is the best nutrient source which can be offered to newborn children (7). Likewise, breast milk provides active immunological substances, and changes its composition according to the requirements of the newborn (8).

Even though breast feeding has provided nutritional benefits to newborn children, large numbers of mothers have expressed difficulties in nursing their children, mainly because of low milk production. Milk production from mothers whose children have been born prematurely or with health problems is also uncertain; particularly when it becomes necessary to maintain production even though there is no suckling stimuli by the child. Under these conditions it is quite difficult to produce milk after four to six weeks after birth (1).

In Guatemala, popular tradition holds that there are vegetable products or specific foods which mothers can use to increase milk production and output when it is insufficient.

The first phase of this present study concerned itself with acquiring some knowledge about the beneficial effects of the natural vegetable resources on milk production and their identification. The herbs most frequently mentioned in surveys included: a) macuy or hierbamora (*Solanum nigrum*), often also used as a vegetable for daily consumption; ixbut (*Euphorbia lancifolia*); alhucema (*Achillea millefolium*); amaranth or bledo (Amaranthus sp) and chaya (*Cindosiolus aconitifolius*). All of these are consumed as an infusion for the purpose of increasing milk production as indicated by the survey (previous papers).

In order to evaluate the galactogogue potential of these natural products, the second phase of the study consisted of the development of a rat model (previous papers). Basically, it involved feeding pregnant and lactating rats a high nutritional quality basal diets to which the dehydrated vegetable matter or water extracts were added. The effects were measured through weight gain of the litter and individual units of the litter, the qualitative examination of the mamary gland, serum prolactin content and DNA, RNA quantities in the mamary gland.

The available data from the rat studies suggest that certain plants native to Guatemala have a positive galactogogue effect. The rat model, however, may not be the best for the above purpose, mainly because of the size of the animal and its low milk output. It was therefore decided to use rabbits for purposes of evaluating the effectiveness of vegetable lactogogues as claimed by the population surveyed.

OBJECTIVES

1. To evaluate the rabbit as an experimental animal in lactation studies

2. To determine the effect of *Achillea millefolium* on milk production and its chemical composition, using the rabbit model.

MATERIALS AND METHODS

A total of 40 female New Zealand white rabbits (NZW) from 5 local sources and of 6 months of age were used. All rabbits were bred within 5 days with males of the same breed. Pregnancy was confirmed in 30 does. The pregnant does were individually placed in all-wire screen cages (90x45x45 cm). These cages have incorporated within their area a nest (30x45x45 cm) for the litter; when they were born, the litters were separated from the mother. All cages were within a well-ventilated structure, with curtains to protect the animals from rain and abrupt changes in temperature. This fluctuated between 21-23°C.

All does were fed a basal pellet-form diet which was calculated to meet the lactating rabbit's nutrient needs according to NRC (9). Fresh feed and water were available at all times.

28 days from breeding, the nests were disinfected, cleaned and cushioned with paper strips. The kits were transferred to their nest 24 hours after delivery. Milk production was then measured from day 3 to 21 after delivery. To establish milk production, the method of weight-lactation-weight was used according to the indications of Lukefahr et al (3). Except during the lactation period, all kits were kept away from the mother, feed and water. Lactation was allowed only once a day for a 5-minute period. The doe was weighed and then allowed to lactate within the nest for 5 minutes; she was then separated and weighed again, once every 24 hours. The weight difference before and after lactation was used to estimate daily milk production. Lebas (1968) (2) reported that the difference in the does' weights before and after lactating provides a better estimate of milk production than that which could be derived from the weight changes of the litter. The litters were weighed every four days for a total of 3 weeks. At 21 days of age they were allowed feed and water by opening the door between the nest and the rest of the cage. All animals were weaned at 30 days of age.

At the end of the study at 21 days, all does were milked. The collected milk (20 ml per doe) to be used for chemical analysis was frozen immediately after collection and kept at -20°C.

Statistical design and analysis

The trial was a completely randomized block design with repetitions, using the location of the cage within the animal facility as blocks. A total of 4 blocks were established, and each doe was taken as an experimental unit (5).

Milk production

This was measured by calculating the difference in weight before and after lactation.
Milk production = IW - Fw, where
IW = Initial weight (weight before lactation)
Fw = Final weight (weight after lactation)

Dietary treatment

Two dietary treatments were evaluated. The control diet, and the same diet containing 5% alhucema flour. This material was used since it represents one resource very often mentioned and because it is a dried product not requiring any process other than grinding.

Analysis

Although the design used was to evaluate the true effect of the addition of alhucema to the diet on milk production, the possible effect of misleading variables had to be eliminated from the final statistical analysis. These covariables were: the weight of the doe, the number of kits born in the litter, the litter weight, feed intake, as well as the place of origin of the rabbits even though all were New Zealand whites.

a. doe weight

Since the weight of the doe was found to be directly associated to milk production, this was then estimated as milk productivity, calculated on the basis of the live weight of each doe. Milk productivity was then used to compare differences between treatments. Productivity was calculated from the following equation:

$$MP = \frac{Iw-Fw}{Fw} * 100 ;$$

Where ;

MP = milk productivity
Iw = Initial weight (before lactating)
Fw = Final weight (after lactation)

The daily productivity is then equal to:

$$MPi = \frac{Iwi - Fwi}{Fwi}$$

where,
i is equal to 3, 4, 5, 6,... up to 21 days of observation.

b. sample size

On the basis of the standard error for milk production of 10.2 g. according to McNitt and Lukefahr (6), the number of does necessary for the desirable level of significance was assigned to each treatment.

RESULTS AND DISCUSSION

In order to establish a true evaluation of milk production by the does fed diets with and without the "lactogogue" it was necessary first of all to determine the significance of the effects induced by covariables identified in the experimental design.

From the results of the weight of the does it was established that their weight was directly related to their own individual milk production capacity ($P < 0.05$). This effect was eliminated in the statistical analysis of the data by converting production to milk productivity as indicated before. Milk productivity increased with respect to time for both groups. It appears, however, that the difference in productivity between treatments which in general was higher for the alhucema group, became larger as time of lactation increased from day 15th to day 21st. This is also evident for milk production per doe per day in Table 1, where total milk production is shown. This increase in milk production and productivity was reponsible for the higher weight of the litter, as shown in Table 2. It would appear from these data, that the effect of the lactogogue was to increase milk production to some extent all along lactation. The demand for a higher milk consumption increases with the age of the litter, which can also explain the increase in the differences in milk production and weight changes between the control and experimental group in the later stages of lactation. Table 3 shows the results of the statistical analysis of the data. Food intake (FI) was significantly higher in the does which consumed the diet with 5% alhucema. This variable affected productivity significantly ($\alpha = 0.057$). Litter weight (LW) from mothers fed 5% alhucema was greater than the weight of the control group ($\alpha = 0.0014$). The number of kits born per litter was not significantly different between dietary treatments, neither was the location of the doe in the animal facility (blocks). On the other hand, the site of origin of the rabbits had significant effects on milk productivity ($\alpha = 0.0188$). All the data show that alhucema increased milk production, confirming that this vegetable resource is a lactogogue as claimed by the women surveyed. Although the weight gain data of the young animals was not statistically analyzed, since the experimental design was not concerned with this purpose, it was observed that the litters on the control diet weighed 29030 g, while those on the alhucema diet weighed 31681 g. at the end of the lactation period, a difference of 2651 g, which was the result of a greater milk production in mothers fed diets with the lactogogue.

From these studies it is concluded that the rabbit model is adequate to study lactation from the practical point of view. The animals are tame and gentle (and so are less affected by stress fron handling than rats), and are easy to handle and weigh. The size of the animal is also an important factor in collecting milk. Chemical analysis of the milk samples obtained in this study is pending. The results of the studies with rabbits, as well as those with rats reported previously, show that the plant galactogogues tested induce, in general, a higher milk production.

Obviously, the information obtained up to now is still not enough, and other biochemical tests should be conducted.

REFERENCES

1. EHRENKRANZ, Z.A. , ACKERMAN, B.A. 1986. Metoclopramide effect on faltering milk production by mothers of premature infants. Pediatrics 78 (4) : 614-620.

2. LEBAS, F. 1968. Measure quantitative de la production laitiere chez la lapine. Ann. Zootech. (Paris) 17:169.

3. LUKEFAHR, S.W., HOHENBOKEN, D., CHEEKE, P.R. AND PATTON, N.M. 1983. Characterization of straightbred and crossbred rabbits of milk production and associative traits. J. Animal Sci. 57:100.

4. MARTINEZ, G. A., DODD, D.A. 1981. Milk feeding patterns in the United States during the first 12 months of life. Pediatrics 1983. 71: 166-170.

5. MATUTE, J. 1990. Cuántas repeticiones tengo que hacer en mi ensayo? Edited by Gilda R. Gomar D. Nutrición al día (Guatemala). Boletín Semestral de la Escuela de Nutrición. Facultad de Ciencias Químicas y Farmacia, USAC 4(2):29-48.

6. McNitt, J. I. , LUKEFAHR, S.D. 1990. Effect of breed, parity, day of lactation and number of kits on milk production of rabbits. J. Animal Sci. USA. 68:1505-1512.

7. MONTAGO, A. 1979. Breastfeeding and its relation to morphological, behavioral and psychocultural development. Edited by Dana Raphael. Academic Press, N.Y. p.189.

8. PITT, Jane. 1979 . Immunological aspects of human milk. Edited by Dana Raphael. Academic Press, N.Y. p. 233.

9. THE NATIONAL RESEARCH COUNCIL NATIONAL ACADEMY OF SCIENCES. 1978. Nutrient requierements of laboratory animals. USA. 10:23.

TABLE 1

TOTAL MILK PRODUCTION DURING 19 DAYS OF LACTATION (G)

Treatment	Production ave./doe g	Production ave./doe/day g
Control	2,750.15	144.74
Alhucema	2,975.37	156.59
Difference	225.22	11.85

TABLE 2

WEIGHT CHANGES OF LITTER BELONGING TO DOES CONTROL AND ALHUCEMA DIETS

Day of life	Ave./wt/litter g	
	Alhucema	Control
1	6,611	6,134
5	9,762	8,814
9	14,608	13,672
13	20,529	19,155
17	26,396	24,127
21	31,681	29,030
Gain	25,070	22,896

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TABLE 3

ANALYSIS OF VARIANCE OF THE EFFECTS INDUCED BY THE MAIN VARIABLES ON RABBIT MILK PRODUCTION

Source of variation	DF	MS	Pr > F
BETWEEN SUBJECTS:			
Feed intake (FI)	1	18.6	0.057
Litter weight (LW)	1	64.4	0.001
No. of live newborns (NLN)	1	4.3	0.400
Block (B)	3	7.6	0.207
Origin (O)	4	17.6	0.019
Treatment (Treat)	1	29.7	0.019
Error	18	4.5	-----
WITHIN SUBJECTS:			
Time (t)	18	0.815	0.009
t * FI	18	0.428	0.414
t * LWt	18	0.356	0.605
t * NLN	18	0.597	0.097
t * B	54	0.449	0.288
t * Orig	72	0.433	0.342
t * Treat	18	0.371	0.559
Error * t	324	0.405	-----