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QUANTITATIVE AND QUALITATIVE STUDY OF MILK PRODUCTION OF THE PELIBUEY SHEEP

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15 Pelibuey ewes were managed under a restricted grazing system on African star grass supplemented with 200 g of concentrate (35% crude protein on a fresh weight basis) twice a day. Hand milking was carried out at 0700 h and 1500 h from the fourth day after lambing to the 16th week. The quantity of milk produced kept near to the maximum level until the 7th week, from which time it began to decline. Persistency percentage was good, being of the order of 67.8%. The ewes weight at lambing was the parameter which had most effect on the total production of milk. The total quantity of milk and its fat content were most closely correlated with the quantity secreted at the 6th week. The percentages of lactose, crude protein, casein and dry matter in the milk did not change during the lactation. Criteria to be used in the selection of ewes are proposed according to the milking capabilities of the animals. The idea of weaning lambs at 60 days is discussed. Cheese made from the sheep's milk was found to be moderately acceptable following an accepability test.

Key words: ewes, Pelibuey, milk, cheese, lactation, persistency

The growth of lambs during the first weeks of their lives depends very much on the milk production of the ewe. This dependency is most marked during the first month of life and from then onwards dependence is reduced due to the lesser production of milk by the mother and the initiation of consumption of solid food by the lamb.

Results have been reported on the growth of Pelíbuey lambs during the period before weaning (Talavera et al 1974) and these show gains of 97 g/d during the first three months of life. However there have been no data reported with respect to the dams milk production and its composition.

The present work was carried out in order to elaborate this last point. In addition the possibility of using Pelibuey sheeps' milk as raw material for the making of cheese was considered.

Materials and Methods

The present work was carried out in the Centro Experimental Pecuario de Mocochá which is a dependency of the Instituto Nacional de Investigaciones Pecuarias - SAHR, located in the state of Yucatán, Mexico.

15 Pelibuey sheep which were about to give birth, were managed on a restricted grazing system with African star grass from 0800 h to 1500h. 13 of these animals gave birth during the month of November 1979 and 2 during the month of December. During the first three days after lamb-

ing the mothers remained with their lambs in order that the lambs could take advantage of the colostrum produced. After 4 days the lambs were separated from their mothers and fed separately. The ewes were selected according to their conformation of the udder, so that hand milking was possible. Milking was carried out before and after grazing. During each milking the animals received 70 g of crude protein and 1.7 Mjoules of metabolizable energy in the form of a concentrate,which was based on sunflower meal, molasses and urea. At 12 weeks the sunflower was substituted for coconut meal but the level of crude protein was kept the same. However, the consumption of energy was increased to 2.52 Mjoules. Milking was carried out up to the 16th week.

During the night, which the animals spent in the corral, minerals were freely available (61.5 rock phosphate, 36% iodised salt and 2.5 % of a trace element premix). Very often the ewes received cut grass during their stay in the corral. Weekly weighings were made of the mother and the lambs (without fasting). A sample was also taken weekly of the milk produced and this was analysed in the laboratory in order to determine its content of fat (according to the method of Gerber), total nitrogen (Kjeldahl method), lactose (using Fehling's reaction) and casein (by the method of Sorenson-Walker). The methodology utilised was that sited by Rosell and Dos Santos (1952). At the 13th week after lambing three ewes were sampled in order to evaluate the variation of milk composition during the day, carrying out samples at 0700, 0900, 1300 and 1600 h.

An acceptability test was carried out on the fresh cheese made from the milk of the Pelibuey sheep. The cheese was fabricated by coagulating the milk using a commercially available tablet, adding salt , pressing and refrigerating. A panel composed of 21 students from the Escuela Tecnica Agropecuaria was used, and these assessed two types of cheese, that of the Pelibuey sheep and a cheese prepared from cows milk in the same way. They were unaware of the origin of the cheese.

Statistical methods used were those of correlation and regression (Lison 1968).

Results and Discussion

Production of milk: Total production of milk during the 16 weeks of study is shown in Figure 1. In general terms production was main - tained at its maximum level during the first three weeks and diminished slightly towards the 7th week at which time the decline became more severe. It should be noted that the fall and subsequent recuperation in milk production at the 10th and 11th week was attributable to the fact that there was no concentrate available at this time. However, afterwards feeding was normal again. No effect was noted on milk production during the last month of measurements which could be attributable to the change in protein supplement used in the concentrate mix . The amount of milk recorded in the present work is compared to that noted in the previous papers in Table 1. It is notably inferior to that found in temperate breeds; the comparison is closer with the rustic desert breeds and with the production from ewes in temperate regions where a low plane of nutrition is practised.

Figure 1:
Milk production curve (median and confidence limits)

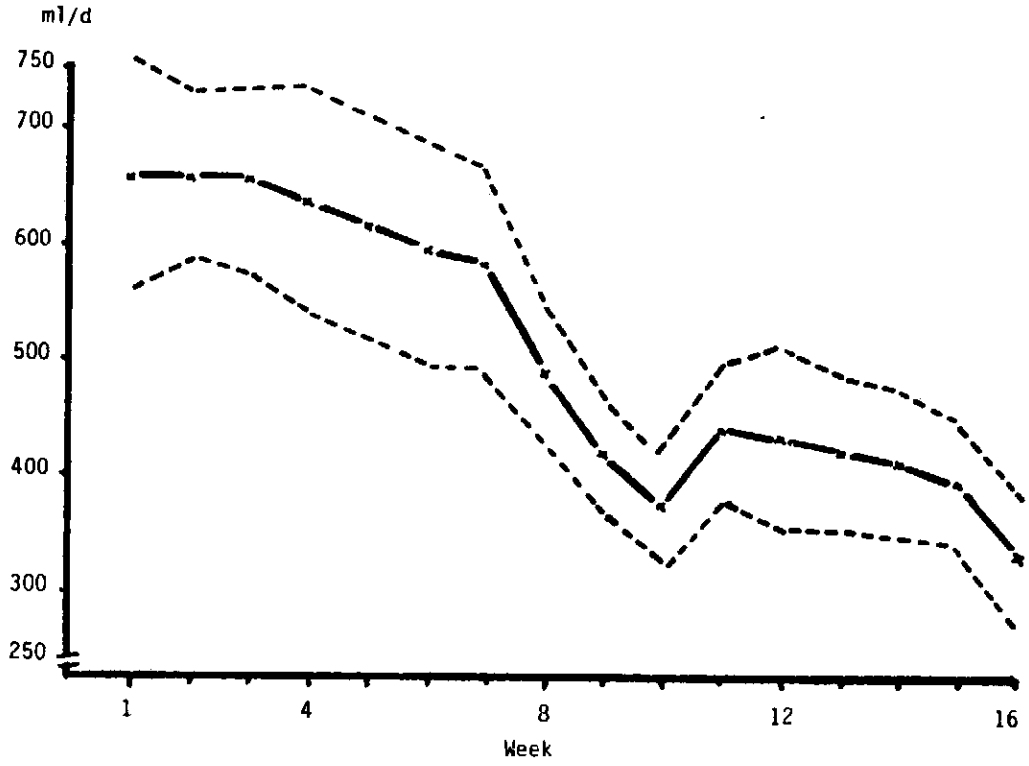


Table 1:
Comparison of milk production for different breeds of sheep

Source	Breed of ram	Weeks of lactation	Total Production (kg)
Thomson & Thomson 1953*	Cheviot High nutritional plane	13	93
	Low nutritional plane	13	51
Wallace 1948*	Border Leicester x Cheviot	12	170
	Suffolk	12	136
Burris & Baugus 1955*	Hampshire	12	77
Owen 1957	Welsh Mountain	8	64
Sahni & Tiwari 1975	Malpura	13	41
	Chokla	13	41
	Malpura x Rambouillet	13	118
	Chokla x Rambouillet	13	48
This work	Pelibuey	13	51

* Cited by Owen 1957

The low production recorded could be attributed to the method utilised in this work for extracting the milk. The two methods most usually employed are:

a) Indirect measurement through the weighing of lambs before and after suckling
b) The use of oxytocin before hand milking of the ewes

According to Coombe et al (1960) the second method allows more milk to be extracted than the first, the first also having the disadvantage of being more work. In this present work neither method was utilised for practical reasons.

Looking at the lactation curve one can see that the production was affected by an accident in feeding (the non-availability of concentrate at the 10th week). However, production recuperated to its previous level very quickly after concentrate became available once again. This recuperation is not characteristic of cattle.

The percentage persistency of milk production (following the formula put forward by McDowell et al (1961) is 67.8% ± 9.92 (SD) which can be considered very satisfactory.

There was a significant correlation between the total amount of milk produced and the quantity produced per week. The highest and most constant values of r were those of the 4th, 5th and 6th week of lactation (r = 0.93, 0.94 and 0.95 respectively). It is important to be able to predict quickly the production level of an ewe to be able to carry out rapid selection within the flock. The equation which would allow this prediction at the 6th week of production is:

$Y = 72.6726X + 12.0021$ in which
Y = total production of milk in 16 weeks (litres) and
X = the average daily milk production at 6 weeks (litres)

The average weight of the ewe at lambing (35 kg) increased to the 4th week (37 kg) and after this time oscilated irregularly.

Many factors can influence the total amount of milk produced by an ewe. Amongst those, three criteria have been selected as being of prime importance:

1. The weight of the ewe at lambing. From an analysis of the 15 sets of data available a significant correlation was found between the weight of the dam at lambing and the total production of milk. This will indicate that the larger ewes were those that produced the higher quantity of milk

$Y = 2.0758X + 19.9279$; $r = 0.52$ in which
Y = the total production of milk in kg and
X = the weight of the ewe at lambing

Similar results were reported by Robinson et al (1968) who worked with sheep of the Greyface breed.

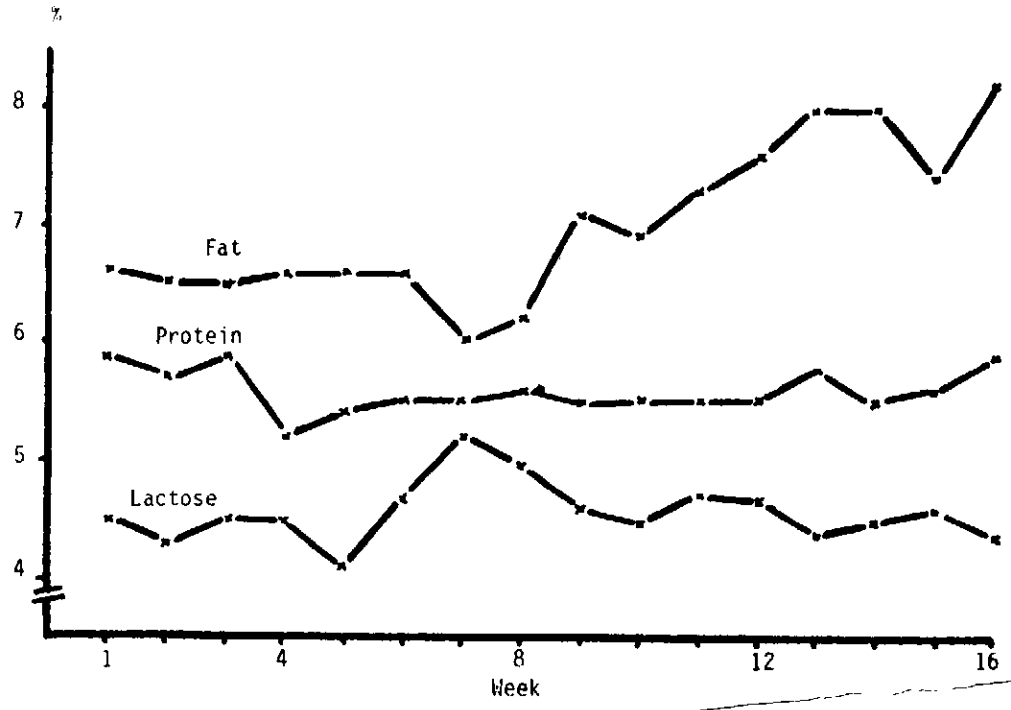
2. The weight of the lamb (s) at birth. The relationship of this parameter and the total production of milk by the dam was not found to be significant. Owen (1957), using sheep of the Welsh Mountain breed did encounter a significant relationship, however Coombe et al (1960) working with Merino crosses found no relationship. It would

appear that these criteria may be influenced by other factors such as breed and feeding regime, these having direct repercussions on the weight of the dam and its progeny at lambing.

3. The age of the ewe. In the present work no relationship was found between this parameter and the total production of milk.

Milk composition: The milk composition pattern for the sampling period is presented in Figure 2. The amount of fat in the milk rose

Figure 2:
Milk composition with time



significantly as the lactation proceeded and due to this the energetic value of the milk tended to increase also. Using the equation put forward by Sauvant et al (cited in Jarrige et al 1978) and which was used to estimate the energetic value of goats milk:

E = 312.9 + 11.168 G in which
E = energy in Kcal/kg of milk
G = fat in the milk g/kg

The energy value of the milk from the Pelibuey sheep increases towards the end of the lactation. However, due to a fall in the volume prod -

	1st month	2nd month	3rd month	4th month
g of fat/kg	65.5	63.5	72.3	79.0
Kjoules/kg	4364	4272	4682	4995
Kjoules secreted/d	2709	2303	1818	1797

uced, the total quantity of energy secreted diminishes as the lact - ation proceeds . Tissier et al (1978) cited values of 4389 Mjoules / kg for the first month of milking which are quite similar to those put forward here.

The quantity of fat in the milk was highly correlated with the to tal production over the whole measurement period with the best correl- ation being found at 6 weeks (r = 0.94). The linear regression line es- tablished between these parameters is expressed by the following equat - ion:

$Y = 9.4996X + 153.5810$ in which
Y = the total production of fat (from the means of 16 weeks g))
X = the quantity of fat secreted (g) as a daily mean during the 6th week

The quantities of lactose and crude protein varied only a little over the sample period of 4 months (Figure 2).

Casein represented 83.6 ± 5.2 of the total crude protein found over the length of the experiment. The mean total solids during the 16 weeks of sampling was 15.85%, this being similar to the figures encountered in the literature for other breeds of sheep, and well over the 8 - 10 % which characterises cows milk .

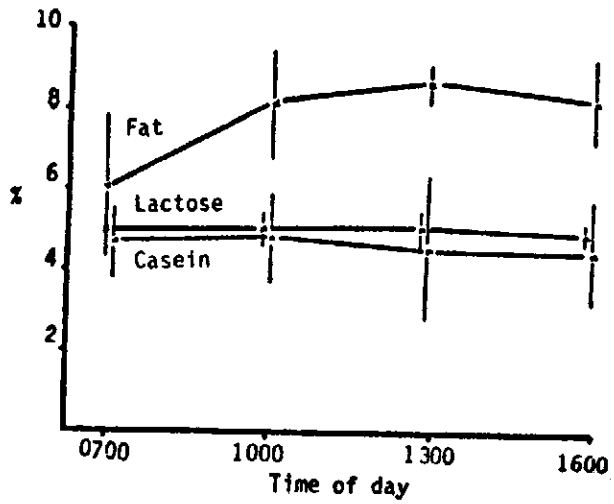
If one measures the change in these values from the slope of the re gression line established between the lactation week and the quantities of lactose, protein, casein and dry matter in the milk (Y) we find this gives the following values:

Lactose	0.0047
Crude protein	0.0004
Casein	0.0201
Dry matter	0.0643

This shows the independence of these parameters with respect to the week ly production.

The quantity of fat secreted is greater during the afternoon hours in comparison to that secreted in the morning (Figure 3); However , in

Figure 3:
Variation in milk composition (median and standard deviation)



contrast, the quantities of lactose and casein didn't show any variation during the day. The increase in the quantity of fat between 0700 h and 1000 h could have been due to the consumption of grass during this period which lead to an increment in the proportion of acetic acid in the rumen. Acetic acid is well known as a starting point for the synthesis of milk fat.

Acceptability of a milk derivative: The results of the acceptability test (Table 2) indicate that, according to all the criteria employed, the cheese produced from cows milk was more acceptable than that made

Table 2:
Palatability of two types of fresh cheese

	Pelibuey Cheese	Cows milk cheese
General apearence	4.6*	5.1
	1.2**	1.o
Colour	3.9[a]	4.8[b]
	1.4	1.4
Smell	3.9	4.2
	1.4	1.1
Texture	4.0	4.3
	1.3	1.1
Humidity grading	3.8	4.5
	1.7	1.4
Flavour	3.4[a]	4.6[b]
	1.5	1.5
Texture in the mouth	3.7[a]	5.0[b]
	1.7	1.3
Aftertaste	4.1	4.4
	1.6	1.7
General satisfaction	3.9a[2]	4.6c

* Mean value ** Standard deviation of the mean

[1] Mean values with subscripts a-b signifies significant difference at $P < 0.05$

[2] Mean values with subscripts a-c signifies significant difference at $P < 0.01$

from sheeps milk although this was only significantly so in the following parameters: colour, taste, texture and general acceptability. It should be noted that for almost all of the parameters the standard deviation was greater for the sheeps milk cheese. This reflects the wide and contradictory response of the jury to particular criteria.This could be explained by the fact that the jury's taste had not adapted to this cheese, having very little experience of it.

If a taste was developed for this type of product, it is likely that its acceptability would be greater.

If one establishes correlations between the different paramters studied (Table 3) it is notable that general appearance of the cheese is

Table 3:

	Colour		Smell		Texture		Humidity		Flavour		Texture in the mouth		Aftertaste	
	PB	C	PB	C	PB	C	PB	C	PB	C			PB	C
General appearence	.26	.42	.25	.54*	.35	.38	.23	.70**	.41	.64**	.43	.52*	.08	.54*
Colour			.31	.20	.63**	.41	.23	.13	.27	.37	.52*	.36	.17	.26
Smell					.48*	.48*	.62*	.70**	.61**	.25	.71**	.41	.40	.28
Texture							.14	.29	.57**	.59**	.58**	.22	.45*	.31
Humidity									.39	.46*	.46*	.59**	.04	.23
Flavour											.53*	.46*	.36	.26
Texture in the mouth													.48*	.24

PB = Pelibuey C = cow

* P <.05 ** P <.01

not an important factor for any of those criteria evaluated. Smell is the most important parameter. Colour is seen as a reflection of the quantity and composition of the fat in the milk, and this must be a factor which greatly effects the acceptability of sheeps milk cheese.

These results differ from those encountered for cows cheese, whose acceptability appears to be regulated by general appearance and by humidity, these priorities being most correlated with all the rest.

From the results obtained in this study one can conclude that the milk productivity of the Pelibuey ewe, when milked twice a day, is low. Bearing in mind that the production diminishes sharply at the end of the second month after lambing, a strategy for the weaning of the lambs at this time is put forward and it is suggested that the success of this weaning will depend on the type of feed which the lamb (s) receives.

The data obtained from the present work suggest that one can make an early selection of the ewes, using as criteria the milk production and the percentage of fat. This can be carried out bearing in mind a dual purpose system of production; to raise the quantity of milk available for the lamb and/or to make available a greater quantity of raw materials for the fabrication of cheese.

It would be of great interest to continue working along the lines of this paper, studying the milk production through other measurement techniques and the relation between the growth of lambs over different weight ranges in order to corroberate the findings reported here.

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