Milk is for Children, Colostrum silage is for calves.

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SUMMARY

One sixth of the world population is starving. In the meantime, producers from all over the world daily disdain billions of liters of bovine colostrum, which is seen as rich in nutrients, immunoglobulin and bioactive substances. The milk is the most expensive component in the final costs of calves breeding. Considering the impossibility of substituting the milk to feed the calf, different ways to use the colostrum have been studied however with controversial results. We have developed colostrum silage. This product is economical and possible to store in the environment for up to eighteen months. Being efficient for calf breeding, yielding income and profit to the dairy business. The colostrum silage keeps the necessary physicochemical characteristics for the development of the calves. Calves fed with this product had a significant higher weight gain comparing to the ones fed with milk. Then the milk can be used for human consumption.

Key words: colostrum, starvation, bovine, food safety

INTRODUCTION:

According to FAO[1] until 2050, the world population will be of approximately 9 billion people. In order for everyone to have access to food, the food supply should increase in 70% in the next 40 years[2]. Among these food items, milk is one to be highlighted, as it is one of the most perfect foods in nature, being a rich source of essential proteins and minerals to promote the growth and the quality of life of mammals. Although there is a shortage of milk for human consumption, billions of liters of milk are used in calf breeding. However for this milk is destined for human consumption, there is need for adequate milk replacement to feed the calf. Once the bovine's proteolytic system is immature from birth up to three weeks, and therefore they cannot digest proteins unless they derive from milk[3].

The bovine colostrum is considered fundamental for the calf development, not only as food, but as a passive immunity transmitter[4]. Considering management of dairy cows, the calves are fed with colostrum during four days of their lives, after that they start being fed with whole milk[5]. However, the milk has an economic value for the producers, and due to need to commercialize it, the calf is then incorrectly fed with milk replacement [5]. In most times, the milk is replaced by milk replacement whose components present a questionable quality, therefore not being well digested and resulting in a

low performance from the animals. Thus, there is the need for developing adequate substitutes for the proper animal feeding[6]. The colostrum is a milk replacement which presents nutritional characteristics higher than milk itself, and it can be used to feed the calves[7]. *Guidelines for the usage of acidified colostrum were set [8]. Although the usage of exceeding* acidified *colostrum has become more usual in many countries in the end of the 1970s and beginning of the 1980s, later it fell into disuse [9].*

The milk, which is used in calf breeding, may have a different destination, that is, human consumption. The purpose of the present study was to evaluate the use of colostrum silage as milk replacement for calf breed.

MATERIAL AND METHODS

The colostrum was collected through machine milking of Jersey and Holstein cows in farms in southern Rio Grande do Sul, Brazil. The colostrum was kept in 2-liter plastic bottles, all filled up, closed and kept in room temperature (ranges from 2ºC to 35ºC) for fermentation resulting in a product called "colostrum silage". After a period from 21 days to 18 months of fermentation the bottles were opened and the content was used as a replacement for milk to feed the calves. The applicability of colostrum silage as milk replacement was evaluated in thirty-six newborn calves, both males and females, of the Holstein breed. The animals were divided in two groups: one being fed with milk and the other with colostrum silage. The milk group had 14 calves (control) and the silage group 22 animals. All the animals received appropriate sanitary, feeding and handling care in mobile cabins following the recommendation from EMATER/RS.[5] All animals were weighed at birth, as well as in their thirtieth and sixtieth day of age. The weight gains were statistically evaluated using the ANOVA software.

In order to evaluate the microbiological and physicochemical characteristics the samples were collected in 226 mL plastic bottles and kept for fermentation. The samples were analyzed in natura and each every 7 days until 60 days of storage.

To evaluate the microbiota, aliquots de 10µL of colostrum silage, with different periods of fermentation, were inoculated onto the following culture media blood Agar, MacConkey, Chapmann, Man, Rogosa and Sharpe, incubated in aerobiose and microaerophilic for 24 to 48 hours at 37ºC. The culture obtained were submitted to Gram dye and characterized biochemically.

The colostrum and the colostrum silage samples from different fermentation periods were evaluated in duplicate. For the physicochemical we used the methodology described in the Adolfo Lutz Institute Analytical Norms [10]. The parameters evaluated were pH, acidity, lactic acid, protein, dry extract, ashes, fat and lactose. The aspect, color, taste and palatability characteristics were checked through tasting and visual tests performed by the researchers involved in the work.

RESULTS

The microbiological evaluation of the colostrum highlighted the presence of the following bacteria genera Lactobacillus spp; Staphylococus spp; Escherichia spp; Klebisiella spp; Bacillus spp., Serratia spp and yeast. After 21 days of fermentation and up to 18 months of storage only Lactobacillus spp. were isolated from the colostrum silage.

The values of protein, dry matter, humidity and fat evaluated in the initial colostrum were kept during the period of ensiling. However, there was a considerable decrease in the percentage of lactose. The pH values reduced after the fourth day of fermentation followed by an increase in the percentage of lactic acid (Table 1). The fat percentage (6.2%) remained constant for the colostrum *in natura* until the end of the fermentation process.

Table 1: Physical and chemical evaluation of colostrum and colostrum silage

Time	*Protein*		*Lactose*		*pH*		*Humidity*		*Ashes*		*Lactic Acid*	
	Min.	*Max*	*Min.*	*Max*	*Min.*	*Max*	*Min.*	*Max*	*Min.*	*Max*	*Min.*	*Max*
Colostrum	*5,84*	*20,94*	*1,48*	*2,9*	*6,34*	*6,72*	*71,36*	*84,03*	*1,23*	*3,98*	*3,1*	*7,4*
7-day Silage	*4,13*	*19,88*	*0,7*	*2,42*	*3,98*	*4,69*	*72,56*	*85,35*	*1,4*	*3,5*	*8,95*	*20,8*
14-day Silage	*5,6*	*19,2*	*ND*	*1,98*	*3,79*	*4,82*	*72,91*	*87,83*	*1,19*	*3,5*	*11,37*	*28,75*
21-day Silage	*5,68*	*21,53*	*ND*	*1,65*	*3,62*	*4,93*	*71,85*	*85,46*	*0,63*	*2,13*	*10,55*	*22,9*
30-day Silage	*6,36*	*19,45*	*ND*	*1,60*	*3,70*	*4,44*	*71,68*	*85,03*	*1,06*	*2,44*	*11,85*	*24,77*
60-day Silage	*7,5*	*18,98*	*ND*	*ND*	*3,67*	*4,41*	*77,55*	87,36	*1.06*	*2,44*	*23,95*	*33.6*

ND- Undetected levels

Min – Minimum

Max - Maximum

When evaluated sensory characteristics we observed a product of yellowish color, pleasant and salty acid taste with smell characteristic of a milk product. When administered to animals, they accepted the silage with no restriction whatsoever. The colostrum silage used as milk replacer did not present any physiological changes such as diarrhea, weight loss or death. By comparing the weight gain, it has been observed that calves which were fed with the colostrum silage presented a 250-gram ($P< 0.05$) average daily weight gain over the animals fed with milk. The colostrum silage was confirmed as milk substitute, resulting in savings in average 300 liters of milk for each calf being fed and the milk is then sold, resulting in economy and income for the producer.

DISCUSSION

According to FAO[1] in 2014 the world will have an estimated population of 7.7 billion people (with new consumers from the emerging countries), that will have a deficit of 34 billion liters of milk for alimentation. The bovine milk has been used by mankind for years. It is considered a complete food, a basic source of protein being the most appropriate replacement to maternal milk. The deficit calculated by the FAO may be reduced if we stop breed calves with milk, and give this amount to

feed humans. However, to do so we need to develop a natural and economical milk substitute to be used in the calves breeding.

The nutritious value of colostrum has been known since the mid-1950s [11], however, its availability, and preservation are factors which make its usage harder. Since that time conservation forms have been studied such as freezing [12, 13], natural acidification and preservatives[8, 15-18]. Many researches have been developed in order to motivate the usage of bovine colostrum but it fell into desuse in the 1980s due to the difficulty to preserve and store it [9].

The colostrum silage proposed here does not demand refrigeration, freezing or additives, although studies mention the impossibility of preserving the colostrum in temperatures above 30ºC [18]. It was observed that the colostrum silage in temperatures ranging from 2ºC to 35ºC, showed no changes in its initial characteristics. Thus it can be stored for as long as 18 months.

The fermentation process, with a pH decrease for levels around 4.0 was sufficient to inhibit the microorganism identified in the samples of colostrum *in natura*. It was noticed that the only viable bacteria after 21 days up to 18 months was the lactobacilii spp. This observation makes us believe that this is the microorganism responsible for the fermentation process. And also it's important to emphasize that this bacteria genera are used as probiotic in foods for humans and animals [19].

The evaluations of the colostrum silage stored from 21 days to 18 months presented adequate odor, appearance, palatability and acceptance for the calves consumption. Similar results were reported in other studies with acidified colostrum, [16, 17 - 20]. On the other hand, they differ from authors who reported problems concerning the refusal to use acidified colostrum [8, 15].

The colostrum differs from the regular milk mainly due to its high concentration of proteins, minerals, vitamins, fat, total solids and ashes[7]. The content and characteristics of the constituent fresh colostrum are related and several aspects inherent to the animal, such as: breed, individuality, parity, pre birth, and dry period, time postpartum and feeding[8]. Our findings show that even after a 60-day silage period the colostrum keeps the initial percentage values of protein, dry matter, fats and minerals.

The colostrum silage is an adequate substitute for milk, solving the problems found in the literature concerning storage, preservation and usage time. It is a low-cost food, easy to be produced, stored and used and it does not demand special additives or equipment for its elaboration. Besides being an efficient substitute, the colostrum silage presents economical advantages. The producer saves in average 300 liters of milk for each calf being fed and the milk is then sold, resulting in economy and income for the producer. Nowadays there are about 245 million lactating dairy cows in the world [22]. Then, one can estimate that 31 billion liters of milk are needed to feed the newborn calves. Thus, if we use the milk currently directed to the calves breeding for human food, we might

be able to feed 155 million people of milk/day. Therefore, the milk which would be used to feed the animals can now be directed for human consumption. With this study we hope to contribute in order to solve the starvation problem in the world.

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