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**THE EFFECT OF PROBIOTICS ON THE PERFORMANCE OF SUCKLING CALVES FOR THE PERIOD FROM BIRTH UP TO WEANING**

Kipriotis E.A., Kousenidis K.V.
*National Agricultural Research Foundation, (N.AG.RE.F.),*
*Agricultural Research Station of Komotini*
*P.O. Box 63, Komotini 69100, Greece*

*ABSTRACT*. The effect of probiotics given orally to calves, right after birth and after the first colostrum intake and repeated one week later, was studied during a period of 56 days after birth up to weaning, by recording live weight gain, food conversion efficiency, scour symptoms and viability. Calves were given twice orally a boluced culture of *Lactobacillus acidophilus* containing 20 billion living microorganisms concentrated in one capsule. The so treated calves were compared against a control group which was treated by the same way with neutral capsules. Live weight gain in probiotic treated calves was higher against the control (0,53 against 0,48 kg, P≤ 0,05) reflected by same differences in food conversion efficiency which showed lower values for the treated calves over all the experimentation period (8,84-10,54 kg milk/kg live weight gain for the treated calves against 10,13-12,95 kg milk/kg live weight gain for the control group). The scour symptoms, recorded as days of incidence, in the group of treated calves appeared to be lower compared to control (11 days for treated group against 53 days for control). In general, probiotic calves treated right after birth and one week later on, seem to be beneficial on their performance, adding as well the advantage of more effective control of pathogens and the development of a normal and beneficial rumen microflora

*Key words: Suckling calves, probiotics, lactobacillus acidophilus, live weight gain, food conversion, scour symptoms*
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The beneficial effects deriving from the consumption of fermented milk products, which contain big number of lactic acid bacteria, had been very early discussed. Already in 1908, Elias Metchnicof in his book ‘‘The prolongation of life’’ recommended the use of such products for human consumption, underlining their beneficial effects. Later studies indicated that the mentioned beneficial effects were resulted from *Lactobacillus acidophilus* action, a lactic acid bacterium contained in high quantity in the fermented milk products (Speck, 1978). Since then this bacterium has been studied in details concerning its interference to the animal’s intestinal microflora and the disorders deriving from its imbalances and influencing the growth rate, food conversion, food intake and gut pathogeny. In the animal’s digestive tract numerous species of endemic microorganisms exist (Smith, 1965) of both categories, symbiotic and pathogenic. The balance between these two categories mainly depends upon the host animal’s health status, which in many cases permits the harmful microorganisms to take over and cause various disorders. In many studies performed on the digestive tract’s microflora of the domestic animal, serious evidences were found that certain microorganisms, especially the lactic acid bacteria, contri-

bute to the maintenance of a beneficial balance between symbiotic and pathogenic microorganisms, either being as a part of the animal's gut microflora, or given as cultures of them orally to the animal (Fuller, 1977). This result is achieved by these microorganisms through the excretion of antibiotic substances and organic acids, which cause a reduction of the gut's pH. Both these factors act antagonistically to the harmful microorganisms (Savage, 1969, Knarreborg et al., 2002) and promote and maintain a beneficial balance, contributing to the better digestion, the more efficient use of the nutrients and to the suppression of several pathogens action (Hentges, 1992). This situation is very difficult to be maintained, especially under the present practice of intensive production technologies, where animals are continuously exposed to stress conditions deriving from overstocking, sudden nutritional and environmental changes, use of antibiotics and many other factors (Cole et al., 1994). Under such circumstances the harmful microorganisms very often take over and disturb this balance, giving rise to several disorders like poor food conversion, reduced weight gain, diarrheas, susceptibility to secondary infections, - situations which all in very serious cases lead to death (Chopra, 1963, Lee et al., 2000). The presence of lactic acid bacteria in the gut, in quantity able to suppress the dominance of the pathogens, had been studied in details (Rosenburg, 1975, Fuller, 1977) and it was proved that it could contribute to the prevention of such conditions. In contrast to that it was found (Miller et al., 1971, Shahani et al., 1978) that in absence of lactic acid bacteria in the animal's gut, some microorganisms break down the food proteins with formation of non absorbable components, which in addition promote the multiplication of the pathogens and the appearance of diarrhea symptoms. The tool which seems to be provided by the lactic acid bacteria and counteracts to these situations, as it was mentioned above, is the secretion of antibiotic substances by them and the reduction of the gut's pH, both factors act very antagonistically against the pathogens (Shahani et al., 1978, Speck, 1972). The above observations led to study aimed to explore this phenomena by either providing orally to the animals several antibiotic substances, or directly some microorganisms producing such substances (Schvarz et al., 2001). The use of probiotics in animal nutrition is a well established practice aimed to enforce the prophylactic barrier against gastrointestinal disorders, as well as the promotion of growth through improved efficiency of feed conversion, a practice which was studied by many scientists (Ellinger et al., 1980, Gillilland et al., 1981, Aldrovandi et al., 1984, Watkins et al., 1984, Chesson, 1994, Johnson et al., 1985).

In general, a great number of authors have attempted to investigate the efficiency of probiotics as feed additives, especially for young animals. Most of them conclude that the oral administration of lactic acid bacteria results in a systemic augmentation of the immune response of the animals, but some of them report a limited improvement in live weight gain.

In calves a normal rumen flora is established around the sixth week of age, combined to the simultaneous development of the animal's own immune system. This situation allows at earlier stages the development of other pathogenic microorganism populations, some of which, like *Escherichia coli*, lead the calves to severe scouring, growth depression, and in serious cases to death. Several antibiotics are known to treat or prevent such situations, but in the case of ruminants they cause disturbances in the rumen normal microflora and also the depression of the animal's own immune system. Probiotics, such as *Lactobacillus acidophilus*, have been also used for the same purpose, without the abovedescribed side effects. Such probiotics are typically administered either in the feed, or

directly into digestive tract, orally in the most cases and their use has been shown to significantly improve the gut environment in context of its flora population, resulting in amelioration of general health status and animal performance. In the present work it was attempted to study the effect of probiotics given orally to calves in two doses, one at birth, after the first colostrum intake and the second one week later, on their performance during the suckling period and up to weaning.

Thirty two (32) new born Holstein calves had been used in the experiment during 8 week period, housed individually in slatted cages with a floor area of 1,44 $m^2$ each (1,2 x 1,2 m) situated in a well insulated brick building, under natural ventilation. The calves formed two groups of 16 animals each, with equal number of males and females, randomly distributed among the cages. One group (16 animals) was treated orally, right after birth and after the first colostrum intake, with a *Lactobacillus acidophilus* culture, given as a bolus concentrated in one capsule (the commercial product Biomax BC, Hansen's Biosystems, Denmark) containing 20 billion living microorganisms (C.F.U., colony forming units). The procedure was repeated one week later. The other group, used as control, was treated the same way, at the same times with neutral boluses in order to induce the same stress. The calves of both groups during the first 24 hours after birth were bucket - fed by colostrum, milked from the calving cows of the herd and then were bucket - fed again with fresh cow's milk, coming from the herd's lot, on a basis of 10% of body weight daily, given at 3 equal doses three times daily (07.00 am, 14.00 pm, 21.00 pm).

*Table 1*. ***Recorded and calculated parameters***

| Parameters | *Treatment* | Control |
|---|---|---|
| **Mean birth weight, kg** | 37.63 | 39.86 |
| 2nd week (14 days) mean weight, kg | 42.62 | 44.17 |
| Mean weight gain up to 14 days, kg | 4.99 | 4.31 |
| Mean daily weight gain up to 14 days, kg | 0.36 | 0.31 |
| Feed/gain ratio, kg milk/kg weight gain up to 14 days | 10.54** | 12.95** |
| 4th week (28 days) mean weight, kg | 50.34 | 50.11 |
| Mean weight gain up to 28 days, kg | 12.71** | 10.25** |
| Mean daily weight gain up to 28 days, kg | 0.45** | 0.37** |
| Feed/gain ratio, kg milk / kg weight gain up to 28 days | 8.84** | 11.77** |
| 6th week (42 days) mean weight, kg | 57.59 | 57.91 |
| Mean weight gain up to 42 days, kg | 19.96** | 18.05** |
| Mean daily weight gain up to 42 days, kg | 0.48** | 0.43** |
| Feed/gain ratio, kg milk/kg weight gain up to 42 days | 9.16** | 10.57** |
| 8th week (56 days) mean weight, kg | 67.03 | 66.69 |
| Mean weight gain up to 56 days, kg | 29.40 | 26.83 |
| Mean daily weight gain up to 56 days, kg | 0.53 | 0.48 |
| Feed/gain ratio, kg milk / kg weight gain up to 56 days | 8.96 | 10.13 |

** Differences statistically significant ($P \leq 0,05$)

The daily provided milk quantities were recorded individually for each calf and all the non consumed amounts were collected and recorded for the calculation of the total milk

consumption and food conversion efficiency for each animal. Free access to fresh drinking water was provided with non-chlorinated water, pumped out of a well, in order to avoid any bacteriostatic action of chlorine. During the experiment any diarrhoea incidence was recorded as ‘’ diarrhoea day’’ and in any case no antibiotics were used, in order to avoid any inhibition of the lactobacillus action. The body weight was recorded at two week intervals, thus five times during the experiment (at birth and at day 14, 28, 42, 56) and the weight gains were calculated and the food conversion efficiency was estimated on the basis of the weight gain and the consumed milk quantities. The results were statistically analysed by analysis of variance using the Microsoft Excel software.

As it appears in table 1, the probiotic and control groups entered the study with mean birth weights 37,63 and 39,86 kg respectively, i.e. the probiotic group showed an advantage to the control group, giving 2,23 kg higher mean birth weight. During all the experimental period the probiotic treated calves showed higher weight gains (table 1 and figures 1 and 3) calculated in two week intervals. This situation lead this group to overcome the initial difference and to reach at the end of the 4$^{th}$ week the mean body weight values recorded in control group (50,34 kg versus 50,11 kg in control group). The probiotic treated group kept this balance until the 6$^{th}$ week (57,59 kg versus 57,91 kg in control group) and at the end of treatment period (8$^{th}$ week) reached higher final body weight (67,03 kg versus 66,69 kg in control group), though without giving statistical significance. The above described body weight progress of probiotic treated calves was a result of a more efficient feed utilization and conversion (figure 2) observed through the entire experimental period, with higher daily weight gain values (figure 3).

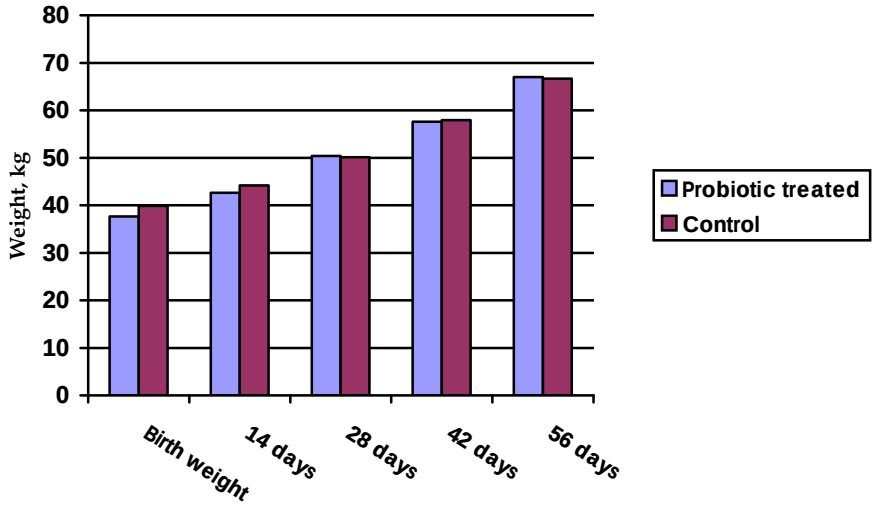


*Figure 1. Body weight progress during experiment*

In the data presented in table 1 and figure 2 there are continuous lower food/gain values (F.C.E.) for the probiotic treated calves, calculated in two week intervals. For the first two week period F.C.E. was 10,54 kg milk/kg live weight gain for the treated calves, against 12,95 kg milk/kg live weight gain for the control group, the difference being statistically significant ($P \leq 0,05$) and the same differences were observed through all the experimental period (8,84 versus 11,77 kg milk/kg live weight gain at the 4$^{th}$ week and

9,16 versus 10,57 kg milk/kg live weight gain for the 6th week). Such difference was not observed later at the end of experiment on the 8th week, when the values were 8,96 versus 10,13 kg milk/kg live weight gain in treatment and control group respectively, the difference being statistically not significant.

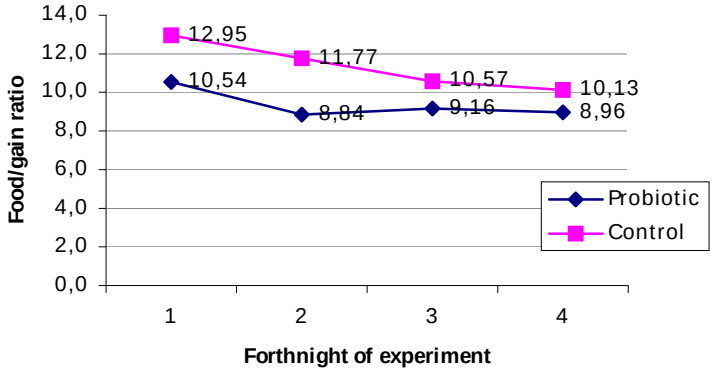


*Figure 2. Dynamics of feed (milk) conversion efficiency during experiment*

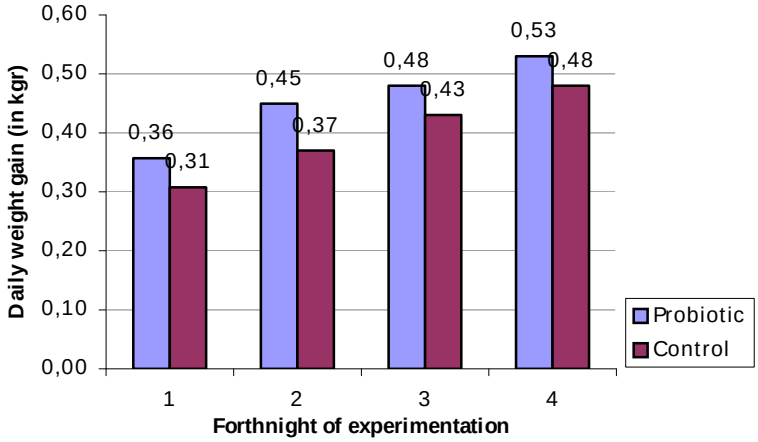


*Figure 3. Daily weight gain of calves*

This more efficient food utilization and conversion was reflected in higher weight gains recorded in treated group (table 1 and figure 3), which gave to this group the ability to overcome the initial lower mean body weight and reach higher final values. Already in the first two week period the treated calves had a mean daily weight gain of 0,36 kg, against 0,31 kg in control group, leading to a mean total weight gain during this period 12,71 kg against 10,25 kg respectively, the difference being statistically significant ($P \leq 0,05$). The same differences were observed through the rest of experimental period up to 42nd day, with daily gain 0,45 versus 0,37 kg during 4th week and 0,48 versus 0,43 kg at the 6th week. The situation again changed during the last two weeks and the values of daily gain for that period were 0,53 versus 0,48 kg at the 8th week, the difference being sta-

tistically non significant. Using mean total weight gains there was the same picture, with gains of 12,71 kg in treated group at the end of the 4$^{th}$ week of experiment, against 10,25 kg in control group respectively. The values for the next fortnight were 19,96 versus 18,05 kg (6$^{th}$ week) the differences being continuously significant ($P \leq 0,05$). For the last two weeks the values were 29,40 kg for the treated calves against 26,83 kg for the control group (8$^{th}$ week), the difference being statistically non significant. The data presented in figure 2 and 3 indicate that the differences between the treated calves and the control ones tend to be smaller after week 5 and 6 of the experiment. Taking into account that the normal development of the calve's own immune system reaches satisfactory levels around this period, there might have been an amelioration in the control of the gut microflora, which in turn results in better health status of the control group, as well in better F.C.E. values and higher weight gains compared to the previous ones.

Another parameter that appears to be interesting in this experiment is the appearance, the severity and the mean duration of the scours symptoms, expressed as days per case all over the experiment in the treated and non-treated calves, which in some manner indicates the severity of the symptoms. From table 2 we can see that the mean duration of the mild symptoms were 8 days for the probiotic treated calves against 4 days for the control, although difference was non significant. On the other hand, the control group had 49 days of severe scour symptoms against only 3 days for treated calves, the difference being very significant which can most possibly explain the better F.C.E. values and the higher weight gains in probiotic treated animals.

***Table 2.*** *Scour symptoms (in days) during experimentation*

| Group | Severity of symptoms | | |
|---|---|---|---|
| | mild | severe | total scour days |
| Probiotic treated | 8 | 3 | 11 |
| Control | 4 | 49 | 53 |

As it comes out from the above described and analyzed data, probiotic treatment of calves right after birth and one week later, seems to be beneficial to their performance all over the period up to their weaning. Live weight gain and food conversion are promoted and health status seems to be better based on diarrhea incidences, although in this work no mortality had occurred in both groups. So, the probiotic treatment can be considered as beneficially acting upon the performance, food utilization and health status in calves.

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