Scientific Works. Series C. Veterinary Medicine. Vol. LXI (2)
ISSN 2065-1295; ISSN 2343-9394 (CD-ROM); ISSN 2067-3663 (Online); ISSN-L 2065-1295

# INFLUENCE OF PROTEIN RESTRICTION IN CALVES AFTER WEANING ON CONSUMPTION, WEIGHT GAIN AND FEEDING EFFICIENCY

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***Abstract***

*The study was done on 40 Holstein calves after weaning and followed the effects of lower protein level of rations on some breeding parameters. It was a pre-experimental period of 3 weeks, when all animals were fed by classic rations, reaching about 87 kg body weight.*
*The experience was conducted in two periods of 12 and 10 weeks, respectively. In the first period, the animals were divided in two experimental groups (20 cap. each one), one fed a normal protein level in ration (NP) and the other with a low protein level in ration (LP). In the 2nd period, the animals were divided in 4 experimental groups: NP_NP (normal protein level in both periods of experience), NP_LP (normal protein level in the first period and low in the second), LP_NP (low protein level in the first period and normal in the second) and LP_LP (low protein levels in both experimental periods).*
*Calves were fed ad libitum by a corn-silage-based compound diet. The latter had 20% CP (in DM) in NP diet or 10% CP in LP diet. The entire ration had 14.7% CP (in DM) in the normal situation and 9% CP if protein was restricted.*
*In terms of reducing the level of protein, decreases feed intake, lowest in group LP_LP, 72.2 g DM/kg $kg^{0.75}$ during the 2nd period.*
*LP_NP group recorded, in the second part of the experience, the greatest increase in weight, 1329 g/day, as against (?) NP_NP group, 1131 g/day, and a difference between the two groups (which ones?) of 17.5%, which demonstrates the compensatory growth. The whole experience, considering the weight gain of NP_NP group (1118 g/day) a reference element (100%), NP_LP group achieved 71%, LP_NP achieved 72% and LP_LP group achieved only 34%.*
*Regarding the specific consumption of protein in the whole experience, it was 563 g CP/kg gain in group NP_NP and 793 g CP/ kg gain in group LP_NP.*

***Key words****: calves, protein restriction, consumption, gain, efficiency.*

## INTRODUCTION

For economic reasons, farmers may bring animals to a temporary feed restriction, quantitative or qualitative (including protein). The question is related to the effects of this approach.
Low protein level would result in favourable effects, like reduction in the cost of feeds and decreasing the amount of nitrogen excreted. There may be adverse consequences, such as decreased growth of animals (Yambayamba et al., 1996; Tolla at al., 2003), decreased feed efficiency (Kamalzadeh et al., 1997; Singh et al., 2008) and carcass quality (Barash et al., 1998; Rossi et al., 2001).
However, many studies show that after a period of feed restriction, including protein, followed by a period in which returns to a level considered normal, animals can recover, at least partially, "delay" by <compensatory growth>, depending on the nature, severity, length, of restriction a.s.o. (Hoch et al., 2003).
In this paper we aimed to quantify the effects of temporary moderate protein restriction for Holstein calves on growth parameters, such as feed consumption, weight gain and feeding efficiency.

## MATERIALS AND METHODS

The study was conducted on 40 Holstein weaned calves at about two months. In a pre-experimental period of 3 weeks, all animals were fed the same rations considered normal, animals reaching about 87 kg.
The experience was conducted in two periods of 12 and 10 weeks. In the first period two groups of animals (20 capita each one) were used, one fed a normal protein level diet (NP) and the other fed by a low protein level diet (LP). In the second period there were four groups of animals: NP_NP (normal protein level in both periods of experience) NP_LP (normal protein level in the first period and low in the second), LP_NP (low protein level in the first period and normal in the second) and LP_LP (low protein level in both periods of the experience).
Calves were individually fed *ad libitum* with corn silage and compound feed (CoF). Compound feed had 20% CP in DM in the normal situation and 10% CP in DM when restriction was applied. In the same situations, in full rations were 14.7% CP in DM and 9% CP in DM.

## RESULTS AND DISCUSSIONS

In Table 1 is presented the compound feed structures.
Reduction the protein level in compound feed with low protein was done by excluding soybean meal in structure.

Table 1. Compound feed (CoF) structures (%)

| Specification | CoF with normal protein level | CoF with low protein level |
|---|---|---|
| Maize | 63.88 | 86.02 |
| Peas | 10.00 | 10.00 |
| Soybean meal | 22.43 | - |
| Dicalcium phosph. | 0.52 | 0.93 |
| Calcium carbonate | 2.17 | 2.05 |
| Min.-vit. premix | 1.00 | 1.00 |

In Table 2 is presented feed's nutritive values.
Energy nutritive value was expressed in MFU (Meat Fodder Unit), protein nutritive values in CP (Crude Protein), IDPN (Intestinally Digestible Protein permitted by Nitrogen) and IDPE (Intestinally Digestible Protein permitted by Energy) and mineral nutritive values in Calcium and Phosphorus (Nicolae et al., 1993; Dragomir et al., 2001).
Crude protein content of the two types of compound feed was 19.9% in DM, respectively 10.3% in DM.

Table 2. Feed's nutritive values (related to 1 kg DM)

| Specification | Maize silage | CoF with normal protein level | CoF with low protein level |
|---|---|---|---|
| MFU | 0.80 | 1.17 | 1.17 |
| CP (g) | 69 | 199 | 103 |
| IDPN (g) | 42 | 101 | 78 |
| IDPE (g) | 65 | 102 | 93 |
| Ca (g) | 2.0 | 11.0 | 11.0 |
| P (g) | 1.8 | 5.5 | 5.1 |

In Table 3 and Table 4 we presented the food intake, on the two parts of experience, on whole experience, on the feed ingredients of rations and of the total rations.

Table 3. Feed consumption in the first part of the experience

| **Specification** | **Group PN** | **Group PR** |
|---|---|---|
| Maize silage intake (g DM/day) | 1350 | 1087 |
| Compound feed intake (g DM/day) | 2070 | 1727 |
| Total intake (g DM/day) | 3420 | 2814 |
| Total intake (g DM/kg$^{0.75}$) | 87.3 | 71.9 |
| Share silage in DM rations (%) | 39.5 | 38.6 |

In the second period of the experience, the highest total consumption was recorded in the group PR_PN, with 109.2 g DM/kg$^{0.75}$, and lowest in the group PR_PR, with 72.2 g DM/kg$^{0.75}$ (close value was recorded in the group PN_PR, with 77.1 g DM/kg$^{0.75}$).
The whole experience, are registered a maximum total consumption in group PN_PN, with 91 g DM/kg$^{0.75}$ (very closely group PR_PN, with 88.8 g DM/kg$^{0.75}$) and a minimum in group PR_PR, with 72 g DM/kg$^{0.75}$.
Results gave the same trend communicated and other authors (Kamalzadeh et al., 1997); Grimard et al., 1998).

Table 4. Food intake in the second part and whole experience

| **Second part of exper.** | **Group PN_PN** | **Group PN_PR** | **Group PR_PN** | **Group PR_PR** |
|---|---|---|---|---|
| Maize silage intake (g DM/day) | 2275 | 1898 | 2525 | 1752 |
| Compound feed intake (g DM/day) | 3135 | 2478 | 3668 | 2345 |
| Total intake (g DM/day) | 5410 | 4376 | 6193 | 4097 |
| Total intake (g DM/kg$^{0.75}$) | 95.4 | 77.1 | 109.2 | 72.2 |
| Share silage in DM rations (%) | 42.1 | 43.4 | 40.8 | 42.8 |
| **The whole experience** | **Group PN_PN** | **Group PN_PR** | **Group PR_PN** | **Group PR_PR** |
| Maize silage intake (g DM/day) | 1770 | 1599 | 1741 | 1389 |
| Compound feed intake (g DM/day) | 2554 | 2255 | 2609 | 2008 |
| Total intake (g DM/day) | 4325 | 3855 | 4350 | 3397 |
| Total intake (g DM/kg$^{0.75}$) | 91.0 | 82.7 | 88.8 | 72.0 |
| Share silage in DM rations (%) | 40.6 | 41.2 | 39.6 | 40.5 |

In Table 5 and Table 6 are presented weight gains. In first part of the experience group PN recorded a gain of 1107 g/day and group PR recorded 371 g/day.

Table 5. Weight gains in the first part of the experience

| **Specification** | **Group PN** | **Group PR** |
|---|---|---|
| Initial weight (kg) | 86.5 | 87.7 |
| Final weight (kg) | 179.5 | 118.9 |
| Average daily gain (g) | 1107 | 371 |

Table 6. Weight gains in the second part and whole experience

| ***Second part of exper*** | ***Group PN_PN*** | ***Group PN_PR*** | ***Group PR_PN*** | ***Group PR_PR*** |
|---|---|---|---|---|
| Initial weight (kg) | 178.4 | 180.6 | 119.3 | 118.5 |
| Final weight (kg) | 257.6 | 209.4 | 212.3 | 145.6 |
| Average daily gain (g) | 1131 | 411 | 1329 | 387 |
| **The whole experience** | **Group PN_PN** | **Group PN_PR** | **Group PR_PN** | **Group PR_PR** |
| Average daily gain (g) | 1118 | 791 | 806 | 378 |

In the second part of the experience, group PR_PN had the highest weight gain, with 1329 g/day, exceeding the group PN_PN (which can be considered control group) with 17.5% (therefore this group manifested compensatory growth). Between groups PN-PR and PR_PR (with the smallest increases in weight), 411 g/day, respectively 387 g/day the differences are minimal.

For the whole experience, the highest weight gain is recorded in group PN_PN, reference group, with 1118 g/day, followed by PN-PR and PR-PN groups, with gain values of 791 g/day and 808 g/day respectively, close to each other (not matter in which period there was restriction), and the end group PR-PR, with 378 g/day.

Therefore, the group that was continued protein restriction, weight gain was more than two times lower compared to the situation when the restriction was applied in one of the periods of experience and 3 times lower compared to the situation in which the protein was provided at a normal level for the entire experience.

The same trend is also Barash et al., 1998 and Rossi et al., 2001.

In Table 7 and Table 8 are given specific consumption of diets and in Table 9 and Table 10 specific consumption of protein, in kg DM/kg gain, respectively in kg CP/kg gain.

Table 7. Diet specific consumption in the first part of the experience

| **Specification** | **Group PN** | **Group PR** |
|---|---|---|
| Consumption DM by ration (g/day) | 3420 | 2814 |
| Specific consumption diet (kg DM/kg gain) | 3.09 | 7.58 |

Table 8. Diet specific consumption in the second part and whole experience

| **The second part of the experience** | **Group PN_PN** | **Group PN_PR** | **Group PR_PN** | **Group PR_PR** |
|---|---|---|---|---|
| Consumption DM by ration (g/day) | 5410 | 4376 | 6193 | 4097 |
| Specific consumption diet (kg DM/kg gain) | 4.78 | 10.65 | 4.66 | 10.59 |
| **The whole experience** | **Group PN_PN** | **Group PN_PR** | **Group PR_PN** | **Group PR_PR** |
| Consumption DM by ration (g/day) | 4325 | 3855 | 4350 | 3397 |
| Specific consumption diet (kg DM/kg gain) | 3.87 | 4.88 | 5.39 | 8.98 |

Table 9. Protein specific consumption in the first part of the experience

| **Specification** | **Group PN** | **Group PR** |
|---|---|---|
| Consumption protein by ration (g CP/zi) | 505 | 419 |
| Specific consumption protein (kg CP/kg gain) | 0.456 | 1.129 |

Table 10. Protein specific consumption in the second part and whole experience

| **The second part of the experience** | **Group PN_PN** | **Group PN_PR** | **Group PR_PN** | **Group PR_PR** |
|---|---|---|---|---|
| Consumption protein by ration (g CP/zi) | 781 | 624 | 904 | 588 |
| Specific consumption protein (kg CP/kg gain) | 0.691 | 1.518 | 0.680 | 1.519 |
| **The whole experience** | **Group PN_PN** | **Group PN_PR** | **Group PR_PN** | **Group PR_PR** |
| Consumption protein by ration (g CP/zi) | 630 | 559 | 639 | 496 |
| Specific consumption protein (kg CP/kg gain) | 0.563 | 0.707 | 0.793 | 1.311 |

Figure 1 show, in relative terms, specific consumption of dry matter and protein.
Trend recorded in weight gains appear and specific consumption (of feeds or protein) as noted and Clark et al., 2007 and Bailey et al., 2008. Extreme values are recorded all at extreme groups (PN_PN and PR_PR) and intermediate values all at intermediate groups.

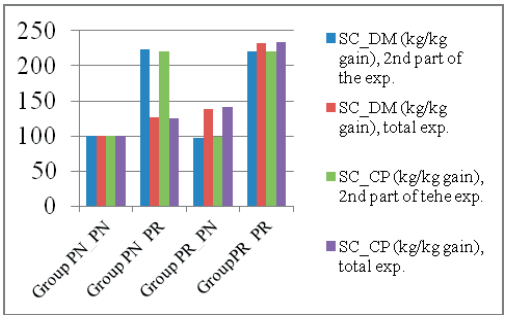


Figure 1. Relative specific consumptions in the second part and total experience (100% = group PN_PN)

## CONCLUSIONS

Throughout the whole experience, the highest consumption was recorded in group PN_PN (which can be considered the reference group), 91 g DM/kg$^{0.75}$. There followed, in descending order, PR-NP groups, PN_PR and PR_PR, with 88.8, 82.7 and 72 g DM/kg$^{0.75}$.
Also on the whole experience, from the same group PN_PN recorded the largest increase in weight, 1118 g gain/day. Next, in order PR-NP, and PR_PR PN_PR groups, with 806, 791 and 378 g gain/day.
The order in the efficiency of feed utilization, given by the amount of feeds and protein consumption to submit a kilo in weight, is the same: PN_PN, PR-NP, PN_PR and PR_PR. Therefore, an induced protein restriction has no favourable effect on the effectiveness of the feeding of the entire experimental period.
Restricting protein in the first part of the experience, as against the second part, had favourable effects on feeds consumption and specific consumption ($P < 0.01$) and insignificants effects on weight increases.

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