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EFFECTS OF HORNS ON PRODUCTION AND REPRODUCTION EFFICIENCY IN ROMANIAN BLACK AND WHITE DAIRY COWS - PRELIMINARY STUDY

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Abstract

The widely growing interest in animal welfare has placed many livestock production practices such as disbudding or dehorning, under enhanced scrutiny. Disbudding is a commonly applied procedure that eases the management of cattle, having welfare implications given that the integrity of the animal is impaired. Aim of this study was to evaluate the effects of horns on production and reproduction efficiency and welfare of dairy cows. A total of 34 Romanian Black and White cows managed under identical conditions, were either horned (n = 17) or polled as a result of disbudding as calves (n = 17) and kept mixed, being housed in tied stanchion barns. Horns presence significantly influenced ($p \leq 0.05$) body condition score, with horned cows having higher fat deposits and maintaining better condition during lactation, compared to polled animals. However, no significant influence ($p \geq 0.05$) of horns was found on fertility traits, coat cleanliness, mastitis and retained placenta incidence or integuments alterations.

***Key words**: animal welfare, calves disbudding, cattle dehorning, dairy cattle, polled cows.*

INTRODUCTION

During natural selection horns have provided advantages concerning defence and competition for resources (Knierim et al., 2015). Throughout the last decade the selection of cattle shifted towards practices such as polledness, disbudding representing a widely accepted welfare concern, given that animals experience high levels of pain (Gavojdian et al., 2018). Throughout history, presence of horns was appreciated and included in selection (especially in heritage breeds such as Hungarian or Italian grey breeds), given the additional advantage that age of the animal can be estimated by counting the surface rings (Knierim et al., 2015). Dehorning is defined as the removal of horns in older animals, whereas disbudding is generally defined as removal of horns in calves of up to 2 months of age. Surgical treatment such as dehorning is welfare relevant for various reasons (Winckler et al., 2002). Calves disbudding or cattle dehorning are regarded as a common and undesirable procedure in dairy farming, since that, in horned cows head butts and fast head movements are a risk of injuries for other herd mates and also for the stock-people (Cozzi et al., 2015). Nowadays, almost all dairy cattle are dehorned as calves to avoid injuries (Windig et al., 2015). The phylogenetic functions of horns in cattle can include a benefit for males, regarding competition for mates under natural selection (Bro-Jorgensen, 2007), moreover, horn size was showed to express health and fitness in African bovines (Ezenwa and Jolles, 2008). However, these phylogenetic functions are not relevant under the current livestock systems, given the wide use of artificial inseminations in dairy cattle and the single bull mating system used in beef production. Dehorning was showed to cause behavioural, physiologic and neuroendocrine changes in cattle (Stock et al., 2013). Up-to-date, more than 80% of the European dairy cattle are dehorned or disbudded, in most cases without the use of pain relief medication (De Boyer des Roches et al., 2014), this being a clear animal welfare issue affecting the cows integrity. A reliable and feasible solution could be represented by the introgression of polledness genes from Aberdeen Angus breed to specialised dairy breeds (Windig et al., 2015). The alternative is to breed polled cattle that do not develop horns and therefore do not require to be dehorned (Prayaga, 2007; Gotz et al., 2015). A lower percentage of cattle reared in tie-stall systems, compared to loose housing systems are dehorned (Cozzi et al., 2015).

Significant efforts for artificial selection were made for the reduction of horns frequency, with a special focus on the use of genetically polled cattle strains. This is limited given the lower number of polled AI bulls available commercially and restraints of farmers to use bulls that have generally lower estimated breeding values (Knierim et al., 2015). Given that, polled Holstein-Friesian derived breeds were shown to have lower average genetic merit than their horned contemporaries (Cole et al., 2019). However, previous studies on breeding programs to produce genetically polled bulls have been successful in the Fleckvieh (Gotz et al., 2015) and the Charolais breeds (Windig et al., 2015).

The overall objective of this preliminary study was to evaluate the effects of horns on production and reproduction efficiency and welfare of dairy cows housed in tied stanchion barns, when milk yield attributes and reproduction outputs are concerned.

MATERIALS AND METHODS

Animal management

The preliminary study was performed at the Research and Development Institute for Bovine Balotesti (44°36′46″N 26°4′43″E) Romania, (altitude of site 92 m), where 34 (17 horned and 17 polled) purebred Romanian Black and White cows (Holstein-Friesian group, Bălţată cu Negru Românească national name) were raised under identical conditions. Cows taken into study were between 1^{th} and 4^{th} lactation, during the summer of 2020. Animals were kept in a tie-stall barn (170/85 cm), using wheat straws as bedding, having *ad libitum* access to water, mineral blocks and during warm weather had access to outside paddocks (8 m^2/head, maximum 12 hours/day). The feeding line outside was not individualized, cows competing for access to feed, ensuring minimum 0.75 cm/head. Cows were milked twice per day in the barn (starting at 5:00 and 17:00), with individual milking machines and received a daily feed ration of 35 kg corn silage, 6 kg of alfalfa hay and 7 kg of concentrates. Concentrates were fed exclusively inside the barn, after milking. Dehorning was carried out at the age of up-to two months, only on 17 female calves. The two groups were formed through unrandomized selection from the herd, with age, weight and parity balanced. A data-set from 34 animals, with 13 parameters per cow was taken into account and analysed for estimation of the effects concerning the presence of horns on production and reproduction outputs.

Data collection and statistical analysis

Milk yield per milking session (kg) and milk duration (minutes) together with ID tag number, were collected directly by one observer in the barn during the milking procedure. The average milking speed (kg/min) was obtained by fractioning production to time spent milking. Milk production per lactation was taken from the results of the official performance recordings, and standardized for the first 100 days in milk (100 DIM) and mature equivalent (cow's parity), using correction coefficients (Cziszter et al., 2016). Body condition score (BCS) was recorded on the same day, using a scale from 1 (severe under-conditioning) to 5 (severe over-conditioning) in increments of 0.5 (Kock et al., 2018). Cleanliness of udder, rump and hind legs (scores 0 - no dirt or minor splashing, 1-intermediate or 2 - separate or continuous plaques of dirt) were evaluated for each individual cow according to WelfareQuality® (2009) protocol for dairy breeds. The body weight of cows was measured using a weight tape. Reproductive outputs of the cows were recorded by the research institute's veterinarian and technicians. Worth mentioning is that the calving interval (CI) was calculated as the difference in days between the last lactation and the start of the penultimate. Mastitis and retained placenta incidences were recorded from the experimental farm health registers, while the tarsal joint lesions incidence was evaluated during the horn presence assessment of animals. All the statistical inferences were carried out using comparisons between the 2 horn classes (phenotypes) using Minitab software (Minitab LLC®). Decisions about the acceptance or rejection of the statistical hypothesis have been made at the 0.05 level of significance

RESULTS AND DISCUSSIONS

The phenotype of cows significantly influenced body condition score (p-value = 0.017), with the horned cows having higher fat deposits, compared to polled cows. However, no statistically significant influence was found on milk yield (p-value = 0.782), body weight (p-value = 0.809) or milking speed (p-value = 0.863) (Table 1).

Current results regarding the influence of horned/polled phenotype on body condition score (BCS) might be attributed to the fact that polled cattle are generally regarded to be less aggressive when competing for feed and resources, compared to their horned counter-parts. Similar to our findings, Knierim et al. (2015) reported a decreased risk of injury in polled cows, this being corelated with a lower social position in horned-polled mixed herds.

On the contrary, Gavojdian et al. (2018) found no correlations between phenotype classes and BCS in Fleckvieh dual-purpose cows.

Milk yield and milking speed were not influenced by the phenotype (p>0.05). Current results are not in accordance with those published by Gehrke et al. (2016) and Gavojdian et al. (2018), which reported that polled German Holstein and Fleckvieh dual-purpose cows had lower milk yields than their horned contemporaries, both authors attributing the differences to the social hierarchy of cows. Alongside the lower milk yield of the dairy cows, Dressel et al. (2016) found that polled German Holsteins bulls had lower breeding values for milk yield.

The body weight of cows was not influenced (p>0.05) by the horned phenotypes. Previous studies outlined that in hornless herds, body weight is the main influencing parameter concerning social rank (Lanaeta-Hernandez et al., 2013), while in horned herds, cows age and experience are the main influencing factors (Knierim et al., 2015). Holand et al. (2004) found a correlation between body weight and social rank in polled herds.

Lack of differences in the parameters of cows from the two phenotypes in the current study could be explained by the feeding regime under tied stanchion barn, where competition for feed was significantly reduced between the individual cows. Moreover, Windig et al. (2015) reported that horned animals are better adapted for the tie stalls and it seems more practical to reintroduce polledness phenotypes only in loose housing systems. Several studies have shown that polled and horned cattle have similar genetic merit for calving ease, health traits, growth rates, and reproduction traits, thus results from previous studies were made both on horned/dehorned cows and horned/ genetically polled animals (Lamminger et al., 2000), with no differences among them.

Table 1. Milk yield, body weight, body condition score (BCS) and milking speed in horned and polled cows (mean ± SEM)

Phenotype	Milk yield (kg/100 DIM)	Body weight (kg)	BCS (1-5)	Milking speed (kg/min)
Horned	3195.0 ± 194.00[a]	688.7 ± 29.00[a]	3.02 ± 0.24[a]	1.58 ± 0.162[a]
Polled	3271.0 ± 182.00[a]	691.5 ± 23.20[a]	2.17 ± 0.205[b]	1.59 ± 0.136[a]

[1]DIM=days in milk; [2]SEM - standard error of the mean; [3]Column means with different superscript differ significantly at p≤0.05.

Regarding the effects of horns on reproduction efficiency, no significant influence of the phenotype (horned/polled) was found for the following parameters: number of inseminations per gestation (p-value = 0.782), calving interval (p-value = 0.733), age at first calving (p-value = 0.986) or retained placenta incidence (p-value = 0.389) (Table 2).

Number of inseminations per gestation (AI) was not influenced (p>0.05) by the horned phenotype in our study. Current results are in accordance with those previously published by Gavojdian et al. (2018), which found no correlations between horn status and the number of AI/gestation in dual-purpose cattle. There are previous reports in the un-scientific literature that polled dairy cattle have reduced fertility compared with their horned counterparts (Cole et al., 2019). Calving interval was not influenced by existence/absence of the horns ($p>0.05$), however, the calving interval was shorter with 70 days in horned cows, when compared to polled animals. Age at first calving was not influenced by the horn phenotype of cows ($p>0.05$) nor did the retained placenta incidence ($p>0.05$), although, polled cows had higher incidences of retained placenta, when compared to horned animals.

Table 2. AI/gestation, calving interval, age at first calving and retained placenta in horned and polled cows (mean ± SEM)

Phenotype	AI/gestation	Calving interval (days)	Age at first calving (months)	Retained placenta (%)
Horned	3.0 ± 0.48[a]	472.6 ± 31.60[a]	28.3 ± 1.43[a]	5.8 ± 5.88[a]
Polled	2.2 ± 0.36[a]	542.5 ± 59.80[a]	28.5 ± 1.09[a]	23.5 ± 10.60[a]

[1]AI = artificial inseminations; [2]SEM - standard error of the mean; [3]Column means with different superscript differ significantly at $p\leq0.05$.

No significant influence of the horn phenotype was found on integuments alterations, such as the tarsal joint lesions incidence (p-value = 0.389), mastitis incidence (p-value = 0.782), cleanliness of udder (p-value = 0.406), cleanliness of rump (p-value = 0.828), cleanliness of hind legs (p-value = 0.750) (Table 3).

Tarsal joint lesion incidence was not influenced ($p>0.05$) by the phenotype horn status. Pilz et al. (2006), cited by Knierim et al. (2015), reported that some farmers believe that polled animals tend to have a higher lameness incidence, which could be linked with the tarsal joint lesions. Mastitis incidence was not influenced ($p>0.05$) by the phenotype, although polled cows expressed a higher mastitis incidence, this might be attributed to udder injuries caused by the horn thrusts. Knierim et al. (2015) found some consequences regarding horn thrusts, which translates into visible blood traces in milk, having further economic implications. Cleanliness of the rump, udder and of hind legs were not influenced ($p>0.05$) by the phenotype (horned/polled). Numerous studies stated that horns may be used during self-grooming of cow body regions which are otherwise out of range (Knierim et al., 2015).

Further studies, on a greater number of animals and a more diverse range of rearing systems is advised, especially in organic production registered dairy farms, where removal of horns is not recommended and has a low level of acceptance among the consumers and policy-makers.

Having in mind the current results, keeping mixed herds of horned-polled adult cows is not advisable, given the social hierarchy structure of cattle and the intense competition of the animals for resources (feed, resting space, water, shade, etc.). Moreover, horns presence is expected to have a greater impact in loose housing systems and there where the stocking density is high, compared to the current setting, where cows were fed their concentrates indoors, and the competition for feed was significantly reduced.

Table 3. Tarsal joint lesion, mastitis incidence cleanliness of rump, cleanliness of the udder and cleanliness of hind legs in horned and polled cows (mean ± SEM)

Phenotype	Tarsal Joint Lesion (%)	Mastitis (%)	Cleanliness of rump (0-2)	Cleanliness of udder (0-2)	Cleanliness of hind legs (0-2)
Horned	23.5 ± 10.60[a]	23.5 ± 10.60[a]	1.37 ± 0.183[a]	1.14 ± 0.143[a]	1.33 ± 0.142[a]
Polled	41.2 ± 12.30[a]	29.4 ± 11.40[a]	1.30 ± 0.133[a]	1.40 ± 0.163[a]	1.41 ± 0.149[a]

[1]SEM - standard error of the mean; [2]Column means with different superscript differ significantly at $p \leq 0.05$.

CONCLUSIONS

Current partial results suggest that horned animals achieve greater fat deposits and are maintaining better condition throughout the lactation, compared to polled animals, when kept under identical feeding and management conditions. Breeding genetically polled cattle is a viable alternative, providing a long-term solution to the presence of horns issues and addressing the welfare concerns of dehorning and disbudding of calves and cattle.

However, production and reproduction efficiency parameters were not influenced by the presence/absence of horns in dairy cows managed under tied stanchion barn.

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