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Calf Note #247 – EFSA Scientific Opinion on Welfare of Calves, Part 2

Introduction

In February of 2023, The European Food Safety Agency (**EFSA**) published a Scientific Opinion entitled "Welfare of Calves" (EFSA, 2023). A committee of experts developed this document as a guide to governments within the European Union to develop regulations and laws to protect and promote the welfare of young calves. The document surely will become the basis for many recommendations, too, for producers and consumers who wish to ensure that calf welfare is protected during the growing period.

The mandate from the European Commission to EFSA was to "*give an independent view on the protection of calves*" (EFSA, 2023). The request to EFSA was to describe current husbandry systems and practices; relevant welfare consequences and measures to assess these consequences; identify hazards leading to these welfare consequences; and recommendations to prevent, mitigate or correct the welfare consequences. The "relevant" consequences were not necessarily based on a data-driven risk assessment, but on the EFSA's expert opinion.

Much of the text refers to male calves raised for veal within the EU. While many of the recommendations may have been made in the context of veal farming, many don't distinguish among male calves raised for veal, male calves raised for non-veal beef production, or replacement dairy heifers. Therefore, it is possible that these recommendations may be implemented (in terms of legislation) to all calf raising systems.

A previous Calf Note discussed the EFSA recommendation regarding NDF intake for calves. The purpose of this Calf Note is to discuss the EFSA recommendation regarding cow-calf contact, particularly related to rates of failure of passive transfer of immunity (**FPT**) and neonatal morbidity and mortality. For the sake of clarity and brevity, I will not discuss effects of calf separation on calf welfare outside the context of health and survival. A future Calf Note will discuss the importance of hygiene in the calving area on calf separation.

Cow-Calf Separation

The EFSA Committee spent a significant amount of their review discussing separation of calves from cows (Sections 3.18.10 and 3.18.11) and referenced studies related to welfare aspects of separation of calves from the dam at varying ages. The Committee's recommendations (Section 3.18.11) regarding cow-calf separation were:

> *The calf should be kept with the dam for a minimum of ~ 24 h and be housed with another calf after that. This would improve the current situation in which calves are mostly separated from the cow shortly after birth and housed individually after that.*
>
> • *Prolonged cow–calf contact should increasingly be implemented due to the welfare benefits for calf and cow. In the future, calves should have contact with the dam during the whole preweaning period.*
>
> • *The second-best alternative to dam–calf contact is prolonged contact with a foster cow.*
>
> • *Further research is needed to better understand how to implement CCC in a larger scale and to identify the best options.*

EFSA Conclusions Regarding Separation

In Section 3.18.10, the Committee made several conclusions regarding cow-calf contact. Their first conclusion was most important. They wrote:

Separation of dam and calf immediately after birth is carried out by the great majority of dairy farms (conventional system). This practice prevents calves from experiencing positive effects of contact with the dam, related with vitality, growth, higher resilience to gastroenteric disorders (or diarrhoea) and appropriate development of social competences (certainty 90–100%).

Let's "dig into" this conclusion and the subsequent recommendation that calves be left with the dam for a minimum of 24 hour of age.

Farmers Separate Calves

The Committee concluded that "a great majority of dairy farms" separate cows shortly after birth. That's indeed the case, and, in fact, the recommendation of the great majority of veterinarians and other dairy professionals around the world. Why? Because, when calves are left to nurse the dam, a large proportion fail to consume sufficient maternal colostrum. More calves get sick. More calves die. Full stop.

The conclusion made by the Committee in Section 3.18.10 is incorrect. Calves left with the dam to obtain passive immunity via consumption of colostrum don't generally have higher vitality, growth, nor resilience to gastrointestinal disorders. Calves left to nurse the dam without farmer intervention are more likely to have FPT (i.e., low serum IgG concentrations), which are consistently associated with greater calf morbidity and mortality.

I will try to briefly summarize some salient points regarding the importance of early colostrum feeding with high quality colostrum, but there are many reviews and summaries available in the scientific literature and popular press that document the important of ensuring that calves consume enough colostrum as soon as possible. Many Calf Notes also address various aspects of colostrum management.

Most producers separate calves from cows to facilitate early colostrum feeding and to reduce the risk of transmission of pathogens to the calf from the dam, other cows in the calving area, and the calving environment. A separate location also facilitates the use of supplemental heat in cold climates.

Here are a few recommendations regarding calf separation and colostrum feeding. Beam et al. (2009) reported that the overall rate of FPT in calves (n = 1,816) sampled during the 2007 NAHMS study in the United States was 19.2% but was significantly higher in calves left to nurse the dam. Their recommendation was "*This study identified several management practices associated with FPT. Specifically, producers should be encouraged to hand feed single-source colostrum within 4 h of birth.*" In their review of colostrum feeding, Lopez and Heinrichs (2022) concluded "*It is recommended to feed colostrum with a concentration ≥50 mg/mL of IgG and provide it within 2 h after birth.*" And, finally, Godden (2009) made recommendations regarding colostrum feeding: *"[C]onsidering that acceptable levels of serum IgG can be achieved without housing the calf with the dam, and given that the latter practice may increase the calf's risk of exposure to pathogens in the dam's environment, it is currently recommended that the calf be removed from the dam within 1 to 2 hours of birth and hand-fed colostrum."* The second recommendation was "*It is recommended that calves be fed 10% to 12% of their body weight (BW) of colostrum at first feeding (3–4 L for a Holstein calf).*"

Separation of calves from the dam is, indeed, practiced on a large majority of dairy farms around the world. Proper training to separate calves and implement intensive colostrum feeding programs have dramatically reduced or eliminated FPT on many dairy farms (Williams et al., 2014). This management practice allows administration of sufficient colostrum to ensure successful passive transfer in a majority of calves and has resulted in declining rates of morbidity and mortality on progressive dairy farms.

Minimize FPT… and Minimize Death Loss

The relationship between FPT and increasing rates of neonatal morbidity and mortality is well established (e.g., Robison et al., 1988; Donovan et al., 1998; Raboisson et al., 2016, Urie et al., 2018). For example, Robison et al. (1988) reported that calves with FPT had two times the mortality rate than calves with successful passive transfer (6.8 %vs. 3.3%, respectively). Other researchers have made similar observations with individual herds and in multi-farm surveys.

Dissemination of programs to ensure early consumption of an adequate amount of colostrum has resulted in great improvements in rates of passive transfer of immunity and reduced losses due to sickness and death of newborn calves. Rates of FPT are declining as farmers implement early and aggressive colostrum feeding programs. For example, rates of FPT in the United States have declined from 41% in 1991 (USDA, 1993) to 19% in 2007 (Beam et al., 2009) and to 12% in 2014 (Shivley et al., 2018). Renaud et al. (2020) reported the rate of FPT in Ontario dairy farms was 24% and an improvement over previous studies conducted in Canada following implementation of educational programs for intensive colostrum feeding. Rates of FPT in other countries show great variability and generally reflect the intensity of colostrum management in those parts of the world. Published studies reporting rates of FPT generally ranged from 17% in Turkey (Kara and Ceylan, 2021) to 21% Renauld et al. in Canada (2020), 33% in New Zealand (Cuttance et al. 2017), 35% in the Czech (Staněk et al. 2019) and 41% in Italy (Lora et al., 2018). Abuelo et al. (2019) reported that 41.9% of calves had FPT on Australian dairy farms and the authors attributed at least part of this high rate of FPT to a significant proportion of producers (24%) allowing calves to nurse the dam as their primary method of colostrum acquisition. Reduced rates of FPT result in greater calf health, lower rates of mortality, and improved calf welfare. Key to these improvements have been monitoring colostrum quality by BRIX refractometry and feeding enough colostrum to ensure ingestion of 150 to 200 grams of IgG by 2 hours of age.

Inherent to these programs is separation of the calf from the cow. This enables the farmer to proactively provide the requisite amount of colostrum at the appropriate time and minimize the risk of infection with pathogens that may be in the calving environment. A recent example is from Sutter et al. (2023), wherein calvings from 3,434 Holstein cows on one farm in Germany were monitored. Calves were separated at birth and fed 4 L of high-quality colostrum (BRIX >22%) within 1 hour of birth and an additional 2 L of colostrum at 6 to 12 hours thereafter. Rate of FPT (i.e., serum IgG < 10 g of IgG/L) as estimated by BRIX refractometry was 4.8%. Overall rates of mortality and morbidity on the farm for all calves were 3.1% and 32.6%, respectively. Calves with FPT were more likely to have diarrhea (odds ratio {**OR**}= 1.57), pneumonia (OR = 2.00), overall morbidity (OR = 1.99) and mortality (OR = 2.47) compared to calves with excellent passive transfer of immunity.

Similarly, Bandlow et al. (2023) recently reported that only 4.9% of Jersey calves had FPT when calves were separated from the dam and fed 4 L of heat treated, pooled colostrum. Educational programs to improve colostrum management and feeding practices (including separating calves from the dam and feeding high quality colostrum can reduce rates of FPT (Atkinson et al., 2017).

Of course, separation of the calf from the cow and individually feeding colostrum does not guarantee high rates of successful passive transfer (SPT) of immunity. Variation in colostrum quality, amount of colostrum fed and timing of feeding all affect the calf's ability to absorb ingested IgG (Godden et al., 2008). This is why colostrum quality should be measured with a BRIX refractometer and most veterinarians recommend administration of 4 L of colostrum to large breed calves by esophageal feeder within 2 hours of birth.

Calves left with the Dam

When rates of FPT in conventional systems are evaluated, one factor commonly associated with greater rates of FPT is allowing the calf to nurse the dam. For example, Beam et al. (2009) reported that the odds of FPT was 2.4 time higher for calves that were allowed to nurse the dam compared to those that were hand-fed colostrum.

An important consideration of leaving a calf with the dam is the time required for the calf to stand, find the udder, and begin to nurse. In some calves, the process of nursing may be delayed, particularly if they have experienced a difficult birth. For example, Edwards and Broom (1979) reported that 11% of calves born from heifers and 46% of calves born from cows had not suckled by 6 hours after birth. Similarly, Edwards (1982) reported that 32% of 161 calves failed to suckle by 6 hours after birth. Factors affecting time to nurse included udder conformation, abnormal maternal behavior, parity, and poor calf vigor. Ventrop and Michanek (1992) also reported the importance of udder conformation on the calf's ability to consume colostrum when left to nurse the dam. Penhale et al. (1973) argued that higher rates of FPT in calves nursing the dam *"…is attributed to suckling difficulties leading to delayed ingestion, rather than to a defective absorptive mechanism or to deficiencies in colostral content."*

Rajala and Castren (1995) allowed calves (n = 15) to nurse colostrum from the dam or were fed colostrum by hand (n = 15) at 3 periods after calving (2 L at 4 h, two feedings of 3 L thereafter). Forty percent of calves left to nurse the dam did not suckle by 6 hours and were subsequently assisted to consume colostrum. These researchers also reported that 33% of nursed calves had FPT or partial FPT compared to 7% of calves that were fed by hand.

Jenny et al. (1981) reported a linear increase in rate of neonatal mortality with time left with the dam up to 3 days, as well as a linear decline in mortality with volume of colostrum fed. Trotz-Williams et al. (2008) surveyed management on Ontario dairy farms in 2004 and reported that the odds of FPT in calves on farms where >75% of cows were allowed to remain with their calves for more than 3 h after calving were significantly higher than when dams and calves were separated within 3 h of the birth. They also reported that feeding more colostrum to calves within 6 h of birth was significantly associated with a reduced risk of FPT.

Nocek et al. (1984) reported that allowing the calf to nurse the dam for 12 to 24 hours resulted in lower serum IgG at 24 h compared to calves fed 1.8 L of colostrum. Calves that nursed were assisted to ensure that they began nursing within a few hours of birth. There were no differences in administration of veterinary treatments between the two treatment groups. Vasseur et al. (2009) reported that ad libitum intake of colostrum from a nipple bottle depended on calf body weight and vigor; calves with low vigor after calving (usually related to calving difficulties) consumed less colostrum voluntarily. On the other hand, vigorous calves are able to consume significant amounts of colostrum. Vasseur et al. (2009) reported that more than 40% of calves voluntarily consumed >4 L of colostrum whereas 22% of calves consumed <2 L.

Many calves are born on pasture in locations such as the UK or Australia. A common practice in Australia is to collect calves from the pastures once or twice per day and to feed them 2 to 4 L of colostrum in addition to amount consumed from the dam. In a study by Vogels et al. (2013), 38% of calves were reported to have FPT (total serum protein < 5.0 g/dl). More frequent (i.e., twice daily) removal of calves from pasture and earlier administration of supplemental colostrum was associated with reduced rates of FPT. A more recent meta-analysis by Van et al. (2023) also reported 38% FPT in pasture-born calves in Australasia. The researchers concluded "*The prevalence of FTPI at day 1 was high… without additional colostrum feeding. This suggests that the high prevalence of FTPI was a result of the uncontrolled first feeding of calves left with their dams on pasture. Thus, more frequent collection of newborn calves combined with early feeding of colostrum appears advantageous.*" Finally, Wesselink et al. (1999) monitored 74 dairy calves left to nurse the dam during the first 24 hours of life. They concluded "*About one half of New Zealand dairy calves may not receive colostrum from their dams even when they are together for up to 24 hours. Most calves that are going to suck of their own accord will do so within 6 hours of birth.*"

Interestingly, Shivley et al. (2018) reported rates of FPT in calves suckling the dam were not different from those of calves fed by hand. However, the authors failed to discuss whether calves left with the dam were fed supplemental colostrum.

Benefits of Nursing the Dam

Several researchers have suggested that the efficiency of IgG absorption is improved when the calf nurses colostrum from the dam (Stott et al., 1979) or nurses in the presence of the dam (Selman, 1971a,b; 1973). Waltner-Toews et al. (1986) concluded that farms with policies to ensure calves receive sufficient amounts of colostrum after (active suckling without or with supplemental hand-fed colostrum) had lower odds of mortality than farms that allowed the calf to nurse the dam without intervention. A report by Quigley et al. (1995) with Jersey calves suggests that when properly managed to ensure intake of colostrum, calves achieved serum IgG concentrations higher than calves that were bottle fed 2 L of colostrum in the first 24 hours of life. This is likely due to a combination of improved efficiency of IgG absorption and increased colostrum intake. However, in this study, colostrum consumption was not recorded, so it is impossible to determine which factor(s) might contribute to the increased serum IgG concentration.

A Critical Review of Recent Research

Beaver et al. (2019) published an exhaustive review of the effects of early calf separation on cow and calf health. Although a thorough review of this manuscript is beyond the scope of this Calf Note, I will offer some comments regarding the authors' review of the effects of calf separation on calf immunity. The authors' assessment of the existing literature regarding calf immunity was "*Thus there may be challenges and benefits associated with both hand feeding and nursing colostrum from the dam. Given the conflicting evidence presented, and the flawed comparisons between groups, the common recommendation to separate the cow and calf immediately after parturition to ensure successful immune transfer should not be considered to be evidence based. However, leaving the calf unsupervised with the dam cannot serve as a replacement for careful colostrum management.*"

Their conclusion contradicts the information in their Table 5, which documents results of several studies that reported increased rates of FPT in calves that are left with the dam). I created Table 1 to document some studies that indicate that calves left to nurse the dam without some intervention to ensure adequate colostrum intake are at greater risk of FPT. Most of these studies were not considered by Beaver et al. (2019). In many or most of the studies in Table 1, calves were left with the dam, but assistance to nurse or supplemental colostrum was generally not provided. Generally, however, the data appear to be quite clear. Leaving calf with cow without assistance results in higher rates of FPT. This certainly seems to be evidence based.

Author	n	FPT* %
Klaus et al., 1969	10	30
Brignole & Stott, 1980	983	42
Robison et al. 1988	1,000	28
Besser et al., 1991		61
Rajala & Castren, 1995	30	33
Wesselink et al. 1999		50
Beam et al., 2009	1,816	26
Vogels et al., 2013	1,018	38
Shivley et al., 2018	392	10
Johnsen et al., 2019	156	31
Lora et al., 2019	107	60
Mason et al., 2022	689	59
Van et al., 2023	13,430	33

*Table 1. Published rates of failure of passive transfer of immunity in calves left to nurse the dam for 24 or more hours after birth. *FPT was generally defined as serum IgG < 10 g/L or serum total protein < 5.2 g/dl when measured >24 hours after birth.*

The variation in FPT reported in the literature may be due to whether or not researchers ensured colostrum intake by calves left with the dam. The authors failed to discriminate between these groups in their analysis.

In their manuscript, the authors report a positive association between suckling and IgG absorption in neonatal calves as an argument to maintain cow-calf contact. They cite Stott et al. (1979) and Quigley et al. (1995) to support this contention. As mentioned above, my data (i.e., Quigley et al., 1995) in no way supports a positive association between suckling and IgG absorption. In my study, calves were bottle fed 2 L of colostrum (1 L as soon as possible and 1 L at 12 h of age) or were allowed to nurse the dam for 3 days. We ensured that all calves that nursed the dam actually drank colostrum; however, we did not determine the amount of colostrum ingested. It's quite possible that calves that nursed simply consumed more colostrum than calves fed by bottles. So, the suggestion that there is a positive association of suckling and IgG absorption is incorrect. But, if the calf doesn't actually consume colostrum, the animal's ability to absorb the IgG therein is unimportant. Beaver et al. (2019) confused AEA with the ability of the calf to actively stand, find the udder, and consume enough colostrum soon enough after birth to ensure successful passive transfer. While there are data to suggest improved AEA when calves are in the presence of the dam, the factor(s) associated with this improvement are not clear.

Beaver et al. (2019) also suggests that latency to stand, delays in colostrum intake, and generally smaller amounts of colostrum consumed by calves left with the dam likely result in greater rates of FPT compared to calves that are separated from the dam and fed large amounts of high-quality colostrum by nipple bottle or esophageal feeder. Thus, equalizing colostrum intake of unseparated calves by "assisted nursing" might be a viable option for reducing rates of FPT.

A Role for "Assisted Nursing"?

An important manuscript by Lora et al. (2019) indicates the potential value of "assisted nursing" or providing an additional colostrum meal to calves left to nurse the dam. In this study, 107 cow-calf pairs were assigned to be hand feeding colostrum from the dam to the calf (**HF**), nursing the dam (**NF**), or leaving the calf to nurse the dam and an additional feeding of 3 L of colostrum from the dam by nipple bottle (**SF**) within 6 hours of birth. Serum IgG was measured after 24 hours. Results are in Figure 1. Calves fed HF consumed 1.9 L of colostrum at a mean age of 2.2 hours. Calves fed SF consumed 2.0 L of colostrum at a mean age of 1.4 hours. Sixty percent of calves in NF treatment had FPT whereas only 11% of calves had FPT when they were supplemented with maternal colostrum (SF group). Assisted nursing also resulted in a greater percentage of calves with serum IgG >16 g/L, indicating greater success of passive immunity. The authors concluded "*This study showed that offering a supplementary colostrum meal within 6 h of birth to the calves allowed to nurse colostrum from their dams for the first 12 h of life was an effective practice in maximizing the passive immunity transfer.*"

Assisted nursing has been successful in reducing the rate of FPT in calves not separated from the dam immediately after birth in other studies (e.g., Logan et al., 1981; Petrie et al., 1984; Franklin et al., 2003; Webb et al., 2022). Conversely, Johnsen et al. (2019) reported that mean serum IgG (average = 16 g/L) was lower when calves were supplemented with colostrum on 20 organic herds in Norway and Sweden. Calves that were routinely fed colostrum in addition to nursing the dam consumed an average of 1.9 L of colostrum at an average of 4 hours after birth. However, colostrum IgG was low in this study (39 g/L) and only 23% of samples were >50 g of IgG/L. Further, only healthy calves were included in the analysis, thereby potentially skewing results. Robbers et al. (2021) distinguished between voluntary suckling and assisted suckling and concluded "*Altogether, it appears that (assisted suckling) can lead to adequate transfer of passive immunity, but these methods do in general result in lower serum IgG levels when compared to active methods to deliver colostrum, such as esophageal or bottle feeding.*"

The act of separating calf from cow at birth may be unnecessary with the following caveats: (1) the calving area is meticulously clean; (2) cows can give birth in individual pens; (3) calves are assisted in consuming colostrum within the first 2 hours of birth by providing them a minimum of 3 L of high quality, clean colostrum. However, significant additional research is needed to determine optimal programs to ensure that calves remaining with the dam obtain SPT.

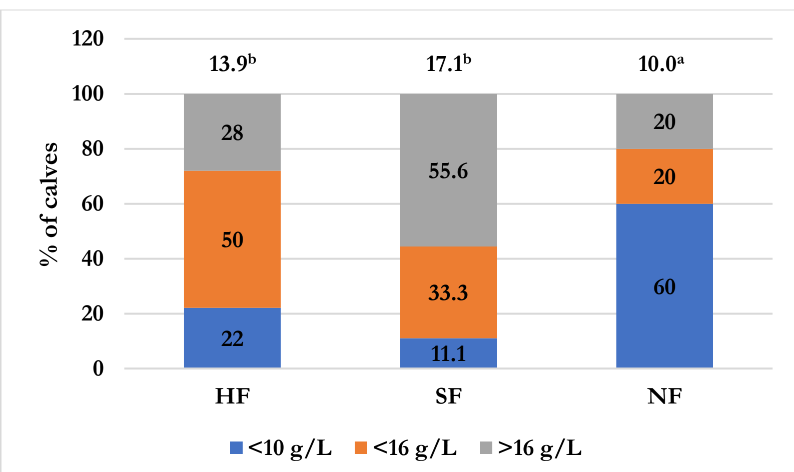

Figure 1. Distribution of calves within serum IgG groups. Means are the percent of calves in each serum IgG category (<10 g of IgG/L; >10 and <16 g/L; and >16 g/L). Mean serum IgG concentrations (g/L) for groups were different $^{a,b}P < 0.01$. Adapted from Lora et al., 2019.

Summary

The EFSA recommendation that calves be left with the dam for a minimum of 24 hours is counter-productive to calf welfare. Without a comprehensive plan for administration of sufficient high-quality colostrum (as determined by BRIX refractometry) to ensure successful passive transfer as recommended by Lombard et al. (2020), more calves will get sick and die than is necessary. This is not calf welfare. The most appropriate method is to separate the calf from the dam to ensure early consumption of high quality, clean colostrum in volumes sufficient to ensure SPT. If the calf is left with the dam, a well-designed program of "assisted nursing" should be considered for calves that are left with the dam. Strategies to improve hygiene of the calving area and allow cows to calve individually are required to minimize the risk of transmission of pathogens from cow to calf. More research is needed to define these programs, followed by comprehensive educational programs, and properly apply them. Only then will the practice of leaving calf with cow after birth improve animal welfare.

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