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Dairy farmer and farm staff attitudes and perceptions regarding daily milk allowance to calves

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ABSTRACT

The benefits of feeding calves more milk are increasingly being recognized by dairy farmers. However, most producers have still not implemented higher feeding plans. The aim of the present study was to gain a deeper understanding of farmer and farm staff attitudes, and the perceptions and factors considered in their decision-making regarding daily milk allowances. We collected data through focus group interviews with dairy farmers, farm managers, and calf-care workers who were selected using purposive and snowball sampling. In total, 40 persons (24 women and 16 men) joined a focus group interview (6 in all, each with 5–8 participants). Interviews were recorded, and recordings were transcribed and analyzed thematically. Participants had contrasting opinions about the minimum, maximum, and recommended daily milk allowances to their calves. Their suggested lowest daily milk allowance to sustain animal welfare ranged from 4 to 8–10 L and the maximum allowance from 6 to 15 L. We found that farmers' and farm staff's choices and recommendations of milk-feeding protocols were influenced by a large number of factors that could be grouped into 4 themes: (1) *Life beyond work*, (2) *Farm facilities and equipment*, (3) *Care of the calves*, and (4) *Profitability and production*. Participants' considerations were similar and aimed to maximize daily milk allowance based on farm conditions. However, the allowances they described as optimal for their calves often differed from what they considered practically feasible. We found that the care of the calves and the well-being of the owners and the staff was central in the participants' decision-making, but that this care perspective was challenged by the social and economic sustainability of the farm. Most participants fed their calves twice daily and did not think that increasing that number would be practically feasible. Our results indicate that the participants' viewpoints regarding calves were important for their decision-making about milk allowances. We suggest that a more holistic perspective should be used when advising farmers about milk allowances, putting particular emphasis on the caring and social sustainability aspects of the individual farm.

Key words: dairy cattle, calves, milk feeding, qualitative research, farmer perceptions

INTRODUCTION

Traditionally, restricted milk-feeding plans have been used for dairy calves, and for a long time, these plans have been set to 10% of BW/day (corresponding to approximately 3–4.5 L/d; Khan et al., 2011). Today, most dairy producers feed calves 6 to 7 L/d manually (Klein-Jöbstl et al., 2015; Medrano-Galarza et al., 2017; Urie et al., 2018), but large variations among farms in daily milk allowance have been described (Barry et al., 2020; Wilson et al., 2023). Feeding plans of 5 to 6 L/d have been found to cause signs of sustained hunger (de Paula Vieira et al., 2008; Rosenberger et al., 2017) and to cause loss of body condition during the first month of life, delayed postnatal growth (Curtis et al., 2018), and to have detrimental effects on organ (e.g., intestinal and mammary gland) development (Geiger et al., 2016; Soberon and van Amburgh, 2017; Koch et al., 2019). Calves fed more milk or milk replacer have been reported to have higher subsequent first lactation milk yield (Gelsinger et al., 2016) and an improved small intestinal mucosal growth at weaning, indicating a higher absorbing capacity (Koch et al., 2019). Growing evidence shows that an adequate nutrient supply is important for maturation of the intestinal immune system and successful defense against pathogens (Ollivett et al., 2012; Hammon et al., 2018), and that higher milk-feeding plans are associated with lower calf morbidity (Jorgensen et al., 2017; Lorenz et al., 2021b). All of

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this evidence bolsters the recommendation that calves should be fed higher levels of milk or milk replacer. Such feeding plans are often referred to as accelerated or intensified, but because they are more similar to the amount that suckled calves would receive, they have also been called biologically normal plans (Lorenz, 2021a).

As producers have learned about these benefits, the practice of feeding calves higher levels of milk has been increasingly adopted (Medrano-Galarza et al., 2017; Urie et al., 2018). However, these recommendations have not yet been implemented by most producers. In Sweden, milk-feeding practices were last surveyed in the '90s, at which time calves were generally fed 2.5 L twice a day (Pettersson et al., 2001). Although it is generally felt that levels of 5 L/d are now rare, our experience suggests that many Swedish farmers do not adhere to biologically normal feeding plans. This may be due to concerns about reduced solid feed intake associated with higher levels of milk (Khan et al., 2011; Miller-Cushon et al., 2013), high costs of both milk and labor for feeding additional meals, or the belief that when calves are fed more milk they have an increased incidence of diarrhea (suggested by Parsons et al., 2021). However, the attitudes and perceptions of those who work on dairy farms regarding the daily milk allowance have not been closely investigated. If the goal is to encourage implementation of biologically normal feeding levels, we suggest that the perspectives of farmers and farm staff are important to keep in mind when such recommendations are developed. A better understanding of these perspectives can help advisory services understand what factors are important to consider when helping farms improve their milk-feeding protocols.

The aim of this study was to gain a deeper understanding of farmer and farm staff attitudes toward and perceptions about the benefits of, and challenges for, high and low daily milk allowances, and the factors these people consider when they make decisions about daily milk allowances.

MATERIALS AND METHODS

We used a qualitative design and collected data through focus group interviews (**FGI**; Patton, 2002) with dairy farmers, farm managers, and calf-care workers. Focus group interviews are intended to collect high-quality data in a natural environment where participants influence and are influenced by each other. These reciprocal influences may reveal the participants' viewpoints and practices that otherwise may be hard to access, and expose the underlying reasons behind their ways of thinking and acting (Patton, 2002; Stewart and Shamdasani, 2015). The data were analyzed by thematic analysis (Braun and Clarke, 2006).

The study was conducted in a region in southwest Sweden with one of the highest dairy cow densities in the country. This region is known for a large diversity of farms and farming conditions, and is therefore especially well-suited for studying the various conditions characterizing Swedish dairy production. The region includes plains, woodland, and mixed farming conditions and farms of all sizes (from <50 to >500 cows).

Ethical Considerations and Consent from Participants

Swedish law (The Swedish Parliament, 2003) implies that research involving human subjects should be reviewed by a regional ethical board if the study collects personal data about violation of the law or if it collects sensitive personal data subject to European Union data protection regulations (The European Parliament, 2016). Sensitive personal data are defined as data about racial or ethnic origin, political opinions, religious or philosophical beliefs, trade-union membership, health, sexual life or sexual orientation, and genetic data and biometric data processed solely to identify a human being. Because no such data were collected, this study was not subjected to an ethical review.

The study was carried out in accordance with institutional guidelines, with written informed consent from all participants in accordance with the Declaration of Helsinki (World Medical Association, 1964). Participation in the study was voluntary and participants were assured that they could withdraw from the study at any time. Participants were informed about the purpose and materials of the study and that participation in the study would not affect them physically or mentally. Participants were also informed that collected data would be anonymized so that their identities would not be revealed and that no unauthorized person would be able to access the data.

No information about consent, who agreed to participate, or who declined to participate was given to persons who suggested participants for the study. Participant information was anonymized in the data management process.

Study Team

The study team consisted of 3 women: 1 veterinarian researcher in cattle medicine (C. S.), 1 researcher in cognitive sciences who also has a background as a veterinary assistant (J. L.), and 1 veterinarian expert

in animal welfare (A.-L. H.). The first and last authors have PhDs, are senior university researchers, and have experience in FGI methods. The cognitive science researcher has extensive experience in interview techniques and qualitative analyses. A.-L. H. is employed by Sweden's largest advisory organization for dairy cattle.

Recruitment of Participants

We aimed for a large variety of participants to capture different experiences, attitudes, and opinions regarding milk allowances. We therefore sought to invite persons of different genders, ages, and with different roles on their farm (owner, farm manager, calf-care worker). We also sought to invite participants who used different milk-feeding systems (automatic milk feeders, milk taxi, manual feeding using teat buckets, and open buckets), numbers of daily milk meals (2 or 3 meals per day), types of milk (milk replacer, whole milk, combinations), milk allowances, production systems (organic, conventional), milking systems (voluntary milking system, parlor, or pipeline 2 or 3 times daily), and herd sizes (small, average, large). Additional sampling criteria included the ability to participate in an FGI at a specific location on a specific date and time and the willingness to share one's own experiences, thoughts, and opinions.

We used a combination of purposive sampling and snowball sampling to recruit participants (Patton, 2002). We asked veterinary practitioners and advisers in the region to suggest participants based on the above criteria and to ask for their permission to share their contact information with the research team. A total of 38 persons who were suggested agreed to share their contact information. In addition, we asked persons who agreed to participate to suggest additional persons who they thought would be interested in joining the discussions. Twelve persons were suggested by other participants. The 50 potential participants were then contacted by the first author by phone, received information about the purpose of the study and the format of the FGI, and were invited to participate. To ensure a minimum of 4 to 5 persons per group to allow rich discussions between participants (Patton, 2002; Stewart and Shamdasani, 2015) and accounting for expected dropouts due to disease or other unexpected events and to provide sufficient information power, we continued sampling until we had identified a minimum of 7 individuals who could participate in FGI at each of 6 specified time points at 2 different locations. We aimed to have groups of 4 to 8 persons with both males and females representing both organic and conventional, as well as small, large, and medium-sized, herds in all groups. We aimed for calf-care workers to be in groups separate from farm owners and farm managers, or at least to be the majority of the group. Altogether 47 persons from 47 farms agreed to participate and received a confirmation by email. Of the 47 persons, 7 persons were unable to attend the FGI due to health problems, business meetings, or sick animals on the farm.

Procedure and Data Collection

Focus Group Interviews. Each participant joined 1 FGI, each FGI was carried out in a meeting room arranged for this purpose at a conference center, and meetings started and ended with lunch or coffee that was offered free of charge. All FGI lasted for 1.5 to 2 h, were recorded using Dictaphones (Olympus Corporation), followed the same format, and were carried out with all 3 authors present. No other people were present apart from the authors and the participants.

The first author facilitated the FGI, and the second author observed the conversations and took notes. The last author acted as a cofacilitator supporting the facilitator to ensure that all participants were active during the FGI, and she sometimes also introduced additional questions to clarify the participant's opinions.

Before the interviews started, each participant filled in a form for reimbursement of travel costs. Participants were then again welcomed and introduced to the purpose and format of the FGI. We clarified that we were not looking for right or wrong answers but rather wanted to explore the diversity of perceptions and attitudes regarding 3 prompts: (1) their current milk allowance, (2) their suggested maximum allowance, and (3) their suggested minimum allowance. Participants were informed that interviews would be recorded, that the material when presented would be reported at the group level or by anonymized quotes, and that they would receive a summary of the preliminary results via email before the study would be published. Farmers and farm staff also received information about the funding of the study. All participants agreed to the rule that what was said in the room would stay in the room.

Interviews started with a round of introductions in which each member of the study team presented themselves, their roles during the FGI, and their research interests. C. S. declared her interest in calf health and calf factors that affect cow performance. A.-L. H. described her background at the dairy association and her work in developing welfare assessment tools for farmers. J. L. described her main role as contributing to methodology. Some of the participants had met C. S. during previous studies and knew A.-L. H. from her

work at the dairy association. The participants were asked to introduce themselves as they found suitable and encouraged to describe their experiences in the field and their role(s) in calf management on the farm. They were asked to describe their best moments with calves and then to share their thoughts and opinions and discuss among them the issues raised by the facilitator and the cofacilitator. They were informed that colostrum management and weaning procedures were not included in the study, but that we aimed to collect information about the main milk allowance practice (i.e., to a 4-wk calf), or if they had different allowances for calves of different ages, their full protocol regarding milk allowances. For all FGI, the following questions were raised (translated from Swedish):

(1) Describe the milk-feeding protocol on your farm. How do you feed the calves, how often, what type of milk, and what is the daily milk allowance for your calves?
(2) How did you decide on the current daily milk allowance on your farm?
(3) In your system, what do you think is the maximum volume a calf could drink per day (maximum daily allowance)?
(4) What reasons may there be for not giving the maximum daily allowance mentioned?
(5) What are the benefits of having a protocol to supply a high daily milk allowance?
(6) In your opinion, what is the lowest daily milk allowance you can give a calf and sustain good animal welfare (minimum daily allowance)?
(7) What reasons may there be for supplying calves with a low daily milk allowance?
(8) When you recommend a milk-feeding protocol to a colleague, what would you recommend as the most suitable daily milk allowance?
(9) When you recommend a milk-feeding protocol to a colleague, what would you recommend as the most suitable volume per meal?
(10) Are there additional aspects about daily milk allowance that you would like to add?

During the discussions, the above questions were presented stepwise on a screen using Microsoft PowerPoint.

In addition to field notes and recordings, anonymous notes were collected from each participant; before discussions of questions 1, 3, and 6, participants were asked to individually write down their total daily milk allowance, as well as their suggested maximum and minimum daily milk allowances on separate sticky notes. The 3 notes were fitted onto a piece of paper that was collected after the session.

The interview guide was developed jointly by the 3 authors based on the research objectives, literature, and their prior experience of the target group. It was tested within the research team but not pilot-tested on farmers or farm staff before the FGI.

Debriefing Sessions. Directly after each FGI, the study team gathered to discuss field notes, their impressions from the FGI, and initial interpretation of the observation of participants. The main results regarding each of the main interview questions were summarized in notes.

Participant Characteristics. Data on participants' backgrounds and farm characteristics were collected in conjunction with the FGI. Each participant was asked to complete a 1-page questionnaire gathering data on gender, age, their role on the farm, their experience of calf caretaking, and educational level. They were also asked about herd size, type of production, milking system, milk-feeding system, type of milk fed, total amount of milk, and number of milk meals fed per day on their farm. All questions were multiple-choice except for age and liters of milk fed to calves per day.

Data Analysis

Participant Characteristics. Descriptive statistics for the background data of the participants were calculated using Microsoft Excel (2018). Median (25th and 75th percentiles) ages were calculated together with the proportions of different response categories.

Focus Group Interviews. The recorded FGI were transcribed and imported into NVivo 11 (QSR International) by the first author. Each transcript (or FGI) was given an arbitrary number between 1 and 6, thereby ordering the FGI. Each participant received a number between 1 and 40 according to the order of their FGI and with participants from the same FGI receiving successive numbers. The field notes were used to identify the individual participants' contributions to the transcript. Transcripts were not returned to participants for comments. Data mentioning any aspect related to the (1) background of the milk-feeding protocol on the farm, (2) suggested maximum and minimum daily milk allowances, and (3) suggested potential gains from a high daily milk allowance were not subjected to a full thematic analysis but were compiled and aggregated based on 1–3). During the rest of the analysis, the purpose was to find the patterns of shared meaning in relation to the research aims across the dataset. The data were therefore analyzed thematically using the method described by Braun and Clarke (2006); briefly, a code list was developed based on notes from the debriefing session and transcripts. Initial codes were established

Table 1. Characteristics of the 40 farms represented by 40 persons participating in focus group interviews about milk feeding of calves

Variable	Category	Respondents, % (n)
Farm size (number of lactating cows)	<70	22.5 (9)
	71–150	50.0 (20)
	151–250	12.5 (5)
	>250	15.0 (6)
Type of production	Conventional	70.0 (28)
	Organic	30.0 (12)
Milking system[1]	Tiestall/parlor	32.5 (13)
	Voluntary milking system	70.0 (28)
Milk-feeding system[1]	Manual	37.5 (15)
	Milk taxi or milk wagon	70.0 (28)
	Automatic milk feeder	05.0 (2)
Milk type[1]	Whole milk	80.0 (32)
	Milk replacer	10.0 (4)
	Mix of whole milk and milk replacer	15.0 (6)
Volume of milk at 4 wk of age[2]	5 L/d, including ranges of 5–7 L/d	10.0 (4)
	6 L/d, including ranges of 6–7 L/d	35.0 (14)
	7 L/d, including ranges of 7–8.5 L/d	12.5 (5)
	8–10 L/d	37.5 (15)
	>10 L/d, including ranges 9–11 L/d	5.0 (2)

[1]Multiple systems or milk types were used on some farms.

[2]Some of the participants reported a range, rather than a specific volume of milk. These responses have been incorporated in the category corresponding to the lowest volume in the range.

in an inductive analysis process where the first and last authors first individually read notes and transcripts and then discussed their initial code lists until an agreement was reached. The codes were then discussed with the full study team until an agreement about their naming was reached. These codes were then used for coding the transcripts in NVivo 11 by the first author. Data were organized within each code, and codes were sorted and connected into potential themes by the first and last authors first individually and then jointly until an agreement was reached. Three sensitizing questions were used to identify themes:

(1) What volumes of milk are fed to calves in practice?
(2) What influences the daily milk allowance?
(3) How do the participants reason about the daily milk allowance, and what lies behind those arguments and motivations?

These initial themes were then reviewed by the full study team, defined, and named. Relationships among themes were explored in the same manner, first individually by each author and then jointly until an agreement was reached. Participants received a summary of the findings via email that also welcomed comments and feedback. No participant provided any feedback on the findings.

The provided quotes were chosen to best exemplify the data and were translated from Swedish by the first author. Quotes were modified with square brackets representing replaced or added text and "//" representing omitted text. Pauses are indicated using ellipses. Quoted participants are identified by their number and the number of their FGI.

RESULTS

In total, we carried out 6 FGI with 5 to 8 participants each for a total of 40 participants (24 women and 16 men). We deemed saturation to have been achieved after 4 FGI, based on the failure to identify any new issues raised by participants in our debriefing sessions in subsequent FGI. One FGI included calf-care workers only and 1 had a majority of calf-care workers, whereas the other 4 FGI included farm owners and farm managers. Twenty-three (57.5%) participants were farm owners (including 1 previous owner), 2 (5%) were family members of the owner, 5 (12.5%) were farm managers, and 10 (25%) were employed calf-care workers. Their ages ranged from 25 to 69 (median: 43; interquartile range: 34–54.5) years, and most of them had long experience with calves (27 had >15 yr; 11 had 5–15 yr; 2 had <5 yr). All but 7 (82.5%) had an agricultural education of some sort. Half the participants had lower education (1 had primary level; 19 had secondary level). Of the 20 participants with tertiary-level education, 11 (27.5%) had studied at an agricultural university.

We present the descriptive statistics of the represented farms in Table 1. One of the farms milked its cows 3 times daily, and 1 farm gave its calves 3 meals per day, whereas all the other farms gave calves 2 meals per day,

including 2 farms that had automatic milk feeders for their older calves but fed their younger calves twice a day using a milk taxi.

Of the 19 farms represented in the FGI that served their calves more than 7 L of milk per day (including 7–8.5 L/d), 15 (78.9%) were represented by a woman (age range: 28–67; median: 39 yr) and 4 (21.1%) were represented by a man (age range: 28–59; median 39 yr). Of the 16 farms represented by a man, 12 (75%) fed their calves a low milk allowance of less than 7 L/d (including 6–7 L/d). Of the 24 farms represented by a woman, 9 (37.5%) fed this low milk allowance.

Background of Current Milk-Feeding Protocols

Introducing question 2, how they decided their current daily milk allowances, resulted in a long period of silence in 2 of the FGI, and in 1 FGI, participants expressed genuine surprise when faced with this question. Several participants reported that their current milk-feeding protocol was based on tradition and that they saw no reason to change a feeding protocol that seemed to work well. Some reported that the desire to have calves eating concentrate and roughage along with milk was an important reason to restrict milk allowances. One participant mentioned that they had learned that the abomasum would not allow larger meals without milk overflow into the rumen, and this knowledge was an important contributor to the decided meal volume on their farm. Economic concerns, such as wanting to deliver as much milk as possible to the dairy, was another reason for restricted milk allowances.

Other participants instead described the background of their milk-feeding protocol as the result of a process of trial and error, where digestive problems and a calf's failure to drink the full meal were defined as errors. Some had listened to suggestions about increasing the allowance made by their veterinarian or their feeding and management adviser. Several of the above-mentioned aspects are illustrated by the following dialogue:

- "That's because ... well, it's an old rule that you should use about 3 L mornings and evenings. That's the old-fashioned [way of doing it]. And then, I have tested to push on more, but I don't think that makes the stomachs any better. And that's crucial. But then it's better that they eat other stuff [solid feed] instead." (Participant 12, FGI 4)

- "Well, we give them 8 L and how did we reach that? Well, it's discussions with vets and other things, and then that's where it landed. We used to give them 6 L, too, before, but then you were supposed to give more. I don't know, but the vet thinks so." (Participant 13, FGI 4)

- Facilitator: "You started to test because of the vet, and then you have carried on."

- "Well, it works." (Participant 13, FGI 4)

Participants also mentioned reading about research findings and watching YouTube clips as sources of inspiration. For some of the participants, continuously improving their farms was an important driving force behind increasing milk allowances. Firsthand experiences on the farm of calves being able to tolerate larger volumes, as well as experienced improvements in calf health and growth rate, had encouraged some to continue with a higher scheme. Another reason for a high milk-feeding scheme was having a lot of nonsalable milk (colostrum, transition milk, milk with high SCC, and milk withdrawn after completion of antimicrobial treatment) that they wanted to use for the calves. Hence, we stress that no single factor lay behind the choices of milk-feeding protocol, but rather this study identified a combination of different underlying factors explaining current protocols on the farms.

Suggested Minimum and Maximum Daily Milk Allowances

Our analysis showed that the minimum daily milk allowance needed for a calf to sustain its welfare, as suggested by the participants, ranged from 4 to 8–10 L (Table 2). However, all participants agreed that calves given 4 L would have a very low growth rate. Several of the participants who suggested 4 L to be the minimum daily allowance claimed that they themselves would not use such a low allowance except for individual calves experiencing special conditions, such as if the calf had a diarrhea problem or was tiny (twin or premature calves). Participants who suggested 4 L as a minimum daily allowance to sustain welfare were actually feeding their calves between 5 and 8 L/d, and those who suggested levels of >6 L/d fed more than 7 L daily. The suggested maximum daily milk allowance for a 4-wk-old calf ranged from 6 to 15 L.

Suggested Potential Gains from a High Daily Milk Allowance

Our analysis showed that the most commonly mentioned gains from a high milk-feeding scheme were a higher growth rate, reduced age at first calving, and higher milk production. Several participants emphasized that a high milk allowance was associated with

Table 2. Minimum and maximum milk allowances for a 4-wk-old dairy calf as suggested by 40 participants in a focus group interview study about milk feeding of calves

Category	Level (L/d)	Proportion (no. of participants)
Minimum level[1]	4	27.5 (11)
	5, including ranges of 5–6	30.0 (12)
	6	32.5 (13)
	>6	10.0 (4)
Maximum level[1,2]	6–7, including ranges of 7–8	17.9 (7)
	8–9	28.2 (11)
	>9–10	38.5 (15)
	>10	15.4 (6)

[1]Some of the participants reported a range, rather than a specific volume of milk. These responses have been incorporated in the category corresponding to the lowest volume in the range.
[2]One participant did not suggest any maximum milk allowance.

well-developed and robust calves and prevented problems later in the animal's life. As expressed by 1 participant:

> "Well, we have this young stock barn that doesn't work all that well. There I want bigger animals. If you can push them naturally when they're small, [during their first] 2 to 3 months, so that they grow really well and can manage to move to this tougher environment, then you gain when they continue from group to group to group. // ... you prevent what's coming later on. That they become strong calves later on." (Participant 34, FGI 2).

Furthermore, they stressed that a higher growth rate could also mean earlier weaning, which released pen places for milk-fed calves. A higher price for bull calves sold to fattening farms, better usage of waste milk, and the benefits to calves of suckling for a longer time during the meal were other gains mentioned in FGI.

Factors Affecting Choice of Milk-Feeding Protocol

Our analysis of the FGI revealed the choice and recommendation of the daily milk allowance to be a complex matter influenced by a wide range of factors. We identified 4 themes among factors affecting the farm's choice of the milk-feeding protocol: (1) *Life beyond work*, (2) *Farm facilities and equipment*, (3) *Care of the calves*, and (4) *Profitability and production*. The relationships among the themes are illustrated in Figure 1. The analysis revealed that caring for the calves and the persons involved in their management and concerns about economic and social sustainability were the 2 main drivers influencing the milk allowance, as illustrated by the summary title in Figure 1. The viewpoints of the participants regarding calves seemed to affect their perceptions about how much freedom they had to maximize the milk allowance given the available resources on the farm in terms of personnel and time, facilities and equipment, and monetary resources; participants assigning the calves a high value seemed to perceive a larger freedom of action (Figure 1). Although the farms' milk allowances varied greatly, the underlying considerations made by the participants seemed to be similar. As 1 participant said:

> "Speaking in very general terms, I would say that it is all about maximizing the milk allowance based on farm conditions." (Participant 36, FGI 5)

> "But it is probably a combination of what we think is best for the calf plus what is possible to do in terms of work. Because [if] it is anyway compatible with a certain amount of work, to do this, and then those curves can meet and see where it is most optimal, both in terms of workload and for the calf then. And then I think we end up on this." (Participant 36, FGI 5)

We present the subthemes within each theme in Table 3.

Life Beyond Work. Participants explained that their working conditions were tough with long workdays resulting in little time for family, friends, and leisure activities, and they could not expand their milk-feeding routines further. They pointed out that milk-feeding routines had to work on all days, including weekends and holidays, and had to be uncomplicated and easy to maintain for all staff members—for engaged persons who were extra committed to calves, but also for those who are less interested, less skilled, or having less of a stockman's eye for the animals. Routines also needed to be adapted to work hours for staff and to other commitments for farm owners. Hence, we see that the participants made trade-offs when they strove to accomplish a healthy work-life balance while simultaneously caring

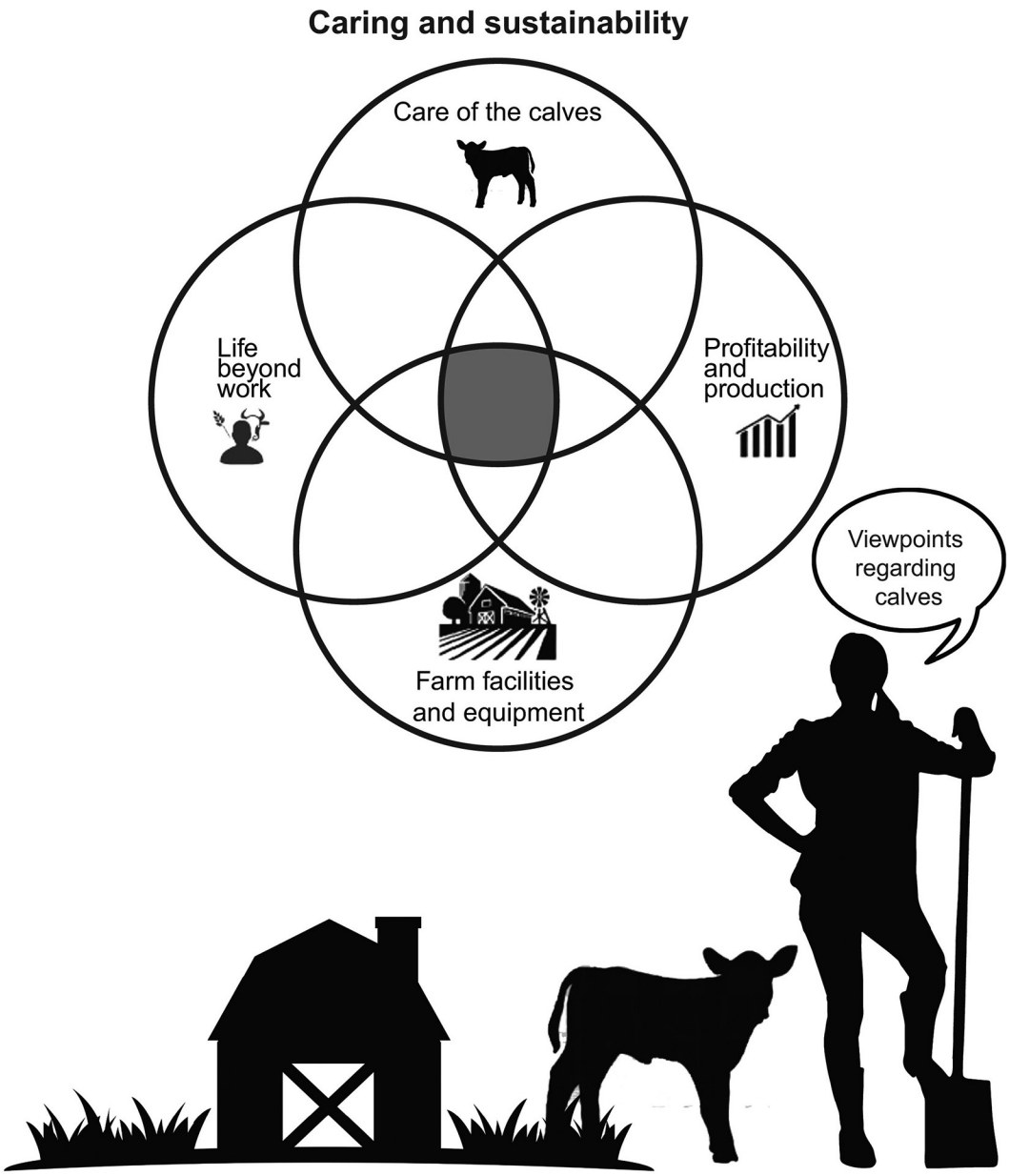

Figure 1. The figure depicts relations between themes among the factors affecting farmers' choice of daily milk allowance. The shaded area in the middle where the 4 themes overlap represents the perceived area for freedom of action and was affected by the participants' viewpoints regarding calves. Participants appreciating calves to have a high value seemed to perceive a larger freedom of action to increase milk allowance.

Table 3. Related subthemes for the 4 themes among factors affecting farmers' choice of daily milk allowances

Life beyond work	Farm facilities and equipment	Care of the calves	Profitability and production
Work-life balance	Equipment	Calf behavior and physiology	Costs
Scheduling	Farm size	Solid food intake	Long- and short-term strategies
Simple routines	Housing	Individual adaptation	Perceived effects
Engagement for calves		Calf health and susceptibility	
Number of and intervals between milk feedings		Number of and intervals between milk feedings	
		Digestive balance	

for the calves and staff when running the dairy farm. Two participants had the following dialogue:

> - "It's the work hours. It's not feasible to feed them 3 times a day. It won't work with family and the rest." (Participant 32, FGI 2)
>
> - "You need to have a social life." (Participant 33, FGI 2)

Farm Facilities and Equipment. The technical equipment on the farm affected the meal sizes and daily milk allowances perceived by participants to be feasible for feeding to their calves. Several participants described their milk taxi as a central resource in their milk-feeding routines, making it possible to feed larger volumes and potentially more meals, but sometimes the capacity of the taxi or the taxi's pasteurizer was a limiting factor on the particular farm:

> "For me, I think it's just a matter of ... if the milk taxi was larger ... then I had tested it. You can always change back if it doesn't work. It's not like it's more work to push the button where it says 4.5 instead of 3.5. It would have been great to give a little more per day." (Participant 27, FGI 6)

Automatic milk feeders were mentioned as facilitating a higher milk allowance, but several participants reported negative experiences, such as cross-sucking, not being able to sufficiently monitor the calves' appetite or health status, poor hygiene, and poor health or performance of calves, with such equipment:

> - "Install a good milk feeder. They eat more then, and there will be less work for you. That's general advice." (Participant 8, FGI 4)
>
> - "We threw our milk feeder out." (Participant 11, FGI 4)
>
> - "We threw our milk feeder out. It was just that calves got ill." (Participant 13, FGI 4)

Several participants reported that they had built additional technical solutions (e.g., pumps, pipes, and refrigerated tanks) to facilitate their milk-feeding routines of whole milk and to ensure good feed hygiene. The availability of whole milk during the day was related to the current milking system on the farm. On farms using milk replacers, a limiting factor was the storage capacity for milk powder.

Farm size was reported to affect the milk-feeding routines and milk allowances. One commonly-expressed view was that more calves, larger total volumes of milk to handle, and potentially more staff workers being involved would reduce flexibility in adapting the milk-feeding protocol to individual calves. As a consequence, larger farms might choose a lower milk allowance that they were sure would not overload the calves' digestive system and therefore felt was safe to administer without detailed information about each individual calf or with less skills to assess the calves' status by the eye. However, 1 farm manager on a smaller farm commented that he saw reasons for a smaller farm to choose a lower milk allowance to be on the safe side, because when 1 person needs to manage all the farm duties, long work hours might affect that person's patience with the calves. An owner of a larger farm with many calf-care workers commented that she had made the decision about the milk allowance for each calf and informed her staff, and that this protocol allowed them to have a high milk allowance with individual adaptation for each calf.

Several farmers and farm staff workers mentioned that the quality of and hygiene in housing facilities affected their choice and recommendation of milk allowance. Participants were eager to optimize the growth and development of their calves and reported that with good quality facilities, high hygiene standards, small group sizes, and low infection load, calves were perceived as needing less milk to grow well. They also reported that healthier calves could drink more milk without the risk of diarrhea. Several participants mentioned that they fed calves kept in uninsulated buildings or in hutches on a higher milk-feeding scheme during the cold season. Some participants advocated this regimen to cover the calves' higher need for energy in cold temperatures, while others meant that calves in colder conditions have a higher capacity to drink milk.

Care of the Calves. Participants' efforts to adjust milk volume to avoid diarrhea and symptoms of colic, and according to each calf's perceived capacity and appetite (as affected by breed, sex, size, and health status), received considerable attention in the FGI and implicitly revealed the participants' attitude about care of the calves.

> "But if there's a calf that's a bit dull and drinks less, then you wait and give it less [milk] for a few days until it's better and then increase again. So that you can check on the one that is a bit sick." (Participant 25, FGI 6)
>
> "All kids have different needs ... some want more, others less. They are all different. So why shouldn't calves be different? But, we have a few crossbred beef calves, and they have a whole different interest

in feed compared to the others. And Jersey calves. There are no calves that eat as much as Jersey calves. Well, they are all different, and I try to see them as individuals and not as one group and now you eat this much." (Participant 34, FGI 2)

Their narratives also revealed that the event of manual feeding of milk was central in their care for the calves because it was the main occasion for supervision of the calves' health status. The value and characteristics of a good calf-care worker (as a person paying attention to detail; being proactive; and having a stockman's eye, i.e., being able to assess the animals' status and needs by the eye to detect even small deviations in calf behavior and appearance) were frequently recurring discussions in the groups.

Furthermore, the narratives demonstrated an eagerness on the part of farmers and farm staff to support the calves' development, health, and welfare. The participants also discussed calf physiology (capacity, adaptation, and development of the calf's digestive system) or behavior (natural suckling behavior and diurnal rhythm) in all FGI. However, participants had different views on and experiences of milk allowances in relation to digestive balance, as demonstrated by the quotes below:

"We have tried, but when we feed them more than 3 L it ends with them getting diarrhea." (Participant 8, FGI 4)

- "They have soft feces, but it's not because they get too much milk. It's those nasty bacilli instead." (Participant 27, FGI 6)

- "Corona and [expletive]." (Participant 26, FGI 6)

- "Cryptosporidia." (Participant 27, FGI 6)

- "I don't think I can get them to drink very much more than 6 L if I gave them twice [daily]." (Participant 20, FGI 1)

- "I think you get the effect that they get a stomachache. That meal is too much all at once." (Participant 21, FGI 1)

- "In the automatic milk feeder, they only get 4 dL each time." (Participant 17, FGI 1)

"So they can eat much more and we have increased [the milk allowance] twice now and yet have not seen any setbacks. Ok, it takes a lot of milk, but at the same time ... what does it matter? You gain in the end anyway. But they can actually ... 2.5 [L], that is nothing. It is absolutely nothing for a calf that can easily drink 5, 6 [L]. And feel well. It is another thing if they would get diarrhea or get ill, but they don't." (Participant 34, FGI 2)

Our analysis revealed that participants had contrasting views regarding the milk allowance in relation to solid feed intake. Many participants argued that a high milk allowance would reduce the calves' solid feed intake preweaning and pointed out the importance of reducing the milk allowance to support the calves' ruminal development. However, participants that offered their calves a higher milk allowance did not seem to perceive low solid feed intake to be a problem for their calves, and their shared experience was that early access to a highly palatable calf feed could alleviate this risk. As 1 participant expressed it:

"Ours receive that [pelleted calf feed, when they are kept] in their single-calf pens, and they eat hay the first week after they have been moved to the group pen, so they indeed eat hay. They really love their hay. So I cannot say that 10 L of milk means less hay ... at least that's our experience ... it [the high milk allowance] does not affect that at all." (Participant 34, FGI 2)

One view that several participants put forward was that a calf that ate a lot of solid feed could tolerate more milk without a negative effect on digestive balance.

Several participants related the experience that if they gave a larger milk meal in the morning, not all calves would want to drink their full meal in the evening, which was the reason given for feeding the calves a smaller meal in the evening than in the morning. Other participants argued that it would be more logical to serve the larger meal in the evening because the interval from evening to morning meal is usually longer than the one between morning and evening meal, and they did not want the calves to go hungry. Several participants also mentioned that determining whether the calf was satisfied or ill could be a difficult task, as illustrated by the quote below:

"You need to find some kind of average so that they want to eat the next time you come. Is it ill or is it just full? That's kind of difficult to determine." (Participant 30, FGI 2)

Participants agreed that calves would be able to drink more milk per day if they had more than 2 meals and if these were spread throughout the 24-h period. However, the shared experience among the participants

was that if they served 3 meals at short intervals, the calves might not drink all their milk. A participant who fed calves 3 meals per day related the experience that more feedings seemed to increase their intake of solid feed:

> "I think that one advantage with giving them 3 times is that you make them go up and eat a third time, and then they automatically eat both calf feed and hay after that. Then you have woken them up yet another time during the day." (Participant 20, FGI 1)

Profitability and Production. Number of feeding times was discussed not only in terms of calf care, but also in terms of productivity. Some participants thought that if there were longer intervals between meals, feeding 3 times daily would not be economically feasible due to personnel costs. A few of them mentioned that they had tested feeding 3 times a day but did not perceive that doing so improved calves' growth rates. However, 1 farm that had used 3 meals for the calves for about a decade believed that doing so had contributed to reduced age at first calving.

The participants said that the calves' growth rate is an important instrument for evaluating the best milk allowance. Considerations regarding best choice were viewed differently depending on the participant's role on the farm and his/her economic responsibility. An employed calf-care worker at a farm feeding calves 8 L milk replacer per day, who also raised bull calves for fattening on 6 L milk replacer per day on her own family farm, argued:

> "I am still doubtful. I think they grow well on 3 L [per feeding]. But now [at the farm where I am employed] it is not just me who makes the decisions. And it is kind of special because ... at home, I pay for the milk replacer but not at work. And I know that they grow well on 3 L. And they grow well on 4 L as well and grow even more, but I don't know. You need to balance, you see. Milk powder is expensive if you compare with ... if calf feed is expensive, then milk powder is even more expensive, you know. So ... it is an economic question, too. And I know it works well with 3 L. And it works with 4 L." (Participant 23, FGI 6)

For farmers using whole milk, milk price was another factor to consider, and they also expressed their desire to use their nonsalable milk and not to waste it. Another pricing issue that was raised by the participants concerned prices for bull calves. If the price for bull calves were set per kilogram instead of per individual calf, this could be an incentive to increase the milk allowance for the bull calves, according to some participants.

Economic considerations also depended on the farmer's short-term versus long-term strategies and their targeted aims.

> "I think we were attending some kind of lecture. I think we used 6 L when I started. And my farmer [the owner of the farm and the boss of this employee], he minds about the economy, and he felt it sounded good to give them some more milk because then they can perform a bit better as heifers and when they calve and [have] higher production. I really think that has had an effect, plus that we manage to give them 4 L of colostrum. And that it is feasible and has worked really well to give them 4 L each meal. Then I often give them an extra liter per meal 'cause it's cold." (Participant 11, FGI 4)

> "My advice is not to save money on what you give your calves 'cause you will have to pay for it in the end. You should not be stingy with their food." (Participant 8, FGI 4)

Our analysis showed that more female than male participants made comments about a high milk allowance being an investment, rather than a cost, whereas males more often than female participants made comments about economic constraints limiting a high milk allowance.

Additional Findings

As described earlier, for the most part, the participants held long experiences of calf management. Their narratives give testimony to a paradigm shift in Swedish dairy production with an increasing focus now being put on the health, welfare, feeding, management, and housing of calves, as compared with previous decades. Narratives also described an increasing interest in feeding higher milk allowances.

> "I think it is quite fascinating that you who are a bit younger do all this job testing different things. I myself, I am walking along this track that there is only one right way of doing things. I guess that is a bit dangerous. This is quite an awakening really that there are so many ambitious and capable people who are testing different things that we all can learn from. I think that is good." (Participant 21, FGI 1)

The practical experiences shared by those who had found larger meals and higher milk allowances to be practically feasible and work well for their calves influenced the views of the other participants.

> "Perhaps there was one truth when I first came here and there will be another when I go home." (Participant 33, FGI 2)

In all but 1 FGI, participants currently feeding 6 L/d expressed an interest in increasing their milk allowance after the discussions. However, in 1 FGI, where all but 1 participant fed 6 L/d, that 1 participant (a farmer who fed 8 L/d) recommended her colleague to feed 6 L, just like all the rest of the participants in the group. The participants sometimes contradicted themselves as illustrated by the quote below from 1 calf caretaker who described 2 contrasting views about milk allowance as a background of diarrhea in the same statement:

> "Well, if you give the maximum allowance [the maximum daily allowance stated in response to question 3] then you are close to a bad stomach [eliciting diarrhea]. But then, well ... 'cause I am so old, I have been to lots of courses ... I have learned from the veterinarians that a calf gets diarrhea, that depends more on that they get too little milk than too much milk. That is a much more important cause of diarrhea." (Participant 33, FGI 2)

Our analysis revealed that the FGI demonstrated considerable interest in the physiology and behavior of calves, and also revealed varying levels of knowledge, as illustrated by the dialogues below:

> - "Well, I see a bit of it, that they suckle on each other. But anyway, I very rarely put on a nose ring. Perhaps it's a behavioral thing. After all, babies have quite a need to suck, and that's why we have pacifiers. // Oops, my brain just made a loop. // Well, I don't use that myself. It's not like I say, well now here you walk around and suck on your pals, you probably need some more milk. That's not how I think." (Participant 3, FGI 3)
>
> - Facilitator: "What about the rest of you? Do you think that this behavior is something you can use to determine that they [the calves] get too little milk"?
>
> - "No, I think it is more bad behavior or that they need to learn how to find the other feed, and that's why we use the lockable gates we have bought and installed." (Participant 6, FGI 3)
>
> - "Is it some kind of deficiency they have when they suck on each other rather than drinking [milk] or is it something ..."? (Participant 21, FGI 1)
>
> - "I think they want to suckle, that's what I think." (Participant 16, FGI 1)
>
> - "That's what I think, too." (Participant 14, FGI 1)
>
> - "They want to ... it's their need to suck." (Participant 15 FGI 1)
>
> - "And that goes on for a while after [they have had their milk], doesn't it?" (Participant 20, FGI 1)

DISCUSSION

We identified a large number of factors that may influence farmers' and farm staff's choices of and recommendations for milk allowance, illustrating the complexity of the decision-making on their farms. What the farmers and farm staff described as optimal for the calves often differed from what they considered practically feasible. These results offer an explanation for the slow implementation of recommendations for biologically normal allowances.

Making decisions about milk allowances requires knowledge about biological factors such as physiology, behavior, health, and welfare of the calf (and if whole milk is used, also of the cow), as well as consideration of a wide range of technical factors, ethical and social factors, practical matters and personal skills, and economic, legal, and consumer issues, all of which add further complexity (McCown, 2002). The complexity of factors affecting calf care on dairy farms has been addressed by Palczynski et al. (2022). Svensson et al. (2019) reported that poor feasibility was a major constraint affecting farmers' adherence to veterinary recommendations. The failure of advisers to understand the complexity, or to acknowledge the importance of practical feasibility and the social well-being of the persons involved, may have contributed to low adherence.

The narratives suggest that calf management is receiving increasing focus on many dairy farms and show a trend toward higher milk allowances. Participants stressed the similarities in their considerations (maximizing allowances based on farm conditions) and indicated that differences in milk allowances largely were due to the different conditions on the farms. Farmers needed to balance caring for the calves, themselves, and their staff against the economic and social sustain-

ability of the farm to ensure future viability. Hence, milk allowance should not be considered in isolation. Instead, all the factors influencing the farmer and the farm staff should be taken into account from a more holistic and sustainable perspective.

Social Sustainability—Life Beyond Work

Social sustainability can be defined as considering the processes that generate social health and well-being in the present and future, and the social institutions that facilitate environmental and economic sustainability in the present and future (Dillard et al., 2009). Although usually handled as part of economic sustainability, farm finances have been identified as a factor of considerable importance for the health of Swedish farmers (Magis, 2010; Röös et al., 2019). Röös et al. (2019) investigated social factors correlated with self-reported overall life satisfaction of Swedish livestock farmers (a considerable share of whom were dairy farmers). Of the 6 factors with the highest correlation to satisfaction, 4 were related to issues also mentioned by the participants in our study as factors affecting milk allowance: (1) having a good financial situation, (2) having a work situation with not too much stress, (3) having opportunities to create a desirable family situation, and (4) having decent working hours. Our participants particularly raised social sustainability issues in discussions about the numbers of and intervals for milk feedings. Most participants fed their calves manually twice per day, and for most of them, supplying 3 meals per day was not perceived as feasible because doing so would have affected social relations and family life.

Relying on calf-care workers, who sometimes do not have a high stockman's eye for and engagement with calves, also necessitated that routines and milk volumes per meal felt safe and uncomplicated. The value of good calf-care workers was addressed frequently in the FGI. However, finding skilled workers is a major challenge for Swedish farmers (Lundström and Lindblom, 2021). The general difficulty to attract personnel also affects the possibilities to create decent working conditions and the possibility for farmers to take time off. Daigle and Ridge (2018) argued that difficulties to attract and retain personnel are related to stockpersons being highly undervalued and underpaid and suggested that investment in stockpersons' education and salaries are important for agricultural sustainability.

Economic Sustainability—Profitability and Production

The rearing of replacement heifers represents the highest expense for a dairy enterprise after feed costs for the cows, with the period from birth to weaning being the most expensive phase (Boulton et al., 2017). Poor profitability of Swedish dairy production poses a considerable challenge to farmers, and economic factors (cost for milk and milk replacer, staff and equipment, reduced income due to reduced volume of milk delivered) influence decision-making about milk allowance on the farm. As also pointed out by Palczynski et al. (2022), the small margins and constant pressure on prices were raised as important aspects that limited investments in infrastructure and staff to manage the calves. Those researchers demonstrated that, although farmers were highly aware that calves represent the long-term future of their herd, they may find it difficult to prioritize the calves when limited short-term resources exist. In the present study, participants said that increasing focus now is being given to calves but that restricted resources were very much a concern, and costs were mentioned as a major reason for supplying a low milk allowance. These findings are in line with Palczynski et al. (2020), who reported reasons for restrictive milk volumes being associated with tradition and cost reduction.

Caring for Calves and People, and Viewpoints Regarding Calves

Care of the calves was at the center of the discussions. Care of the calves was the reason given both for restricting milk feeding (so as to allow the digestive tract to develop by supporting dry food intake and not overloading the digestive tract) and for increasing milk feeding (to improve the growth rate and robustness of the calf). The care of the calves was also apparent when participants described adapting their milk-feeding protocols to meet the needs of individual calves. Several participants (farmers as well as calf-care workers) said that, because of their own skills and engagement, they could potentially manage to supply higher allowances than those presently given on the farm. However, on other days, when a less engaged or less skilled person worked, a higher allowance would not be possible, and routines need to work every day of the year.

The participants' viewpoints regarding calves affected how much freedom they perceived they had to act in the interest of *Care of the calves* (theme 3) while balancing factors related to *Life beyond work* (theme 1), *Farm facilities and equipment* (theme 2), and *Profitability and production* (theme 4; Figure 1). Although the participants in our study were not a representative sample, and the farms represented by females may have had male decision-makers and vice versa, our study indicates that gender is correlated with participants' viewpoints regarding calf care and the needs of a calf. Female partici-

pants expressed more often than male participants the view that a high milk allowance is an investment, rather than a cost. Although the majority of farm owners in Sweden are men (The Swedish Board of Agriculture, 2020), calf management is an area where women have a strong influence. Another factor that may affect the viewpoints regarding calves is the person's role on the farm. Farmers are highly aware of the financial situation on the farm and how much room exists for investment. They are the ones paying the costs, and they are also the ones gaining economically from the benefits of more robust calves, reduced age at first calving, and higher milk production. What complicates their calculations is that costs for a higher milk allowance are evident here and now, whereas some of the gains are expected more than 2 yr in the future. So views about short- and long-term strategies are likely to affect farmers' viewpoints regarding calves. Although employed calf-care workers recognize the financial situation on the farm, they see neither bills nor payments, but their working conditions are largely influenced by practical handling during milk feeding, as well as the calves' health and welfare. This may result in calf-care workers reaching different viewpoints regarding calves than farm owners.

The Concepts of Farmers' Decision-Making and Care

In several instances in the Results and Discussion, we referred to farmers' decision-making ability and care. We will briefly clarify and elaborate on these concepts and how we consider them conceptually in our work.

Farmers' Decision-Making. Since the 19th century, human decision-making has been a well-researched area in psychology and related fields, and several schools of thought exist. Research on decision-making in farming, however, is rather scarce (e.g., McCown, 2002; Lindblom et al., 2017) and deals mostly with economical farm management issues. From a cognitive perspective, normative decision-making theories dominate in farm management research (i.e., the focus has mainly been on the rather narrow and well-defined decision event and not on the decision process as a whole; Hayden et al., 2021). This has led to a knowledge gap regarding "how" decisions are made in practice by farmers. Given the farmers' situations, one cannot expect them to make decisions in a certain stepwise linear sequence in a narrow and well-defined problem space. On the contrary, farmers live and act within a flexible, uncontrolled, socio-technical context in which their life situations are complex dynamic systems, and their decision-making is dynamic and unfolds in a continuous flow (Lindblom et al., 2017).

The naturalistic decision-making (**NDM**) approach focuses on how professional workers make decisions and perform complex functions in demanding situations in the real world (Orasanu and Conolly, 1993). The NDM approach aligns well with the view of Lundström and Lindblom (2018) of the complexity of farming. However, by introducing the care concept, we expand beyond the cognitive ability of NDM to purposely consider the complexities and interdependencies that occur when running a farm and taking care of animals from holistic and sustainability perspectives. In this paper, we do not consider sustainability to be a stable condition, but rather a continuous process that involves adaptation, learning, and changes at several levels, interactions with other humans, nonhumans, and the natural setting, as well as having different roles and functions at different levels in this dynamic system (Folke et al., 2021; Lundström, 2022). To increase agricultural sustainability, we therefore need to apply a relational perspective on the farming context, and this is where the care concept comes in.

The Care Concept. The care concept originates from nursing theory and has recently been applied in agriculture (e.g., Lundström and Lindblom, 2021; Lundström, 2022). As Puig de la Bellacasa (2015, p. 701) pointed out, "care requires thinking from the perspective of the maintenance of a web of relations involved in the very possibility of ecosystems rather than only from their possible benefits to humans." Care could therefore be viewed as reflective and relational management, which builds on compassion, sympathy, and mutual dependency (Puig de la Bellacasa, 2015), implying that we all have a larger responsibility for other aspects in our vicinity. Noddings (2015) distinguished between the concepts *care for* and *care about*. *Care for* implies paying attention and responding to the needs of someone or something (like the 4 themes that we identified here). *Care about* implies having concerns about the needs of someone or something but without necessarily intervening because of those concerns. *Care for*, then, implies increased responsibility to attend to the needs of someone or something close to us, as in a farmer-animal relationship. The means for developing and broadening an increased interest in *caring for*, and applying reflective and relational management, are dialogues that can help co-create meaning and shared knowledge. We suggest that incorporating the care perspective in advisory services is an important strategy for developing and broadening farmers' care of their calves and achieving biologically normal milk allowances.

Implications for Advisory Services—How to Reach Biologically Normal Allowances

Elicitation of Active Reflection. Several participants were puzzled by our question about how they had

reached their current milk allowance, which indicates that this issue may not have been something they had given much reflective thought to, but rather they were continuing traditions established by previous owners and staff. Keeping to tradition and not changing the milk allowance (except with acute need) was also reported by Palczynski et al. (2020) as a reason for restrictive feeding on English dairy farms. Our results suggest that encouraging advisers to discuss milk allowances with their clients, and allowing the farm to reflect more on this topic and encourage active decision-making and reflective calf management from the care perspective, may be means to reach biologically normal milk allowances.

High Milk Allowances Used by Peers Indicate Feasibility. Palczynski et al. (2020) also reported that some farmers were more influenced by colleagues than by advisers, which is in line with our experiences in the FGI, where the influence of participants using higher milk allowances was highly noticeable in 5 of the 6 groups. Inspiration from peers demonstrates the feasibility of the routine in question in the practical farm setting, and proof of feasibility may be 1 reason explaining the seemingly strong influence. Sharing the experiences of farming colleagues who use higher milk allowances (e.g., in farmer magazines, information leaflets, meetings, and farmer exchange groups), may therefore be an instrument for advisory services to motivate farmers to reflect upon their peers' care of their calves and increase their own milk allowances.

Technical Equipment. The use of technical equipment such as pumps and tanks to handle whole milk efficiently and hygienically, and especially the use of milk taxis was reported to open possibilities for higher allowances by facilitating milk feeding. However, their capacity was sometimes a limitation, which further illustrated the economic constraints in calf management. Potentially, encouraging sales companies to adjust their prices or increase the freedom of choice in optional equipment would encourage the purchase of larger models; similarly, providing more easily accessible or more proactive repair services may help increase feasibility of feeding higher milk allowances. The importance of such equipment for reducing the physical workload and the need to include the devices when planning new calf barns may also be an important message that advisory services could use to encourage biologically normal milk allowances. From a care perspective, technical equipment is a means to maintain the web of relations involved in caring for the calves and humans on the farms.

It became evident that supplying 3 meals manually per day was not believed by most participants to be a feasible option. Higher use of automated milk feeders could be another means to encourage increasing milk allowances. Medrano-Galarza et al. (2017) found that Canadian farmers using automated milk feeders served a significantly higher milk allowance to their calves at 4 wk of age (median: 9.5 L/d) than farmers with manual milk feeding (median: 7 L/d). The use of milk feeders by Canadian farms was, however, limited (16% of farmers). In Sweden, 13% of farms were reported to use automatic milk feeders 2 decades ago (Pettersson et al., 2001), and the general experience is that their use has not increased but possibly decreased since those days. Several of the participants said that they had previously used automated milk feeders but that negative experiences had made them abandon them. Research in the past couple of decades suggests that some of these problems can be alleviated. For instance, increasing portion sizes improves feeder usage and reduces competition (Jensen, 2004; Nielsen et al., 2018). Cross-sucking may be reduced by feeding large milk volumes, improving weaning, and modifying the milk feeders (Jung and Lidfors, 2001; Weber and Wechsler, 2001; Ude et al., 2011). Reducing group sizes reduces competition and helps control infectious diseases (Jensen, 2004; Svensson and Liberg, 2006). Detecting disease (which is more challenging with automatic feeding systems than with manual feeding) may be helped by the use of additional automatic disease indicators (Svensson and Jensen, 2007; Bowen et al., 2021).

Terminology—Biologically Normal Allowances. Participants suggested a variety of minimum and maximum daily milk allowances, but they seemed to agree that 4 L daily would sustain survival but not support calf growth, and they therefore argued that this is a low allowance. In contrast, it appeared from the discussion that participants who supplied 6 L daily did not associate this allowance with hunger or impaired calf welfare, and hence did not perceive this allowance as low. It might be advisable for advisory services to use the exact term "biologically normal allowance" (rather than "high allowance" or "allowances supporting accelerated growth") for volumes of $\geq$10 L/d to emphasize that, from a biological perspective, the standard level of 6 L/d should be regarded as low. This new terminology is well-aligned with the "caring for" perspective, and encourages increased responsibility for the calves' nutritional needs.

Knowledge Support About Calf Physiology and Behavior. The varied levels of knowledge among participants regarding physiology and behavior indicates that these topics are important for discussion on farms and in relevant courses, and that knowledge support can be one means to pave the way for increasing milk allowances. The care perspective could be fostered through various kinds of dialogues that support reflec-

tive management. Participants seemed to have a high awareness of the research on the benefits of a biologically normal milk allowance and its association with future milk production but seemed to be less aware of the negative effects of a low or standard milk allowance and the signs of hunger. Further dissemination of research findings demonstrating poor calf welfare and impaired organ development related to restricted milk-feeding plans may increase incentives for farmers to increase their allowances.

One fear that participants identified was that higher milk volumes would exceed the capacity of the abomasum and result in milk entering the rumen. However, Ellingsen et al. (2016; Ellingsen-Dalskau et al., 2020) radiographed 9- to 27-d-old calves before, during, and after they received large meals of milk by teat bottle containing contrast medium. Calves that had been habituated to 3 meals of 2 L daily drank up to 6.8 L voluntarily in 1 meal and the researchers found no evidence of milk entering the rumen, nor any signs of discomfort. Sharing information like this with farmers and making room for reflecting upon the new information may encourage the use of biologically normal milk allowances.

The calves' development into ruminants and productive heifers appeared to be important drivers for the participants. Participants also stressed the importance of other factors than the milk allowance per se for the well-being of the calf. In more intensive milk-feeding schemes, more attention must be paid to ensuring that weaning is not carried out too early or too quickly, as doing so may impair the growth and development of the calf (Mirzaei et al., 2018; Welboren et al., 2019; Parsons et al., 2020). Optimal weaning routines may therefore be an important area for knowledge support and encouraging reflection when increasing milk allowances.

Pricing of Surplus Calves. The results of the present study indicate that if prices were set by kilogram instead of per calf, dairy farmers would be more prone to supply more milk to the surplus calves they sell to beef fattening units. Increasing the milk allowance is likely to make calves less susceptible to diseases on the dairy farm in accordance with results by Ollivett et al. (2012) and Lorenz et al. (2021b). Furthermore, higher body weight and improved status at transport are likely to largely contribute to better health and welfare of these calves at the beef fattening unit as highlighted by Winder et al. (2016) and Renaud et al. (2018). Suboptimal status at transport, long transport at an early age, and commingling at collection centers and suboptimal beef units can all result in high mortality, morbidity, and antimicrobial drug use at fattening units. In Swedish dairy beef production, most bull calves are sold to fattening units using between-farm sale agreements, and a large proportion of calves enter fattening units after weaning (Hessle and Jamieson, 2020). A reduced commingling and number of farms of origin and increased bodyweight at arrival have been associated with reduced levels of morbidity and mortality (Renaud et al., 2018, 2019). However, it is generally acknowledged that the levels of these factors are higher in a fattening unit than they are in replacement heifers that remain in the dairy herd. Incentives for dairy farmers to increase care of their surplus calves are indeed valuable and this paper further supports previous findings by Palczynski et al. (2022) and Wilson et al. (2023) that a new price model is likely to be a constructive way forward.

More Farms Manually Feeding Their Calves May Find 8 L/d Reachable. Participants stressed the importance that the milk allowances are safe and not overloading calves' digestive systems and fit into an uncomplicated routine that could be carried out also by less experienced staff. However, although many of them argued that they used a lower milk allowance because they felt a meal size of 3 L given twice daily was a safe feeding regimen, several participants who gave meal sizes of 4 L (8 L/d) declared this to also be a safe feeding regimen. Hence, although a biologically normal milk allowance would be preferable for the calves, our findings indicate that giving 2 meals of 4 L each may be a feasible way for herds using manual feeding to reach at least a somewhat higher allowance. It should be noted, however, that all herds in the present study feeding manually gave whole milk by nipple buckets, and it is possible that farmers would feel that feeding meals of 4 L milk replacer of poor quality in open buckets is a less safe feeding regimen.

Nonrewarded visits, considered to be a sign of hunger in calves fed with automatic calf feeders, were significantly reduced in calves that received 8 L/d versus 6 L/d (although not as low as in calves that received 10 L/d), indicating that calves on 8 L/d had better welfare than those on 6 L/d (Rosenberger et al., 2017). Rosenberger et al. (2017) did not find significantly higher growth rates for calves on 8 L/d versus 6 L/d because calves on the lower allowance compensated for the reduced energy intake from milk by an increased solid food intake. A higher growth rate for calves on 8 L/d versus 6 L/d was, however, reported by Jafari et al. (2021). Several researchers have failed to demonstrate any effect of feeding frequency (3 vs. 2 feedings daily) on growth rate in calves fed 8 L/d (Kmicikewycz et al., 2013; MacPherson et al., 2019; Jafari, et al., 2021), indicating little economic benefit from increasing the number of meals at this allowance level. Calves given large meals have been reported to have reduced insulin responsiveness (Bach et al., 2013; Yunta et al., 2015),

but MacPherson et al. (2019) did not find this effect and suggested that the different results were an artifact of the use of different approaches to the glucose tolerance test. MacPherson et al. (2019) also suggested that delaying abomasal emptying can be a mechanism for glycemic control in these calves. A reduced abomasal emptying, however, has been proposed to cause abomasal bloat. This condition, as well as abomasal ulcers and ruminal drinking, have been reported to be associated with infrequent large meals. However, the cause of these conditions remains unclear and little evidence exists to support that feeding 2 meals of 4 L daily would induce such problems. This protocol seems to be an acceptable way to increase milk allowance as a step toward biologically normal allowances.

Methodological Considerations

Our motivation for using FGI was that this method is appropriate for exploring specific views on a particular topic, because participants are encouraged to explore, clarify, and discuss individual as well as shared views. The use of FGI enables participants to hear and reflect upon each other's comments without the objective of reaching a consensus beyond their initial utterances. In so doing, FGI allow researchers to cost-effectively collect high-quality data when participants interact with each other (Patton, 2002; Stewart and Shamdasani, 2015). However, FGI have some potential limitations, such as the possibility of limited dialogue and interaction among the participants, and the possibility that participants might not express their own opinions or beliefs about the topic due to groupthink, especially when their thoughts differ from other participants, or if space is not allowed for expression of marginalized opinions and voices. Dominant participants may hinder other participants from sharing and expressing their views. Facilitators can negatively influence FGI by unconsciously revealing their own opinions or biases, or participants might not express their opinions out of fear of disappointing or going against the facilitator. Any of these circumstances occurring can lead to skewed data and inaccurate results (Patton, 2002; Stewart and Shamdasani, 2015). In our study, we tried to minimize these potential weaknesses by not presenting any research on milk allowances to calves or related work. Furthermore, the presence of a cofacilitator (whose main function was to support the facilitator) also encouraged nondominant participants to express their views. Our experience of the discussions in the FGI were that they were intense and vivid, allowing for opposing thoughts to be heard in mostly a positive manner, albeit we cannot ensure that all participants explicitly expressed their own views and opinions. Having the participants write down their milk allowances on sticky notes individually before the group discussions started was our way of reducing the influence that participants might have had on each other regarding this crucial quantitative question.

The study was conducted by a team of 3 persons with differing perspectives. One of the researchers is outside the field. All 3 researchers participated in the FGI and were involved in the analyses. Our procedure of analysis first by the individual researchers separately, and then by the entire team together, increases the trustworthiness of the obtained results.

To capture a diversity of perspectives, we purposely sampled participants to represent a diversity of persons involved in calf management, rather than to represent an accurate subsample of farmers and farm staff in the country. We largely succeeded in recruiting persons according to our selection criteria, but it cannot be excluded that additional perspectives would have been raised if we had been able to include more farms with automatic milk feeders and milking 3 times daily. Calf-care workers were interviewed in separate groups where they constituted the sole or majority of the group so that the power imbalance between owners or managers and calf-care workers would not hinder the workers from presenting their views.

It should be considered, however, that big differences can occur between what people say they do and what they actually do (Patton, 2002). This is an acknowledged fact within qualitative research, and future research could include farm visits and workplace studies to investigate and analyze actual milk allowance protocols and related work routines in practice.

CONCLUSIONS

Our study stresses the importance of practical feasibility for successful advising on milk-feeding management in calves. The complexity of factors influencing farm decision-making may offer an explanation for the slow implementation of biologically normal milk allowances. *Life beyond work*, *Farm facilities and equipment*, *Care of the calves*, and *Profitability and production* were important determinants. Participants strove to maximize the daily milk allowance but felt that they had limited freedom to act within these 4 identified themes. Most participants did not think it practically feasible to feed calves manually more than twice a day. Even so, our results indicate that more farms should be able to reach at least 8 L/d within their current milk-feeding protocols. We suggest that a more holistic perspective should be taken when advising farmers about milk allowances, putting particular emphasis on the caring and social sustainability of the individual farm.

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