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Review

Positive Welfare Indicators in Dairy Animals

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Abstract: Nowadays, there is growing interest in positive animal welfare not only from the view of scientists but also from that of society. The consumer demands more sustainable livestock production, and animal welfare is an essential part of sustainability, so there is interest in incorporating positive welfare indicators into welfare assessment schemes and legislation. The aim of this review is to cite all the positive welfare indicators that have been proposed for dairy animals in theory or practice. In total, twenty-four indicators were retrieved. The most promising are exploration, access to pasture, comfort and resting, feeding, and behavioral synchronicity. Qualitative behavioral assessment (QBA), social affiliative behaviors, play, maternal care, ear postures, vocalizations, visible eye white, nasal temperature, anticipation, cognitive bias, laterality, and oxytocin have been also studied in dairy ruminants. QBA is the indicator that is most often used for the on-farm welfare assessment. Among all dairy animals, studies have been performed mostly on cattle, followed by sheep and goats, and finally buffaloes. The research on camel welfare is limited. Therefore, there is a need for further research and official assessment protocols for buffaloes and especially camels.

Keywords: positive welfare indicator; cattle; sheep; goat; buffalo; camel; exploration; comfort; play

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1. Introduction

Positive animal welfare is not an innovative approach to animal welfare [1,2]. Nonetheless, it is a newer approach compared to the common welfare approach and attracts increasing attention. Welfare by definition includes positive aspects, but in animal welfare science, for decades, the focus had been mainly on alleviating poor welfare and not on promoting positive experiences [3]. Nowadays, the focus is moving gradually to also promoting positive experiences. Positive welfare focuses not only on the negative aspects of welfare, which should be alleviated and kept above a minimum standard [4,5], but also emphasizes the positive aspects of welfare that animals should be experiencing in their lives [4]. It is a topic that is gaining increasing interest not only from animal welfare scientists but also from the public, on both a national and international level since animal welfare is steadily incorporated in legislation, schemes, welfare assessment protocols, and the labelling of livestock products. Consumers demand sustainable production methods, and nowadays, animal welfare is considered an important component of sustainability [6,7]. It is not only that the consumer believes that it is ethically right to promote the enhanced welfare of livestock animals but also that animal welfare is an important part of sustainability and is becoming a necessary part of profitable livestock production that must follow the demands of the consumer [6].

Animal welfare has nowadays been recognized as a worldwide target of sustainable agricultural policy [8]. The United Nations Committee on World Food Security formally denoted animal welfare as a fundamental pillar of sustainable agricultural development, food security, and human nutrition together with the other classic domains, i.e., economics, society, and the environment [9]. At the same time, there is an increasing political modernization around the issue of animal welfare that is become apparent by the "One Health" or "One Welfare" concepts set by national non-governmental organizations (NGOs) and

consumer groups [10,11]. More than 90% of EU citizens prioritize animal welfare, and more than half of them are ready to pay more for products derived from systems offering a high welfare status since they are considered healthier, safer, and more environmentally friendly [12].

Although animal welfare is increasingly viewed as a sustainable solution by the consumer, intensification in livestock species is still high. There is a growing demand for livestock products due to the rapid increase in the world population. Dairy animals, especially dairy cattle, are key species in animal husbandry. Milk production is rising globally, with cattle being responsible for 81% of world milk production [13]. According to FAOSTAT [14], since the 1960s, milk production has more than doubled in developing countries. World milk production is expected to increase by 1.7% over the next decade in almost all the regions of the world [15]. Millions of dairy animals are kept in various husbandry systems, mostly intensively. Can the welfare of these animals be composed of positive aspects so that they experience a good life, and if not, what changes should be made? To answer this question, the role of welfare science is crucial. Despite the debate between scientists, there is an intense need for incorporating gradually positive welfare indicators in welfare assessment schemes and legislation. It is the responsibility of all animal welfare scientists to communicate their knowledge in an understandable manner to all individuals in society [5], and animal welfare should be able to be incorporated into laws by focusing on the ethical part of welfare [16].

The definition of positive animal welfare, and of welfare in general, has been subject to debate because scientists are humans and humans are influenced by their personal values [17]. There have been four different approaches to positive animal welfare: quality of life, positive emotions, positive affective states, and happiness [18]. The quality of life (QOL) approach was introduced by McMillan [19] and defined as "the subjective, conscious experiences of the animals". McMillan [19] also proposed that affect is a multidimensional continuum and that QOL varies along this continuum. The positive emotions approach emphasizes that vertebrates are cognitive species able to experience emotions [20]. Yeates and Main [21] went a step further by stating that vertebrates are able to experience happiness equivalent to human happiness, which is a long-term positive emotion [22]. Finally, Mellor [23] initiated the positive affective state approach by defining as affective states "all feelings and emotions that are consciously experienced as pleasant and unpleasant and motivate the animal to behave in goal-directed particular ways".

Regardless of the positive welfare definition, the core of the approach is the same: that the alleviation of the negatives is not enough for a good life, and that positive experiences and emotions are also necessary. In theory, positive welfare raises the bar higher than the common welfare approach; however, in practice, it is more difficult to be evaluated. Nonetheless, the research on positive welfare indicators is flourishing.

The aim of this study is to review all the positive welfare indicators that have been suggested for dairy animals. Dairy animal husbandry is increasing globally [6,14,15], as is the concern about the welfare of dairy animals and the sustainability of the production [6,7]. Both indicators that have been proposed theoretically or studied experimentally/in the field will be included. As far as authors acknowledge, this is the first attempt to cite the positive welfare indicators that have been proposed specifically for dairy animals. Review articles on the positive welfare of ruminants already exist (e.g., [23,24]) but they refer both to animals of meat and dairy production. We believe that our attempt will help to summarize the positive welfare research on dairy species, and we hope that it can contribute something to readers interested in this important area of research. In addition, our article includes cattle, sheep, goats, buffaloes, and camels. It is, as far as our knowledge goes, the first work including positive welfare indicators not only for ruminants but also for camels. Although camel husbandry is increasing, the research on camel welfare is limited [25]. We believe that our article will stimulate concern and discussion about the positive welfare of this species.

2. Materials and Methods

All material was retrieved through Google scholar and Web of Science. The species that we included in the research were cattle, sheep, goats, buffaloes, and camels. Some keywords that were used for the research alone or in combinations were: "positive welfare", "positive emotion*", "positive state*", "positive welfare indicator*", "cattle* OR cow*", "dairy cattle OR cow*", "calf OR calves", "heifer*", "*Bos taurus*" "steer*", "bull", "sheep", "lamb*", "ewe*", "ram*", "*Ovis aries*", "goat*", "*Capra hircus*", "buffalo*", "*Bubalus bubalis*", "camel*", "dromedary camel*", "*Camelus dromedarius*", and "ruminant*". As a start, general research was conducted. In each case that a positive welfare indicator was retrieved, a specific search was performed about the indicator separately. Some articles were also used after enlarging our research with the references of the articles that we had already retrieved. The search period that we used was 2000–2022 because we wanted to include as much recent research as possible, but in a few cases, we also cited some articles that were published earlier since we thought that their contribution to the results was important [26,27]. Both behavioral and physiological indicators were included. We also selected as results some papers that refer to animals in general and not to the dairy animals that we studied specifically. These results referred to vertebrates [20,28–33], domestic animals [34–37], mammals [38], and farm animals [39]. They could be applied to dairy animals and have also been studied for other livestock species.

Following this selection process, a total of 119 articles were included in our database, including the Welfare Quality protocol for cattle [40] and the AWIN assessment protocol for sheep [41] and goats [42].

3. Positive Welfare Indicators

Twenty-four positive welfare indicators were retrieved, both behavioral and physiological, all animal based. They have been studied experimentally, on the farm level or proposed on a theoretical basis. The indicators, the dairy animals that they correspond to, and the literature findings are summarized in Table 1.

Table 1. Positive welfare indicators categorized by dairy animal.

Positive Welfare Indicator		Animal	References
Behavioral parameters	Exploration	all	[20,28,29]
		cattle	[43–45]
		buffalo	[46]
	Feeding behavior, access to pasture and rumination	all	[28]
		cattle	[47–51]
		sheep	[42–54]
		buffalo	[46]
		camel	[55,56]
	Comfort, lying, and resting behaviors	cattle	[57–59]
		goat	[60,61]
		sheep	[62,63]
		buffalo	[64]
		camel	[55]
	Social affiliative behaviors and brushes	all	[28–30]
		cattle	[34,65–73]
		camel	[56]
	Play behavior	all	[28–32]
		cattle	[74–77]
		sheep	[26,78]

Table 1. *Cont.*

Positive Welfare Indicator		Animal	References
		goat	[79]
	Behavioral synchronization	all	[28,29]
		cattle	[27,58,80]
		sheep	[63,81,82]
	Maternal behavior	all	[28]
		cattle	[44,83–86]
	Wallowing	buffalo	[46,87]
	Mating behavior	all	[28]
	Pro-social behaviors	all	[34]
	Anticipatory behavior	cattle	[88,89]
		sheep	[78,90]
		goat	[91]
Postures, expressions, and vocalizations	Ear postures	cattle	[92–96]
		sheep	[97–100]
		goat	[101]
	Tail postures	cattle	[92]
		sheep	[99]
		goat	[101]
	Body postures	cattle	[29,92]
	Facial expressions	all	[33,38]
	Eye white	cattle	[102–107]
	Vocalizations	all	[29,39]
		cattle	[39,108–110]
		sheep	[100,111]
		goat	[101]
		buffalo	[46,112]
		camel	[56]
Qualitative behavioral assessment		cattle	[113,114]
		sheep	[115]
		buffalo	[116,117]
Positive human–animal interaction		all	[35]
		cattle	[93,94,113,118]
		sheep	[97,99,119]
		goat	[120]
Other indicators	Nasal temperature	cattle	[100,105,118]
	Cognitive bias	cattle	[89,121–124]
		sheep	[54,125–127]
	Laterality	cattle	[92,123,128]
	Resilience	all	[36]
	Oxytocin	all	[37]
		cattle	[129,130]
		goat	[129]
		sheep	[119]

3.1. Behavioral Parameters

3.1.1. Exploration

Exploration is one of the first behaviors that has been studied as a positive welfare indicator. Animals explore their environment to acquire information about the available resources and feel in control of it. It is a behavior strongly correlated to feeding behavior [28]. Exploratory behavior is deeply motivated in ruminants since as prey species they explore their environment not only for foraging purposes but also to avoid predators. According to Boissy et al. [20], exploration is a perfect candidate as a positive welfare indicator because it is a motivational need of vertebrates and is affected by the feeling of fear. It is a behavior that is suppressed under fear or other immediate needs. It indicates the presence of positive emotions and simultaneously the absence of threats to survival and negative emotions. The behavior is self-rewarding and reinforcing, so animals keep performing it repeatedly, although the goal may not always be reached [20]. It is a goal-directed behavior [28], experienced as pleasant. The animal that performs the behavior is driven by the expectancy of the reward that it will acquire. When acquiring the reward, it experiences pleasure, and this plays a reinforcing role in performing the behavior again. As a result, an animal that is expressing exploratory behavior is likely to be experiencing positive affective states [28,131].

There are two types of exploration: inquisitive and inspective exploration [20,29]. Inquisitive exploration is driven by curiosity and when the animal is looking for a change. Inspective exploration is a result of a change in the animal's environment wherein the animal responds to this change. The first type is always linked to positive affect and so is more valid as a positive welfare indicator [20,29] since an animal that explores is an animal that feels safe and chooses to explore [29]. Inspective exploration, on the other hand, should be interpreted with caution since it can be a result not only of a positive affective state but also fear. According to Nawroth et al. [132], exploration could be considered a personality trait that could also be used to predict the performance of animals in cognitive tasks. In their study, less exploratory goats of various breeds performed better in a non-associative cognitive task compared to more exploratory goats due to differences in personality type rather than learning capacities.

Exploratory behavior is increased in more complex environments regarding space and enrichment. Tuomisto et al. [43] observed higher manipulating activity and gnawing at bark in Hereford bulls reared in forest paddocks compared to uninsulated barns. They have interpreted this as higher normal exploratory behavior. Apart from the study of Tuomisto et al. [43], all other studies that have been retrieved assess exploration by using a novel object test. Sabia et al. [46] observed that buffalo heifers housed in an indoor pen with access to pasture devoted more time to exploring a traffic cone during a novel object test in a test arena compared to free-ranging animals. The authors concluded that this finding could be attributed to the fact that animals housed in a less enriched environment were more motivated to express exploratory behavior. On the other hand, Westerath et al. [45] observed only slight differences regarding the exploration of crosses made of plastic hosepipes in beef bulls housed in pens with fully slatted floors compared to bulls housed in littered pens. Still, the bulls housed in pens with slatted floors expressed more total exploration time and licking/chewing of the objects, while all other occupational behaviors with the object generally had the same duration. The authors concluded that the test is not valid for the on-farm evaluation of positive emotions in its current form since licking/chewing can be a result of diets poor in structured crude fiber of animals in the pens. In another study by Santo et al. [133], dairy calves that were separated from their mother twelve hours after birth expressed the same exploration level towards a traffic cone in an experimental arena, and the same exploration towards an unfamiliar cow in a confinement test, as calves reared with their mothers until 14 days of age. All parameters regarding the exploration of an umbrella in an experimental arena were also similar between calves reared with no motherly contact and with motherly contact until fifty-six days of age, as shown in a study by Wenker et al. [44].

Exploration is one of the few positive welfare indicators that has already been incorporated in protocols for the on-farm welfare assessment. According to the Welfare Quality protocol for cattle [40], the positive emotions criterion is judged by qualitative behavioral assessment (QBA), and the term "inquisitive" is used to indicate an animal in a positive state. AWIN assessment protocol for sheep [41] mentions the same term. The AWIN assessment protocol for goats [42] uses the term "curious" to describe an animal that is engaged in exploratory behavior.

3.1.2. Feeding Behavior, Access to Pasture and Rumination

Feeding behavior is strongly linked to exploratory behavior and is a crucial motivational and survival need of all animals [28]. All animals acquire consummatory pleasure and engage in this goal-directed behavior with their environment. It is reinforcing, and the animal experiences the pleasure of feeding, so it is likely to indicate a positive emotional state. Verbeek et al. [54] tested the performance of sheep in a judgement bias test after consuming palatable feed or unpalatable wood chips as a reward. The sheep that had consumed the palatable feed before the test demonstrated more optimistic judgment bias during the test, which indicates that they were in a positive state due to the feed intake. In addition to giving the animals the pleasure of exploring for feed, it is important to provide them with feed variety and the ability to choose. According to Manteca et al. [134], feed choice enables animals to express their natural behaviors, maintain homeostasis and reducing stress, since animals have an internal ability to choose the feed combination that meets their particular needs. Still, feed preference and exploratory foraging behavior are also driven by individual discrepancies. Meagher et al. [49] studied the exploration and feeding preferences of Holstein heifers about various feedstuffs versus their usual diet and discovered consistent personality traits in the individuals. Preference tests are often used to understand which feed is judged as most preferable by the animals and so could be used as a means of environmental positive welfare stimulation. Westerath et al. [51] concluded that specific feeds, especially concentrated, are categorized as positive by dairy calves. In their study, all individuals expressed a preference for novel feed (concentrated feed and carrots) compared to their usual feed (corn silage and hay), while most animals expressed a preference for the novel concentrated feed over the carrots. Spörndly and Åsberg [50] also evaluated the preference of dairy calves between various basic feeds, pellets, and feed mixtures based on ground barley with the addition of sweet or fat products; pellets were the preferable feed, followed by heat-treated rapeseed meal.

Grazing is a strong natural motivational behavior in dairy animals, and so access to pasture can benefit welfare. Cows in the barn typically feed from four to six hours per day, while on pasture, they spend from one to ten hours per day grazing [135]. The behavior has a diurnal rhythm, with peaks at sunrise and sunset [136]. Access to pasture can have various positive effects in addition to fulfilling animal's behavioral needs and giving them access to light and exercise. Crump et al. [48] used pedometers to record dairy cows' walking and lying activities with eighteen hours of overnight access to pasture, compared to cattle kept indoors. The pedometers indicated that cows on pasture walked more and had fewer lying bouts and longer lying times since the surface was more comfortable and there was enough space to enable lying synchronicity. In addition to lying, pasture enables feeding synchronicity among cows. Lying and feeding behaviors are both synchronized in ruminants [135,137]. Due to limited space and feed resources, these behaviors are less likely to be synchronized indoors. Furthermore, cattle on pasture tend to feed in the day and lay down at night [135,136], but in barns, they tend to spread out both behaviors throughout the day and night [135]. Ruminating is also essential for ruminants' well-being. Cattle, sheep, and goats ruminate for about eight hours per day [135,137]. Rumination takes place mostly when animals are lying down and at night [136,137]. As reviewed by Arnott et al. [47], preference tests have also been used to evaluate whether cows select between pasture and indoor housing when given the choice. The general conclusion is that dairy cows have a partial preference for pasture.

Small ruminants are often kept in less intensive systems compared to cattle. Sheep are grazers that occasionally browse, while goats are browsers [137]. Stubsjøen et al. [53] evaluated various welfare parameters of sheep housed in different systems in South Norway. The first component of QBA, labelled "mood", was positively linked to outdoor access during the winter, indicating positive affective states for the animals when being outdoors. Dwyer [52] supports also that the extensive environment offers behavioral freedom to the sheep, but attention is needed to know when the animal begins to suffer because it cannot be adapted to its environment. Feeding behavior is also synchronized in ruminants and can be diminished due to space limitation in contrast to pasture. Small ruminants that cannot feed or drink simultaneously line up behind one another [138], a behavior observed in sheep when space allowance is decreased [63]. The AWIN welfare assessment protocol for goats [42] (but not for sheep) calculates the expression of social behavior criterion by the welfare parameters queuing at drinking and feeding.

In buffaloes, access to pasture also promotes wallowing, which is a strong motivational need. Sabia et al. [46] observed that buffalos kept in a free-ranging system expressed both grazing and wallowing behavior and had stronger immune protection compared to conventionally housed individuals.

Regarding camels, there is not yet a protocol for the assessment of welfare, and scientific research is still limited. Padalino and Menchetti [55] proposed a protocol for the evaluation of camels' welfare, reared in intensive and semi-intensive systems. They tried to adapt the Welfare Quality and AWIN protocols to camels. They propose the number of animals ruminating in the shade as a positive welfare indicator. Zappatera et al. [56] also observed that camels in the shade spend more time ruminating compared to camels under the sun.

3.1.3. Comfort, Lying and Resting Behaviors

Lying and resting behavior is highly motivated in cows. As reviewed by Tucker et al. [59], cows perform rebound lying behavior after being prevented from resting or experiencing frustration and prefer lying down even compared to feeding. Cows lie down about nine hours per day in pasture-based systems and about ten to twelve hours per day in tie stalls and free stalls [59]. The shorter total lying behavior in pasture-based systems can be explained by the longer grazing behavior of the animals in order to fulfill their nutritional needs. High lying time is linked to higher comfort indication and the possibility of positive affective states [57,59]. Still, the causation of lying behavior in the cattle needs further examination since it can be influenced by estrus, parturition, diseases, housing and managing conditions, or even the personal temperament of the animal [59]. Cattle in loose housing systems experience enhanced comfort compared to tie stalls; the less restricted the housing, the more improved the cow's comfort [57]. As reviewed by Beaver et al. [57], the term "cow comfort" is defined differently in the studies that evaluate its effect on the affective state of the animals and is judged by using different metrics. Nonetheless, the result is that the higher the comfort, the higher the expression of natural behavioral repertoire and experience of positive affect. Still, further research is needed to fully understand this behavior in cattle and the use of comfort in the welfare assessment [57,59].

Another factor that indicates that comfort and lying represent a potential positive welfare evaluation tool for the cattle is that the behavior is highly synchronized. Synchronization is another positive welfare indicator of social group-living species. Lying and resting synchronization occurs both indoors and outdoors [57–59]. Stoye et al. [58] observed that 70% of the individuals at pasture exhibited the same posture for approximately 93% of the experimental time. The animals were more synchronized with their near neighbors compared to randomly chosen members of the group. The behavior is associated with laterality, which is influenced by the personal preference of the animals. Tucker et al. [139] observed that some animals display left laterality, whilst others show no preference for lying on one side compared to the other.

In goats, comfort is also correlated with elevated welfare levels [60]. Aschwanden et al. [60] observed that after structural enrichment of pens of small groups of goats, fewer resting bouts were interrupted, the resting bouts were longer, and the animals performed a carry-over effect when they were returned from the enriched situation to the original. In addition, Ehrlenbruch et al. [61] observed that goats prefer to rest more frequently against walls and with wall support in pens with additional walls, especially cubicle walls. On the contrary, additional walls do not increase the resting time or the synchronicity in the resting behavior of ewes [63]. The resting time and comfort of ewes have been observed to increase when front- and back-shaped wood resting platforms are used [62].

Buffaloes exhibit lying and resting behavior similar to cattle [87,140]. They also perform lying idle, which represents a type of resting behavior [64]. For the evaluation of the resting behavior of buffalo, Napolitano et al. [64] proposed as animal-based measures the prevalence of animals lying partly/completely outside, lying in collision with the equipment, and the duration of lying behavior. Padalino and Menchetti [55] proposed the evaluation of the resting behavior of dromedary camels at the herd and animal level for the calculation of criterion comfort around resting.

3.1.4. Social Affiliative Behaviors and Brushes

Social affiliative interactions are typical in dairy animals. Together with aggressive behaviors, they create balance and structure in the group [135]. They strengthen the bond between individuals and create general group cohesion. According to Mellor [28], social affiliative behaviors are perfect candidates as positive welfare indicators since they are strongly associated with bond affirmation and they motivate animals to attain and maintain the comforting positive effects of companionship and protection [28]. Furthermore, they have a social buffering effect and help individuals to recover better after stress, since the presence of conspecifics and the feeling of belonging to a group is perceived as positive by the animals [29]. As analyzed by Špinka [30], there is a social dimension of emotions in social animals, and they can experience positive and negative emotions that strengthen their affiliative connections by emotional and behavioral entrainment. So, social affiliative behaviors play a key role in promoting positive welfare in the whole group and not only to the individual.

Cows perform social allogrooming behavior, also called social licking [135]. It is a type of pro-social behavior with positive effects for the receiver of the behavior, but it can also elicit positive emotions in the emitter [34]. In adult cattle, the emitter is mostly licking the receiver in the neck region [133] and the head [71], the regions of the animal that are unreachable by self-grooming. Social licking has been incorporated in the Welfare Quality protocol for cattle [40] as an indicator of positive social behavior. It has also been observed that cows prefer grooming specific individuals in the group. Social exchange of social licking increases positively with cohabitation between individuals [71]. In addition, it is more common between related animals than half-siblings [72]. Allogrooming is also a strongly motivated behavior of the mother to the calf that enhances the mother–calf bond. Johnsen et al. [65,84] observed that mothers that were separated from their calves and then reunited in a mixing group of animals preferred to lick, sniff, and rub their own calf. Furthermore, in the same study, calves that were kept and raised without their mother spent more time allogrooming each other when reunited in the mixing group. Allogrooming generally contributes to the stabilization of the social relationship in a group [72] but also has a cleaning purpose. Sato et al. [71] observed that social licking tended to increase in a dirty barn and under feed restriction, and that it may have a stress-buffering effect [29,71]. So, these factors must be excluded before it is used as a positive welfare indicator. Allogrooming is also performed by buffaloes, for both body care and maintenance of social structure [87]. No specific studies have been performed about allogrooming in buffaloes, but it is mostly performed in order to ensure body cleanliness [140]. In addition, buffaloes perform another social affiliative behavior, namely

social horning [140]. Camels also come into physical contact by sniffing and allogrooming each other, and this is considered a positive interaction [56].

Self-grooming can be both a positive and negative welfare indicator in cattle. It is a positive indicator since it is a natural behavior [135], but it can also be elicited due to stressors and negative environmental factors. Herskin et al. [141] observed that self-grooming and standing increased when dairy cows were exposed to novel feed or an unfamiliar person. In another study by Lv et al. [142], suckling dairy calves that experienced feed restriction displayed increased self-licking behavior compared to a positively stimulated group of calves that received a feed reward. Westerath et al. [51] also observed that vocalizations and self-grooming were increased in calves after being brushed by a human or offered special feed. Zappatera et al. [56] observed that dromedary camels expressed increased self-grooming when under the sun, while they expressed increased social interactions under shade; they concluded that shade areas should be used in camel farming to promote the positive welfare of the animals.

Automatic brushes have been increasingly used and studied during the last decade since they enhance the welfare of cattle due to their grooming action and contribute to the skin cleansing of the animals. Cows are highly motivated to access a mechanical brush and have been observed to choose access to the brush over fresh feed [68]. It has also been observed that brushes reduce the stress of calves after weaning, decrease the non-active time of the calves, and increase the eating time and weight gain [73]. In another study by Horvath et al. [67], the provision of automatic brushes to dairy calves after weaning increased the coat cleanliness and decreased pen-directed suckling. Park et al. [70] studied the effects of environment enrichment with mechanical brushes in steers. The animals performed less stereotypic behaviors, were less aggressive, and did not habituate to the brush, although the experiment lasted 253 days, indicating that the brush can provide a lasting positive welfare benefit for the animals. Furthermore, dairy cows during parturition have been observed to lick their offspring more during the first hour post-calving if they had access to an automatic brush pre-calving [69]. Brushes also increase self-grooming [66] and have been proposed as a means to detect animals with lameness (locomotion score 4), since these animals only use brushes that are installed near to the feed bank [143].

3.1.5. Play Behavior

Play is considered a luxury behavior, performed mostly when there are no threats to fitness; it is a behavior that is suppressed both in quality and quantity under feed restriction or environmental conditions that risk fitness [31,32]. It has a self-rewarding nature and can be exciting and relaxing [28]. There is neurological evidence that it is rewarding [28,32] and that animals are motivated to play because of the pleasure that they experience [31]. The positive impact on animal welfare is both immediate and long term: immediate for the emotional affect that the animal experiences and long term because the behavior helps the animal to develop and enhance somatic skills that will help it to deal with stressful situations in the future [32]. Play behavior is emotionally contagious [30,32]. It is not clear yet if the recipient's emotional state is altered and then play is performed by the recipient or the opposite, but this is not important since in both cases the welfare benefit is the same [30]. For all the above reasons, play is considered a promising positive welfare indicator. However, some parameters should be taken into consideration. This behavior has high flexibility, not only between different species, but also among animals of the same species. In addition, it is a behavior expressed mostly by young animals and declines with age [28,29,32].

All the studies that have been retrieved about play as a positive welfare indicator have been conducted in young animals. Locomotory play in calves decreases at weaning [74,76]. Krachun et al. [76] observed that locomotory play behavior has a positive correlation with energy intake, especially in early-weaned calves, and so proposed play as a useful means of understanding whether the welfare of calves is affected by the feeding practices. In another study, Miguel-Pacheco et al. [77] also observed a positive correlation between play and

energy intake, but after the first week post-weaning. In this study, solid feed was also used to improve the weight gain; still, there was a significant decrease in locomotory play during the first week after weaning. It was suggested that the decrease in locomotory play the first week after weaning is not only due to low energy intake but also because the calf is trying to adapt to the change. These findings are in accordance with Held and Špinka [32], suggesting that play is decreased under threats to fitness. In addition, Duve et al. [75] observed that calves housed in pairs spent more time feeding than calves housed singly after weaning and are more motivated to play and cope successfully with weaning. It has also been found that healthier calves stimulate more social play as well as that the health score of the play companion affects the play behavior. If the companion has a high health score, calves perform more solitary play and less frontal pushing [74]. In addition, calves are more motivated for parallel locomotory play and not frontal pushing [74]. Nonetheless, morphine administration increases social play but has no effect on locomotory play in calves, indicating that social play may be more adequate as a positive welfare indicator compared to locomotory play. Although the evaluation of play behavior on the farm may be difficult and time-consuming, studies support that it can be detected successfully by using accelerometers [144,145].

Play behavior has not been studied in lambs and goat kids as much as in calves, while no studies have been retrieved for buffaloes and camels. Hass and Jenni [26] studied the social play of bighorn sheep (*Ovis canadensis*). The play patterns of lambs were the same as those of adults used in courtship and intraspecific conflict, meaning that social play enables lambs to prepare and develop skills for the future [32]. Social play decreases earlier than object play, and lambs display more play behaviors when released in an enriched arena [78]. In goats, the presence of the mother reduces play-fight compared to kids reared artificially in group, but kids reared with their mother initiate more social play after weaning. Positive gestational handling of the mothers has also been found to positively influence the development of play behavior in the offspring [79].

Play behavior is not used as a separate positive welfare indicator in the Welfare Quality protocol for cattle [40] but the term "playful" is used for the assessment of emotions by QBA. The AWIN protocol for goats [42] evaluates play indirectly, again during the QBA of emotions. A "content" or "sociable" goat is among others a playful goat with its environment of conspecifics, respectively. The AWIN protocol for sheep [41] does not evaluate play behavior.

3.1.6. Behavioral Synchronization

Behavioral synchronicity is high in dairy animals since they are all group-housed social species. It is a promising positive welfare indicator since it is rewarding and the animals experience group cohesion [29], exactly as in social affiliative behaviors. By taking into consideration the emotional contagion and empathy that animals can experience, a behavior can be spread to the whole group [30]. A disadvantage of synchronization as a protentional positive welfare indicator is that it is a group phenomenon, while welfare is a characteristic of the individual [29]. Nonetheless, it can be studied together with other indicators in a whole animal approach.

Various behaviors are synchronized in ruminants. In cattle, postural synchronicity occurs both indoors and outdoors and the behavior is mostly synchronized in the morning and the evening [58]. Lying, feeding, and standing synchronicity is higher in pasture than in pens [80] and when there is enough space for the animal to express the behavior. Nielsen et al. [27] observed that lying synchronicity increased and aggression decreased when the lying area increased in group-housed heifers. Bøe et al. [81] also observed that the lying synchronicity was reduced after the lying space was shortened in ewes. Jørgensen et al. [63] concluded that the resting and feeding synchronicity of ewes was reduced and the time spent queuing to feed was increased after the space allowance was decreased. Since lying synchronicity indicates that animals have enough resources and space, and so reduced aggression and competition, Richmond et al. [82] proposed

lying synchronicity as an animal-based indicator for the welfare assessment of sheep in protocols. Buffaloes also perform behavioral synchronicity, but its implications on welfare and productivity have not yet been studied in detail [140].

3.1.7. Maternal Behavior

Maternal care has been proposed as a positive welfare indicator because it demands a strong bond between the mother and the young that generates positive states in both parties. According to Mellor [28], this bonding is so strongly motivated by the animals, and experienced so positively, that it can be developed even between different species. In addition to strengthening the mother–young bonding, it contributes to peer bonding.

The cow and calf bond can be developed regardless of whether nursing is prohibited, a fact that proves that the bond should generate positive states in the animals. Johnsen et al. [65,84] studied the affiliative behaviors and the latency to reunite between dairy cows and their claves. Three groups were studied: calves reared exclusively on milk feeders, calves exclusively nursed, and calves reared both on milk feeders and their mothers. During the mixing and reunion period, in all three groups, all pairs spend more time allogrooming each other than other individuals. Latency to reunite was higher for the mix-fed group. Lenner et al. [85] also studied how long after abrupt weaning (six to ten months of age) a cow and its young have the need to reunite and how strong this need is. In their study, the need was very strong after one week but decreased at three and five weeks after the separation. Various behavioral criteria were used to calculate the connection apart from proximity to approaching.

Extending the contact period between the cow and the calf can reduce oral stereotypical behaviors of the calf, reduce the stress of claves to novelties, and improve their social development [86]. Calves with partial cow–calf contact show a low response to debonding compared to calves with no contact or stressful debonding strategies from their mother such as using a nose-flip [44]. Dairy calves reared without cow contact display a higher heart rate at the beginning of confronting a novel object and less submissive behaviors in a cow confrontation test since rearing with a cow can contribute to more developed and adaptive social behavior in the calves [83]. In another study by Santo et al. [134], during a new-cow confrontation test, calves raised without cow–calf contact were more vigilant compared to those dam-reared for 14 days that searched more for social contact. The effects of prolonged cow–calf contact have been studied mostly for the offspring and not the dam [86].

3.1.8. Mating Behavior

Mating behavior is pleasurable for both sexes and indicates the experience of positive affective states [28]. Some animals perform the behavior even outside the breeding season. However, in intensive husbandry systems, it is difficult to apply as a positive welfare indicator. In dairy cattle husbandry, the breeding occurs mostly artificially. In small ruminants and buffaloes, artificial insemination is not efficient enough, so males are still used for breeding.

3.1.9. Pro-Social Behaviors

According to Rault [34], pro-social behaviors are “actions in which an individual engages, in order to benefit others”. They always benefit the recipient of the behavior, but not necessarily the emitter. Rault [34] also describes them as “helpful” or “other-regarding” behaviors. If these behaviors occur regularly, since they are always beneficial for the recipient and in many cases also beneficial for the emitter, they promote positive welfare states and can be used as positive welfare indicators in domestic animals. Affiliation, parental care, social play, and synchronization are pro-social behaviors that have already been studied in dairy animals and have been analyzed separately. However, according to Rault [34] there are various pro-social behaviors that can be an approach for future studies,

such as sharing behavior, namely sharing resources and space with other individuals of the same group.

3.1.10. Wallowing

Wallowing is a natural behavior expressed by buffaloes and has been proposed as a species-specific positive welfare indicator. It has thermoregulatory action, especially during hot periods, and enhances protection against parasites [141]. De Rosa et al. [87] studied the effect of two different housing systems on the behavior of buffalo cows, one with an outside yard and a concrete pool, and one with no outdoor paddock or pool. It was observed that the animals with pool access spend significantly more time wallowing, presented increased social affiliative behaviors and interactions, and had increased milk production during the hot months compared to the animals with no pool provision. In another study by Sabia et al. [46], free-ranging buffalo heifers showed a decreased reaction to a novel object test and higher immune protection since they were able to express strongly motivated natural behaviors of grazing and wallowing compared to confined kept heifers. Lately, buffalo farming has become increasingly intensive, and the animals lack access to potholes or pools. As reviewed by Napolitano et al. [140], these systems use other mechanisms to help the thermoregulation of the animals such as showers and spontaneous vegetation; still, this is a risk for buffalo welfare status.

3.1.11. Anticipatory Behavior

An anticipation test is a way of evaluating the affective state of an animal, judging by its anticipation level when waiting for a reward. The anticipation is evaluated between the signaling of a reward and the receiving of the reward, which describes conditioned and unconditioned stimuli, respectively [146]. It is generally considered as a positive experience due to the release of dopamine and endorphins [146,147]. According to Spruijt et al. [146], welfare is a balance between positive (reward) and negative (stress) experiences, and reduced differences between the actual and the expected indicate good welfare. So, the higher the anticipation for the reward during an anticipation test, the more compromised the welfare. Yet, it is important to exclude the fact that the individual in the test is not experiencing such a severe negative state that anticipating behavior is not displayed at all, for example, when an animal is depressed.

Neave et al. [88] studied the anticipation of dairy calves in different housing systems using access to an enriched pen as a reward. The individuals that were housed in basic pens displayed increased anticipation and decreased latency to approach the reward compared to the animals that were housed in a more enriched environment. Furthermore, animals in basic housed pens expressed suppressed behavior after the reward was lost. Crump et al. [89] also observed that cattle with pasture access displayed less anticipation and approached a reward bucket slower compared to cattle that were housed exclusively indoors. Regarding lambs, anticipation has been studied considering play [78,90] and feed as a reward [104]. During play anticipation, they expressed high exploration and locomotion [78,90] and short behavioral bouts with frequent behavioral transitions [90], indicating high anticipation and motivation to play. The behavioral bout and transitions, and so the motivation, differed for feed reward [90]. Goats, on the other hand, have been observed to display increased anticipation and reduced locomotion when they face an uncovered feed bowl compared to a covered one [91].

3.2. Postures, Expressions, and Vocalizations

3.2.1. Ear Postures

Both ear postures and the frequency of ear posture changes have been evaluated as potential indicators of positive emotions, mostly in cattle and sheep, and have been recommended as feasible, non-invasive, and promising positive welfare indicators. The horizontal ear posture in sheep has been suggested to indicate a neutral or positive state, ears pointing backwards uncontrollably in negative situations such as fear, and ears raised

up controllably in unpleasant situations such as anger [96]. Asymmetric ear postures are a result of a sudden situation that promotes surprise [96]. Tamioso et al. [100] observed the ear postures of sheep during brushing by a human. They categorized them as: ears raised up (noted mostly pre-brushing), ears horizontal and backwards (noted mostly during brushing), and ears horizontal (observed mostly after brushing). The raised-up ears before the brushing were attributed to the attention of the animals anticipating the brushing. The horizontal ears during brushing are in accordance with the findings of Boissy et al. [96]. Coulon et al. [97] observed that sheep mostly had their ears horizontal when being brushed and had general tactile contact with their caregiver. Reefmann et al. also observed that sheep during human stroking [99] and positive feeding interaction [98] showed a high proportion of horizontal ears. On the contrary, asymmetric ear postures were often observed during the negative experiences of separation of the group [98] and eating unpleasant feed [99]. In the study of Tamioso et al. [100], the sheep also performed half-closed eyes, leaned against the brush, and stretched the neck during brushing, actions that indicate that they were experiencing a positive state. Regarding the frequency of change in ear postures, it has been observed that sheep change ear postures less often when they are in a positive state [98,99].

In cattle, a hanging ear posture is correlated to positive emotions of low arousal induced by being stroked by a human [93–95]. De Oliveira and Keeling [92] observed that, during automatic brushing, cows often had the left ear hanging backwards (asymmetric ear position). Proctor and Carter [95] observed that both ears were hanging backwards, the most frequent position during the stroking period. On the contrary, ears forward and upright were more frequent during the post- and pre-stroking periods. Lange et al. [93,94] observed that heifers held their ears hung back longer when they were being stroked both on the neck and head compared to when they were being stroked only on the neck [93] and when they were moving freely than being restrained [94]. Mattiello et al. [23] observed that cows have ears hanging down or backwards and closed eyes during pasture, when they are in a relaxed state, and they have their ears forwards or upright when their eye white is visible. They concluded that pasture indicates a low arousal positive stimulus, and that the ear posture is a promising indicator of emotional valence in combination with eye whites showing, which is a promising indicator of emotional arousal.

Goats in positive situations have been observed to have their ears more often orientated forward [101]. Still, more research is necessary.

3.2.2. Tail Postures

Tail postures and the frequency of tail movement have also been studied, but not as much as ear postures and the frequency of their change. The studies also refer mostly to sheep and cows. Reefmann et al. [98] observed that sheep had their tails held up when they were separated from their group and so experiencing a negative affective state, but not when they were ruminating or being fed. They concluded that a tail held up indicates a negative state of high arousal. Briefer et al. [101] also noted that goats tend to hold their tails up during negative situations. Regarding cattle, de Oliveira and Keeling [92] observed that the tail is mostly hung stationary down during feeding, queuing to feed, and brushing. In addition, brushing was the activity during which the cows wagged their tails more vigorously. Further research is needed about the tail as an indicator of emotional states, since until now, the research is limited for dairy animals.

3.2.3. Body Postures

In addition to tail and ear postures, body postures have been proposed as a potential positive welfare indicator. A disadvantage that may occur is that in specific species the same body posture can be observed in different emotional states, and so the whole-body posture should be interpretated each time, and not only a specific part of the body [29]. De Oliveira and Keeling [92] observed ear, tail, and neck postures in routine activities of dairy cows, combined the results, and clustered them. Furthermore, they represented the

postures in a hypothetical two-dimensional diagram of valence and the arousal of affect. No other studies have been retrieved regarding the body postures of ruminants.

3.2.4. Facial Expressions

The evaluation of facial expressions as emotional indicators started as an assessment of pain indication in vertebrates but has also recently gained attention as a potential positive welfare indicator [33]. Facial expressions of pain have also been studied in cattle [148] and sheep [149], but not other emotional states. According to Descovich et al. [38], facial expressions in mammals can be used as a non-invasive welfare indicator, in combination with other welfare assessment tools. As far as the authors acknowledge, no specific studies have been performed on dairy animals' facial expressions as positive welfare indicators yet, in contrast to other livestock species such as pigs [150].

3.2.5. Eye White

Visible eye white was first been proposed as an indicator of emotional state in cattle by Sandem et al. [106]. Sandem and Braastadt [107] observed that the percentage of visible eye white increased when dairy cows were separated from their calves and were experiencing a frustrating, high-arousal emotional state of negative valence. The percentage of eye white decreased when cows were reunited with their offspring, experiencing a positive state of low arousal and low valence with the final percentage even being below that of the control baseline levels. In another study, Sandem et al. [151] observed the change in eye white percentage when dairy cows were waiting to be fed (state of excitement indicating both high arousal and valence) and were acquiring the feed, during an anticipation test. The percentage increased during anticipation and was kept high and decreased again in this case below the baseline level during the feed intake (low-arousal positive valence state). These findings suggest that the eye white percentage increases in response to both positive [151] and negative [107] high arousal. The fact that in both cases the eye white decreased due to a positive state of low arousal also indicates that valence may play a role. This was studied further by Proctor and Carder [104,105]. Proctor and Carder [104] studied the changes in the percentage of eye white in cows that were being stroked, a positive state of low arousal, also confirmed by the behavioral response of the animals. In this case, the change in arousal was low and not wide as in the studies of Sandem and Braastadt [107] and Sandem et al. [151]. The eye white dropped significantly during the stroking compared to the pre- and post-stroking periods. In order to examine further if visible eye white can be used as an indicator of emotion, also regarding valence and not only arousal, Proctor and Carder [105] studied the differences in eye white percentage in dairy cows fed with standard feed, followed by desirable concentrates, and finally by inedible woodchips. The visible eye white increased during the consumption of both concentrates (positive, low arousal state) and inedible woodchips (negative, low arousal state), and so it was concluded that further research is needed. In a more recent study, Gómez et al. [103] exposed dairy cows in a positive feeding situation and in a negative stressful claw-trimming situation. No differences were detected in the visible eye white or maximum eye temperature, although a higher cortisol concentration was found during claw trimming. Nonetheless, the authors found differences in the visible eye white between breeds of individuals. On the contrary, Sandem and Braastadt [107] did not observe any differences between breeds, although the individuals belonged in different breeds.

So, it can be concluded that visible eye white decreases in both negative and positive states of high arousal both when an individual experiences broad [107,151] and low [104,105] changes in arousal. Visible eye white can be used as a positive welfare indicator only in the case that it is certain that the animal is in positive emotional valence and the arousal needs to be studied [151]. Further studies are needed. In addition, Battini et al. [102] proposed a four-level classification of eye white using pictures, making it feasible as a positive welfare indicator. Their results of in-the-field studies indicate that

eye white can reflect the arousal and can be combined with ear postures as positive welfare indicators that can indicate the valence of emotions in cattle.

3.2.6. Vocalizations

Vocalizations can be a promising tool for the on-farm assessment of positive emotions. They are species related, easy to apply in the field by the assessor or by using automatic microphone systems, and do not require specific training for the animal [39]. Still, more research is needed, and they should be combined with other measures of positive welfare assessment [29,39]. Vocalizations have mostly been studied as an indicator of negative emotions, but they gain more and more ground in studies of positive emotions.

Most studies regarding vocalizations as positive welfare indicators for dairy animals have been conducted in cattle. Cows produce more vocalizations when they are experiencing emotional states of negative valence, compared to positive valence [39]. Schnaider et al. [109] observed that cows vocalized more after they were separated from their calves. They performed higher-pitched vocal calls or calls of a longer duration, depending on the breed. In another study, Stěhulová et al. [110] reported that cows that were separated by their claves vocalized more when the age of the calf at separation was older and when they were kept with sight and acoustic contact with their calves compared to when they could not see or hear their calves. In addition, both studies have shown that calves vocalized more after the separation from their mother [109,110], and in the case that they still could hear and see their mothers after the separation [110]. Regarding vocalizations that clearly indicate a positive affective state, Meen et al. [108] showed that adult dairy cows, when lying and ruminating, produce vocalizations of a low mean maximum frequency that possibly indicates emotions of low arousal and positive valence.

In sheep and goats, a high frequency of vocalization is also linked to negative emotions, but the research is limited. The same applies also to buffaloes and camels. Regarding sheep, Greiveldinger et al. [111] observed that animals that were exposed to a random appearance of a plastic panel vocalized more often compared to the animals that were submitted to regular abilities of sudden events. Heart rate data indicate that the animals regularly subjected to the event were eventually habituated to it. On the other hand, Tamioso et al. [100] reported almost no vocalization of sheep during brushing, a positive experience of low arousal. Briefer et al. [101] observed that goats vocalize more and produce calls with a higher frequency and energy distribution during situations of high arousal, while in positive situations they produced calls with less varied frequencies. Sabia et al. [46] noted that buffalo heifers kept in a conventional system vocalized more during a novel object test compared to free-ranging animals that lived in an environment of higher stimulation. The same results were also obtained by De Rosa et al. [87] since buffaloes kept extensively on pasture vocalized less during a novel object test compared to animals kept indoors with access to outdoor paddocks. Regarding camels, Zappatera et al. [56] observed that camels kept under the sun vocalized more compared to camels under shaded areas due to the stress caused by the hot conditions.

3.3. Qualitative Behavioral Assessment (QBA)

Qualitative behavioral analysis has initially been used for the assessment of the personality and temperament of animals. Wemelsfelder et al. [152] examined its use as a welfare assessment tool, after proposing a free choice profile methodology and evaluating its inter-observer reliability [152] and intra-observer reliability [153], for the behavioral assessment of growing pigs. During QBA, observers are asked to judge the spontaneous behavior of an animal by using only a one-word descriptor. It is a summary of the dynamic interaction of an animal with its environment [152] and indicates a "whole animal" level of organization that can be used for the assessment of its welfare [153]. According to Fleming et al. [154], QBA is a tool characterized as versatile, relevant, and reliable as well as economic to apply and accepted by stakeholders.

The Welfare Quality assessment protocol for cattle [40] and the AWIN assessment protocol for sheep [41] and goats [42] all calculate the positive welfare criterion, which reflects the positive emotional state, by using QBA. The positive emotional state criterion is one of the criteria that is used to calculate the appropriate behavior welfare principle, which answers the question "does the behavior of the animals reflect optimized emotional states?". A trained assessor observes how the animals interact with each other and the environment via spontaneous behaviors and scan sampling. Twenty terms indicating both positive and negative emotional states are scored by using a 125 mm visual analogue scale (the measure of each term is the distance in mm from the beginning of the scale to the point that the assessor's line crosses the scale). Then, the total emotional score of the animals is calculated. QBA, using the terms proposed for cattle, has also been applied in buffalo farms in Italy by De Rosa et al. [116]. Twelve of the twenty terms used for cattle have shown high inter-observer reliability when applied to buffaloes. It was concluded that most of the studied measures applied to cattle could also be included in a final scheme about the buffalo welfare assessment. Napolitano et al. [64] applied QBA for the first time on dairy buffalos and concluded that it can be usefully incorporated in studies about the species. Padalino and Menchetti [55] proposed a welfare assessment protocol for camels, based on those for small ruminants and cattle, and proposed the evaluation of positive emotions by observing the animals' behavioral repertoire at the animal level. Nonetheless, they explain that more studies are necessary concerning the camel ethology and that in the future QBA should be included in the protocol.

In cattle, QBA has also been used as a means to evaluate the human–animal interaction. Ellingsen et al. [113] applied QBA in two cases, firstly for the evaluation of both the stakeholders when interacting with their calves and secondly for the evaluation for the behavior of the calves. It was concluded that stockpersons that keep their animals calm and provide care according to the first case corresponded to calves that were in positive states according to the second case. Schmitz et al. [114] observed more positive states in dairy cows, after improvement of the human–animal relationship due to feed provision. In sheep, QBA is considered the most promising positive welfare indicator for assessing positive emotions [115], but no studies exist on its use in evaluating human–animal interaction. QBA has also been tested for the behavioral evaluation of sheep with a varying burden of parasitical infection and treatment of infection, with promising results [155].

3.4. Positive Human-Animal Relationship

A positive human–animal relationship can benefit both human and animal welfare and contribute to productivity and profitability [156,157]. According to Rault et al. [35], in a positive human–animal relationship, the domestic animal has a positive perception of the human; it approaches voluntary and shows signs of anticipation, pleasure, relaxation and rewarding experience. The effects are positive for the animal not only on the short-term since it experiences positive emotional states, but also in the long-term, with improved resilience health status [35].

Human stroking has been used to elicit positive states of low arousal in various studies of positive welfare indicators in cattle [93–95] and sheep [97,99]. Behavioral and physiological indicators in all of these studies suggest that the animals are relaxed and in a positive state. Ellingsen et al. [113] concluded that when stockpersons handle their calves patiently, pet them, and talk to them calmly, the calves have high QBA scores in descriptors such as "friendly" and "content". As reviewed by Nowak and Boivin [119], it is unquestionable that lambs develop strong attachments both with their mothers and humans, although the presence of the mother reduces the motivation to bond with humans. For the bonding with the mother, suckling is the main stimulation, but with humans, gentling can be enough, even without handfeeding. Goats are animals with high socio-cognitive skills and communicate with humans mostly through visual, vocal, and tactile and less olfactory and gustative cues. Various studies of positive human–goat interactions have been reviewed by Celozzi et al. [120].

The most common indicator of a positive human–animal relationship is that an animal is voluntarily approaching and interacting with a human, while the avoidance distance usually evaluates fear [35]. Nonetheless, the Welfare Quality protocol for cattle [40] evaluated the good human–animal relationship criterion by using an avoidance test. On the contrary, the AWIN assessment protocol for goats [42] uses a latency-to-first-approach test with the animal approaching an unfamiliar human, and the AWIN protocol for sheep [41], a familiar human approach test.

3.5. Other Indicators

3.5.1. Nasal Temperature

Proctor and Carder [118] studied whether the experience of a positive emotion of low arousal can cause changes in the nasal temperature of the cow, driven by findings that support that negative experiences of high arousal in mammals can cause a general peripheral temperature decrease and a decrease in the nasal temperature specifically [118]. While dairy cows were stroked, and so exposed to a positive stimulation of low arousal, a decrease in their nasal temperature was observed. Since the animals were experiencing low arousal before and during the experiment, and since the nasal temperature is expected to decrease during negative stimulation, it was suggested that this decrease was a result of a change in valence and not arousal. Tamioso et al. [100] also experienced a decrease in the nasal temperature of sheep during stroking and concluded that it was elicited by a positive emotional state. In another study, Proctor and Carder [105] studied the change in nasal temperature in cattle due to both positive and negative high-arousal experiences. Concentrated desired feed after standard feed and inedible feed after desired concentrated feed were provided, respectively; in both cases, a significant decrease in the nasal temperature was observed. So, according to the studies by Proctor and Carder [105,118], a decrease in the cattle's nasal temperature indicates a change in emotional valence, but further studies are necessary for the type of valence and the emotional arousal. Tamioso et al. [100] also showed a decrease in the nasal temperature of sheep during stroking.

3.5.2. Resilience

A resilient animal is an animal that has the ability to regain healthy functioning after environmental disturbances [36] and reacquire its former state prior to the disturbance [158]. According to Colditz [36], there is a strong relationship between health, welfare, and resilience. Resilience indicators cover the performance traits of an animal, physiological and behavioral variables, and all of its biological functions. So, they contribute to an animal's functional competence to thrive. Resilience indicators, in other words, reflect how an individual interacts with its environment and if the individual has the ability to cope, both physically and psychologically. Colditz [36] supports that positive welfare as a concept includes both hedonic (acute, short-term) and eudaimonic (long-term) wellbeing. As in humans, both dimensions are important to experience a high level of welfare. Wellbeing should be evaluated through a long period and across the whole life of an animal and is a result of affective valence and arousal. As Colditz [36] explains, the indicators that are being developed for positive welfare assessment focus mostly on positive-valance states and indicate hedonic wellbeing, while positive welfare is eudaimonic and a result of both positive valance and aroused states. We should aim towards long-term eudaimonic welfare and not just short-term hedonic opportunities. Since resilience has benefits for the physical and emotional health of the animal as well as the performance and biological functioning, most studies in cows and sheep, until today, have focused on resistance to infections and heat stress [159–162]. Still, due to their contribution to health and performance, resilience indicators are being evaluated for incorporation in breeding programs [36,158].

3.5.3. Cognitive Bias

Both judgement and attention bias have been used for the emotional evaluation of cattle and sheep, and the evaluation of emotional states in livestock species in general [163].

During a judgment bias task, a trained animal judges an ambiguous stimulus in a more optimistic or pessimistic mood depending on its emotional state. When an attention bias task is performed, the animal allocates its attention between a negative or positive stimulus, if it is a negative or positive attention bias test, respectively [163].

Franchi et al. [123] used feed-related attention bias and visual lateralization towards feed to evaluate the emotional state of dairy cows during feed restriction in the dry-off season. Although the lateralization, as will be explained in the next section, did indeed confirm the hunger of the animals, the feed-related attention bias was not affected. Kremer et al. [124] observed that personality can influence the response of calves in both judgment and attention bias tests, and so the task is difficult to generalize across individuals. In their study, heifers in negative conditions paid attention to the threat later than heifers in a positive state, and the housing of the animals did not influence the animals' performance in a judgement bias test. So, both Franchi et al. [123] and Kremer et al. [124] failed in evaluating the emotional state of the animals by using attention bias. Using a judgement bias task has been more successful. Crump et al. [89] observed that cows with access to pasture perform more optimistically in a judgement bias task. Bučkova et al. [121] stated that calves perform more optimistically when they are housed in pairs compared to individually. Daros et al. [122] observed that calves separated from their mother perform more pessimistically in a judgement bias task. For the judgment bias task in their study, the calves were trained to discriminate colors in a go/no-go task.

Monk et al. [126] used an attention bias task in sheep. Pharmacological treatment induced various emotional states in the animals, but the test could only successfully evaluate negative but not positive emotional states. Monk et al. [125] also concluded that attention bias in sheep cannot discriminate between positive and negative emotions. So, attention bias in sheep, as in cattle, fails to succeed in evaluating positive emotional states. On the contrary, consumption of a feed reward elicited positive judgement bias in sheep that had received the feed compared to those that received inedible wood chips [54]. Furthermore, Stephenson and Haskell [127] observed that sheep housed in more enriched environment chose more optimistically, and this elicited a shorter latency approach to an ambiguous position during a go/no-go judgement bias task compared to standard housed animals.

3.5.4. Laterality

The lateralization of brain processes can reflect emotional states in animals due to the fact that specific cognitive processes can be linked to specific parts of the brain, and so it can be used for the assessment of both positive and negative emotions [149]. There is right dominance of positive emotions. The parts of the animal body that are usually studied are the eyes, ears, and tail. In cattle, eye [123,128], nostril, and ear [92] laterality has been studied as positive welfare indicators. No other studies have been retrieved about other dairy animals. Kappel et al. [128] observed that cattle show lateralized viewing and nostril preference for objects that are placed bilaterally when they look at them and explore them. The cows used in the study also experienced a negative state due to lameness, but no relationship was found between lameness and lateralized behavior. Still, it was concluded that eye and nostril laterality indicated the instant positive affective responses of the animals to a novel bilateral object. Franchi et al. [123] found that cows displayed right laterality towards a source of feed, while they were offered low-energy feed under a dry-off period and were experiencing hunger. De Oliveira and Keeling [92] studied ear, neck, and tail positions in dairy cows. By using these body postures, they developed an arousal/valence framework. It was concluded that having the right ear back was associated with emotions of positive valence, and on the contrary, having the left ear back was associated with negative emotions.

3.5.5. Oxytocin

Oxytocin is linked to social behaviors in domestic animals and positive affective states [37]. Nonetheless, the research on oxytocin is limited, but it is steadily attracting more and more interest. Although the biological mechanism of action needs further investigation, evidence from several species shows that oxytocin can be influenced by the environment and social context and its validity and repeatability as an indicator remain to be tested [37]. So, it is premature to judge its efficacy as a positive welfare indicator, although at first sight it is promising as a positive welfare indicator [37,129] and has direct implications in animal husbandry since it can be stimulated by handling practices and positive human–animal interaction. Oxytocin is involved in the neurochemical system that elicits filial attachment of sheep with the mother or a human caretaker [119] and is clearly linked to a positive affective state, although the detailed frameworks need to be explored. Lürzel et al. [130] did not observe differences in the oxytocin concentration of cattle, pigs, and goats after their interaction with a familiar and non-familiar person. On the other hand, D'Aniello et al. [129] observed a positive correlation between serum oxytocin levels and the duration of social interactions of cows with their caregivers in an impossible task paradigm. According to D'Aniello et al. [129], this is an indication that the positive states generated by oxytocin between the animals can also be generated between the animals and their caregiver and also highlights the importance of positive human–animal interaction in husbandry systems for the promotion of positive welfare. Standard methods of measuring oxytocin need further investigation [37]. Still, oxytocin can be efficiently measured in the saliva of goats, pigs, and cattle [130].

4. Discussion

According to our findings, twenty-four indicators have been retrieved concerning the evaluation of positive welfare in dairy animals. All indicators have been studied in the field or under experimental conditions, apart from pro-social behaviors, proposed by Rault [34] and analyzed on a theoretical basis. They are all animal-based indicators, apart from access to pasture, which can be considered both as an animal-based and a resource-based indicator. Most of them are behavioral indicators and only two of them, nasal temperature and oxytocin, are physiological indicators. Most studies of positive welfare indicators have been applied on cattle, followed by sheep and goats, and finally buffaloes. The least studies have been performed on camels. The positive welfare indicators that presented the most results were pasture, exploration, lying/resting, play, and ear postures.

All indicators that are included in welfare assessment protocols should be valid, meaning that they clearly indicate the impact on welfare between farms, in a reliable way, so that they provide consistent results (inter-, intra- and test–retest reliability) and feasible so that they can be applied in practice by the assessors easily and with limited training [164]. In addition, they should be examined regarding their cost, a determinant factor for their incorporation in welfare schemes. The indicators cited in our review are not analyzed regarding these factors, and many have been studied only theoretically or experimentally and not under farm conditions. Furthermore, there is a relationship between some indicators, but in general, the association between the indicators is not clear and more studies are necessary. Access to pasture is related to synchronization, comfort, exploration, [48,58,63,135,137] and wallowing in buffaloes [46] since it is linked to increased space and stimulation. However, the link between all other indicators is not yet clear and further research is warranted. Few indicators have been studied simultaneously to understand their connection. Mattiello et al. [23] have concluded that ear posture is a promising indicator in combination with eye white. On the other hand, visible eye white decreases in both negative and positive states of high arousal [101,105,107,151]. Ear and tail positions have also been studied a lot, and under the same experiments [92,98,101] but in different species and conditions. We can conclude that the results on positive welfare in dairy animals are scattered regarding the animal species, the husbandry conditions, the life stage of the animals, and even the experimental conditions. For these reasons, it is

not possible to make proposals for key indicators, relation schemes, and incorporation in welfare assessment protocols. We can only make some conclusions and suggestions for the direction of future studies in the positive welfare indicators of dairy ruminants, as analyzed below in this section.

Feeding, ruminating, comfort, lying, and resting behaviors have been proposed and studied on the farm level as positive welfare indicators for all dairy animals, and there is enough research to support their use (more research is necessary for camels). The animals also elicit high synchronicity when performing them, which is also a positive welfare indicator [29,30]. It is easier to promote these behaviors at pasture, due to the increased allowance and the environmental stimulation, but they could be also promoted indoors by increasing space. Synchronicity is an indicator of enough space and resources for all animals that are raised both indoors and outdoors, especially the subordinated ones [27,63,81,82]. A difficulty of incorporating some synchronized behaviors, such as lying behavior as proposed by Richmond et al. [82] for the sheep in protocols, is that it may be lateralized at particular times of the day. Lying synchronicity is higher in cattle in the morning and the afternoon and so may be difficult to assess in practice [58,139].

It should be highlighted that the promotion of exploration, play, comfort, lying, and resting is linked not only to space allowance but also to environmental complexity. Access to pasture is a type of environmental enrichment with stimulations for the ruminants [43]. Species-specific behaviors such as wallowing for buffaloes [61] should be taken into consideration and are promoted with access to pasture [46]. Exploration activity and play are also motivated by environmental stimulation [30] and have been studied a lot in cattle and small ruminants. Play may be considered a more appropriate behavior for juveniles since it decreases with age [32]. It also appears as a valid positive welfare indicator to judge if the energy intake of calves is adequate, after the first week after weaning [74,76]. It could be detected by accelerometers, making it an easily detected parameter [144,145], but this means a higher cost. In general, environmental enrichment and space allowance if not access to pasture are necessary and can be a simple start for promoting positive states, especially in animals kept indoors.

On the contrary, maternal care and mating behavior could not be easily assessed on the farm level since insemination takes place mostly artificially and offspring separation occurs soon in all livestock species. In dairy cattle specifically, the calf is reared group-housed, apart from its mother, separated just a few hours after birth. Promoting cow–calf bonding as a positive welfare indicator would mean reduced income for the farmer since the profit is higher when feeding the calf milk replacer [165]. Consumers are becoming concerned about cow–calf separation, although still, many are unaware of the practice. Some farmers in Germany and the UK have started keeping calves with their mothers, but the economic aspects of this husbandry system remain to be studied [165].

Social affiliative behaviors are also present in all dairy animals, although not studied enough in buffaloes and camels. Automatic brushes have positive results on cattle welfare and should be considered a promising way of promoting positive states [66,68,70,73] but in smaller husbandry systems may represent an expensive solution. Ear movements have also been studied a lot in cattle and small ruminants, but they are insufficient alone as emotional indicators. Still, they can be combined with other indicators and give a more holistic animal approach to positive welfare evaluation, and they are non-invasive, feasible, and easy to detect [92,94]. The same applies for vocalizations that can in addition be detected with microphones [39]. The nasal temperature also seems promising as a positive welfare indicator [105,118] but is a physical indicator that may be difficult to be applied in practice. Cognitive and attention bias and anticipatory tests could also be difficult to apply on a farm level since more time is required.

The results show that QBA is a positive welfare indicator that is more often used for the on-farm assessment of positive emotions in dairy animals. It has been cited for cattle in the Welfare Quality protocol [40], and in the AWIN protocol for sheep [41] and goats [42]. QBA has also been studied on buffaloes [64,117] and has been proposed as a

future study for camels [55]. Exploration, access to pasture, comfort, lying, resting, and synchronization are the most promising welfare indicators since they have been studied the most with results that agree but are not already used for the on-farm welfare assessment as much as QBA. A future research direction would be to try to also incorporate these indicators in schemes and protocols. It is also important to study the relationship between various positive indicators and combine them for a more holistic and valid approach of positive welfare evaluation. Especially indicators such as ear postures and social affiliative behaviors can be easily detected and combined with the above-mentioned indicators. In addition, there is a need for studies in different husbandry species of each dairy species.

The positive welfare research that has been retrieved about camels and buffaloes is limited compared to other dairy animals. Furthermore, as far as our knowledge, there are no official welfare assessment protocols for these species Although the dairy industry of these animals is evolved, especially for camel husbandry, there is no official protocol for their welfare evaluation. Napolitano et al. [64] have proposed a protocol for buffaloes and in general the repertoire of these animals in various studies [87,141,166]. Regarding camels, an experimental protocol has only been studied by Padalino and Menchetti [55] and the regulations regarding legislation on camels are extremely limited [55,56]. Research on camels is generally limited, focusing mainly on food science and camel health, while research in management, nutrition, and welfare is scarce [25]. A direction for future studies could be to start examining potential positive welfare indicators such as exploration, synchronization, play, and ear postures that have already been studied for cattle and small ruminants and then continue to species-specific behaviors.

In order to promote positive welfare, we should undergo drastic changes in the husbandry systems of dairy animals regarding both management and handling procedures. The role of the consumer and public is crucial for these changes, since today animal welfare is driven more by the consumer than the regulations [3]. Animal welfare is considered and can be sustainable [6,7]. A positive welfare approach needs the support of consumers, farmers, and researchers [167]. Consumers are willing to pay more to buy animal products that focus on animal-based and not only resource-based measures, but the problem is that animal-based measures are more difficult to be communicated to the public [168]. Nonetheless, it is not easy to achieve the consumers' willingness to pay for increased animal welfare in practice. The increase in public concern, in some cases, may not be enough to cover the increased price of the final product [169–172]. Other challenges can also be that the willingness to pay is influenced by various factors such as socio-demographic characteristics, gender, and educational level [169]. Still, in general, consumers are concerned about the animal welfare of food productions animal, and clean labelling and information can be a way of increasing the willingness to pay [169,172]. Furthermore, a collaborative approach to a positive welfare protocol between farmers and scientists is also important. Stokes et al. [173] developed a positive welfare assessment scheme for dairy cows based on the scientific literature, applied it on focus farms, consulted the farmers, received their feedback, refined the scheme according to farmers' recommendations, and investigated the farmer's attitude towards positive welfare. Farmers already valued positive indicators such as comfort and access to pasture, agreed with scientists on what could be promoted as positive aspects in the life of dairy cattle, and valued the life of their animals, supporting that they are linked to their wellbeing. They were willing to incorporate positive welfare aspects in the life of their animals, provided that they would receive adequate labeling and so business profit. Vigors and Lawrence [167] also support that positive welfare should be communicated and explained to farmers, since their concern is mostly for preventing the negatives and that, through this approach, positive experiences will arise naturally for their animals. They are willing to promote positive welfare, but they are concerned about whether their business will be economically sustainable.

According to a meta-analysis by Clark et al. [171], the highest estimated consumers' willingness to pay is for dairy and beef cattle, which is hopeful for the welfare of dairy cattle. Still, there are various challenges, as explained above. Positive welfare indicators

should be incorporated in welfare assessment protocols, labeling schemes, and legislation, on a national and international level, to raise the level of welfare of all livestock species. This need is essential for all dairy animals, but especially for small ruminants, and mostly buffaloes and camels, since there is no official welfare assessment protocol for the welfare of these species. Particularly for camels, the research on welfare is limited, and on positive welfare, it is scarce.

5. Conclusions

Various indicators have been recommended as indicators of positive emotions in dairy animals, mostly behavioral but also physiological. Exploration, feeding, access to pasture, lying and resting behavior, synchronization, and QBA have been studied in all dairy animals, excluding camels. They are the most promising positive welfare indicators in dairy animals. Access to pasture, exploration, feeding, and behavioral synchronicity seem to have a positive relationship and are also positively linked to space allowance and environmental stimulation. QBA is the positive welfare indicator that has been most used for on-farm welfare evaluation. It has been studied for all ruminants and proposed also for camels. Directions for future studies should also include the incorporation of the above-mentioned positive welfare indicators. In addition, there is a need for further research in order to find a relation scheme that would identify the key positive welfare indicators and studies that would combine/group various indicators in assessing positive welfare in a holistic animal evaluation. Further research is needed for positive welfare indicators of buffaloes and especially camels. Camels are the dairy animals with the least research not only on positive welfare but their welfare in general.

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References

1. Hollands, C. Toward positive animal welfare. *Behav. Brain Sci.* **1991**, *14*, 757–758. [CrossRef]
2. Verhoog, H. Defining positive welfare and animal integrity. In *Diversity of Livestock Systems and Definition of Animal Welfare*; University of Reading: Reading, UK, 2000; pp. 108–119.
3. Rault, J.-L.; Sandøe, P.; Sonntag, Q.; Stuardo, L. Positive animal welfare: Bridging gap or raising inequalities worldwide? *Front. Anim. Sci.* **2022**, *3*, 825379. [CrossRef]
4. Mellor, D.J. Updating animal welfare thinking: Moving beyond the "Five Freedoms" towards "a Life Worth Living". *Animals* **2016**, *6*, 21. [CrossRef]
5. Webster, J. Animal welfare: Freedoms, Dominions and "A Life Worth Living". *Animals* **2016**, *6*, 35. [CrossRef]
6. Broom, D.M. Farm animal welfare: A key component of the sustainability of farming systems. *Vet. Glas.* **2021**, *75*, 145–151. [CrossRef]
7. Dwyer, C.M. Can improving animal welfare contribute to sustainability and productivity? *BSJ Agric.* **2020**, *3*, 61–65.
8. Buller, H.; Blokhuis, H.; Jensen, P.; Keeling, L. Towards farm animal welfare and sustainability. *Animals* **2018**, *8*, 81. [CrossRef]
9. United Nations Committee. *Proposed Draft Recommendations on Sustainable Agricultural Development for Food Security and Nutrition Including the Role of Livestock*; Animal Health and Welfare: Easton, PA, USA, 2016; Article VIII.
10. Destoumieux-Garzón, D.; Mavingui, P.; Boetsch, G.; Boissier, J.; Darriet, F.; Duboz, P.; Fritsch, C.; Giraudoux, P.; Le Roux, F.; Morand, S.; et al. The one health concept: 10 years old and a long road ahead. *Front. Vet. Sci.* **2018**, *5*, 14. [CrossRef]
11. Pinillos, R.C.; Appleby, M.C.; Manteca, X.; Scott-Park, F.; Smith, C.; Velarde, A. One Welfare—A platform for improving human and animal welfare. *Vet. Rec.* **2016**, *179*, 412–413. [CrossRef]
12. Eurobarometer. European-Commission. *Attitudes of EU Citizens towards Animal Welfare, Report; Special Eurobarometer 442*; European Commission: Brussels, Belgium, 2016; p. 84.
13. FAOSTAT. Available online: https://www.fao.org/faostat/3n/#data/qp (accessed on 28 October 2022).

14. FAOSTAT. Dairy Production and Products: Products (fao.org). Available online: https://www.fao.org/dairy-production-products/products/en/ (accessed on 10 November 2022).
15. FAO. Dairy and Dairy Products- OECD-FAO Agricultural Outlook 2019–2028. Dairy Production and Products: Products (fao.org). Available online: https://www.agri-outlook.org/commodities/Dairy.pdf (accessed on 10 November 2022).
16. Dockès, A.C.; Kling-Eveillard, F. Farmers' and advisers' representations of animals and animal welfare. *Livest. Sci* **2006**, *103*, 243–249. [CrossRef]
17. Fraser, D. Animal behaviour, animal welfare and the scientific study of affect. *Appl. Anim. Behav. Sci.* **2009**, *118*, 108–117. [CrossRef]
18. Lawrence, A.B.; Vigors, B.; Sandøe, P. What is so positive about positive animal welfare?—A critical review of the literature. *Animals* **2019**, *9*, 783. [CrossRef] [PubMed]
19. McMillan, F.D. Quality of life in animals. *J. Am. Vet. Med. Assoc.* **2000**, *216*, 1904–1912. [CrossRef] [PubMed]
20. Boissy, A.; Manteuffel, G.; Jensen, M.B.; Moe, R.O.; Spruijt, B.; Keeling, L.; Winckler, C.; Forkman, B.; Dimitrov, I.; Langbein, J.; et al. Assessment of positive emotions in animals to improve their welfare. *Physiol. Behav.* **2007**, *92*, 375–397. [CrossRef] [PubMed]
21. Yeates, J.W.; Main, D.C.J. Assessment of positive welfare: A review. *Vet. J.* **2008**, *175*, 293–300. [CrossRef]
22. Webb, L.; Veenhoven, R.; Harfeld, J.L.; Jensen, M. What is animal happiness? *Ann. N. Y. Acad. Sci.* **2018**, *1438*, 62–76. [CrossRef]
23. Mattiello, S.; Battini, M.; De Rosa, G.; Napolitano, F.; Dwyer, C. How can we assess positive welfare in ruminants? *Animals* **2019**, *9*, 758. [CrossRef]
24. Keeling, L.J.; Whinckler, C.; Hintze, S.; Forkman, B. Towards a Positive Welfare Protocol for Cattle: A Critical Review of Indicators and Suggestion of How We Might Proceed. *Front. Anim. Sci.* **2021**, *2*, 753080. [CrossRef]
25. Iglesias Pastrana, C.; Navas González, F.J.; Ciani, E.; Barba Capote, C.J.; Delgado Bermejo, J.V. Effect of Research Impact on Emerging Camel Husbandry, Welfare and Social-Related Awareness. *Animals* **2020**, *10*, 780. [CrossRef]
26. Hass, C.C.; Jenni, D.A. Social Play among Juvenile Bighorn Sheep: Structure, Development, and Relationship to Adult Behavior. *Ethology* **1993**, *93*, 105–116. [CrossRef]
27. Nielsen, L.H.; Mogensen, L.; Krohn, C.; Hindhede, J.; Sørensen, J.T. Resting and social behavior of dairy heifers housed in slatted floor pens with different sized bedded lying areas. *Appl. Anim. Behav. Sci.* **1997**, *54*, 307–316. [CrossRef]
28. Mellor, D.J. Positive animal welfare states and encouraging environmental-focused and animal-to-animal interactive behaviors. *N. Z. Vet. J.* **2015**, *63*, 9–16. [CrossRef] [PubMed]
29. Keeling, L. Indicators of good welfare. In *Encyclopaedia of Animal Behavior*, 2nd ed.; Chun, C.J., Ed.; Elsevier: London, UK, 2019; pp. 134–140. [CrossRef]
30. Špinka, M. Social dimension of emotions and its implication for animal welfare. *Appl. Anim. Behav. Sci.* **2012**, *138*, 170–181. [CrossRef]
31. Ahloy-Dallaire, J.; Espinosa, J.; Mason, G. Play and optimal welfare: Does play behavior indicate the presence of positive affective states? *Behav. Process.* **2018**, *156*, 3–15. [CrossRef] [PubMed]
32. Held, S.; Špinka, M. Animal Play and Animal Welfare. *Anim. Behav.* **2011**, *81*, 891–899. [CrossRef]
33. Whittaker, A.L.; Marsch, L.E. The role of behavioral assessment in determining positive affective states in animals. *CAB Rev.* **2019**, *14*, 1–13. [CrossRef]
34. Rault, J.-L. Be kind to others: Pro-social behaviors and their implication for animal welfare. *Appl. Anim. Behav. Sci.* **2019**, *210*, 113–123. [CrossRef]
35. Rault, J.-L.; Waiblinger, S.; Boivin, X.; Hemsworth, P. The Power of a Positive Human—Animal Relationship for Animal Welfare. *Front. Vet. Sci.* **2020**, *7*, 590867. [CrossRef]
36. Colditz, G. Competence to thrive: Resilience as an indicator of positive health and positive welfare in animals. *Anim. Prod. Sci.* **2022**, *62*, 1439–1458. [CrossRef]
37. Rault, J.-L.; van den Munkhof, M.; Buisman-Pijlman, F.T.A. Oxytocin as an Indicator of Psychological and Social Well-Being in Domesticated Animals: A Critical Review. *Front. Psychol.* **2017**, *8*, 1521. [CrossRef]
38. Descovich, K.; Wathan, J.; Matthew, C.; Leach, M.; Buchanan-Smith, H.; Flecknell, P.; Farningham, D.; Vick, S.-J. Facial expression: An under-utilized tool for the assessment of welfare in mammals. *Altex* **2017**, *34*, 409–429. [CrossRef] [PubMed]
39. Laurijs, K.A.; Briefer, F.E.; Inonge, R.; Webb, L.E. Vocalizations in farm animals: A step towards positive welfare assessment. *Appl. Anim. Behav. Sci.* **2021**, *236*, 105264. [CrossRef]
40. Welfare Quality Assessment Protocol for Cattle. Welfare Quality Consortium. Lelystad. Nederlands. 2009. Microsoft Word—Old Cattle Protocol without Veal Calves—120809—PPN (wur.nl). Available online: http://www.welfarequalitynetwork.net/media/1088/cattle_protocol_without_veal_calves.pdf (accessed on 20 September 2022).
41. AWIN Welfare Assessment Protocol for Sheep 2015. Available online: https://neiker.eus/wp-content/uploads/2020/02/AWIN-Sheep.pdf (accessed on 5 October 2022).
42. AWIN Welfare Assessment Protocol for Goats 2015. AWINProtocolGoats.pdf (unimi.it). Available online: https://air.unimi.it/retrieve/handle/2434/269102/384790/AWINProtocolGoats.pdf (accessed on 5 October 2022).
43. Tuomisto, L.; Ahola, L.; Martiskaienen, P.; Kaupinnen, R.; Huuskonen, A. Comparison of time budgets of growing Hereford bulls in a uninsulated barn and in extensive forest paddocks. *Livest. Sci.* **2008**, *118*, 44–52. [CrossRef]

44. Wenker, L.M.; van Reenen, C.G.; Bokkers, E.A.M.; McCrea, K.; de Oliveira, D.; Sørheim, K.; Cao, Y.; Bruckmaier, R.M.; Gross, J.J.; Gort, G.; et al. Comparing gradual debonding strategies after prolonged cow-calf contact: Stress responses, performance, and health of dairy cow and calf. *Appl. Anim. Behav. Sci.* **2022**, *253*, 105694. [CrossRef]
45. Westerath, H.S.; Laister, S.; Winckler, C.; Knierim, U. Exploration as an indicator of goof welfare in beef bulls: An attempt to develop a test for on-farm assessment. *Appl. Anim. Behav. Sci.* **2009**, *116*, 126–133. [CrossRef]
46. Sabia, E.; Napolitano, F.; De Rosa, G.; Terzano, G.M.; Barile, V.L.; Braghieri, A.; Pacelli, C. Efficiency to reach age of puberty and behavior of buffalo heifers (*Bubalus bubalis*) kept on pasture or in confinement. *Animal* **2014**, *8*, 1907–1916. [CrossRef]
47. Arnott, G.; Ferris, C.P.; O'Connell, N.E. Review: Welfare of dairy cows in continuously housed and pasture-based production systems. *Animal* **2017**, *11*, 261–273. [CrossRef]
48. Crump, A.; Jenkins, K.; Bethell, E.J.; Ferris, C.P.; Arnott, G. Pasture access affects behavioral indicators of wellbeing in dairy cows. *Animals* **2019**, *9*, 902. [CrossRef]
49. Meagher, R.K.; Weary, D.M.; von Keyserlingk, M.A. Some like it varied: Individual differences in preference for feed variety in dairy heifers. *Appl. Anim. Behav. Sci.* **2017**, *195*, 8–14. [CrossRef]
50. Spörndly, E.; Åsberg, T. Eating rate and preference of different concentrate components for cattle. *J. Dairy Sci.* **2006**, *89*, 2188–2199. [CrossRef]
51. Westerath, H.S.; Gygax, L.; Hillmann, E. Are special feed and being brushed judged as positive by the calves? *Appl. Anim. Behav. Sci.* **2014**, *156*, 12–21. [CrossRef]
52. Dwyer, C.M. Welfare of sheep: Providing the welfare in an extensive environment. *Small Rumin. Res.* **2009**, *86*, 14–21. [CrossRef]
53. Stubsjøen, S.M.; Moe, R.O.; Mejdell, C.M.; Tømmerberg, V.; Knappe-Poindecker, M.; Kampen, A.H.; Granquist, E.G.; Muri, K. Sheep welfare in different housing systems in South Norway. *Small Rumin. Res.* **2022**, *214*, 106740. [CrossRef]
54. Verbeek, E.; Ferguson, D.; de Monjour, P.Q.; Lee, C. Generating positive affective stated in sheep: The influence of food rewards and opioid administration. *Appl. Anim. Behav. Sci.* **2014**, *154*, 39–47. [CrossRef]
55. Padalino, B.; Menchetti, L. The first protocol of assessing welfare in camels. *Front. Vet. Sci.* **2021**, *7*, 631876. [CrossRef]
56. Zappatera, M.; Menchetti, L.; Costa, L.N.; Paladino, B. Do camels (Camelus dromedarius) need shaded area? A case study of the camel market in Doha. *Animals* **2021**, *11*, 480. [CrossRef]
57. Beaver, A.; Weary, D.M.; von Keyserlingk, M.A.G. Invited review: The welfare of dairy cattle housed in tiestalls compared to less-restrictive housing types: A systematic review. *J. Dairy Sci.* **2021**, *104*, 9383–9417. [CrossRef]
58. Stoye, S.; Porter, M.A.; Dawkins, M.S. Synchronized lying in cattle in relation to time of day. *Livest. Sci.* **2012**, *149*, 70–73. [CrossRef]
59. Tucker, C.B.; Jensen, M.B.; de Passillé, A.M.; Hänninen, L.; Rushen, J. Invited review: Lying time and the welfare of dairy cows. *J. Dairy Sci.* **2021**, *104*, 20–46. [CrossRef]
60. Aschwanden, J.; Gygax, L.; Wechsler, B.; Keil, N.M. Loose housing of small goat groups: Influence of visual cover and elevated levels on feeding, resting and agonistic behavior. *Appl. Anim. Behav. Sci.* **2009**, *119*, 171–179. [CrossRef]
61. Ehrlenbruch, P.; Meisfjord-Jørgensen, G.H.; Andersen, I.L.; Bøe, E.K. Provision of additional walls in the resting area—The effects on resting behavior and social interactions in goats. *Appl. Anim. Behav. Sci.* **2010**, *122*, 35–40. [CrossRef]
62. Jørgensen, G.H.M.; Bøe, K.E. The effect of shape, width and slope of a resting platform on the resting behavior of and floor cleanliness for housed sheep. *Small Rumin. Res.* **2009**, *87*, 57–63. [CrossRef]
63. Jørgensen, G.H.M.; Andersen, I.L.; Bøe, K.E. The effect of different pen partition configurations on the behavior of sheep. *Appl. Anim. Behav. Sci.* **2009**, *119*, 66–70. [CrossRef]
64. Napolitano, F.; De Rosa, G.; Serrapica, M.; Braghieri, A. A continuous recording approach to qualitative behaviour assessment in dairy buffaloes (*Bubalus bubalis*). *Appl. Anim. Behav. Sci.* **2015**, *166*, 35–43. [CrossRef]
65. Johnsen, J.F.; Ellingsen, K.; Grøndahl, A.M.; Bøe, K.E.; Lidfors, L.; Mejdell, C.M. The effect of physical contact between dairy cows and calves during separation on their post-separation behavioural response. *Appl. Anim. Behav. Sci.* **2015**, *166*, 11–19. [CrossRef]
66. Horvarth, K.C.; Miller-Cushon, E.K. Characterizing grooming behavior patterns and the influence of brush access on the behavior of group-housed dairy calves. *J. Dairy Sci.* **2019**, *102*, 3421–3430. [CrossRef] [PubMed]
67. Horvath, K.C.; Allen, A.N.; Miller-Cushon, E.K. Effects of access to stationary brushes and chopped hay on behavior and performance of individually housed dairy calves. *J. Dairy Sci.* **2020**, *103*, 8421–8432. [CrossRef]
68. McConnachie, E.; Smid, A.M.; Thompson, A.J.; Weary, D.M.; Gaworski, M.A.; von Keyserlingk, M.A.G. Cows are highly motivated to access a grooming substrate. *Biol. Lett.* **2018**, *14*, 20180303. [CrossRef]
69. Newby, C.N.; Duffield, T.F.; Pearl, D.L.; Leslie, K.E.; LeBlanc, S.J.; von Keyserlingk, M.A.G. Short communication: Use of a mechanical brush by Holstein dairy cattle around parturition. *J. Dairy Sci.* **2013**, *96*, 2339–2344. [CrossRef]
70. Park, R.M.; Schubach, K.M.; Cooke, R.F.; Herring, A.D.; Jennings, J.D.; Daigle, C.L. Impact of a cattle brush on feedlot steer behavior, productivity and stress physiology. *Appl. Anim. Behav. Sci.* **2020**, *228*, 104995. [CrossRef]
71. Sato, S.; Sako, S.; Maeda, A. Social licking patterns in cattle (*Bos taurus*): Influence of environmental and social factors. *Appl. Anim. Behav. Sci.* **1991**, *32*, 3–12. [CrossRef]
72. Sato, S.; Tarumizo, K.; Hatae, K. The influence of social factors on allogrooming in cows. *Appl. Anim. Behav. Sci.* **1993**, *38*, 235–244. [CrossRef]
73. Velasquez-Munoz, A.; Manriquez, D.; Paudyal, S.; Solano, G.; Han, H.; Callan, R. Effect of a mechanical grooming brush on the behavior and health of recently weaned heifer calves. *BMC Vet. Res.* **2019**, *15*, 284. [CrossRef]

74. Bertelsen, M.; Jensen, M.B. Does dairy calves' motivation for social play behavior build up over time? *Appl. Anim. Behav. Sci.* **2019**, *214*, 18–24. [CrossRef]
75. Duve, L.R.; Weary, D.M.; Halekoh, U.; Jensen, M.B. The effects of social contact and milk allowance on responses to handling, play, and social behavior in young dairy calves. *J. Dairy Sci.* **2012**, *95*, 6571–6581. [CrossRef]
76. Krachun, C.; Rushen, J.; de Passille, A.M. Play behavior in dairy calves is reduced by weaning and by a low energy intake. *Appl. Anim. Behav. Sci.* **2010**, *122*, 71–76. [CrossRef]
77. Miguel-Pacheco, G.G.; Vaughan, A.; de Passillé, A.M.; Rushen, J. Relationship between locomotor play of dairy calves and their weight gains and energy intakes around weaning. *Animal* **2015**, *9*, 1038–1044. [CrossRef]
78. Chapagain, D.; Uvnäs-Moberg, K.; Lidfors, L.M. Investigating the motivation to play in lambs. *Appl. Anim. Behav. Sci.* **2014**, *160*, 64–74. [CrossRef]
79. Baxter, E.M.; Mulligan, J.; Hall, S.A.; Donbavand, J.E.; Palme, R.; Aldujaili, E.; Zanella, A.J.; Dwyer, C.M. Positive and negative gestational handling influences placental traits and mother-offspring behavior in dairy goats. *Physiol. Behav.* **2016**, *157*, 129–138. [CrossRef]
80. Tuomisto, L.; Huuskonen, A.; Jauhiainen, L.; Mononen, J. Finishing bulls have more synchronised behavior in pastures than in pens. *Appl. Anim. Behav. Sci.* **2019**, *213*, 26–32. [CrossRef]
81. Bøe, K.E.; Berg, S.; Andersen, I.L. Resting behavior and displacements in ewes—Effects of reduced lying space and pen shape. *Appl. Anim. Behav. Sci.* **2006**, *98*, 249–259. [CrossRef]
82. Richmond, S.E.; Wemelsfelder, F.; de Heredia, I.B.; Ruiz, R.; Canali, E.; Dwyer, C.M. Evaluation of Animal-Based Indicators to Be Used in a Welfare Assessment Protocol for Sheep. *Front. Vet. Sci.* **2017**, *4*, 210. [CrossRef] [PubMed]
83. Bunchli, C.; Raseli, A.; Bruckmaier, R.; Hillmann, E. Contact with cow during the young age increases social competence and lowers the cardiac stress reaction in dairy calves. *Appl. Anim. Behav. Sci.* **2016**, *187*, 1–7. [CrossRef]
84. Johnsen, J.F.; de Passile, A.M.; Mejdell, C.M.; Bøe, K.E.; Grøndahl, A.M.; Beaver, A.; Rushen, J.; Weary, D.M. The effect of nursing on the cow-calf bond. *Appl. Anim. Behav. Sci.* **2015**, *163*, 50–57. [CrossRef]
85. Lenner, A.; Ragán, P.; Komlósi, I. Study of changes in the strength of the connection between grey cattle cows and their offspring after weaning. *Acta Agrar. Debr.* **2021**, *1*, 129–136. [CrossRef]
86. Meagher, R.K.; Beaver, A.; Weary, D.M.; von Kayserlingk, M.A.G. Invited review: A systematic review of the effects of prolonged cow-calf contact on behavior, welfare and productivity. *J. Dairy Sci.* **2019**, *102*, 5765–5783. [CrossRef]
87. De Rosa, G.; Grasso, F.; Pacelli, C.; Napolitano, F.; Winckler, C. The welfare of dairy buffalo. *Ital. J. Anim. Sci.* **2009**, *8*, 103–116. [CrossRef]
88. Neave, H.W.; Webster, J.R.; Zobel, G. Anticipatory behavior as an indicator of the welfare of dairy calves in different housing environments. *PLoS ONE* **2021**, *16*, e0245742. [CrossRef]
89. Crump, A.; Jenkins, K.; Bethell, E.J.; Ferris, C.P.; Arnott Kabboush, H. Optimism and pasture access in dairy cows. *Sci. Rep.* **2015**, *11*, 4882. [CrossRef]
90. Anderson, C.; Yngvesson, J.; Boissy, A.; Uvnäs-Moberga, K.; Lidforsa, L. Behavioural expression of positive anticipation for food or opportunity to play in lambs. *Behav. Process.* **2015**, *113*, 152–158. [CrossRef]
91. Gygax, L.; Reefmann, N.; Wolf, M.; Langbein, J. Prefrontal cortex activity, sympatho-vagal reaction and behavior distinguish between situations of feed reward and frustration in dwarf goats. *J. Behav. Brain. Res.* **2013**, *239*, 104–114. [CrossRef] [PubMed]
92. De Oliveira, D.; Keeling, L. Routine activities and emotions: Integrating body language into an affective state framework. *PLoS ONE* **2018**, *13*, e0195674. [CrossRef] [PubMed]
93. Lange, A.; Franzmayr, S.; Wisenöcker, V.; Futschik, A.; Waiblinger, S.; Lürzel, S. Effect of different stroking styles on bahaviour and cardiac parameters in heifers. *Animals* **2020**, *10*, 426. [CrossRef]
94. Lange, A.; Waiblinger, S.; van Hassel, R.; Mundry, R.; Futschik, A.; Lürzel, S. Effect of restrain on heifers during gentle human-animal interaction. *Appl. Anim. Behav. Sci.* **2021**, *243*, 105445. [CrossRef]
95. Proctor, S.H.; Carder, G. Can ear postures reliable measure the positive emotional state of cow? *Appl. Anim. Behav. Sci.* **2014**, *161*, 20–27. [CrossRef]
96. Boissy, A.; Aubert, A.; Désiré, L.; Greieveldinger, L.; Delvar, E.; Veissier, I. Cognitive science to relate ear postures to emotion sin sheep. *Anim. Welf.* **2011**, *20*, 47–56.
97. Coulon, M.; Nowak, R.; Peyrat, J.; Chandèze, H.; Boissy, A.; Boivin, X. Do lambs perceive regular human stroking as pleasant? Behavior and heart rate variability analysis. *PLoS ONE* **2015**, *10*, e0118617. [CrossRef]
98. Reefmann, F.; Bütikofer Kaszàs, F.; Wechsler, B.; Gygax, L. Ears and tail postures as indicators of emotional valence in sheep. *Appl. Anim. Behav. Sci.* **2009**, *118*, 199–207. [CrossRef]
99. Reefmann, F.; Wechsler, B.; Gygax, L. Behavioral and physiological assessment of positive and negative emotion in sheep. *Anim. Behav.* **2009**, *78*, 651–659. [CrossRef]
100. Tamioso, P.R.; Rucinque, D.S.; Taconeli, C.A.; Da Silva, G.P.; Maiolino Molento, C.F. Behavior and body surface temperature as welfare indicators in selected sheep regularly brushed by a familiar observer. *J. Vet. Behav.* **2017**, *19*, 27–34. [CrossRef]
101. Briefer, F.E.; Tettamanti, F.; McElliigott, A.G. Emotions in goats: Mapping physiological, behavioral and vocal profiles. *Anim. Behav.* **2015**, *99*, 131–143. [CrossRef]
102. Battini, M.; Agostini, A.; Mattiello, S. Understanding cows' emotions on farm: Are eye white and ear postures reliable indicators? *Animals* **2019**, *9*, 477. [CrossRef] [PubMed]

103. Gómez, Y.; Bieler, R.; Hankele, A.K.; Zähner, N.; Savary, P.; Hillmann, E. Evaluation of visible eye white and maximum eye temperature as non-invasive indicators of stress in dairy cows. *Appl. Anim. Behav. Sci.* **2018**, *198*, 1–8. [CrossRef]
104. Proctor, S.H.; Carder, G. Measuring positive emotions in cows: Do visible eye whites tell us anything? *Physiol. Behav.* **2015**, *147*, 1–6. [CrossRef]
105. Proctor, S.H.; Carder, G. Can changes of nasal temperature be used as an indicator of emotional state in cows? *Appl. Anim. Behav. Sci.* **2016**, *184*, 1–6. [CrossRef]
106. Sandem, A.; Braastadt, B.; Bøe, K. Eye white may indicate emotional state on a frustration-contentedness axis in dairy cows. *Appl. Anim. Behav. Sci.* **2002**, *79*, 1–10. [CrossRef]
107. Sandem, A.; Braastadt, B. Effects of cow-calf separation on visible eye white and behavior of dairy cows—A brief report. *Appl. Anim. Behav. Sci.* **2005**, *95*, 233–239. [CrossRef]
108. Meen, G.H.; Schellenkens, M.A.; Slegers, M.H.M.; Leenders, N.L.G.; van Erp-van der Kooij, E.; Noldus, L.P.J.J. Sound analysis in dairy cattle vocalisation as a potential welfare monitor. *Comput Electron. Agric.* **2015**, *118*, 111–115. [CrossRef]
109. Schnaider, M.A.; Heidemann, M.S.; Silva, A.H.P.; Taconeli, C.A.; Molento, C.F.M. Vocalization and other behaviors as indicators of emotional valence: The case of cow-calf separation and reunion in beef cattle. *J. Vet. Behav.* **2022**, *49*, 28–35. [CrossRef]
110. Stěhulová, I.; Lidfors, L.; Špinka, M. Response of dairy cows and calves to early separation: Effect of calf age and visual and auditory contact after separation. *Appl. Anim. Behav. Sci.* **2008**, *110*, 144–165. [CrossRef]
111. Greiveldinger, L.; Veissier, I.; Boissy, A. Emotional experience in sheep: Predictability of a sudden event lowers subsequent emotional responses. *Physiol. Behav.* **2007**, *92*, 675–683. [CrossRef] [PubMed]
112. Rosa, D.; Napolitano, F.; Saltalamacchia, F.; Bilancione, A.; Sabia, E.; Grasso, F.; Bordi, A. The effect of rearing system on behavioral and immune responses of buffalo heifers. *Ital. J. Anim. Sci.* **2007**, *6*, 1260–1263. [CrossRef]
113. Ellingsen, K.; Coleman, G.J.; Lund, V.; Mejdell, C.M. Using qualitative behavior assessment to explore the link between stockperson behavior and dairy calf behavior. *Appl. Anim. Behav. Sci.* **2014**, *153*, 10–17. [CrossRef]
114. Schmitz, L.; Ebinghaus, A.; Ivemeyer, S.; Domas, L.; Knierim, U. Validity aspects of behavioural measures to assess cows´ responsiveness towards humans. *Appl. Anim. Behav. Sci.* **2020**, *228*, 105011. [CrossRef]
115. Zufferey, R.; Minnig, A.; Thomann, B.; Zwygart, B.; Keil, N.; Schüpbach, G.; Miserez, R.; Zanolari, P.; Stucki, D. Animal-Based Indicators for On-Farm Welfare Assessment in Sheep. *Animals* **2021**, *11*, 2973. [CrossRef]
116. De Rosa, G.; Grasso, F.; Winckler, C.; Bilancione, A.; Paceli, C.; Masucci, F.; Napolitano, F. Application of the Welfare Quality protocol to dairy buffalo farms: Prevalence and reliability of selected measures. *J. Dairy Sci.* **2015**, *98*, 6886–6896. [CrossRef]
117. Napolitano, F.; De Rosa, G.; Grasso, F.; Wemelsfelder, F. Qualitative behaviour assessment of dairy buffaloes (*Bubalus bubalis*). *Appl. Anim. Behav. Sci.* **2012**, *141*, 91–100. [CrossRef]
118. Proctor, S.H.; Carder, G. Nasal temperatures in dairy cows are influenced by positive emotional state. *Physiol. Behav.* **2015**, *138*, 340–344. [CrossRef]
119. Nowak, R.; Boivin, X. Filial attachment in sheep: Similarities and differences between ewe-lamb and human-lamb relationships. *Appl. Anim. Behav. Sci.* **2015**, *164*, 12–28. [CrossRef]
120. Celozzi, S.; Battini, M.; Prato-Previde, E.; Mattiello, S. Humans and Goats: Improving Knowledge for a Better Relationship. *Animals* **2022**, *12*, 774. [CrossRef]
121. Bučková, K.; Špinka, M.; Hintze, S. Pair housing makes calves more optimistic. *Sci. Rep.* **2019**, *9*, 20246. [CrossRef] [PubMed]
122. Daros, R.R.; Costa, J.H.C.; von Keyserlingk, M.A.G.; Hötzel, M.J.; Weary, D.M. Separation from the Dam Causes Negative Judgement Bias in Dairy Calves. *PLoS ONE* **2014**, *9*, e98429. [CrossRef] [PubMed]
123. Franchi, A.G.; Herskin, M.S.; Jensen, M.B. Do dietary and milking frequency changes during a gradual dry-off affect feed-related attention bias and visual lateralization in dairy cows? *Appl. Anim. Behav. Sci.* **2020**, *223*, 104923. [CrossRef]
124. Kremer, L.; Bus, J.D.; Webb, L.E.; Bokkers, E.A.M.; Engel, B.; van der Werf, J.T.N.; Schnabel, K.S.; van Reenen, C.G. Housing and personality effect on judgement and attention biases in dairy cows. *Sci. Rep.* **2021**, *11*, 22984. [CrossRef] [PubMed]
125. Monk, J.; Belson, S.; Colditz, I.; Lee, C. Attention Bias Test Differentiates Anxiety and Depression in Sheep. *Front. Behav. Neurosci.* **2018**, *12*, 246. [CrossRef] [PubMed]
126. Monk, J.E.; Lee, C.; Dickson, E.; Campbell, D.L.M. Attention Bias Test Measures Negative But Not Positive Affect in Sheep: A Replication Study. *Animals* **2020**, *10*, 1314. [CrossRef]
127. Stephenson, M.; Haskell, M.J. The Use of a "Go/Go" Cognitive Bias Task and Response to a Novel Object to Assess the Effect of Housing Enrichment in Sheep (*Ovis aries*). *J. Appl. Anim. Welf. Sci.* **2022**, *25*, 62–74. [CrossRef]
128. Kappel, S.; Mendl, M.T.; Barrett, D.C.; Murrell, J.C.; Whay, H.R. Lateralized behavior as indicator of affective state in dairy cows. *PLoS ONE* **2017**, *12*, e0184933. [CrossRef]
129. D'Aniello, B.; Mastellone, V.; Pinelli, C.; Scandurra, A.; Musco, N.; Tudisco, R.; Pero, M.E.; Infascelli, F.; Di Lucrezia, A.; Lombardi, P. Serum Oxytocin in Cows Is Positively Correlated with Caregiver Interactions in the Impossible Task Paradigm. *Animals* **2022**, *12*, 276. [CrossRef]
130. Lürzel, S.; Bückendorf, F.; Waiblinger, S.; Rault, J.-L. Salivary oxytocin in pigs, cattle, and goats during positive human-animal interactions. *Psychoneuroendocrinology* **2020**, *115*, 104636. [CrossRef]
131. Mellor, D.J. Enhancing animal welfare by creating opportunities for positive affective engagement. *N Z Vet. J.* **2015**, *63*, 3–8. [CrossRef] [PubMed]

132. Nawroth, C.; Prentice, P.; McEllligott, A. Individual personality differences in goat predict their performance in visual learning and non-associative cognitive tasks. *Behav. Process.* **2017**, *134*, 43–53. [CrossRef] [PubMed]
133. Santo, N.K.; von Borstel, U.K.; Sirovnik, J. The influence of maternal contact on activity, emotionality and social competence in young dairy calves. *J. Dairy Res.* **2020**, *87*, 138–143. [CrossRef] [PubMed]
134. Manteca, X.; Villalba, J.J.; Atwood, S.B.; Dziba, L.; Provenza, F. Is dietary choice important to animal welfare? *J. Vet. Behav.* **2008**, *3*, 229–239. [CrossRef]
135. Tucker, S. Behaviour of cattle. In *The Ethology of Domestic Animals: An Introductory Text*, 3rd ed.; Per Jensen, J., Ed.; CABI: Wallingford, Oxfordshire, UK; Boston, MA, USA, 2017; pp. 189–198.
136. Kilgour, R.J. In pursuit of "normal": A review of the behavior of cattle at pasture. *Appl. Anim. Behav. Sci.* **2012**, *138*, 1–11. [CrossRef]
137. Dwyer, C.M. Behavior of sheep and goats. In *The Ethology of Domestic Animals: An Introductory Text*, 3rd ed.; Per Jensen, J., Ed.; CABI: Wallingford, Oxfordshire, UK, 2017; pp. 199–213.
138. Plummer, P.J.; Hempstead, M.N.; Shearer, J.K.; Lindquist, T.M. Evaluating the welfare of small ruminants: Practical management advice. *Vet. Clin. North Am. Food Anim. Pract.* **2021**, *37*, 33–54. [CrossRef]
139. Tucker, C.B.; Cox, N.R.; Weary, D.M.; Špinka, M. Laterality of lying behavior in dairy cattle. *Appl. Anim. Behav. Sci.* **2009**, *120*, 125–131. [CrossRef]
140. Napolitano, F.; Pacelli, C.; Grasso, F.; Braghieri, A.; De Rosa, G. The behavior and welfare of buffaloes (*Bubalus bubalis*) in modern dairy enterprises. *Animal* **2013**, *7*, 1704–1713. [CrossRef]
141. Herskin, M.S.; Kristensen, A.-M.; Munksgaard, L. Behavioural responses of dairy cows toward novel stimuli presented in the home environment. *Appl. Anim. Behav. Sci.* **2004**, *89*, 27–40. [CrossRef]
142. Lv, J.; Li, J.; Wang, C.; Zhao, P.; Bi, Y.; Zhang, X.; Yi, R.; Li, X.; Bao, J. Positive or negative emotion induced by feeding success or failure can affect behaviors, heart rate and immunity of suckling calves. *Physiol Behav.* **2018**, *196*, 185–189. [CrossRef]
143. Mandel, R.; Harazy, H.; Gygax, L.; Nicol, C.J.; Ben-David, A.; Whay, H.R.; Klement, E. Short communication: Detection of lameness in dairy cows using a grooming device. *J. Dairy Sci.* **2018**, *101*, 1511–1517. [CrossRef] [PubMed]
144. Gladden, N.; Cuthbert, E.; Ellis, K.; McKeegan, D. Use of a Tri-Axial Accelerometer Can Reliably Detect Play Behavior in Newborn Calves. *Animals* **2020**, *10*, 1137. [CrossRef] [PubMed]
145. Rushen, J.; de Passillé, A.M. Automated measurement of acceleration can detect effects of age, dehorning and weaning on locomotor play of calves. *Appl. Anim. Behav. Sci.* **2012**, *139*, 169–174. [CrossRef]
146. Spruijt, B.M.; Van den Bos, R.; Pijlman, F.T.A. A concept of welfare based on reward evaluating mechanisms in the brain: Anticipatory behavior as an indicator for the state of reward systems. *Appl. Anim. Behav. Sci.* **2001**, *72*, 145–171. [CrossRef]
147. Schultz, W.; Dayan, P.; Montague, P.R. A neural substrate of prediction and reward. *Science* **1997**, *275*, 1593–1599. [CrossRef]
148. Gleerup, K.B.; Andersen, P.H.; Munksgaard, L.; Forkman, B. Pain evaluation in dairy cattle. *Appl. Anim. Behav. Sci.* **2015**, *171*, 25–32. [CrossRef]
149. McLeenan, K.M.; Rebelo, C.J.B.; Corke, M.J.; Holmes, M.A.; Leach, M.C.; Constantino-Casas, F. Development of facial expression scale using footrot and mastitis as model in sheep. *Appl. Anim. Behav. Sci.* **2016**, *176*, 19–26. [CrossRef]
150. Camerlink, I.; Coulange, E.; Farish, M.; Baxter, E.M.; Turner, S. Facial expression as a potential method of both intend and emotion. *Sci. Rep.* **2018**, *8*, 17602. [CrossRef]
151. Sandem, A.; Braastadt, B.; Bakken, M. Behavior and percentage eye white in cows waiting to be fed concentrate—A brief report. *Appl. Anim. Behav. Sci.* **2006**, *97*, 145–151. [CrossRef]
152. Wemelsfelder, F.; Hunter, E.A.; Mendl, M.T.; Lawrence, A.B. The spontaneous qualitative assessment of behavioural expressions in pigs: First explorations of a novel methodology for integrative animal welfare measurement. *Appl. Anim. Behav. Sci.* **2000**, *67*, 193–215. [CrossRef]
153. Wemelsfelder, F.; Hunter, E.A.; Mendl, M.T.; Lawrence, A. B Assessing the 'Whole Animal': A Free Choice Profiling Approach. *Anim. Behav.* **2001**, *62*, 209–220. [CrossRef]
154. Fleming, P.A.; Clarke, T.A.; Wickham, S.L.; Stockman, C.A.; Barnes, A.L.; Collins, T.; Miller, D.W. The contribution of qualitative behavioral assessment to appraisal of livestock welfare. *Anim. Prod. Sci.* **2016**, *56*, 1569–1578. [CrossRef]
155. Grant, E.P.; Wickham, S.L.; Anderson, F.; Barnes, A.L.; Fleming, P.; Miller, D.W. Behavioral assessment of sheep is sensitive to level of gastrointestinal parasite infection. *Appl. Anim. Behav. Sci.* **2020**, *223*, 104920. [CrossRef]
156. Dwyer, C.M. Farming sheep and goats. In *Routledge Handbook of Animal Welfare*, 1st ed.; Routledge: London, UK, 2022; pp. 89–102.
157. Simitzis, P.; Tzanidakis, C.; Tzamaloukas, O.; Sossidou, E. Contribution of Precision Livestock Farming Systems to the Improvement of Welfare Status and Productivity of Dairy Animals. *Dairy* **2022**, *3*, 12–28. [CrossRef]
158. Berghof, T.V.; Poppe, M.; Mulder, H.A. Opportunities to improve resilience in animal breeding programs. *Front. Genet.* **2019**, *9*, 692. [CrossRef]
159. Bisset, S.A.; Morris, C.A. Feasibility and implications of breeding sheep for resilience to nematode challenge. *Int. J. Parasitol.* **1996**, *26*, 857–868. [CrossRef]
160. Chienjina, S.N.; Behnke, J.M. The unique resistance and resilience of the Nigerian West Africa Dwarf goat to gastrointestinal nematode infections. *Parasit. Vectors* **2011**, *4*, 12. [CrossRef]
161. Knox, M.R.; Torres-Ascota, J.F.J.; Aguillar-Caballero, A.J. Exploit the effect of dietary supplementation of small ruminants on resilience and resistance against gastrointestinal nematodes. *Vet. Parasitol.* **2006**, *139*, 385–393. [CrossRef]

162. Köning, S.; May, K. Invited review: Phenotyping strategies and quantitative-genetic background of resistance, tolerance and resilience associated traits in dairy cattle. *Animal* **2019**, *13*, 897–908. [CrossRef]
163. Baciadonna, L.; McElligott, A.G. The use of judgement bias to assess welfare in farm livestock. *Anim. Welf.* **2015**, *24*, 81–91. [CrossRef]
164. Sørensen, J.T.; Fraser, D. On-farm welfare assessment for regulatory purposes: Issues and possible solutions. *Livest. Sci.* **2010**, *131*, 1–7. [CrossRef]
165. Placzek, M.; Christoph-Schulz, I.; Barth, K. Public attitude towards cow-calf separation and other common practices of calf rearing in dairy farming—A review. *Org. Agric.* **2021**, *11*, 41–50. [CrossRef]
166. De Rosa, G.; Grasso, F.; Braghieri, A.; Bilancione, A.; Di Francia, A.; Napolitano, F. Behavior and milk production of buffalo cows as affected by housing system. *J. Dairy Sci.* **2008**, *92*, 907–912. [CrossRef] [PubMed]
167. Vigors, B.; Lawrence, A. What are the positives? Exploring positive welfare indicators in a qualitative interview study with livestock farmers. *Animals* **2019**, *9*, 694. [CrossRef]
168. Vigors, B. Citizen' and farmers' framing of positive animal welfare and the implications of farming positive welfare in communication. *Animals* **2019**, *9*, 147. [CrossRef]
169. Alonso, M.E.; González-Montaña, J.-R.; Lomillos, J.M. Consumers' Concerns and Perceptions of Farm Animal Welfare. *Animals* **2020**, *10*, 385. [CrossRef]
170. Lagerkvist, C.L.; Hess, S. A meta-analysis of consumer willingness to pay for farm animal welfare. *Eur. Rev. Agric. Econ.* **2011**, *38*, 55–78. [CrossRef]
171. Clark, B.; Stewart, G.B.; Panzone, L.A.; Kyriazakis, I.; Frewer, L.J. Citizens, consumers and farm animal welfare: A meta-analysis of willingness-to-pay studies. *Food Policy* **2017**, *68*, 112–127. [CrossRef]
172. Napolitano, F.; Girolami, A.; Braghieri, A. Consumer liking and willingness to pay for high welfare animal based product. *Trends Food Sci. Technol.* **2010**, *21*, 537–543. [CrossRef]
173. Stokes, J.E.; Rowe, E.; Mullan, S.; Pritchard, J.C.; Horler, R.; Haskell, M.J.; Dwyer, C.M.; Main, D.C.J. A "Good Life" for Dairy Cattle: Developing and Piloting Framework for Assessing Positive Welfare Opportunities Based on Scientific Evidence and Farmer Expertise. *Animals* **2022**, *12*, 2540. [CrossRef]