



Study on the improved methods for animal-friendly production, in particular on alternatives to the castration of pigs and on alternatives to the dehorning of cattle

D.2.3.3. Final recommendations to DG-SANCO regarding alternatives to dehorning

SP2: Alternatives to dehorning: To develop and promote alternatives to the dehorning of cattle.

WP2.3: Short and long term strategies for future development.

Due date of deliverable: November 09

Actual submission date: November 09

Final

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Table of contents

1	Introduction	1
2	The horns	1
3	Dehorning : current practices	2
3.1	Definition	2
3.2	Today's situation in the member states regarding dehorning	2
3.2.1	Frequency of dehorning in the Member States	2
3.2.2	Farmers' attitudes and expectation.....	3
3.3	Conclusion.....	4
4	Welfare implications of dehorning.....	5
4.1	Reducing pain during dehorning	5
4.2	Conclusion.....	6
5	Alternatives to the dehorning	7
5.1	Polled cattle	7
5.2	Conclusions	8
5.3	Keeping horned cattle.....	8
5.4	Conclusions on keeping horned cattle.....	9
6	The stakeholder views expressed during the Stakeholder Conference, Bologna, 28 th of October	9
7	Final recommendation.....	11
7.1	General Recommendations	11
7.2	Points of action.....	11
7.2.1	Improvement of disbudding	11
7.2.2	Promoting breeding for polled animals.....	12
7.2.3	Support keeping of horned cattle	13

1 Introduction

In Europe, there is a growing support of citizens for the development of more welfare-orientated production systems. However, in order to underpin policy development in this area, there is a need for solid scientific data.

The general objective of this sub-project of the Alcasde project is to look in depth into alternatives for the dehorning of cattle and to evaluate different strategies to promote these alternatives.

The present deliverable provides final recommendations, based on the findings of the whole sub-project on alternatives to the dehorning of cattle. Here we take into account:

- the current situation regarding dehorning in the member states,
- the scientific literature and data available on consequences of dehorning and alternatives to dehorning,
- the opinion of the main stakeholders about the way to improve the welfare situation with regard to dehorning.

Finally we formulate recommendations on what seems, based on these findings, the main points that need to be taken into account to promote more welfare friendly system for cattle farming in relation to dehorning

2 The horns

Horns are the pair of hard, bonelike, permanent growths projecting from the head of cattle. The horn is covered by dense keratin and elongates from its base.

The horn bud starts to develop during the first two months of life. The horn is produced at the corium, the area of cells located at the junction of the horn and the skin. As the calf grows older, the horn bud attaches to the skull, more precisely to the periosteum of the frontal bone overlying the frontal sinus. A small horn then starts to grow. Once the horn bud attaches to the skull, the horn core becomes a bony extension of the skull. Around the age of 7 - 8 months the hollow centre of the horn core opens directly into the frontal sinuses of the skull.

In cattle, both males and females of horned breeds have horns. Hypotheses on the evolutionary function of horns in female ungulates include predator defence, use in resource competition, defence of their offsprings against dominant males. In addition for males, horns may reflect genetic quality.

Cattle appear to be well aware of their horns. The presence of horn will affect the way of fighting although physical agonistic interactions seem to be less frequent among horned

animals. Some authors hypothesized that it may be due to the effectiveness of threat signals in relation with previous aversive experiences of horns.

Different hypotheses or claims have been formulated about other functions of the horn such as their relation with production traits. However many of these hypotheses are not yet confirmed by scientific evidence.

3 Dehorning : current practices

3.1 Definition

Dehorning is the removal of horns or part of the horns. This definition does not include the removal of the tips of the horn in non sensitive tissue in order to decrease the sharpness of the horns. We define dehorning as a practice in animals older than 2 months by means of cup and scoop type dehorners, electrical or wire saws, or shears.

Disbudding is the removal or destruction of the horn-producing cells of the horn buds. Disbudding is practised on young calves (before 2 months of age) when the horn itself is not yet developed. It is carried out using a hot iron, caustic paste, or by surgical removal with a tube, a scoop or a curved knife.

3.2 Today's situation in the member states regarding dehorning

3.2.1 Frequency of dehorning in the Member States

In Europe, more than 80% of dairy cows are hornless and this percentage reaches approximately 90% in conventional farming systems in Western Europe. The percentage of hornless cows is lower in tie stalls, in organic systems and in Eastern Europe. However, even in these cases, half of the dairy cows are hornless. Disbudding is the more frequent procedure of horn removal . In most of the farms disbudding is practiced by the means of hot iron (75 to 95% according to regions) followed by caustic paste (mainly used in Spain). A wire saw is the more frequent tool used to dehorn older cattle (90 %). Medication appears to be used in 25% of the cases of disbudding (mainly in the North of Europe due to specific regulation) and in more than 70% of the cases of dehorning. But the protocols used for medication vary largely across Europe..

In dairy cattle, dehorning is carried out to reduce the risk of injuries among penmates and for the stockman. Easier handling and adaptation of cattle to housing facilities are also important factors to explain this practice. On the one hand, 30% of the questioned expert reported that there is an obligation for farmers to dehorn mainly for economic reasons (transport, slaughterhouse, market). On the other hand, 25% of them put forward obligations to not dehorn mainly in relation with breeding standards, market or biodynamic farming.

In suckler herds, more than 60% (from 40 % in the South to 85 % in the North) of the cows are hornless. Polled cattle represent approx 8% of the animal in relation with the use of certain breed in the North of Europe. The proportion of hornless cattle is lower in tie stalls and permanent grazing systems (on average, approx 30% hornless cattle and these systems represent 25% of the animals).

Except in North Europe, hornless suckler cattle can be found less in organic farms. While Disbudding is less frequent in suckler cows than in dairy cow, it is nevertheless still predominant (>60 % cows) except, in some countries, due to rearing systems, like France, Poland and Spain. Use of drugs during dehorning, often realized by farmers (44 %) is less frequent than for dairy cows (41 %). Farmers dehorn mainly for safety and handling reasons and, noticeably in the South, to reduce carcass depreciation. Polled cattle is considered the most viable alternative to dehorning.

In beef cattle, only approximately 40% are hornless while the level of polled cattle is approx. 4 %. Hornless beef are less frequent in the South of Europe (<10%) than in other European regions. Hornless beef cattle are very rare in tie stalls or organic farms but these systems represent a very low percentage of European farms. Disbudding is the more frequent practice (>60% on average across Europe). Dehorning is more frequent in South and East Europe in relation with treatment of injured cattle with broken horns. In these regions it is also more frequent to remove only parts of the horn for safety reasons. Tools used and practices of disbudding are similar to those observed for dairy cattle but caustic paste appears to be more frequently used. Farmers dehorn for the same reason as for suckler herds.

3.2.2 Farmers' attitudes and expectation

Interviews of farmers in 3 countries (France, Germany, Italy) in different production systems and areas confirm the main motivation of farmers to keep hornless cattle. However, farmers who kept horned cattle argue that the risk for humans is not much higher than being kicked for instance. In favor of keeping horns, different motivations such as ethic reasons (cattle integrity, naturalness, avoidance of pain and stress), a good farmer-animal relationship, and a presumed better cattle health and product quality were mentioned. On the other hand, farmers that keep hornless cattle also think that it is better for the welfare of animals to reduce the risk and severity of injuries. In fact, all farmers agreed on the higher risk for the animals themselves when they are horned and on the need to pay more attention to the behavior of the animals. Adaptations of the housing and equipment which are sometimes difficult to realize may be needed when keeping horned cattle. Some farmers reported experiences of changes from tie stall to loose housing which finally led to decision to dehorn their cattle.

There is a clear impact of tradition (geographical area, housing, breed) on the practices and many farmers have always worked with the same kind of animals (either always with horned animals or always with hornless animals). Farmers that keep hornless cattle think that it's better for the welfare of animals thanks to a reduction of the frequency and the severity of

injuries. Sometime there are market incentives to rear hornless cattle. By contrast, farmers who keep horned animals put forward aesthetic reasons, ethical principles or other beliefs in relation to naturalness of horns. Except for fattening animals where it could be manageable, farmers agree that mixing horned and hornless animals is not satisfactory.

A number of farmers who keep hornless cattle have unpleasant recollection of dehorning and they think that disbudding is preferable because of less stress during handling and less pain. Each farmer who disbud or dehorn cattle has its “own” technique and thinks that it is the best one. Furthermore, while they agreed about the pain inflicted to the animals, there were debates about the level of this pain according to their own observations or anthropomorphic comparisons. Few of them use anesthetics or sedation and sometimes there is confusion about the different drugs to be used.

For reasons mentioned above, most farmers do not want to stop dehorning or disbudding and, in the sample, there was a balance between the few of them who intend to stop or to start. Most farmers are prepared to use polled cattle but they complain about the lack of quality and diversity of available bulls. Their priorities, however, remain good productive and reproductive traits. On the other hand, farmers in organic schemes who keep horned cattle disapprove such genetic selection. Most farmers, whatever their system, would like to keep the possibility to choose between different alternatives.

3.3 Conclusion

- *Keeping hornless adult cattle (dairy or suckler) is the most frequent situation in the EU member states*
- *Disbudding with hot iron by the farmer and without the use of a pain releaser is the most frequent practice*
- *Training and guides for good practice are not very frequent and farmers are not always aware of specific regulations or possibilities to use pain releasers and there is some interest in having more information.*
- *Reducing the risk and the severity of injuries for the farmers and for the animals is the main reason for disbudding and dehorning while ethical reasons is the main motivation not to dehorn*
- *The choice to keep horned or hornless cattle are exclusive choices and has direct implication on housing and management practices*
- *Disbudding is preferred in comparison to dehorning by farmers as a less stressful and less painful procedure for the animal*

- *Using polled cattle will be an alternative to dehorning for farmers if bulls of high genetic quality are available but freedom of choice between different alternatives remain one of the main expectation of farmers*

4 Welfare implications of dehorning

As already mentioned, there are very few studies that investigate the effect of being horned or hornless on physiological and productive traits of cattle. Furthermore, as most of the animals are dehorned in Europe, it is obviously difficult to measure specific risk for human safety or for the animals themselves linked to the presence of horns.

Most of the studies focus on the effect of dehorning/disbudding (or the methods of) on pain and the use of pain releaser.

4.1 Reducing pain during dehorning

Disbudding and dehorning cause tissue damage which results in activation and release of intracellular contents from damaged cells, inflammatory cells and nerve fibres that will probably lead to similar experiences of pain as they would in human beings. Many studies have shown that dehorning or disbudding induce pain evaluated by physiological or behavioral indicators in both young and old animals. According to the method used, the damage of tissues and the animal's reactions differ. In fact, disbudding/dehorning by cut of the tissue appears to induce more pain than other methods, although not all studies are unequivocal

There is no clear evidence that younger animals are less pain sensitive than older ones. However, regarding dehorning versus disbudding :

- comparisons between studies suggest that long term effects (for instance, depletion of growth rate) are higher after dehorning compared to disbudding.
- cortisol response to hot iron disbudding is lower and shorter than that to dehorning.
- behavioral responses from 6 to 24 hours after disbudding or dehorning also indicate more pain in scoop dehorned than in hot iron or caustic paste disbudded calves

Furthermore, dehorning implies more severe wounds than disbudding with opening of the frontal sinus. Healing of the wounds lasts several weeks and may be complicated by bleeding and infections. Altogether, these different results suggest that less pain is imposed by disbudding than by dehorning.

While it is difficult to comparatively evaluate the different pain qualities resulting from different disbudding methods, the welfare risks of using caustic paste are higher, e.g due to over dosage leading to necroses, or chemical burns on other parts of the body or other animals.

Only little research has been devoted to disbudding/dehorning consequences in terms of pain after 24 hours post operation.

Sedatives can facilitate handling of the animals during disbudding/dehorning by reducing physical activity but is not a mean of reducing pain in itself. Injection of a local anaesthetic into the corneal nerve area desensitizes this region. However, efficacy depends on the method used for disbudding/dehorning, characteristics of the animal, as well as concentration and volume of the anaesthetic injected. The sensitivity of the area has to be tested prior to disbudding/dehorning and sufficient time is needed after the injection to allow anesthesia. As calves have also to be restrained during the injection, it is also suggested that sedation should be applied but, in some cases, sedation may mask the response of calves to local anaesthesia so that monitoring of anaesthesia becomes difficult.

Local anaesthesia lasts only during a short period. At the end, there is a huge increase of cortisol. Use of nonsteroidal anti-inflammatories is recommended to prolong analgesia and reduce inflammatory pain.

4.2 Conclusion

- *Both disbudding and dehorning induce tissue damages and produce physiological and behavioral reactions that indicate pain*
- *Disbudding induce less negative welfare consequences than dehorning*
- *For disbudding, the use of a hot iron appears to be preferable*
- *Local anesthetics reduce pain during disbudding/dehorning and non-steroidal anti-inflammatory drugs reduce pain during the following hours*
- *Sedation allows an easier handling of the animals and an easier administration of local anesthetic but interfere with the monitoring of anesthesia.*
- *There is a lack of knowledge about possible long term pain after disbudding/dehorning*

5 Alternatives to the dehorning

5.1 Polled cattle

The model commonly accepted for inheritance of horns implies three loci: polled, scurs and African horn. The polled locus has two alleles: P (polled or absence of horns) and p (horned). P is dominant over p. Consequently animals carrying one or two P alleles are always polled. For breeding polled animals, the polled gene is the most relevant since it is independent of the sex. *Scurs* and *African horn* are dependent of the sex and interfere with the expression of the polled phenotype.

The polled gene is located on the Bovine chromosome 1 and markers are available commercially to distinguish between homozygous (PP) and heterozygous (Pp). The most likely explanation for the mutation that leads to polledness is that the expression of a gene at the start of the pathway forming horns is disrupted so that the development of horns does not take place.

The presence of polledness has been known for a long time and some breeds are completely polled (for instance, Aberdeen Angus or Hereford). Some breeds have a substantial proportion of polled animals (>20 %, for instance Norwegian Red). In other breeds, a few polled bulls (generally heterozygous) are available (Holstein, Charolais for instance). At last, polledness is completely absent in some breeds (for instance, Meuse Rhine Ijssel).

In Holstein Friesian, 39 bulls are now available for artificial insemination but their breeding values are clearly lower than the Top 100 bulls. In Charolais, 7 polled bulls are progeny tested. However, the frequency of *Scurs* allele (development of small horn-like growth loosely attached to the skull) is problematic in this breed. In the German Fleckvieh breed, after 30 years of breeding, 12 bulls are available and the gap in the production for the dairy line is almost closed between horned and hornless. However, some negative traits occur frequently in polled cattle that may have resulted from genetic drift or inbreeding effects caused by the use of few ancestors.

Availability of bulls with the polled gene opens up the possibility of breeding programs. Usually, an introgression program is used to introduce a required gene in a population without the gene. Modern molecular techniques may help in this process. In the Holstein Friesian, a rough simulation shows that a classical introgression program would last 20 years and not close the gap between polled and horned bulls in genetic merit. To reduce the loss, selection on genetic merit can be applied simultaneously. With the help of genomic selection, simulations show that in 4 generations a significant number of polled animals could be obtained with reduced genetic gap between horned and polled animals. The main advantage, from a classical selection based on offspring performance, is a reduction in the interval between generations.

The future of polled cattle is difficult to predict. For farmers, it is not a priority as long as dehorning (or disbudding) is an accepted practice. Nevertheless, the case of the Fleckvieh showed that the availability of bulls of high breeding value can induce a quick switch towards polled animals. For consumers, a Dutch study showed that polled cattle seem to be acceptable only when resulting from a natural process but not from genetically modified animals (which is not the case). Currently, a few small breeding companies are specialized in polled cattle. Depending on policy and commercial opportunities, we suppose that in ten years a significant number of polled bulls could be obtained in the main breeds.

5.2 Conclusions

- *The most relevant gene to control the hornless phenotype, the polled gene, has two alleles with the Polled (P) one dominant.*
- *The presence of polledness depends on the breed with some main beef breeds being completely polled but in most main breeds only a few number of heterozygous bulls are available. Many problems still need to be solved as low breeding values, presence of Scur alleles or negative traits.*
- *Classical introgression programs take 20 years and there is still a gap in genetic merit between horned and dehorned animals. To reduce the loss of genetic merit of polled animals and the time needed for introducing the polled gene, genomic selection seems a promising method. Then, in the main breeds, it can be hypothesized that sufficient polled bulls with a high value can be obtained in approximately ten years.*
- *The future of polled cattle is hard to predict. It will mainly depend on the acceptability by citizens, efforts made by breeding companies and availability of high breeding value bulls for farmers.*

5.3 Keeping horned cattle

Usually, keeping horned cattle in tie stalls is not seen as problematic and that explains why dehorning is not frequent in this housing condition. In loose housing systems, due to increased risk of injuries, it is generally advised to dehorn cattle and consequently only few recommendations are available for keeping horned cattle, mainly from Germany, Austria and Switzerland. They are based partly on epidemiological studies showing that keeping horned cows in loose housing is feasible, i.e. the risk of injuries is minimized provided appropriate management, human-animal interactions and housing.

There is a general agreement in these recommendations that, in order to reduce conflict, dimensions of feeding places, of passageways, general space allowances and availability of cubicles should be increased while many other adaptations to the housing conditions are also favourable (e.g., avoiding dead-end situations, use of feed barriers open at the top, cubicles

with escape possibilities to the front). Furthermore, the management of situations where there is a high risk of competition (e.g. feeding and of course integration of unfamiliar animals) is a key factor. Many recommendations also apply to dehorned cattle in order to reduce social stress. However, further research is clearly needed in order to give solid-based recommendations.

Many of the adaptations needed to improve housing and management of horned cattle may increase the cost of investment or labour. As long as there is no measurable effect on production traits, this leads to a reduced income for farmers. Furthermore, in some cases, there can be some additional requirements (for instance, from slaughterhouse or insurances) that limit the possibilities for farmers to keep horned cattle. Then, without any support or development of a label, farmers who want to keep horned cattle may suffer economic losses.

Finally, if breeding leads to a domination of polled cattle in the coming years, farmers who want to keep horned cattle will probably be limited in their choice of available bulls if not of available breeds. So, there is some concern about the balance between the two alternatives.

5.4 Conclusions on keeping horned cattle

- *As dehorning in loose housing system is largely predominant, few recommendations and information are available for farmers who want to keep horned cattle and further research is needed in order to improve existing recommendations.*
- *Keeping horned cattle can induce economic losses in combination with higher investment costs and farmers need additional support.*
- *As keeping horned cattle and keeping polled cattle are the two alternatives to dehorning, future policy should take into account the benefits and disadvantages of both options so that they both remain viable.*

6 The stakeholder views expressed during the Stakeholder Conference, Bologna, 28th of October

For most stakeholders, veterinarians, animal welfare organization, meat industry and farmers, disbudding/dehorning in itself is not a major ethical issue but reducing pain during disbudding/dehorning is an important objective. It was put forward that there is a balance, in term of welfare, between the risk of injuries of penmates or during transport, the way of housing (loose is preferable to tie stall) and disbudding/dehorning. All stakeholders expressed that disbudding is acceptable when pain is reduced, even if their motivations for this view were different.

In order to reduce pain, most stakeholders agreed that only disbudding young animals (less than 2 months old) should be allowed on a routine basis, and dehorning be restricted to emergency cases. There was general agreement that the use of local anaesthesia and analgesia is needed. This also means that disbudding has to be realized by skilled operators and an example was given from UK where farmers are allowed to apply local anaesthesia themselves for disbudding. At last, caustic paste used in some countries by farmers to disbud was in majority not regarded to be acceptable.

However, some farmers expressed concern about specific situations like those observed in some countries for suckler herds where calves are born outside and stay there with their dam and are thus not approached by humans when they are young. While they agreed to improve their practice, they also underlined that, due to their production system, several modifications of the system will be needed in case of restrictions on dehorning.

Mixing dehorned and horned animals is regarded as a bad situation, on farms as well as during transport and slaughter,.

Polled cattle was appreciated as one way forward. Breeding companies confirmed the availability of polled bulls and the major breakthrough linked to genomic selection. However, concerns were also expressed about the risk that polled cattle would completely replace horned cattle in the future and this might be associated to some detrimental effects. For instance, if polledness is achieved in one main breed (e.g. Holstein) then others could be marginalised and more or less abandoned. Consequently, there is a risk of reduction of biodiversity. Additionally most stakeholders support the importance of a free choice for farmers to keep horned animals or to use polled animals, so that both options should be available.

At last, keeping horned adult cattle, primarily if there will be a great availability of polled cattle in some breeds in the future, will largely depend on the development of specific schemes and perhaps on public support.

7 Final recommendation

7.1 General Recommendations

Based on all the results of this project, the partners of the project Alcasde recommend:

- *To improve disbudding/dehorning practices. This includes to*
 - *restrict dehorning to emergency cases,*
 - *safeguard that the procedure of disbudding is carried out by a qualified operator,*
 - *define best practices of disbudding including the use of local anaesthesia and analgesia.*

- *To promote breeding for polledness but to also monitor and control possible consequences . This includes that*
 - *breeding programs should minimise inbreeding,*
 - *selection for polled animals should also take into account other important traits,*
 - *breeding program should leave the freedom to go back to horned animals,*
 - *both phenotypes should remain available.*

- *To support keeping of horned cattle by information, subsidies and allowing premium food products*

7.2 Points of action

A series of action points are proposed below that could be used to achieve the above recommendations.

7.2.1 Improvement of disbudding

- Harmonize/upgrade legislation at European level according to the recommendation above

- Caustic paste should not be recommended

- Harmonization of European legislation in order to allow certified farmers to use local anaesthetics and analgesic would be helpful

- Encourage adoption of Good Practice. The adoption of common guidelines by stakeholders across Europe should be encouraged together with the production of a Good Practice Guide at European level. This guide should include :

- - General information about anatomy, physiology, behaviour and pharmacology, in particular with regard to pain perception and expression,
 - principles of handling animals,
 - protocols for disbudding (apparatus with information on key parameters, procedure, pain releasing protocol),
 - criteria for self-monitoring the process and its consequences (for instance, monitoring of anesthesia, behaviour associated with pain)
- Encourage training for operators based on the same points as for GPG with a certification process
 - Develop general information to advisers of farmers
 - Take and support initiatives in order to test and give independent information about disbudding equipment and procedures.

Further research needs

There is a lack of scientific data on

- welfare effects of sedation during disbudding under different conditions,
- possible long-term pain after disbudding.

7.2.2 Promoting breeding for polled animals

- Encourage communication on polledness that makes clear that breeding is not genetic modification and that the polled gene has been around for a long time
- Support cryopreservation of genetic material (semen, oocytes, embryos...) from horned animals
- Provide independent information/advice to farmers willing to convert the herd to polled cattle

Further research needs

- In breeds with small population, genomic selection is difficult because the links between markers and traits cannot be estimated reliably. Improvements might be achieved by increasing availability of more markers.
- Development of protocols that take into account inbreeding
- Analysis of the reasons for anomalies in polled Fleckvieh (for instance, is it due to inbreeding or linked to the polled gene and is it present in other breeds?)

7.2.3 Support keeping of horned cattle

- Spread the knowledge about the feasibility of keeping horned cattle in modern cattle farming systems, so that, for example, stakeholders know that a change from tie housing to loose housing does not imply dehorning.
- Provide easy access to qualified information and advice for farmers willing to keep horned cattle

The supporting solutions for the above two points could be:

- Develop special courses to provide information and try to change attitudes and behaviour of stock people and all professionals working with cattle to enable successful keeping of horned animals with low risk of accidents. Course content should deal with social behaviour of cattle, recommendations for keeping horned animals and human-animal interactions;

- Provide information to all the stakeholders of the cattle production chains in order to avoid biased depreciation due to keeping horns;

- Develop proper supporting material in different languages including videos showing practical cases explained by farmers;

- Include information on keeping horned cattle in agricultural education and veterinary curricula.

- Support demonstration on farms, where successful keeping of horned animals is practiced.

- Develop and promote adequate housing solutions (e.g. special equipment) for horned cattle
- Provide subsidies for keeping horned animals in welfare-friendly cattle production systems or guarantee that no exclusion from subsidies will occur due to spacious construction of housing.
- Promote certified premium food products from horned animals

Further research needs

Further research is needed on

- the effects of space allowances, dimensions, equipment and management practices during farming, transport and slaughter on the welfare of horned cattle and safety of humans.
- possible effects and relevance of horns for social interactions, stress, health, and product quality.

