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Review paper

On-farm killing as a method to minimize pre-slaughter stress: a qualitative analysis from Switzerland

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ABSTRACT

Pre-slaughter stress is often caused during the different stages of animal handling, live transportation, stunning and dry bleeding. Such condition has a negative impact on animals and operators, meat quality and consumer satisfaction. A slaughter practice that intends to minimize pre-slaughter stress applicable to the small-scale commercial sector is on-farm killing (OFK) using the captive bolt pistol or gunshot method. A trust-based training of operators and cattle facilitates the killing process at the farm and thereby represents a viable substitute for live animal transportation. Our paper presents the results of qualitative research on the use of OFK methods after its legalization in Switzerland in 2020. Eight farms participated in this study, and results suggest that OFK methods are technically and economically viable in Switzerland. In fact, after the six-year-long pilot phase, farmers declare that OFK mitigates the stress for cattle, provides for less hazardous work and improves consumers' preference for their meat. In this sense, OFK may serve as a contribution to alternative slaughter methods in industrial countries. Nonetheless, the dimension of the farm still represents a major constraint for the application of these methods. In fact, OFK as a replacement for live transportation is usually viable in small-scale contexts with fewer animals, shorter distances to slaughterhouses and minimal logistical challenges.

1. Introduction

Pre-slaughter stress and how to minimize it in beef production is widely discussed (*Harris*, 2001; *Speer et al.,* 2001; *Ferguson & Warner*, 2008; *Muchenje et al.*, 2009; *Probst et al.* 2012; *Schwartzkopf-Genswein et al.*, 2012; *Wigham et al.*, 2018; *Hultgren et al.*, 2020; *Terlouw*, 2020). It involves animal handling, live transportation, stunning and dry bleeding. If mismanaged, these stages can trigger strong adaptive responses in cattle which may have a negative impact on their welfare and also on meat quality (*Muchenje et al.,* 2009; *Wigham et al.,* 2018; *Jorquera-Chavez* 2019; *Reiche et al.*, 2019; *Terlouw,* 2020), causing considerable economic losses (*Ferguson & Wagner*, 2008; *Muchenje et al.*, 2009; *Probst et al.* 2012; *Wigham et al.*, 2018; *Terlouw*, 2020) and concerns among consumers (*Vanhonacker & Verbeke*, 2014; *Buddle et al.*, 2018). The main hazards for animals and operators can occur during live transportation due to loading density, travel duration and distance, feed and water withdrawal, weather and driving conditions, handling of animals and animal juvenility (*Schwartzkopf-Gens-*

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wein et al., 2016). Other hazards relate to the stunning phase due to poor skills of staff as well as inadequate facilities and equipment (*EFSA*, 2020). Although the issue of live cattle transport is widely studied and reported in the literature (*Hultgren et al.*, 2020, *Schwartzkopf-Genswein et al.*, 2012), it can be considered an indispensable prerogative for the large-scale beef production process (*Harris,* 2001; *Speer et al.,* 2001).

On the other hand, looking at small-scale beef production, some solutions have been recently proposed. On-farm killing (OFK) minimizes pre-slaughter stress for animals by eliminating the element of live transportation, and facilitating a handling and stunning process that is grounded in specialized and skilled training of all involved entities. Two of these methods described in the literature involve either a mobile slaughter unit (MSU), also known as mobile abattoir, in which animals are stunned with a captive bolt pistol; and the so-called gunshot method by which animals are shot without restraint at close range (*Schiffer*, 2015; *Hultgren et al.*, 2022). Several experiences in the use of MSUs for red meat production from private small-scale meat producers in industrialized countries have been reported in literature since the early 2000s. The earliest use of licensed MSUs were reported in 2002 in the USA (*USDA*, 2010) and in 2006 in Canada (*Pinkney,* 2014), as a way for farmers in marginal areas to reduce the costs of animal transportation. Today, MSUs are known to be used across all continents except for Antarctica (*Hultgren et al.*, 2022). The use of the gunshot method, however, seems less common. It has been so far documented in. Australia, Canada, Germany, New Zealand, Switzerland and the USA (*Hultgren et al*., 2022). To our knowledge, Switzerland is currently the only country that legalized a third variant of OFK for which the acts of stunning and dry bleeding are performed with a CBP but without an MSU.

The pros and cons of OFK methods were recently evaluated (*Berger Richardson*, 2022). While the potential of OFK to replace large scale slaughter as an integral part of the contemporary meat production process seems unlikely (*Harris*, 2001; *Speer et al.*, 2001), it nonetheless is a viable option for small-scale businesses to reduce pre-slaughter stress and the related hazards for animals and operators, and consequently improve meat quality (*Ferguson*, 2008; *Jorquera-Chavez*, 2019) and consumer satisfaction (*Lagerkvist & Hess*, 2011; *Marescotti et al.*, 2020). Little is known in the literature about the particular application and implementations of OFK in farmer practices, especially in the commercial sector. When Switzerland legalized OFK in July 2020, we took this as the starting point for the present study which pursues the questions: how do farmers implement OFK methods? What advantages and disadvantages might this practice entail? What significance does OFK have for the mitigation of pre-stress slaughter? To address these questions, we provide context on the Swiss legislation and present original empirical data of a qualitative study on eight different farms that delivers the first complete insight into the implementations of OFK in the European area. Results of the present research contribute to the literature on alternative slaughter methods, as this seminal study could be highly valuable for scholars and different stakeholders within the meat industry.

2. Materials and methods

2.1 Data collection

Given the scarcity of farms that adopted OFK in Switzerland, and in view of the novelty of the topic, we opted for a data collection using qualitative methods, which was carried out in two stages.

During the first stage, material was collected to study the legal framework of OFK methods and reconstruct their introduction in the Swiss pilot phase (2014–2020) as well as the newly extended Swiss legislation concerning slaughter in 2020 (VSFK, SR 817.190, §2a., Art. 9a). Between April 2020 and February 2021, we studied the context of Swiss OFK via governmental guidelines and press reports; via the Research Institute of Organic Agriculture, FiBL, which was assigned to the OFK project in 2014; by studying cantonal veterinary documents; and via the websites of several farms who adopted OFK. This first stage enabled us to generate codes for the interview guidelines (*Mattimoe*, 2021), which were applied in the second stage of the research. The initial codes involved “farm development”, “farm transition to OFK”, “human-cattle relations”, “producer-consumer relations” and “marketing”. We used the analysis of these sources to create a semi-structured interview protocol, which included open-ended and generative questions.

The second stage of the study was carried out through the application of qualitative research methods, which allowed empirical *in situ* data collection. Empirical data were collected from March

2021 to April 2023, using ethnographic methods (*O'Reilly*, 2011; *Breidenstein et al.*, 2013). Specifically, we conducted semi-structured interviews with eight Swiss farmers and engaged in overt observations and participant observation, a method that describes a research process of conscious involvement of the researcher, alternating with a structured detachment to ensure objectivity of the findings (*Tedlock*, 1991). In a reiterative cycle, involvement allowed us to personally engage with the specific OFK context of each farm individually (*Collins & Gallinat*, 2010), while detachment facilitated the reflection, analysis, and interpretation of data and experiences on a regular basis (*Miles & Huberman*, 1994; *O'Reilly*, 2011; *DeMello,* 2012, *Fassin*, 2013; *Atkinson*, 2008; *Ejimabo*, 2015). Thus, the present research profits from unique first-hand insights which involved extended *in situ* stays at the studied farms. The choice of methods were applied over different periods of time (Table 1) to understand the different implementations of OFK and the required cattle handling.

2.2 Sampling and data analysis

Given the small number of farms that adopted OFK in Switzerland, a non-probabilistic method was implemented for the selection of the eight farms included in the final sample. Some farms were selected according to relevance and diversity of OFK methods (i.e., farms 1, 3, 4 and 8 were pioneers during the pilot phase of Swiss OFK from 2014–2020), while the remaining farms were contacted by snowball sampling (farms 2, 5, 6 and 7). The characteristics of the farms are described in Table 1. Farms 1, 6, 7 and 8 use the captive bolt pistol method for stunning, combined with a lifting arm attached to a tractor or the stable ceiling for dry bleeding while hanging, and a T-Trailer for carcass transportation (https://www.innovative-schlachtsysteme.de/t-trailer). Farms 2, 4 and 5 use the captive bolt pistol method for stunning, combined with a mobile slaughter unit (MSE-200) for dry bleeding and carcass transportation. Farm 3 practices the gunshot method from a high porch and uses a lifting arm attached to a tractor and a T-Trailer.

Table 1. Characteristics of the interviewed Swiss farms

On-farm killing solution / performance option	Swiss Canton	OFK since	Farm*	Herd size	Cattle breed	Participant	Periods of conducted research
Captive Bolt Pistol / Mobile Slaughter Unit MS-200	Lucerne	2021	Farm 2	35	Limousin	Female (f1)**	Aug. 2021
		2015	Farm 4	20	Miniature Zebu, Aubrac	Male (m3)	Sept. 2021
	Berne	2021	Farm 5	100	Montbélliarde, Norwegian Red, Holstein	Male (m4)	Sept. 2021
Captive Bolt Pistol / Lifting arm and T-Trailer	Grisons	2015	Farm 1	30	Grauvieh	Male (m1)	March / Sept. 2021
	Lucerne	2020	Farm 6	17	Grauvieh	Female (f2)	Oct. 2021 – April 2023
	Zurich	2021	Farm 7	20	Piedmontese, Highland, Black Angus, Grauvieh	Male (m6)	Oct. 2021
	Solothurn	2015	Farm 8	80	Red Angus	Male (m7)	Feb. 2022
Gunshot / Lifting arm and T-Trailer	Zurich	2014	Farm 3	25	Red and Black Angus	Male (m2)	Sept. 2021

*Numbers indicate the chronology of research visits, **Number in brackets indicate the data source code

Between March 2021 and April 2023, we conducted interviews with the participants, made observations about the farm infrastructure, and participated in four successful (Farms 2 and 6) and one failed (Farm 5) OFK. The authors triangulated (*Basit*, 2003; *Ritchie*, 2003) all material gathered from the first and second stage to present a holistic representation of OFK, how the methods are carried out in practice and why they work or fail in individual cases. Interviews were written in real time or recorded electronically and later transcribed and coded manually to select themes and assign categories (*Basit*, 2003; *Mattimoe*, 2021), based on the relevance of OFK as alternative slaughter method in theory and in practice. Results were not quantified but rather qualitatively explored and presented as individual business cases (*Basit*, 2003).

3. Preliminary results

3.1 Captive bolt pistol in combination with a mobile slaughter unit (MSU)

According to the data collected at Farms 2, 4 and 5, the success of the use of captive bolt pistol in combination with a mobile slaughter unit as OFK method depends on trust-based training between farmer and cattle as well as a skilled routine of both farmer and MSU operator. Cattle are required to willingly enter the ramp outside the MSU and be fixated in the attached head gate where they are stunned with a captive bolt pistol. This has to be practiced in advance by positive conditioning, enticing the animal with their favourite food. The ramp is then reeled into the MSU, and the lying carcass is stabbed in the chest for dry bleeding inside the shut trailer (*FiBL*, 2020).

The main advantages and disadvantages of this method seem to be the following:

- Advantages: the described method is the most hygienic as it collects the blood in a closed system. According to the MSU operator, with the mobile abattoir it was also much quicker than with other OFK methods, “because you didn’t have to hang the cow for dry bleeding” (m3, Table 1). He explained that it was also safer, referring to his experiences of cattle falling off the crane to which they were not properly hooked.
- Disadvantages: some Swiss farmers reported an increasing amount of cancelled or failed OFKs in Switzerland and are under the impression that this is due to the cattle’s unfamiliarity of the MSU trailer: farmers rent the platform for the training in advance but not always the whole unit. This way, only at the day of slaughter the cattle are facing the unfamiliar open trailer head-on and sometimes refuse to approach. We witnessed a failed OFK on farm 5 due to insufficient familiarization of the cattle with the stunning area.

3.2 Captive bolt pistol in combination with a T-Trailer

The use of captive bolt pistol in combination with a T-Trailer is similar to the one described in 3.1 but involves a different stunning and dry bleeding facility. The head gate here is part of a stable annex which is ideally a frequented, accessible area for the cattle. After a successful stunning, the head gate is opened, and the carcass released before it is attached to the chain of a lifting arm by one leg and hung up just above the blood container for dry bleeding. The hanging carcass can be stabbed either in the chest or the throat (*FiBL*, 2020). After the main gush is collected, the carcass is lifted onto the T-Trailer, which is then sealed for transportation.

The main advantages and disadvantages of this method seem to be the following:

- Advantages: the costs of the required infrastructure (head gate, area barrier and blood collection equipment) and vehicle (tractor with lifting arm) can be lowered by material shared with other farmers, which is practiced by some in Switzerland.
- Disadvantages: to chain and lift the carcass requires a well-rehearsed teamwork and timing (the maximum allowed duration between stunning and dry bleeding is 60 seconds). Further, the trust-based human-cattle training requires individual attention of single cattle characters (*Ferguson*, 2008) and a dedicated trial phase before the OFK appointment.

3.3. Gunshot method in combination with a T-Trailer

The use of the gunshot method in combination with a T-Trailer needs human-cattle shooting practice on a regular basis to keep the shooter in trainings and to familiarize the herd with the

sound. Our research participant from farm 3 (m2, Table 1) shoots his cattle from a high perch at close range with a red dot visor .22 magnum and lead soft point bullets, to have no exiting of the bullet from the head and, therefore, no energy waste of the slug expansion. Several potential slaughter cattle are gathered below in a small paddock and as soon as one looks up to him, he shoots. After the successful shot, the remainder of this OFK method is the same as in 3.2, with the exception that the maximum allowed duration between stunning and dry bleeding is 90 seconds.

The main advantages and disadvantages of this method seem to be the following:

- Advantages: direct contact with cattle is possible (as practiced at farm 3) but not required for the training. Handling can be done with the method of low-stress stockpersonship (LSS) (*Stookey & Watts*, 2014; *Barnes & Hibbard*, 2016). Furthermore, the infrastructure is not complex, and therefore, is less costly than for other OFK methods.
- Disadvantages: this method requires a rifle license and precision shooting.

4. Discussion and conclusion

The present study provides the first preliminary qualitative insights into the main methods of commercial OFK (*Collins & Gallinat*, 2010) and carves out their advantages and disadvantages to support a well-informed and individually suited implementation for the adoption of either a yard or pasture infrastructure (*Pinkney*, 2014). OFK definitely does not provide a "one size fits all" approach, being most suitable in small farms, where, however, it generates a premium product by minimizing the level of stress emanating from handling and reducing to zero the stressors of live transportation and hazardous stunning (*Ferguson & Warner*, 2008; *Jorquera-Chavez*, 2019). As such, OFK provides a window of opportunity to rethink the value chain of meat production and uses its very last stage as a means to provide consumers with a high animal-welfare product (*Probst et al.* 2012; *Schwartzkopf-Genswein et al.*, 2016; *FiBL,* 2020). This study contributes to the stream of literature on alternative slaughter techniques and OFK methods in particular (*Schiffer*, 2015; *Hultgren et al*., 2022), which seem to present a viable repertoire of ways to solve the long-lasting problem of pre-slaughter stress, at least in the small-scale context.

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