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KNOWLEDGE MANAGEMENT

Study of death indicators at Catalan slaughterhouses

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Index

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2. Introduction

The previous work of Community of practices (CoP) of Animal Welfare evaluated the fulfilment of Regulation (CE) 1099/2009 related to animal welfare at slaughtering. This was accomplished by a survey addressed to official veterinarian services of slaughterhouses (SVOE) and it was answered by colleagues of 43 slaughterhouses all around Catalonia, representing 64 sacrifice lines.

The results of the survey showed that in 16 of the 64 sacrifice lines of a particular number of species, regardless of the application of a proper stunning, there was a significant number of animals which could present vital signs between the stunning and the dressing of the carcass. This deficiency could be partly attributed to the extended idea that in the killing phase, applying a proper stunning suffices to reach absence of vital signs.

However, section 3 of the Regulation's Annex III clearly indicates that "the slaughtering or the scalding only will be executed once the lack of vital signs has been verified". Therefore, not only applying a proper stunning in the killing phase is relevant. It is also necessary to confirm the death of the animal by checking absence of vital signs before carcass processing.

The objective of this CoP is to study the killing process of the animal previous to the scalding or dressing, which represents a critical point in the animal welfare at the slaughterhouse.

3. Objectives

- Determine the prevalence of animals showing vital signs just before slaughtering.
- Analyse the possible causes.
- Propose specific death indicators complementary to the stunning ones, in order to include them in the standard operation procedures (SOP) of supervision of business operators as well as into the protocol of official controls.

4. Methodology

A transversal observational study was designed in order to evaluate the occurrence of particular death indicators just before processing the carcass.

Death indicators selected for this study are the ones proposed by EFSA for cattle, pigs, sheep, goats and chickens.

- Absence of muscular contractions.
- Absence of respiration.
- Presence of mydriasis.

Field research was conducted in 18 Catalan slaughterhouses located in Girona province (7), Barcelona province (3), the area of central Catalonia (3) and Camp of Tarragona (5).

The target population of the study was the sacrificed animals of the following species (and slaughterhouses): cattle (4 slaughterhouses), sheep (3 slaughterhouses), pigs (5 slaughterhouses), chickens (5 slaughterhouses) and rabbits (1 slaughterhouse).

In order to obtain a statistically representative sample, and assuming as initial hypothesis that between 0.5% and 1% of the sacrificed animals could present vital signs at the moment of carcass processing, we decided to evaluate a minimum of 1,000 animals per species, with an optimum number of 5,000 animals per species.

Between July and December 2014, the CoP members collected information of the three mentioned death indicators in those establishments where they routinely perform inspection tasks.

Data were collected individually per animal during the last 5 seconds previous to the processing of the carcass.

Depending on the operational procedure of each slaughterhouse, sacrificed animals were evaluated with previous proper stunning or without it (religious ritual halal).

For each slaughterhouse, the registered values were the amount of animals killed, speed of the processing line, stunning system, bleeding system and, specifically, bleeding duration and the time between sticking (for bleeding) and the first manipulation.

The following variables were recorded in each slaughterhouse for each animal species:

- Number of evaluated animals.
- Percentage of evaluated animals from the total number of sacrificed animals.
- Percentage of animals showing muscular contractions from the evaluated animals.
- Percentage of animals showing breathing from the evaluated animals.
- Percentage of animals showing absence of mydriasis from the evaluated animals.
- Percentage of animals showing both muscular contractions and absence of mydriasis from the evaluated animals.
- Percentage of animals showing both breathing and absence of mydriasis from the evaluated animals.

5. Results and discussion

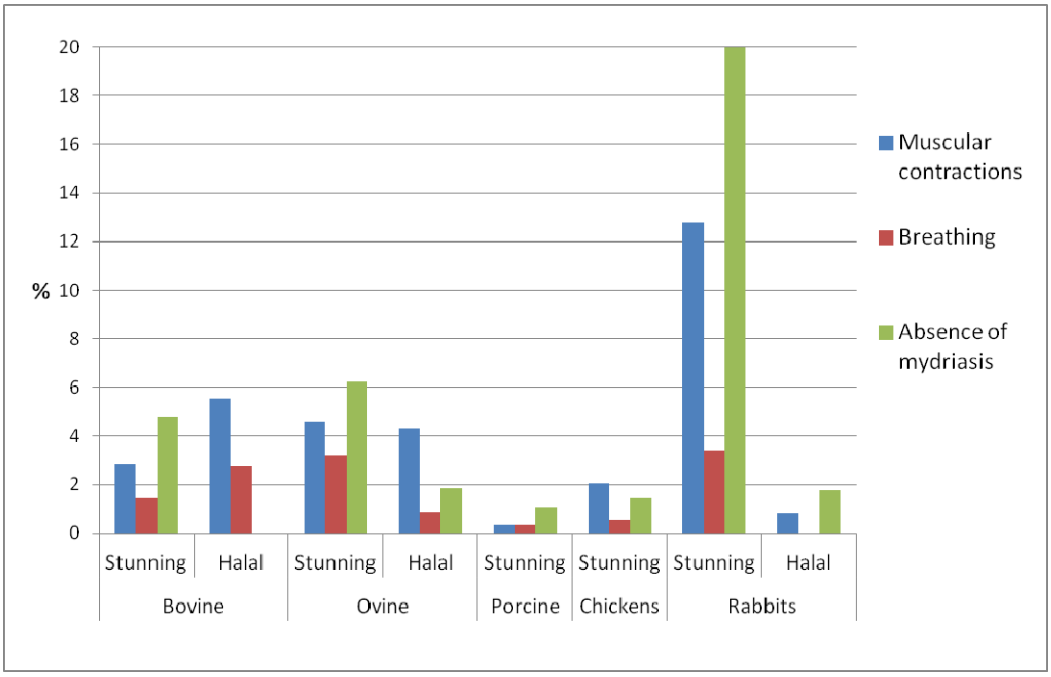
A total amount of 12,397 animals were evaluated and for each species the minimum value of the required sample was overtaken. The amount of evaluated animals for each species was: 1,094 cattle, 2,172 sheep, 1,304 pigs, 6,758 chickens and 1,069 rabbits.

Regarding the death indicators, pigs and chickens were the species which had by far the best results. On the mid-term, cattle and sheep, and last, with increased percentages of presence of vital signs at the moment of killing, the rabbits (figure 1). This order was maintained

independently of vital sign surveyed (presence of muscular contractions, or breathing or absence of mydriasis).

In any event, there was a higher percentage of animals than expected, still showing vital signs, which carcass was being processed. Depending on the vital sign considered, these percentages may oscillate among the following ranges: 0.34 – 1.05% in porcine, 0.53 – 2.03% in chickens, 1.8 – 3.58% in bovine, 2.4 – 4.78% in ovine and 1.69-12.4% in rabbits.

Figure 1. Percentage of the evaluated animals, split by species, showing different vital signs.



Among the three death indicators evaluated, mydriasis is the most difficult to observe, basically due to the difficult access to the head of the animal in the bleeding zones. Furthermore, in some cases its evaluation may be rather subjective. However, this was the parameter which gave the highest percentages of incidence in comparison to the other two.

It must be understood that what the presence of a breathing pattern and muscular contraction do, is confirming that an animal is not dead. Whereas the presence of an evident and clear mydriasis states the contrary, that is to say, confirming that the animal is dead. In fact, mydriasis takes a time in appearing, so their presence confirms death but their absence it doesn't mean necessarily that the animal is still alive. This would explain why the percentages of animals without mydriasis appear a little bit higher than the other two.

Probably, the easiest indicator to observe is the respiration, ahead the muscular contraction. Respiration, if it is rhythmic, indicates that the animal is recovering consciousness and it is therefore considered a relevant indicator.

In case of observing muscular contraction, the simultaneous observation of mydriasis may be interesting in order to settle if the observed contraction is due to a knee-jerk reaction (for

example, because of a cut in a nearby zone or just a mistake of the observer) or it is owing to the fact that the animal is alive. That means that a muscular contraction in an animal with evident mydriasis will not be considered in any case as a vital sign. Therefore, determining the presence/absence of mydriasis is only useful in presence of any of the other two indicators (muscular contractions or breathing) to determine if the animal is still alive. This is to say, if only absence of mydriasis is observed, it cannot be stated that the animal is alive. The animal must present other vital signs (breathing patterns and/or muscular contractions).

Hereafter, the results per species and slaughterhouses are described:

Bovine

A total of 1,094 sacrificed cattle were evaluated in four slaughters. All they were stunned by percussion (penetrating captive bolt), but they were bled in different ways: by slitting the brachiocephalic trunk at the slaughterhouse Girona 1, by slitting the carotid arteries at Catalunya Central 1, and by slitting the brachiocephalic trunk and the carotid arteries at Barcelona 3. At the slaughterhouse Girona 2, the brachiocephalic trunk was severed in animals stunned, and both carotids in animals sacrificed by halal ritual without stunning.

The best results, meaning the least number of animals with vital signs in the assessed area, were observed in slaughterhouses where the bleeding time was longer, such as Barcelona 3 (a slaughterhouse where both kinds of bleeding were applied).

In the slaughterhouse of Catalunya Central 1, in spite of allowing a long bleeding time, there was a considerable percentage of animals with vital signs. This was related to the bleeding system: only the carotids were cut. That allows the maintenance of a cranial blood circulation through deep blood vessels of the neck, which pass further on through intervertebral channel. This is the reason why they keep protected from the slit (table 1).

Table 1. Percentage of animals showing vital signs in bovine slaughterhouses

Slaughterhouse	Number of animals	Timing slit-dressing (s)	Muscular contractions (%)		Respirations (%)		Mydriasis absence (%)
			Total	No mydriasi	Total	No mydriasi	Total
Girona 1	116	60	4.31	0	0.86	0	1.83
Girona 2	72	180 – 280	5.55	1.83	2.77	1.69	0
Catalunya C. 1	56	120 – 300	3.57	1.78	3.57	1.78	12.50
Barcelona 3	850	360	0.70	0	0	0	0
TOTAL	**1,094**		**3.53**	**0.9**	**1.8**	**0.87**	**3.58**

Ovine

A total of 2,172 sacrificed sheep were evaluated in three slaughterhouses of Girona province (Girona 3, 4 and 5). At the slaughterhouses Girona 4 and Girona 5 the stunning was performed by electronarcosis. In Girona 3 the sacrifice was performed without stunning (halal ritual).

In comparison to cattle, similar (or increased) percentages of animals presenting muscular contractions and relatively minor percentages of animals breathing before carcass processing were observed among slaughterhouses. The percentage of vital signs decreases when the number of animals showing contractions plus mydriasis or respiration plus mydriasis simultaneously is considered. Thus confirming that much of these contractions or respirations are not real, but rather false positives. This is to say, it seems indispensable to confirm vital signs by observing if there is mydriasis or not in the animals (table 2).

Table 2. Percentage of animals showing vital signs in ovine slaughterhouses

Slaughterhouse	Number of animals	Timing slit-dressing (s)	Muscular contractions (%)		Respirations (%)		Mydriasis absence (%)
			Total	No mydriasi	Total	No mydriasi	Total
Girona 3 (halal)	20	60	4.31	0	0.86	0	1.83
Girona 4	193	184 – 280	5.55	0.54	2.77	0	0
Girona 5	1,959	120 – 300	3.57	0.32	3.57	0.27	12.50
TOTAL	**2,172**		**4.48**	**0.29**	**2.4**	**0.09**	**4.78**

Porcine

A total of 1,304 sacrificed pigs were evaluated in five slaughterhouses. In this species, the compliance was high. Thereby, practically all pigs (with isolated exceptions) were manipulated (dressing and scalding) being dead. When the stunning is performed using gases, the high concentration of gas used causes the death or almost the death of the animal, which explains these good results. However, Camp de Tarragona 2 and Girona 7 stunned by electronarcosis, and Girona 7 obtained a deficient result, probably due to the short time of bleeding (20 s) (table 3).

Taula 3. Percentage of animals showing vital signs in porcine slaughterhouses.

Slaughterhouse	Number of animals	Timing slit-dressing (s)	Musculars contractions (%)		Respirations (%)		Mydriasis absence (%)
			Total	No mydriasis	Total	No mydriasis	Total
Camp Tarr. 2	64	> 420	0	0	0	0	0
Catalunya C. 2	672	60 – 80	0	0	0	0	0
Catalunya C. 3	348	40	0	0	0	0	0
Girona 6	160	N.D.	0	0	0	0	0
Girona 7	60	20	1.70	1.70	1.70	1.70	5.26
TOTAL	**1,304**		**0.34**	**0.34**	**0.34**	**0.34**	**1.05**

Chickens

A total of 6,758 sacrificed chickens were evaluated in five slaughterhouses. As a whole, the ratio of chickens which presented vital signs at the beginning of the dressing of the carcass was not superior to the other species, such as ruminants or rabbits. These results are in contrast to the results obtained in the former work of CoP of Animal Welfare. In that case the number of animals showing vital signs during scalding or plucking was surveyed and chicken was the species with worse results. Thereby, these new results mitigate the bad impression about the method of sacrifice of this species.

Table 4. Percentage of animals showing vital signs in chickens slaughterhouses.

Slaughterhouse	Number of animals	Timing slit-dressing (s)	Muscular contraction (%)		Respirations (%)		Mydriasis absence (%)
			Total	No mydriasis	Total	No mydriasis	Total
Barcelona 1	991	225	0.50	0.20	0.60	0	0.91
Barcelona 2	2,826	220	1.02	0.25	0.17	0.17	0.50
Camp Tarr. 1	603	250	0.83	0.33	0.33	0.17	0.34
Camp Tarr. 4	1,600	125	3.87	3.62	0.06	0.06	3.87
Camp Tarr. 5	738	335	3.92	3.19	1.49	0.71	1.77
TOTAL	**6,758**		**2.03**	**1.52**	**0.53**	**0.22**	**1.48**

A major number of animals with vital signs is detected at the beginning of the carcass preparation in those slaughterhouses with bad bleeding system (for example, mechanical bleeding by cut of only one carotid, or bleeding by slitting the oropharynx), a short bleeding time or when heavier animals are sacrificed (Camp de Tarragona 4 and 5, table 4).

Rabbits

A total of 1,069 rabbits were evaluated in only one slaughterhouse that made two types of sacrifice: sacrifice with stunning and halal sacrifice without stunning. In both cases, bleeding was performed by cutting both carotids. Results are clearly worse in the first case probably due to different skills of the personnel performing both types of cuts. In halal ritual, the neck cut was very wide, from side to side; whereas in the sacrifice with stunning the incision was overly lateral and probably the two carotids were not cut. Furthermore, the timing slit-dressing was superior in the halal sacrifice.

In these rabbits, anew, approximately 50% of the animals showing respiration or muscular contraction had simultaneously mydriasis. This outlines the relevance of checking presence of mydriasis to confirm that these vital signs corresponded to animals that were slaughtered alive (table 5).

Table 5. Percentage of animals showing vital signs in rabbit's slaughterhouses

Slaughterhouse	Number of animals	Timing slit-dressing (s)	Muscular contractions (%)		Respirations (%)		Mydriasis absence (%)
			Total	No mydriasis	Total	No mydriasis	Total
Camp Tarr. 3 (with stunning)	947	90	12.77	6.95	3.38	1.16	22.99
Camp Tarr. 3 (halal)	122	125	0.81	0.88	0	0	1.77
	1,069		**6.79**	**3.92**	**1.69**	**0.58**	**12.4**

Differences in percentages of animals with muscular contractions or respiration oscillate considerably in all species, being the lowest the percentage of muscular contractions. Muscular contractions can be misleading to the observer. There is a risk of overestimating its number.

Respirations may also be difficult to observe, particularly in big species, because they may have frequency lapses that impede detecting them if the observation time is too short. Even though, observation of respirations cannot be extended easily because in the functioning of the slaughterhouse the spare time is determined by the speed of the chain. Consequently there is a risk to underestimate the number of animals showing respirations.

Finally, the presence of mydriasis is also difficult to evaluate and, in chains with increased speed, its observation is prone to certain subjectivity. Therefore to achieve a 100 % compliance, it is recommended not to use a single indicator, but a combination of muscular contractions or respirations with presence/absence of mydriasis.

6. Recommendations

Based on the results and field research observations, the following measures are proposed to decrease the frequency of animals showing vital signs when the carcass is being processed.

Baseline measures to implement to all species

- Proper slit of blood vessels.
- Provide enough time between the slit and the dressing (bleeding time). For instance, with an adequate chain design (longer chain or with a standby time before the carcass processing).
- Training courses for the killers.

- Include the death indicators in the SOP of business operators and in the official controls. These death indicators must include as a minimum two of the three EFSA indicators.

Immediate measures in animals with vital signs

- In the majority of cases it will be enough waiting until the animal does not manifest vital signs.
- In case waiting is not feasible, implement a re-stunning and re-slitting, or re-slitting sprightly.

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