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To cite this article: L. Nanni Costa, D.P. Lo Fiego & F. Tassone (2005) Relationship between pre-slaughter handling and carcass bruising in calves, Italian Journal of Animal Science, 4:sup2, 257-259, DOI: [10.4081/ijas.2005.2s.257](https://doi.org/10.4081/ijas.2005.2s.257)

To link to this article: <https://doi.org/10.4081/ijas.2005.2s.257>



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Published online: 03 Mar 2016.



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Relationship between pre-slaughter handling and carcass bruising in calves

L. Nanni Costa¹, D.P. Lo Fiego², F. Tassone¹

¹Dipartimento Protezione e Valorizzazione Agroalimentare, Università di Bologna, Italy

²Dipartimento Scienze Agrarie, Università di Modena e Reggio Emilia, Italy

Corresponding author: Leonardo Nanni Costa. Dipartimento Protezione e Valorizzazione Agroalimentare, Sezione Allevamenti Zootecnici. Via F.lli Rosselli 107, 42100 Reggio Emilia, Italy – Tel: +39 0522 290522 Fax: +39 0522 290523 – Email: leonardo.nannicosta@unibo.it

RIASSUNTO – Relazione tra le operazioni pre-macellazione e le lesioni sulla carcassa di vitello. Sono stati esaminati i tempi di svolgimento delle operazioni di carico, scarico, sosta e attesa pre-stordimento di 105 vitelli a carne bianca di razza Frisona. Inoltre, durante tali operazioni è stata rilevata la frequenza di eventi quali la caduta, l'inversione, la testata, la monta, il rifiuto di movimento, il salto, la scivolata, l'evacuazione e la vocalizzazione nonché il numero di applicazioni di pungolo elettrico. Sulle carcasse si è poi proceduto all'individuazione e alla classificazione delle lesioni superficiali utilizzando una scala a tre classi (1=assente, 2=leggera, 3=grave) allo scopo di esaminarne le relazioni con la durata delle operazioni pre-macellazione e con la frequenza degli eventi comportamentali. I tempi di svolgimento delle operazioni di scarico e di sosta hanno influenzato significativamente ($P<0,01$) la distribuzione delle carcasse nelle tre classi di lesioni. Inoltre, lesioni sia leggere che gravi sono risultate presenti nelle carcasse provenienti da soggetti che, in media, hanno presentato una maggior frequenza di cadute o di monte e una minor frequenza d'evacuazioni durante le operazioni pre-macellazione.

Key words: calf, pre-slaughter handling, carcass, bruising.

INTRODUCTION – A bruise is a tissue injury with rupture of the vascular supply and accumulation of blood and serum in tissues (Hoffman *et al.*, 1998). Bruises can occur during each pre-slaughter operation including loading at the farm, transportation, and unloading and resting at the abattoir. Carcass injuries result in an economic loss to the meat industry; the overall cost of carcass bruising is caused by loss of edible parts, labour cost to trim out the bruising and general carcass value depreciation. Bruises also reflect poor handling practices. Despite its importance for animal welfare and carcass quality, there is little information on potential causes of bruising on calves carcasses. The aim of this work is to describe in terms of handling time and behaviour occurrences the calves that showed bruises on their carcasses.

MATERIAL AND METHODS – From January to May 2003, 105 Friesian-Holstein male calves supplied by one farm were examined during three commercial consignments to a slaughterhouse. The calves were kept at the farm in individual boxes (0.6x1.7 m) on a grating floor. Before loading, the calves were randomly kept in groups of 15 subjects. These 7 groups were maintained during loading, transport, unloading and resting. During handling, the time needed to load and unload the groups and the time spent in lairage and in the race before stunning were recorded for each group of calves. The number of falls, reversals, heads, mounts, balks, jumps, slips, evacuations and vocalizations, together with the number of electric prod applications, were noted during loading, unloading, resting and before stunning on each group of calves. A description of the behaviour events and loading and unloading terms are reported by Maria *et al.* (2004). The space allowance during transit ranged from 0.7 m² to 0.9 m² per head. Calves were stunned by captive bolt and the exsanguination occurred within 30 sec after stunning. About 30 min after slaughter, carcass bruising were assessed subjectively using a 3 point scale (1=none, 2=slight, 3=severe) on the basis of photographic standards (Honkavaara *et al.*, 2003).

Cold carcass weight was in average kg 141.4±13.5. The distribution of carcasses with different bruising score within time classes related to the duration of pre-slaughter procedure was evaluated. The incidence of the behaviour events was calculated taking into account all the pre-slaughter phases and expressed as a percentage of total events observed. The data were processed by FREQ (Fischer Exact Test) and NPAR1WAY procedures (Wilcoxon Scores) of SAS (1996).

RESULTS AND CONCLUSIONS – The incidence of bruised carcasses was amounted to 72.4%. Slight and severe bruises were evident, respectively, on 47.6 and on 24.8% of the total carcasses. Bruises were localized mainly on the back (78.0%) while their presence was lower on the tail (9.7%), round (2.6%), side (3.5%) and shoulder (6.2%). The frequencies of the different events observed during the pre-slaughter procedures are shown in Table 1. Slip was the more frequent event during loading, unloading and waiting before stunning. At loading and unloading, the sum of events as slip, fall, reversal and bulks, which are related to the difficulties in driving the calves, reached 80% of the total behaviour occurrences. There were more falls and balks during loading than unloading. Similar results were found during an examination of the handling procedures carried out on bulls (Maria *et al.*, 2004). During the resting, vocalization was the event more frequent. Slips and falls were also recorded during this period because calves took some time to calm down after the end of unloading procedure. The order of events recorded during the waiting before stunning was similar to those noted at loading and unloading. The number of electric prod applications per head decreased from about 5 at loading to 2.5 at unloading and to 1.8 during the waiting before stunning, suggesting a more problematic handling management at the farm.

Table 1. Frequencies (%) of behaviour events and number of electric prod applications per head during the pre-slaughter handling of calves groups.

Behaviour events	Loading	Unloading	Resting	Waiting before stunning
Fall	19.6	15.5	14.0	16.4
Reversal	9.1	11.8	--	7.2
Head	1.7	--	1.7	--
Mount	--	--	4.5	0.3
Balk	19.2	6.2	--	11.1
Jump	3.3	0.9	2.1	0.6
Slip	31.2	51.9	28.0	42.5
Evacuation	9.7	7.8	19.9	11.4
Vocalization	6.2	5.9	29.8	10.5
No. prod/head	4.8	2.5	--	1.8

The relationship between the distribution of carcasses into the three classes of bruising score and the time necessary to carry out the pre-slaughter procedures is reported in Table 2. Due to difficulties in handling at the farm and at the abattoir, this time varied widely among calves groups and pre-slaughter procedures. The time (min) for loading, waiting before unloading, unloading, resting and waiting before stunning ranged from min 7.8 to 20.7, from 4.2 to 55.5, from 2.2 to 4.9, from 4.3 to 37.9 and from 11.7 to 37.5 respectively. The distribution of carcasses into the bruising score classes was significantly affected ($P < 0.01$) by the unloading and resting duration. Both faster and slower unloading led to an increase in the percentage of carcasses severely bruised. This result highlights the negative effect on carcass quality due to a staff working in a hurry as well as a staff that can have problems in unloading the animals from the truck. The incidence of carcasses severely bruised was found very high (40%) in calves submitted to a resting period less than 10 minutes. This result is probably due to an insufficient recovering time for the calves after the unloading procedures. As before reported, calves in resting box took some time to calm down. Prolonged resting time of more than 30 min did not show a negative effect on the incidence of carcasses with severe bruising but increased the frequencies of carcasses with score 2 (slight bruising). This

long period allowed the calves to interact also showing antagonistic behaviour (Table 1) and, consequently, increasing the risk of bruises. The different duration of loading, waiting before unloading and waiting before stunning did not influence the distribution of the carcasses in the bruising score classes. In general, there was a tendency to a higher incidence of non-bruised carcasses in the intermediate class of the procedure duration, suggesting that either too fast or too slow handling could have a negative effect on carcass quality.

Table 2. Incidence (%) of carcasses with different bruising score within classes of pre-slaughter procedures duration.

Bruising Score	Loading (min)			Waiting before unloading (min)			Unloading (min)			Resting (min)			Waiting before stunning (min)		
	< 10	10 - 15	> 15	< 20	20 -30	>30	< 3	3 - 4	>4	<10	10 - 30	>30	<15	15 -25	>25
1	26.7	33.3	23.3	28.9	30.0	20.0	16.6	44.4	13.3	15.6	50.0	20.0	13.3	33.3	20.0
2	48.9	46.7	43.4	37.8	53.3	63.3	40.7	44.4	53.4	44.4	40.0	63.3	60.0	38.3	63.3
3	24.4	20.0	33.3	33.3	16.7	16.7	36.6	11.2	33.3	40.0	10.0	16.7	26.7	28.4	16.7
P	0.803			0.201			0.006			0.002			0.164		

The relationship between the frequency of behaviour events and the bruising score is shown in Table 3. Slight and severe bruises were found on carcasses coming from calves that showed a higher frequency of falls (P<0.02) and mounts (P<0.06) and a lower frequency of evacuations (P<0.03). A relationship between carcass bruises and falls during handling is not surprising. The latter, which are usually due to rush animals while moving them on wet and smooth flooring, are strictly related to a very rough handling. It is also well known that the mounting is a behavior easily observable in unfamiliar mixed cattle, such as the calves examined, and that it can increase the possibility to causes injuries leading to bruising. The relationship between bruises and evacuation during pre-slaughter handling is not easily interpretable on the basis of the general scheme that fear leads to defecation and urine retention. Due to practical constraint, it was not possible to record these occurrences separately; thus the reduction of the elimination can not be associated to a particular situation occurred during the pre-slaughter handling. The results achieved confirm that bruises can be reduced by working on handler education and on the design of the pre-slaughter facilities.

Table 3. Mean of frequencies (%) of behaviour events related to the bruising score classes.

Bruising score	Fall	Reversal	Head	Mount	Balk	Jump	Slip	Evacuation	Vocalization	No. prod/head
1	14.0	8.7	0.8	0.6	13.2	1.8	35.9	12.7	12.4	9.9
2	17.4	6.8	0.9	1.1	11.2	1.8	38.2	11.7	10.8	10.5
3	16.5	7.0	1.2	1.0	12.2	2.6	37.5	11.8	10.3	9.9
P	0.019	0.337	0.646	0.057	0.113	0.323	0.349	0.029	0.569	0.346

ACKNOWLEDGEMENTS – Research supported by EU Project CATRA (QLK5-CT-1999-01507). Thanks to Dr. Pollini of CLAI S.c.r.l. abattoir in Faenza for the technical assistance.

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