



TRANSPORT RELATED BRUISING IN CATTLE

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Introduction

The bruising of cattle is used as an indicator for animal welfare problems during pre-slaughter handling and can reduce meat quality (1). The aim of this study was to describe the prevalence of carcass bruising in cattle observed at *post-mortem* meat inspection in a Norwegian abattoir and to assess risk factors.

Materials and methods

The study was carried out in a commercial abattoir processing approximately 20,000 cattle a year. The drivers recorded transport parameters. Carcass bruising were assessed by two official veterinarians at *post-mortem* meat inspection. Bruises were categorised according to size as small (diameter < 4 cm), medium (diameter 4 - 10 cm) or extensive (diameter > 10 cm). Only bruises adjacent to *Tuber coxae*, *Trochanter major* or *Tuber ischii* were recorded. Data on carcass conformation, fat cover and weight were obtained from the abattoir.

Carcass bruising was set as continuous response variable, and the regressor variables included both categorical and continuous variables. Descriptive statistics were performed, and ANOVA was used for hypothesis testing of risk factors. An ANOVA model was used for each bruise site and size.

Statistical analysis

The data were analysed using one-way cross tabs procedure for bruising, descriptive statistics and analysis of variance (ANOVA) procedure for hypothesis testing of the risk factors. Carcass bruising was set as response variable, and transport risk factors were set as regressors. The following model was used (2):

$$Y_i = \beta_0 + \beta_1 + \dots + \beta_j + \varepsilon$$

Where i = p number of bovine carcass bruising, j = q number of transport risk factors

No interactions were included in the model.

The model was analysed using SYSTAT Version 10 © SPSS Inc. 2000 Standard Version, Statistics – GLM – Estimate Model. Carcass bruising was set as continuous response variables, and the regressor variables both included categorical and continuous variables.



Results and discussion

Data from 84 transports comprising 1252 cattle were obtained during a period from May to August 2003. All animals were transported direct from the farms, and included The predominant breed in the region is Norwegian dairy cattle. Transport times were generally short (Table 1).

Table 1. Transport time

Transport time (hours)	
Minimum	0.25
Maximum	7.0
Mean	2.35
Median	2.0

The overall prevalence of carcasses with bruises ≥ 4 cm was 36.2 %. Table 2 summarises the recorded bruises.

Table 2. Prevalence (%) of bruises in cattle (n=1252) according to size and localisation

Bruise diameter (cm)	< 4			4 – 10			> 10		
Site of bruising	None	Unilat.	Bilat.	None	Unilat.	Bilat.	None	Unilat.	Bilat.
<i>Tuber ischii</i>	11.4	16.7	71.9	80.4	15.0	4.6	88.3	8.1	3.6
<i>Trochanter major</i>	3.7	13.4	82.9	87.3	10.3	2.4	94.5	4.4	1.1
<i>Tuber coxae</i>	2.1	10.9	87.0	89.9	8.8	1.3	96.7	3.0	0.3

The ANOVA identified animal category, driver, increasing transport time, increasing number of herds mixed in vehicle pen, ascending order of loading and increasing area (m²) per animal as the primary risk factors for carcass bruising. Details from the ANOVA analysis (Table 3).

Table 3. Effects of risk factors on bruising (univariable analyses)

Bruise site		<i>Tuber ischii</i>			<i>Trochanter major</i>			<i>Tuber coxae</i>		
Risk factor	Bruise size (cm)	< 4	4 - 10	> 10	< 4	4 - 10	> 10	< 4	4 - 10	> 10
Category (steer, heifer, cow, calf)		***	***	*	*	NS	NS	***	***	NS
Driver ID		*	NS	NS	NS	**	NS	NS	NS	**
Transport time		*	NS	*	NS	NS	NS	NS	NS	**
No of herds mixed in vehicle pen		NS	NS	**	*	NS	NS	NS	NS	NS
Order of loading		NS	NS	NS	NS	NS	NS	NS	*	**
Area per animal (m ²)		NS	NS	NS	NS	NS	NS	*	NS	**
Registrar		NS	NS	NS	NS	NS	NS	NS	NS	**
Number of stops for loading		*	NS	NS	*	NS	NS	NS	NS	NS
Number of animals in vehicle pen		NS	NS	NS	NS	NS	NS	NS	NS	*
Carcass weight (kg)		NS	NS	NS	NS	NS	NS	NS	NS	NS
Carcass conformation (EUROP)		NS	NS	NS	NS	NS	NS	NS	NS	NS
Carcass fat cover (EUROP)		NS	NS	NS	NS	NS	NS	NS	NS	NS
Loose or tied		NS	NS	NS	NS	NS	NS	NS	NS	NS
Vehicle pen (front, middle or rear)		NS	NS	NS	NS	NS	NS	NS	NS	NS
Placement in pen if tied (front or rear)		NS	NS	NS	NS	NS	NS	NS	NS	NS
Area per 100 kg carcass weight (m ²)		NS	NS	NS	NS	NS	NS	NS	NS	NS

*P-value 0.01 – 0.05, **P-value 0.001 – 0.01, *** P-value < 0.001, NS (non-significant) P-value > 0.05

The low prevalence of bruising found in this study contrasts earlier findings from the UK. Jarvis and others (3) found that 97 % of carcasses observed were bruised, and that cattle from markets had more bruises than cattle transported direct from farms. Weeks and others (4) found that in cattle transported direct to abattoir 53.7 % of observed carcasses were bruised, while in cattle from markets 71.0 % were bruised. The difference in prevalence of bruising found in this study and other studies can partly be explained by differences in bruise recording system and type of lairage. All cattle in this study were lairaged in individual pens, which eliminates mounting behaviour. Cows have a higher risk for bruising than other categories of cattle. The same observation has been made in previous works by Weeks and others (4) and Wythes and others (5). This may be due to poorer muscle conformation,



reduced ability to cope with movements of the vehicle during transport, or a combination. The predominant housing system for dairy cows in the region is tie stalls, while steers mainly are kept loose in pens. Holleben and others (6) found higher bruising scores in cattle from tied housing. Transport time is found to be a risk factor for bruising, indicating that transport time is relevant in terms of animal welfare. Ascending order of loading is also identified as a risk factor, despite that transport time is shorter for cattle loaded in the end of the journey. In previous work performed by Tarrant and others (1988) stress was found to increase with pen localisation towards the tail of the truck (7). The truck design is probably of importance in this matter and should receive further investigation. The driver is showed to influence the risk of bruising. This could be explained by the fact that driving skills varies between drivers. Careful braking and cornering is important for the animals in order to avoid loss of balance (7).

Conclusion

The overall prevalence of bruising ≥ 4 cm was 36.2 %. The primary risk factors for bruising were found to be category, driver ID, transport time and number of animals mixed in vehicle pen.



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