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Welfare and health of horses transported for slaughter within the European Union Part 1: Methodology and descriptive data

D. MARLIN*, **P. KETTLEWELL**[†], **T. PARKIN**[‡], **M. KENNEDY**[§], **D. M. BROOM**[#] and **J. WOOD**[¶]

Hartpury College; [†]ADAS Drayton; [‡]Boyd Orr Centre for Population and Ecosystem Health, Institute of Comparative Medicine, Faculty of Veterinary Medicine, University of Glasgow; [§]Department of Life Sciences, Anglia Ruskin University; [#]Centre for Animal Welfare and Anthrozoology; and [¶]Cambridge Infectious Diseases Consortium, Department of Veterinary Medicine, University of Cambridge, UK.

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Summary

Reasons for performing study: **Anecdotal evidence collected by a variety of organisations has highlighted poor welfare in horses transported long distances to slaughter within the European Union.**

Objective: **To investigate welfare of horses being transported long distances within the EU to slaughter.**

Methods: **Data on transported horses were recorded at 2 assembly centres in Romania and at 4 abattoirs in Italy over an 8 month period in 2008.**

Results: **A total of 1519 horses in 64 separate shipments were observed in Romania prior to transport of which 212 horses were deemed unfit for transport and only 3 shipments (5%) complied with Council Regulation (EC) no. 1/2005 with respect to both horse and vehicle compliance. The destination most commonly stated for the horses from these assembly centres was Italy. A total of 1271 horses in 63 separate shipments were observed after transport in Italy, of which 86 horses in 4 shipments had also been observed prior to transport in Romania. The majority of the horses**

observed at these abattoirs originated from Poland (51%) and Romania (44%). On arrival in Italy at the time of unloading, 471 of 1271 horses (37%) were deemed unfit for transport in accordance with Council Regulation (EC) no. 1/2005 and none of the shipments were compliant with respect to both vehicle and horse requirements. An average of 6 horses per shipment (28% of each shipment) had at least one acute injury on arrival in Italy. A significantly higher prevalence of severe injuries and lameness was found in animals on arrival In Italy compared with animals leaving Romania. Horses examined on arrival in Italy were twice as likely to have 1–3 acute contusions or excoriations as horses examined in Romania. There was also a 2-fold increase in the number of animals deemed unfit for transport.

Conclusion: **This study has identified evidence of poor welfare in horses being transported long distances to slaughter, including severe lameness and injuries, and a high level of noncompliance with Council Regulation (EC) no. 1/2005 on the Protection of Animals during Transport.**

*Corresponding author email: dm@davidmarlin.co.uk

Introduction

Within mainland Europe there is a significant trade in horses for human consumption, mainly in Italy, France, Belgium and Holland, with horses primarily sourced from Romania, Poland and Spain, and other sources including Bulgaria, Lithuania, Hungary and Belarus. There is a strong demand in Italy for fresh, local horsemeat, which is probably the driving factor for the high demand for live horses as opposed to carcases. Processed meat from horses that originate in other countries but are slaughtered and processed locally can be stamped as produce of Italy. The distance between origin and market creates therefore a trade involving long distance transport of large numbers of live horses. For example, in 2007 49,560 live horses were imported into Italy for slaughter (Anon 2007). Field evidence collected by World Horse Welfare, the Royal Society for the Prevention of Cruelty to Animals (UK) and Animals' Angels has found evidence of poor welfare in horses transported long distances to slaughter within the EU. In the context of this report, welfare is taken to mean "*the state of an individual as regards its attempts to cope with its environment*" (Broom 1986). As stated by Broom (1991) "*Both failure to cope with the environment and difficulty in coping are indicators of poor welfare. Suffering and poor welfare often occur together, but welfare can be poor without suffering and welfare should not be defined solely in terms of subjective experiences*" and "*The indicators of poor welfare include the following: reduced life expectancy, impaired growth, impaired reproduction, body damage, disease, immunosuppression, adrenal activity, behaviour anomalies, and self-narcotisation*."

The health of the individual is an important part of its welfare (Broom and Fraser 2007). Cussen (2008) also found that compliance with legislation regarding animal transportation was not adhered to in many instances involving horses transported within the EU for slaughter. Many Member States appear either to ignore the Regulation on transport or fail to police it properly. The European Commission, Health and Consumer Protection Directorate General Annual Report 2001 by the Food and Veterinary Office

(FVO) found varied levels of enforcement in the Member States visited with regard to compliance with legislation on the transport of animals and with regard to Staging Points (Anon 2001).

There is a significant volume of published scientific literature on the responses to transport of performance research horses maintained under appropriate husbandry conditions and transported sympathetically (see review Marlin 2004). However, there is less literature regarding conditions experienced in commercial transport to slaughter (Friend 1989, 2000; Friend *et al*. 1997, 1998; Gibbs and Friend 1999, 2000; Grandin *et al*. 1999a,b; Collins *et al*. 2000; Stefancic and Martin 2005; Iacono *et al*. 2007a,b; Werner and Gallo 2008). Furthermore, almost all of this work has been undertaken in the USA and many of these studies have involved healthy and well maintained animals that were used to being transported. Few of the studies were of animals being transported to slaughter under commercial conditions (Grandin *et al*. 1999a,b; Stefancic and Martin 2005; Werner and Gallo 2008).

While most of the evidence of poor welfare in horses commercially transported long distances for slaughter within Europe has been from field investigations, the study by Stefancic and Martin (2005) reported on observations on 161,685 horse movements through the road and railway border stations in Sezana and Port of Koper in Slovenia. The rate of death in these shipments for horses and cattle combined was around 2.5/1000. As this was at a border station, these animals were being observed during transit and not at the destination. The authors observed that death of horses was common even for journeys as short as 800 km and they concluded that this was due to a lack of fitness for transport. By contrast, cattle were less likely to die on journeys <800 km. The authors also reported that, compared with cattle, the rate of injury in horses was 8–25 times greater.

The higher rate of injury in horses may be due to their greater susceptibility to transport associated injury and or disease, to a poorer initial physical condition compared with cattle or, alternatively, to poorer transport conditions.

The welfare of horses during transport can be assessed by simple measurements, clinical data and the study of behaviour, which may indicate subjective mental state (Broom and Fraser 2007). Furthermore, observation and collection of data on behaviour does not result in alteration of the phenomena under study, in contrast with more invasive methods such as blood sampling. When combined with noninvasive physiological and physical methods of welfare measurement, the incorporation of behavioural measures of welfare enhances the power of the overall welfare assessment.

The aim of the present study was to undertake an epidemiological investigation into the welfare, including health, of horses being transported long distances for slaughter within Europe in accordance with Council Regulation (EC) no. 1/2005 on the Protection of Animals during Transport. As the main destination for horses for human consumption is Italy, this was selected as the destination country. Currently there is a significant trade in horses sourced in Romania for slaughter and this was therefore selected as the origin country to study. The report presents the simple descriptive observations from the study

and in Part 2 more detailed epidemiological analysis is intended to identify risk factors for poor health, welfare and injury, defined as lack of fitness to transport, in these animals.

Materials and methods

Data collection was undertaken between March and September 2008 by 4 veterinarians with experience of working with horses, who were employed and trained specifically for the project. One team of native speakers was based in Romania and the other in Italy. All data from Romania were obtained from 2 different assembly centres in the same region (designated AC1 and AC2). All Italian data were collected from 4 different abattoirs in the same region (designated AB1 to AB4).

The initial training of the 4 veterinarians took place in February 2008, immediately prior to commencement of the study, at the World Horse Welfare Hall Farm in Norfolk and World Horse Welfare Glenda Spooner Farm in Somerset, UK. As part of their training, the teams visited a livestock market, a professional livestock haulier and an abattoir slaughtering horses, with members of the scientific team. Training covered all aspects involved in the project, including instruction in using record forms and standardisation of recording within and between the Italian and Romanian teams. The teams were also given detailed instruction on: equine assessment; current EU legislation on fitness to travel as defined by Council Regulation (EC) no. 1/2005 on the Protection of Animals during Transport and as contained in the guidance notes from the Department for Environment, Food and Rural Affairs, UK (Anon 2009); vehicle design; and humane slaughter. Training was undertaken by members of the scientific project team, which included 4 veterinarians and 3 scientists.

Data were collected on shipments of animals (i.e. all animals that were to be or had been shipped together in a single lorry or lorry and trailer) and on all individual animals within a shipment. Separate forms were used for shipment data and individual horse observation data. Behavioural observations over 5 min periods were also made. All occurrences of 14 behaviours (see Table 5) were recorded over a 5 min observation period whilst horses were penned in Romania prior to transport; horses arriving in Italy after transport were observed in their pens for the same length of time. As the number of horses in each pen differed, these data were converted to mean occurrence per horse per 5 min period.

Data were recorded on custom designed record sheets and subsequently entered into a custom database (Microsoft Access V)[1]. The variables recorded are shown in Tables 1 and 2.

Ambient (shade) temperature and relative humidity were measured using a portable hygrometer (Testo 608-H1)[2]. In addition, each team was provided with a microchip reader (Trovan ARE H5)[3]. Body condition score was estimated using the 5 point scale as described by Carroll and Huntington (1988).

On completion of the study, the degree of agreement between the 4 individual observers (R1 and R2 Romanian team and I1 and I2 Italian team) on fitness to transport was

investigated. Each observer independently examined 36 photographs of horses and 16 live horses and was asked to decide if the individual animals were fit for transport.

On completion of the project and prior to analysis, the data were checked for inconsistencies. Shipment and individual horse data were described using STATA version 10.0. These analyses were performed separately for the Italian and Romanian horse and transport data.

Logistic regression for grouped (blocked) data was used to compare the percentage of horses per shipment with acute and chronic injuries during off-loading in Italy and loading in Romania. Two models were fitted that included country as a fixed effect. The response variables were coded as the proportion of horses in each shipment that were observed with at least one acute or one chronic injury, respectively.

Behavioural data were nonnormally distributed and log transformation of the data did not result in data suitable for

TABLE 1: Variables recorded for shipments of animals either before departure from assembly centres (AC) in Romania or on arrival at abattoirs (AB) in Italy

TABLE2: Variables recorded for individual animals either before departure from assembly centres in Romania or on arrival at abattoirs in Italy

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. 1 Shipment reference number

. 2 Location

. 3 Time of observations

. 4 Climate

. 5 Weather

. 6 Loading/Unloading commenced Loading/Unloading completed

. 7 Horse handling Resistance to loading Horses haltered or tied-upVeterinary surgeon presentOverall how were the horses handled

. 8 Vehicle type (graphic on form) PartitionsNumbers of horses per penTotal number of horses in shipment

. 9 Other observations

Unique reference for identification of shipments

AC1 or AC2AB1, AB2, AB3 or AB4 Date and time Temperature (°C) Humidity (%RH)Full cloudPartly cloudySun, minimal cloud HazyLight rainModerate rainHeavy rainRain and sunFrostWindThunderstormSnowDay/NightTime of dayTime of day

Yes/NoYes/NoYes/No Appropriately/Mishandled Articulated

DrawbarTruckMarked on form Marked on form Counted/Estimated Written on form

1 Shipment reference number 2 Location

3 Time of observation4 Location of observation

5 Passport number 6 Microchip number 7 Sex

8 Age

9 Wither height

10 Body condition score11 External injuries (Recorded on a

graphic of a horse viewed from the left and right side)

12 Demeanour

13 Observed moving 14 Head posture

15 Gait

If lame

16 Food available? If yes, eating?

17 Water available? If yes, drinking?

18 Clinical signs Cough

Nasal discharge SweatingDiarrhoeaAbdominal discomfort Mucous membranes Skin pinch

Skin condition

Respiratory rate 19 Fit to transport

If no, explanation required 20 Other observations

Unique reference for identification of shipments

AC1 or AC2AB1, AB2, AB3 or AB4 Date and timeAt loadingOn vehicleAt unloadingIn pens

MareStallionGeldingPassportHealth certificateIf neither the passport nor health

certificate were available then

horses were aged either by: Dental examinationVisual estimateFrom passport

Estimated 1–5Cuts Bruising Other Acute Chronic Mild Moderate Severe Normal Quiet Excited Depressed Exhausted Dead Yes/No Normal Low

High Sound Lame Ataxic Recumbent Mild Moderate Severe Yes/No Yes/No Yes/No Yes/No

Yes/NoYes/NoYes/NoYes/NoYes/NoNormal/Congested/Pale Normal/Slow/Very Slow

Normal/Inflamed/Photosensitised Normal/Elevated/Decreased Yes/No

parametric tests. The Mann-Whitney test was used to compare the frequency of all behaviours pre- and post transport.

Data are presented as frequency, mean or median and significance for all statistical tests was set at $P<0.05$.

Results

General observations

Romania: A total of 1519 horses in 64 separate shipments were observed in Romania prior to transport, giving an average shipment density of 24 horses per shipment. Eighty-eight percent (88%) of the observations were made at one of the 2 assembly centres (AC1). The most common stated destination for the horses from these assembly centres was Italy (61 of 64 shipments). Data were incomplete in 2 shipments. Horses in 59 of 62 shipments observed were considered to have been appropriately handled, in accordance with Council Regulation (EC) no. 1/2005; Chapter 3, Paragraph 1.8.

Ambient temperatures at the time of observations ranged from 0–38°C (median 24°C); and ambient relative humidity 30–86% (median 63%). Resistance of horses to loading was observed in 39 out of 62 shipments (63%). An official veterinarian was observed to be present at the time of loading for 42 of the 62 (68%) shipments.

Observations were predominantly made at the time of loading (64%) as opposed to in pens (36%) prior to loading. Most horses were female (69%), with 16% being geldings and 15% entire males. The age of horses was obtained by estimation from dentition (653 horses; 43%) or from health certificates (229 horses; 15%). Horses were categorised into one of 4 age groups: 32% (282) of horses were <2.5 years; 28% (250) of horses were 2.5–5 years; 36% (314) of horses were 6–12 years and 4% (36) of horses were >12 years.

Body condition score (BCS) was most commonly 3 or 4 out of 5 (82%), with 10% of animals observed considered obese (BCS of 5). Most animals were considered to have a normal demeanour (95%) and head posture (89%). Only 38% (n = 577) of the animals had food available at the time of examination and of these only 16% (n = 90) were observed to be eating. Only around one-third of animals (n = 506) had access to water and of those that did only 3% (n = 15) were observed drinking.

Italy: A total of 1271 horses in 63 separate shipments were observed after transport in Italy, giving an average shipment density of 20 horses per shipment. Fifteen percent of the observations were from AB1, 59% from AB2, 17% from AB3 and 9% from AB4. The majority of the horses observed at these abattoirs originated from Poland (51%) and Romania (44%) with around 1.5% each from Russia, Lithuania and Spain. A total of 86 horses in 4 shipments that arrived in Italy had also been observed prior to transport in Romania.

Ambient temperatures at the time of observations ranged from 15–32°C (median 24°C);

and ambient relative humidity 25–89% (median 51%). Resistance among horses to unloading and handling was recorded in 66% of shipments (41 shipments). An official veterinarian was only present for the unloading of 9 of the 63 (14%) shipments. Overall, the majority of the shipments (63%) arriving at these 4 abattoirs were considered to be appropriately handled at the time of unloading.

Horses were observed in pens following unloading (59%) compared to at time of unloading (41%); and 49% were female, 36% entire males and 15% were geldings. Access to health certificates, passports or direct access to horses to make an estimation of age based on dentition was available for only 7% (86) of horses unloaded in Italy. The majority of horses were <2.5 years (54; 63%). Fourteen (16%) horses were 2.5–5 years and 18 horses (21%) were 6–12 years. None of the horses, for which it was possible to identify the age, was >12 years.

Body condition score (1–5 scale) was predominantly 3 or above (1204 horses; 95%). A score of 5 was recorded for 26% (334) of animals. The majority of animals were regarded as showing normal demeanour (84%) and head posture (95%). Fifty-seven percent (726) of animals were observed to have food available at the time of examination and of those that did have food available, 70% (505) were observed to be eating. However, only 11% (140) of animals had access to water. Of the animals with access to water, 26% (36) were observed to be drinking.

Clinical observations

Romania: In Romania prior to transport, 212 out of a total of 1519 horses (14%) were deemed not fit for transport in accordance with Council Regulation (EC) no. 1/2005. Ninety percent (n = 1363) of the animals were observed moving and of this subset 8% were considered to be lame (n = 110) or ataxic (n = 4). Of the lame animals, 35% (n = 38) were considered to be moderately lame and 12% (n = 13) were considered to be severely lame.

The majority of horses deemed not fit for transport (n = 168, 79%) had at least one of the clinical signs detailed in Table 2. The most common clinical signs observed were nasal discharge (n = 137, 9%), elevated respiratory rate (n = 117, 8%), congested mucous membranes (n = 94, 6%) and coughing (n = 83, 5%).

The most common combinations of clinical signs were: 34 horses (16%) with nasal discharge, congested mucous membranes, elevated respiratory rate and a cough; a further 24 horses (11%) displayed nasal discharge, congested mucous membranes and an elevated respiratory rate and 16 horses (8%) were observed with nasal discharge, an elevated respiratory rate and a cough (Table 3). Of the 21% of horses (44/212) deemed not fit for transport that did not display any of the clinical signs listed in Tables 2 and 3, 27 were lame and 2 ataxic. Of the remaining 15 horses, 7 records had further comments from which the reason for being not fit for transport could be identified. Of these, 3 were donkeys, 2 of which were too young to transport, one being under 2 weeks of age. Other reasons included an inflamed sheath, umbilical hernia, overgrown hooves and ocular discharge. All horses on which observations were made, including the 212 (14%) deemed

not fit for transport, were subsequently transported.

Italy: At the time of unloading in Italy, 471 out of a total of 1271 horses (37%) were deemed not fit for transport in accordance with Council Regulation (EC) no. 1/2005. Eighty-nine percent (n = 1129) of the animals were observed moving and of this subset 21% were considered to be lame (n = 237) or ataxic (n = 2). Of the lame animals, 23% (n = 56) were considered to have moderate lameness and 10% (n = 25) were considered to have severe lameness. One severely lame animal had a suspected fracture of the left hind leg.

The majority of horses deemed not fit for transport (n = 416, 88%) also had at least one of the clinical signs detailed in Table2. The most common clinical signs observed were nasal discharge (n = 271, 21%), sweating (n = 202, 16%), congested mucous membranes (n = 177, 14%) and elevated respiratory rate (n = 143, 11%). The most common combinations of clinical signs were: 47 horses (10%) with nasal discharge, congested mucous membranes, sweating and elevated respiratory rate; a further 29 horses (6%) displayed nasal discharge, congested mucous membranes and sweating and 26 horses (6%) were observed with nasal discharge alone (Table3). Of the 12% of horses (55/471) deemed not fit for transport that did not display any of the clinical signs listed in Table 2 and 44 horses were lame. Of the remaining 11 horses, 9 horses had further comments from which the reason for being not fit for transport could be identified and included excoriations, overgrown hooves, complete blindness and body condition score close to 1.

External injuries

There were 417 acute and 1530 chronic injuries observed in the 1519 horses loaded in Romania. The number of contusions, cuts, fractures, swellings and other types of injury and the severity of those injuries observed are detailed in Table 4. There were 360 acute and 142 chronic injuries observed in the 1271 horses off- loaded in Italy. The number of contusions, cuts, fractures, swellings and other types of injury and the severity of those injuries are detailed in Table 4. Of 1519 horses observed being loaded in Romania, 740 (49%) horses had at least one chronic injury and 258 (17%) horses had at least one acute injury. Of 1271 horses observed

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TABLE 3: The 20 most common combinations of clinical signs observed in horses before transport in Romania and in horses arriving in Italy

Romania (departure)
Nasal discharge
Italy (arrival)
Nasal discharge

Mucous membranes Sweating

Normal No Congested No Congested No Normal No Normal No Normal No Normal No Congested No Normal No Congested No Congested Yes Congested No Congested Yes Congested No Congested No Normal Yes Congested No Congested No Normal Yes Congested No Congested Yes Congested Yes

Mucous membranes Sweating

Congested Yes Congested Yes Not examined No Not examined No Congested No Congested No Normal No Normal Yes Normal Yes Not examined No Congested Yes Congested No Not examined No Normal Yes Normal No Congested Yes Normal No Congested No Normal Yes Not examined No

Respiratory rate Cough Diarrhoea

Normal No No Elevated Yes No Elevated No No Elevated Yes No Elevated No No Normal Yes No Normal No No Normal Yes No Elevated No No Normal No No Elevated No No Normal No No Elevated Yes No Elevated Yes Yes Elevated No No Elevated No No Decreased Yes No Elevated No Yes Elevated No No Elevated Yes No Elevated No No Elevated Yes No

being off-loaded in Italy, 133 (11%) horses had at least one chronic injury and 297 (23%) horses had at least one acute injury.

For the subsets of horses leaving Romania destined for Italy and for horses arriving in Italy that had originated from Romania, horses examined on arrival in Italy were around twice as likely to have 1–3 acute contusions or excoriations as horses examined in Romania (Fig 1).

The distributions of the percentage of horses per shipment with at least one acute or one chronic injury, in Italy and Romania for horses travelling on that route only (i.e. Romania to Italy) are shown in Figure 2. The percentage of horses per shipment with at least one acute injury and that were deemed unfit for transport was significantly greater in Italy than in Romania ($P<0.001$). The mean percentage of horses per shipment with at least one acute injury in Romania was 19% (median = 17%), whereas the mean percentage of horses per shipment with at least one acute injury in Italy was 28% (median = 24%). This equates to an average of 6 horses with at least one acute injury, on arrival in Italy, per average sized shipment of 22 horses. The percentage of horses per shipment with at least one chronic injury was significantly lower in Italy than Romania ($P<0.001$). There was also a near 3-fold increase in the number of animals unfit for transport (Fig 2).

Behavioural observations

The median (with mean and range) occurrence of specific types of behaviour per horse per 5 min observation period is shown in Table5. Foraging ($P<0.001$), threatening ($P<0.001$) and fear ($P = 0.03$) behaviours were significantly more common in horses post transport than pretransport. Drinking, defaecating, urinating, vocalising, kicking objects, pawing the ground and grooming behaviours were significantly (at least $P = 0.02$) more common in horses pretransport than horses post transport. Mutilation behaviours were also significantly more common in horses

TABLE 4: The number (and column % in brackets) of contusions, cuts, fractures, swellings, cuts with swelling and other injuries and their severity observed in horses prior to transport in Romania (n = 1519 horses) and horses arriving in Italy (n = 1271 horses)

Fig 1: Percentage of horses observed with 1, 2, 3, 4 or □5 acute contusions or excoriations and acute cuts, during loading in Romania and off-loading in Italy. Only includes horses being transported from Romania to Italy.

pretransport but these behaviours were very rarely reported in Romania and never reported in Italy.

Shipment compliance and noncompliance

Of the 64 shipments observed at loading in Romania, 45 (70%) were noncompliant and, of the 63 shipments observed unloading in Italy, 55 (87%) were noncompliant, in both cases due to the circumstances of the transport and not due to individual horse factors. The combinations of reasons for noncompliance are provided in Table6. The most common single reason for noncompliance in both Romania (31 of 45 [69%] of noncompliant shipments) and Italy (23 of 55 [42%] of noncompliant shipments) related to side/rear gates on transport vehicles. In addition, 81%

1 injury2 injuries 3 injuries 4 injuires ≥5 injuries

Fig 2: Box plots showing the distributions of the percentage of horses per shipment with at least one acute and at least one chronic injury observed during loading in Romania and off-loading in Italy (the horizontal line within each box indicates the median; the box indicates the interquartile range; the vertical lines indicate the range of the majority of data and the dots indicate potential outliers). Only includes horses being transported from Romania to Italy.

(52/64) and 92% (58/63) of shipments in Romania and Italy, respectively, were noncompliant, as they included at least one horse that was deemed unfit for transport. When both circumstances of transport and individual horse factors were taken into account, only 3 of 64 shipments (5%) observed at loading in Romania were both vehicle compliant and also had no horses on board that were deemed unfit for transport. None of the shipments observed arriving in Italy were both vehicle **and** horse compliant. All shipments were either vehicle **and/or** horse noncompliant.

Inter-observer agreement on fitness to transport

Prestudy: The overall kappa value for all 4 veterinarians during the prestudy consistency assessment was 0.35 (P<0.001), indicating fair agreement (Dohoo *etal*. 2003). All possible pair wise comparisons resulted in kappa values that ranged from 0.15 (slightly more agreement than one would expect by chance) to 0.76 (good agreement). The degree of agreement between different members of the 2 teams, i.e. interteam agreement, ranged from 0.15–0.42.

Post study: From the photographs of horses presented individually to the observers the overall kappa value for all 4 veterinarians was 0.54 (P<0.001), indicating moderate

agreement (Dohoo *et al*. 2003). Notably, R1 and R2 were in agreement 100% of the time (kappa value = 1). The kappa value for agreement between I1 and I2 was only 0.32, indicating fair agreement. Nevertheless this was still significantly more agreement than would have been expected by chance (P = 0.01). The degree of agreement between teams was moderate (kappa value = 0.52 and 0.48) when comparing each of the Italian team with either of the Romanian team.

For the observations on live horses, the overall kappa value for all 4 veterinarians was 0.52 (P<0.001). The kappa value for R1 and R2 was 0.60 (P = 0.004) and the kappa value for I1 and I2 was 0.75 (P = 0.001); both suggest good agreement. The inter-team agreement ranged from 0.25 (fair agreement) to 0.71 (good agreement).

The only post study pair wise comparison between any 2 veterinarians that did not demonstrate significant agreement was between R1 and I1 (kappa = 0.25; P = 0.07) during the assessment of live horses.

Discussion

Potential limitations

Conducting a field based observational study of this type has advantages in that the actual trade and working conditions are being observed. In addition, within a 7 month period it was possible to make observations on almost 3000 horses. However, there are a number of potential limitations to this study. The first limitation is that we were only able to work in assembly centres and abattoirs with the consent of the operators. As such the locations at which we collected data were not randomly selected and represent convenience samples. Furthermore, although the veterinarians who recorded the data were present for a large number of shipments, it is conceivable that they were not informed about all shipments leaving or arriving. It may also be that the treatment of the horses was affected by the fact that the staff knew that the veterinary observers were present. However, it is unlikely that the composition of the groups of horses was altered as a consequence of observer presence.

In this study different horses were examined at origin and destination, although paired observations were made at origin and destination of 4 shipments and the results were not inconsistent with those for the unpaired observations. Logistically it would have been extremely difficult to identify shipments at origin and then to try and observe them again at destination, which could have represented one of perhaps several hundred abattoirs many hundreds of kilometres apart. Another potential limitation concerns the behavioural observations. Behaviour was observed over a very short 5 min period, necessitated by the requirement to record other data reported in this study within the limited time available for access to the horses. Nevertheless, significant differences in the frequency of performance of some behaviours before and after transport have been identified and merit consideration. It may also be that not all horses had the opportunity to exhibit all behaviours. For example, in the case of a pen with a very high stocking density, a horse may not have been able to exhibit withdrawal or aggression. However, other behaviours would probably have been unaffected by density, for example, urination or defaecation.

Finally, observations were made by 4 individual observers working in 2 different teams. Whilst it would have been ideal to have one observer make all observations, this would have been logistically impossible. However, in order to try and ensure that the teams were scoring and recording as closely as possible, they all underwent a 5 day training programme before the start of the study. In addition, the agreement exercise carried out at the end of the study indicates acceptable agreement within and between the 2 teams.

Types of horses

Horses originating in Romania were predominantly female and age 2.5–12 years, whilst horses observed in Italy tended to be younger (<5 years) and equal proportions of males (gelding or stallion) and

Percentage of horses per shipment

TABLE 5: Median number of events per horse per 5 min observation period for each behaviour in Romania (prior to transport) and in Italy (following transport). Data are presented as median (with mean and range in brackets)

TABLE 6: Reasons for noncompliance with Council Regulation (EC) No. 1/2005 on the Protection of Animals during Transport for shipments observed leaving Romania (n = 64) or arriving in Italy (n = 63)

between the 2 populations should be taken into consideration when comparing Romanian horses pretransport with horses arriving in Italy (51% originating from Poland and 41% originating from Romania).

Injuries

Horses observed in Romania showed a higher frequency of chronic injuries than horses observed in Italy, irrespective of whether this was expressed as total injuries or frequency per horse. Thus the Romanian horses were in poor condition even prior to transport. However, the ratio of acute to chronic injuries in Romania was 1:0.3, whilst in Italy this was 1:2.4 showing that in the sample of horses following transport acute injuries were more common. In the present study the majority of injuries to horses were classified as mild or moderate. The analysis of the subset of horses destined for Italy examined in Romania and the subset of horses arriving in Italy from Romania provided a clearer insight into the effects of transport as this eliminated the animals originating from Poland which were predominantly younger and male. The animals examined on arrival in Italy that had originated from Romania (Figs 1, 2) had more acute contusions or excoriations and were around 3 times more likely to be considered unfit for transport than those horses destined for Italy, observed in Romania.

Behaviour

The significant increase in foraging observed post transport in Italy compared with

pretransport in Romania may suggest that the horses ate little during transport, even if forage was provided and were clearly hungry. This supports the work of Smith *et al*. (1996) who found that both water and hay intake decreased during a 24 h period of transport. Van den Berg *et al*. (1998) reported that horses did not drink over an 8 h period of transport, although water was provided. The significantly lower frequency of urination as well as defaecation post transport may support a hypothesis that horses not only ate less but drank less during transport, possibly contributing to some degree of dehydration, reported by van den Berg *et al*. (1998) and Smith *et al*. (1996) as the result of 8 and 24 h journeys, respectively. According to Council Regulation (EC) no. 1/2005 horses should be provided with water on or off the vehicle at 8 h intervals or less within 8 h of a journey commencing, but we cannot know if this was carried out. Observations undertaken during field females. As the highest proportion of the horses arriving in Italy were from Poland (51%), if the Romania observations at source are representative of the type of Romanian horses arriving in Italy, this suggests that the majority of horses originating in Poland are young male horses. There is anecdotal evidence that some young horses are being farmed or fattened specifically in Poland for human consumption. The animals in Romania by contrast seem to represent a mixture of types, ages and health; those that are no longer of use, perhaps through illness, injury or infirmity or an inability to keep them from a financial aspect as opposed to animals being bred specifically for the trade. The fact that just over half of the horses observed arriving in Italy had originated from Poland and the highlighted differences in age, body condition and health work (J. White, personal communication) at feed and water stations (control posts) in Europe indicates that horses do eat and drink if feed and water are provided.

The significantly reduced frequency of kicking objects, pawing, vocalisation and grooming exhibited by horses post transport may indicate a general reduction in activity (the latter 2 important social and maintenance activities), which may indicate poor welfare (Broom and Fraser 2007). The significant increase in frequency of threatening and fear behaviour post transport may be indicative of stress due to transport in confined conditions, as space restriction has been reported to increase aggression in cattle and pigs (Houpt 1998) and ponies (Houpt and Keiper 1982), yet, interestingly, overt aggression did not differ significantly before and after transport.

Comparison with other studies

There are few published peer-reviewed scientific data relating to long distance transport of horses for slaughter under true commercial conditions. Grandin *et al*. (1999a,b) reported on 1008 horses arriving in 63 loads at 2 slaughter plants in Texas, but the duration of the journeys was not given. Ninety-two percent of the horses were considered to have arrived in 'good condition'. In the present study, the proportion of animals arriving in Italy deemed fit for transport was much lower (63%). The most common conditions observed that were considered by Grandin *et al*. (1999a,b) to be indicative of a severe welfare problem were emaciation, laminitis, fractured limbs and being nonambulatory. In the present study clinical signs indicative of respiratory disease, cuts and abrasions and lameness were the clinical signs most commonly observed that would infer poor welfare. In the Grandin *et al*. (1999a,b) study, of the horses with severe welfare problems (n = 78) only 15 were considered definitely unfit for transport. Abuse

or neglect by owners was considered to have been responsible for the poor welfare of 60 (77%) of the 78 horses. Only 18 horses were considered to have a severe welfare problem that occurred during 'transport or marketing'. In the present study there was also evidence of poor initial welfare in the horses from Romania in that there were 44 instances of severe acute and 77 instances of severe chronic injuries even prior to transport. Clinical signs of disease were also common, including nasal discharge (n = 137 horses), elevated respiratory rate (n = 117 horses), congested mucous membranes (n = 94 horses) and coughing (n = 83 horses). Grandin *et al*. (1999a,b) concluded that based on their observations the 3 most important causes of suffering were conditions caused by owner abuse or neglect, injuries due to fighting when strange horses are mixed in marketing and transport channels and injuries directly attributed to the design of the trailer.

Stull (1999) studied 306 horses transported for slaughter spread over nine trailer loads covering distances of 596–2496 km. A total of 60 (19.6%) of horses exhibited 81 injuries. These were defined as single or multiple abrasions or lacerations. The most common area to be injured was the face and head (58% of all injuries). More injuries were recorded in horses transported in 2-tiered trailers (29.2% of horses transported in this trailer type) compared with single deck trailers (8.0%). The frequency of horses injured was greater in higher density (29%) compared with lower density (12%) transport. The proportion of horses injured was also greater in long duration trips (33% of horses transported) compared with either medium (9%) or short trips (8%).

Stefancic and Martin (2005) reported on observations of transport of large numbers of cattle (n = 262,929), horses (n = 161,685) and other animals at the road and rail border stations in Sezana and Port of Koper in Slovenia. The cattle and horses were observed in 8016 road shipments and 8906 rail shipments. Death due to 'heart weakness/traumatic lesions' was highest for distances of 600–800 km. As in the present study, these authors also observed that in many cases the animals were not transported according to the legislation at the time (Council Directive 91/628 EEC). The authors also observed an increased risk of death in horses transported in trucks compared with by rail. Horses were reported to be 8–25 times more likely to be injured in transport than cattle.

Many of the welfare concerns identified in the present study in Europe have also previously been identified in horses being transported to slaughter within the USA (Stull, 2001). These included the use of double-deck trailers, stocking density, transit durations, water and feed deprivation, and the shipping of horses unfit for travel.

Conclusions

Acute and chronic injuries and lameness, ranging from mild to severe, were prevalent in animals before departure from Romania and a significantly higher prevalence of severe injuries and lameness was found in animals on arrival at the slaughterhouses in Italy. It was found that there was frequent lack of compliance with Council Regulation (EC) no. 1/2005 on the Protection of Animals during Transport. In addition, it is suggested that many of the practices observed in this study may have evolved to ensure that the long distance transport of horses for slaughter in Italy for human consumption continues to be

economic. The current practices appear to cause marked suffering to the animals involved. Horses, whether because of their nature, degree of domestication, size or anatomy, do not appear to tolerate long distance commercial transport as well as other farm animals as identified in the present study by the high prevalence of clinical signs of disease and injuries following transport. The companion paper identifies specific risk factors associated with poor welfare, including health, as defined as a lack of fitness to transport, in long distance transport of horses for slaughter.

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