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Article

Evaluation of animal welfare conditions of South American camelids admitted to the Huancavelica municipal slaughterhouse, Peru

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Abstract:

Raising South American domestic camelids is the main source of subsistence in the Peruvian Andes. Under the understanding that pre-slaughter handling and transport practices can affect meat quality an evaluation was done of South American camelids based on animal welfare criteria and carcass lesions. Data were collected at the Huancavelica municipal slaughterhouse, Peru. A total of 203 carcasses were inspected post-slaughter for lesions from trauma. Information collected on transport included number of animals transported per vehicle, transport characteristics and animal handling practices. Every one of the 203 evaluated carcasses exhibited evidence of pre-slaughter mistreatment. A total of 1,418 lesions were recorded, with an average of 6.9 ± 0.2 per carcass; four animals (1.9 %) exhibited generalized traumas. Of the 27 animal group arrivals, half were in cars (50.0 %). Grade 2 and 3 lesions were associated with transport in any vehicle type (OR= 2.20, 95% CI: 1.27 - 3.82), and no vision restriction (OR= 2.26, 95% CI: 1.66 - 3.06). Large area lesions were associated with pre-slaughter wait times

greater than 24 h (OR= 1.42, 95% CI: 0.99 - 2.03). South American camelid transport and handling practices at the studied slaughterhouse were generally poor and clearly compromised carcass quality as evidenced by ubiquitous lesions. Animal welfare criteria and regulations for South American camelids were not fulfilled.

Key words: Animal welfare, South American camelid, Lesions, Transport.

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Introduction

Approximately 85 % of the world's domestic South American camelids (SAC) are in Peru. This represents more than 5 million animals of which 4 million are alpacas (*Vicugna pacos*) and 1.2 million are llamas (*Lama glama*)[1]. Raising SAC is the principal means of subsistence in the Peruvian Andean highlands since it is sustainable in this environment and provides wool and meat[2-5]. Slaughter weight for alpacas is approximately 50 kg (52 % carcass yield) and for llamas it is 63 kg (55 % carcass yield)[2,6].

Animal welfare (AW) is defined as the overall mental and physical health condition in which the animal is in harmony with its environment[7]. This condition is ethically and commercially important and aimed at reducing detrimental stress, or distress, and preventing injury to animals during breeding, handling and transport[8,9]. Transport of animals to the slaughterhouse can be a stress factor, and its effect increases with elapsed time[10,11,12]. Such is its potential effect on AW that the World Organization of Animal Health (OIE) provides parameters and regulations for terrestrial transport of animals (Terrestrial Animal Health Code)[13].

Distress causes elevation of catecholamine and blood cortisol levels[14,15], and consequent consumption of muscular and hepatic glycogen, affecting lactic acid formation and lowering muscle pH[16]. Levels of pH greater than 5.8 cause the dark-firm-dry (DFD) phenomenon in meat[17]. Lesions on carcasses lower meat quality, and require additional dressing of the injured parts, which affects final meat sale price[10]. Despite its importance, no research has been done to date on the well-being of SAC during transport to slaughterhouses. In contrast, this aspect of cattle raising has been extensively studied; for example, in one study 58 % of bovine carcasses exhibited evidence of abuse during animal loading, handling and transport to the slaughterhouse[10]. The present study objective was to document handling practices used with South American camelids during

transport to slaughter, and evaluate them considering animal welfare criteria, using post-slaughter carcass lesions as an indicator of mistreatment.

Material and methods

Data were collected at the Huancavelica municipal slaughterhouse, Huancavelica Department, Peru. A total of 203 SAC carcasses were evaluated and information gathered on transport methods.

Description of animal transport to the slaughterhouse was done using a survey validated by an AW group in Argentina. Information on transport time was collected in terms of hours to the slaughterhouse, kilometers traversed and road characteristics (trail, pavement, dirt and mixed). Handling information included type of fastening (i.e. if ropes were tied to anterior extremities, posterior extremities or both), vision restriction, sex, total number of animals transported per vehicle type, and means of transport (by vehicle or on foot). Vehicle types were four-passenger car, pick-up truck, cargo truck, passenger bus or minibus. Data was also recorded on what part of a vehicle the animals were transported in; for example, in the cabin (with and without passengers), the bed, the roof and even in the trunk. Animal density per vehicle could not be calculated due to wide variation in vehicle characteristics. When animals arrived at the slaughterhouse it was observed if they had fallen or died. Unloading was described in terms of wait time pre-unloading, during unloading and pre-slaughter, and if it rained. Handler behavior was also recorded from unloading to the rest corral. Observations were taken of if the animals were pulled by the ears, grabbed by the fleece in lateral areas of the thorax and abdomen, if shouts or whistles were used, and if they were lifted by the rump or beaten in this area.

Carcass lesions were documented by an evaluator on the slaughter floor immediately after slaughter. They were described by direct observation and classified by depth as Grade 1 (superficial, involving subcutaneous tissue and outermost portion of muscle), Grade 2 (intermediate, muscle damage), and Grade 3 (deep, all tissue levels affected, including bone). Lesion area was classified as type A (< 25 cm^2), B (25 to 100 cm^2), C (> 100 cm^2), and generalized (when injury covered at least one entire body region). Affected carcass area was indicated as Region 1 (pelvic area), Region 2 (thorax and abdomen) and Region 3 (lateral surface of thorax, cervical vertebrae and first five thoracic vertebrae).

Data were processed with the Infostat/E ver. 2015e statistical package using a 95% confidence level and 80+% power[10,18]. Analysis was done with parametric and non-parametric descriptive statistics. A chi-squared test was applied to identify associations between handling and transport characteristics and the presence of lesions on the carcasses. The odds ratio (OR) was calculated using PROC LOGISTIC in the Statistical Analysis Systems, version 9.1.3 program (SAS Institute Inc., Cary, NC, USA). The study

design was approved by the Institutional Animal Ethics Committee of the Cayetano Heredia Peruvian University (CONS-CIEA-054-2015).

Results

Most (64.6 %) of the SAC transported to the evaluated slaughterhouse were male. A total of 1,418 lesions were identified on all the carcasses with an average of 6.9 ± 0.2 per carcass.

Means of transport

Twenty-seven (27) arrivals with SAC at the slaughterhouse were recorded, 25 in vehicles and two on foot (7.4 %). Cars were the most common means of transport, with thirteen arrivals (50.0 %) (Table 1).

Table 1: Vehicle type and animal handling data for transport of South American camelids (N = 203)

Variable	Transport		Carcasses		*P* value	
	n	%	n	%	Extension	Degree
Vehicle Type:					<0.001	0.38
Pick-up	3	7.7	16	7.9		
Car	13	50.0	70	34.5		
Bus	4	15.4	25	12.3		
Truck	4	15.4	46	22.7		
Minibus	1	3.8	11	5.4		
On foot	2	7.7	35	17.2		
Vision Restricted:					0.293	<0.001
Yes	6	22.2	51	25.1		
No	21	77.8	152	74.9		
Restraints:					0.004	0.383
Posterior Extrem.	22	81.5	154	75.9		
Both Extrem.	2	7.4	11	5.4		
Posterior Extrem + nose	1	3.7	3	1.5		
Not Restrained	2	7.4	35	17.2		
Unload time:					0.259	<0.001

< 10 mins	21	77.8	136	67.0		
> 10 mins	6	22.2	67	33.0		
Wrangling:					0.09	0.139
Mixed	13	48.1	129	63.5		
Ears	6	22.2	34	16.7		
Rump	3	11.1	17	8.4		
Fleece	3	11.1	17	8.4		
Yelling/Whistling	2	7.4	6	3.0		
Rest Time:					0.005	0.691
48 h.	2	7.4	17	8.4		
24 h.	19	70.4	136	67.0		
1 h.	6	22.2	50	24.6		
Rain					0.309	0.741
No	6	22.2	163	80.3		
Yes	21	77.8	40	19.7		
Road Type:					0.74	<0.001
Trail	12	44.4	107	52.7		
Mixed	8	29.6	54	26.6		
Pavement	6	22.2	36	17.7		
Dirt	1	3.7	6	3.0		

Carcass lesions

A total of 1,418 lesions were documented during the slaughter floor inspection. Most were Grade 1 depth (74.0 %), Type A in area (65.5 %), and almost half (48.8 %) were located in Region 2 (Table 2).

Table 2: Carcass lesion distribution: depth, area and location (N = 203)

Lesion characteristic	n	%
Depth:		
Degree 1	1049	74.0
Degree 2	368	25.9
Degree 3	1	0.1
Area:		
Type A	932	65.5
Type B	264	18.6
Type C	222	15.6
General	4	0.3
Location:		
Region 1	421	29.7
Region 2	692	48.8
Region 3	305	21.5

Download time was less than 10 min in most (77.8 %) transport methods, and wrangling method was largely mixed (48.1 %), employing yells, objects, blows and slaps, among others, to drive the animals. Pre-slaughter rest time was 24 h in 70 % of the groups. Rain during unloading was observed in 21 of the 27 groups arriving at the slaughterhouse. Road type as reported by carriers was trail or path in 44.4 % of cases. Neither rain nor road type constituted risk factors for carcass lesions.

Transport in vehicles more than doubled (OR= 2.20; CI 95%: 1.27-3.82) the probability of Grade 2 and 3 lesions compared to transport on foot, but had no effect on lesion area (Figure 1). Non-restriction of vision also substantially increased the risk of large area (type C) lesions (OR = 2.26; CI 95%: 1.66-3.06), as did a pre-slaughter wait time longer than 24 h (OR = 1.42; CI 95%: 0.99 – 2.03) (Table 3).

Figure 1: Putative cause/effect relationships for transport-related lesions in South American camelids

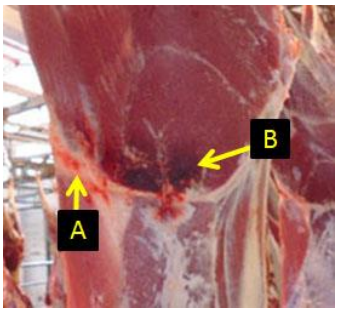
	Transport	Lesion
Description	 Pulling fleece near base of tail to unload and sharp drop to ground	 Irregular lesion on gluteus zone extending to base of tail
Description	 Animal stepped on as passengers get off	 Spotty lesion on back region
Description	 Transported in luggage compartment, sharp fall to ground when unloaded	 Two lesion combination: (A) linear lesion (B) circular lesion

Table 3: Factors associated with lesions in South American camelids by area and degree

	Area		Degree	
	OR	**CI 95%**	**OR**	**CI 95%**
Vehicle type	2.20	1.27 – 3.82	0.86	0.61 – 1.22
Vision restricted	1.19	0.86 – 1.65	2.28	1.67 – 3.11
Rest time	1.42	0.99 – 2.03	1.13	0.85 – 1.5

OR = odds ratio.

Discussion

Presence of at least one injury in the post-slaughter inspections in the present results indicates overall poor animal management practices. This coincides with a previous report in which 92 % of the 264 studied carcasses exhibited at least one lesion with an average of 3.5 lesions per animal[19].

Animal handling and transport are the most stressful and dangerous stages in the livestock production chain[5, 20,21]. The present data confirm this in that the highest average lesion rates were in animals that had been transported in trucks (85.5 %) and minibuses (83.5 %). Abusive handling practices were also documented such as blows with fists and feet, stepping on the animal, as well as blows with wooden sticks, ropes, whips and rocks, among other stressful treatment (Table 1).

Restricting vision with a dark band is known to have a calming effect on livestock[22]. This agrees with the present results which indicate that animals transported with restricted vision remained calmer during transport and consequently experienced fewer injuries. In contrast to cattle[23], rain did not represent a risk factor for lesions among the evaluated SAC. This may be due to the digital pads of SAC, which allows them to better adhere to surfaces.

Pre-slaughter rest time exceeded 24 h in 70 % of the transported animals. This poses a risk for extensive injuries since they can become aggressive when different groups are mixed in the same corral and they begin to establish hierarchies. Some of the recorded lesions could have resulted from fighting during rest time. The present results agree with previous reports[17,24,25] in that the most frequent lesions are Grade 1, followed by Grade 2 and a very few Grade 3.

Distribution of pre-slaughter lesions in cattle is dominated by small area (2 to 8 cm diameter), and Grade 1 lesions (subcutaneous tissue) largely on the legs, iliac crest and abdomen. Larger, deeper lesions occur mostly in the loin, shoulder and thorax regions[19]. The lesion distribution observed here in SAC differs from the pattern in cattle in that 48% of the lesions were located between the thorax and the abdomen. A number of factors may contribute to this pattern, such as scant adipose tissue coverage, the minimal space provided animals during transport, and inappropriate design of transport vehicles. These factors can facilitate blows and traumas against the surface, walls and floor of the transport space, negatively affecting AW. Another possible factor is the use of ropes tied around the posterior portion of the animal, surrounding the caudal part of the abdomen and cranial region of the rump. Injuries occur when the animals attempt to stand, causing the ropes to scrape them and resulting in extensive surface damage. During transport the animals also bump into each, and hit the walls and/or floor. Inadequate restraints frequently cause unnecessary stress to the animals, as well as injury from the restraining method.

Guidelines do exist for camelid transport in terms of the proper use of transport method, vehicle size and number of animals to be loaded[26, 27,28]. In Peru the SENASA publishes a guide to best livestock practices[29], but it includes no specific mention of SAC. Preferable conditions for SAC transport include sufficient space to keep animals calm during transport, as well as providing food and water during long periods of transport, as recommended by the OIE[26]. Only trucks can provide enough space for maintaining SAC well-being and comfort during transport, considering that a load density of 0.55 m² is required for an adult alpaca (40 to 55 kg body weight)[5].

Conclusions and implications

Transport of South American camelids to the Huancavelica municipal slaughterhouse and their handling once there do not promote animal welfare. This was evidenced by evidence of blunt trauma on all the examined carcasses. The most frequent injuries were shallow and located in the thorax and abdomen regions. The absence of conditions promoting animal welfare lowers meat quality, and negatively affects its technological characteristics in storage (reduced preservation time) and processing (economic losses from removal of injured areas and the extra processing time). Consumers of SAC products are increasingly concerned that animal production, transport and slaughter be done under acceptable conditions and managed in a humanitarian manner. This has led to increasing demands for laws and regulations controlling animal welfare, although in Latin America, and especially Peru, any existing regulations are largely ignored. Effective legislation is needed based on research in the area, since animal welfare has both ethical and economic connotations. In addition, scientific research needs to be applied to train SAC producers and processers in proper animal treatment to improve animal welfare and meat quality.

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