EFFECTS OF ROAD TRANSPORTATION OF ARABIAN HORSES ON THEIR BEHAVIOUR AND PHYSIOLOGY

By

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SUMMARY

The transport of animal is considered to cause more episode of stress than any other husbandry practice. So these study was carried to investigate the effect of road transportation of Arabian horses on their behaviour and physiology. Sixty eight Arabian horses of ages ranged from (6-10), years old and had been previously transported by road were used in this study. Three different trailer designs (Automatic Trailer, AT, Commercial Trailer CT, and Lorry), were used in this study. The result indicated that horses transported by (AT), displayed less aversive behaviour and loading time during loading than those transported by (CT), or lorry. While the highest level of stress indices (cortisol, N/L ratio, and Haematocrit %), were recorded among horses transported by lorry than those transported by AT and CT.

Regarding to the duration of transportation it was found that short transport duration was less stressful than long duration. Also the horses which transported facing away from the direction of travel were less stressful and safer than those facing forward or side facing, as horses transported side facing showed the highest increase in stress indices (cortisol, N/L ratio, and H %).

INTRODUCTION

The transportation of horses by road is a relatively recent practice that increasing rapidly both within and between countries. Horses are transported for a variety of reasons including competition, sale, breeding and leisure activities (Grandin, 2000). Although there are statutory requirements that relate to the road transport of horses they are not based on scientific studies that have investigated the behavioural and physiological responses of horses to that form of carriage (Stull, 1997).
Most animals show responses indicative of stress during and after transport. Studies of the effects of transport on horses have mainly been concerned with the measurement of physiological parameters, for examples, increase in plasma cortisol and progesterone have been recorded in horses during transit (Baucus et al., 1990 and White et al., 1991). Also haematological and serum biochemical changes have been found in horses confined during transport by air (Leadon et al., 1989). Stress associated physiological changes may cause embryonic death in pregnant mares (Baucus et al., 1990), and increase susceptibility to microbial diseases (Leadon et al., 1990).

The transport of animals is considered to cause more episodes of stress than any other husbandry practice (Cregier, 1982), and most animals show stress responses during and after a journey (Hails, 1978). It is therefore probable that the majority of horses being transported by road experience some degree of stress because road transport has been reported to induce several physiological and behavioural changes (Waran et al., 1996), including tachycardia, postural abnormality, sweating and diarrhea (Hobo et al., 1995). In addition to changes in metabolic, endocrine and biochemical parameters (Leadon et al., 1990, Baucus et al., 1990 and White et al., 1991).

Historically, the designs of trailers and management of horses during transport have been based on human preferences, with little regard for their effects on horses (Cregier, 1982). Additionally, data collected on selected physiological responses and number of injuries incurred during transport for comparison of trailer designs, floor space per horses and trip duration will assist in drafting science-based guidelines (Schaefer et al., 1997 and Stull, 1999). Orientation of the horse within a transportation vehicle has been identified as a potential source of stress (Creiger, 1989). Several studies have examined horse facing toward or away from the direction of travel (Clark et al., 1993, Smith et al., 1994a and 1994b, Waran et al., 1996, and Collins et al., 2000).

However, there is little documented research which deals specifically with horses, or how their behavioural and physiological responses can be used as objective measures of the stress induced by transport (Waran and Cuddeford, 1995). The aim of this study was therefore to evaluate the effects of different trailer designs, duration of transport and body directions during travel on both behaviour and physiology of Arabian horses during road transportation.
MATERIALS AND METHODS

I- Horses.
Sixty eight Arabian horses were used in this study, their ages ranged from (6-10) years old. All horses had been previously transported by road.

II-Experimental design:
This experiment was conducted to study the effects of different trailer design, Automatic Trailer (AT ), Commercial Truck (CT), and lorry (L), duration of transport, and body direction of the horses during transport on both behavioural and physiological parameters.

1- Effects of Trailer design on both behavioural and physiological parameters.
The current study was conducted to investigate the effects of different types of trailer during road transport on the behaviour and physiology of Arabian horses. Automatic Trailer (AT), n=7, this trailer was designed to load three horses, side facing during travel and accommodated with automatic rear ramp which touch the ground to lift the horse. Commercial truck (CT), n=14, this truck owned to El-Zahraa Stud farm for breeding Arabian horses. (CT) was designed to load four horses, with movable partitions, side facing during travel, with ordinary rear ramp (height about 30cm from ground). The third type of trailer was closed Lorry (L), n=8, the height of its rear ramp was about (80 cm) from the ground.

2- Effects of transport duration on the physiological parameters.
The effects of short duration (45-60min.), n=8 and long duration (120-180min.), n=10 of transportation were determined to explain their influences on concentration of cortisol, Haematocrit %, and Neutrophil: Lymphocyte ratio of Arabian horses during road transport by Commercial Truck (CT).

3- Effects of body directions (orientations), during transport on the physiological parameters.
The effects of different body directions during transportation of Arabian horses, Forward Facing (FF), n=6 (with the direction of the travel), Side Facing (SF), n=7 and Backward Facing (BF), n=8 (away from the direction of the travel) were trailed to chose the
less stressful body direction during transportation. This experiment was conducted in Lorry(L), as it was designed to select the body direction of the horse during transport, either facing forward, backward or side facing.

III- Parameters measured:
A- Behavioural Recordings.

A record was made of all behaviour patterns that were performed during the loading process according to (Waran and Guddeford, 1995) as fellow:

Plant: Standing and refusing to move forward.
Pull-Back: Moving backwards away from the ramp.
Swing: Turning head and body away from the ramp.
Kick: Thrusting one hindleg backwards or sidways.
Buck: Thrusting both hindlegs simultaneously backwards.
Rear: Lifting forelegs and elevating the trunk.
Nosing Ramp: Stretching neck downwards and placing nose on the ramp.

Recording of these behavioural patterns was commenced when the horse at a distance of 8 m from the foot of the ramp, during the walk to the ramp, whilst at the foot of the ramp and when ascending the ramp. Recordings stopped once the horse was at the top of the ramp and therefore in the trailer.
The percent of occurrence of each type of behaviour was then calculated, in addition the total time each horse took to complete loading was recorded (loading time).

B- Physiological Parameters.

Blood samples (15mL) were collected in evaluated glass tubes via needle puncture of the Jugular vein within 2h (pre-samples) before transport and after arrival(post-samples). Blood samples to be analyzed for concentrations of cortisol were immediately placed on ice and allowed to clot. Serum was obtained frozen at -70c. Samples intended for Hematocrit (H) and neutrophil: lymphocyte ratio (N:L) were collected in tubes containing EDTA.

C- Laboratory Analysis

Concentrations of cortisol were determined for all samples using one assay kit (immuno-cortisol(125I) coated tube kit. According to the method of (Clark et al., 1993), in
duplicate at two dilutions using a commercial antisera. Hematocrit (H%) was determined by centrifuging samples, in triplicate, in micro-haematocrit centrifuge for 5 min. and measuring the red cell materials as a proportion of the total height of blood in the tube (Leadon et al., 1990), and neutrophil: lymphocyte ratio (N:L) were determined according to (Heckner et al., 1988).

IV-Statistical Analysis.
The behavioural and physiological data were analyzed using SPSS/PC+ (Microsoft Corp.) and the data were compared using (ANOVA), (Siegel and Castellan, 1988).

RESULTS

Table (1): Effects of trailer design on the behaviour (%) of Arabian horses during loading.

<table>
<thead>
<tr>
<th>Beh. Patterns</th>
<th>Auto. Trailer (AT), n=7</th>
<th>Com. Truck (CT), n=14</th>
<th>Lorry (L), n=8</th>
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</thead>
<tbody>
<tr>
<td>Plant</td>
<td>14.3</td>
<td>35.7</td>
<td>100</td>
</tr>
<tr>
<td>Pull-back</td>
<td>0.0</td>
<td>7.14</td>
<td>50</td>
</tr>
<tr>
<td>Swing</td>
<td>28.6</td>
<td>42.9</td>
<td>87.5</td>
</tr>
<tr>
<td>Kick</td>
<td>0</td>
<td>0</td>
<td>12.5</td>
</tr>
<tr>
<td>Buck</td>
<td>0</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Rear</td>
<td>0</td>
<td>0</td>
<td>12.5</td>
</tr>
<tr>
<td>Nos.ramp</td>
<td>0</td>
<td>7.14</td>
<td>62.5</td>
</tr>
<tr>
<td>Loading time (sec.)</td>
<td>25.0</td>
<td>38.0</td>
<td>57.0</td>
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</table>
Table (2): Effects of trailer design on Physiological parameters during transportation of Arabian horses.

<table>
<thead>
<tr>
<th>Trailer Design Parameters</th>
<th>Automatic</th>
<th>Commercial</th>
<th>Lorry</th>
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</thead>
<tbody>
<tr>
<td>Cortisol, ng/ml</td>
<td>44 ± 0.8</td>
<td>51 ± 0.6</td>
<td>48 ± 0.2</td>
</tr>
<tr>
<td>N:L ratio</td>
<td>3.1 ± 0.2</td>
<td>4.2 ± 0.4</td>
<td>2.9 ± 0.4</td>
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<tr>
<td>Haematocrit, %</td>
<td>43 ± 0.3</td>
<td>45 ± 0.5</td>
<td>42 ± 0.2</td>
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</tbody>
</table>

1 = Pretransportation values.
2 = Post-transportation values.

Table (3): Effects of the duration of transportation of Arabian horses on stress indices in Arabian horses.

<table>
<thead>
<tr>
<th>Stress Indices</th>
<th>Short duration</th>
<th>Long duration</th>
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<tbody>
<tr>
<td>Cortisol, ng/ml</td>
<td>46 ± 0.4</td>
<td>54 ± 0.5</td>
</tr>
<tr>
<td>N:L ratio</td>
<td>3.1 ± 0.1</td>
<td>4.2 ± 0.3</td>
</tr>
<tr>
<td>Haematocrit, %</td>
<td>43 ± 0.4</td>
<td>46 ± 0.2</td>
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</table>

Table (4): Effects of body direction (orientation) of Arabian horses transported by Lorry on physiological parameters.

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<td></td>
<td>Forward</td>
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<td></td>
<td>Backward</td>
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<td></td>
<td>Side Facing</td>
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<tr>
<td>Cortisol, ng/ml</td>
<td>45 ± 0.6</td>
<td>57 ± 0.3</td>
<td>46 ± 0.2</td>
<td>52 ± 0.6</td>
<td>45 ± 0.3</td>
<td>66 ± 0.2</td>
<td></td>
</tr>
<tr>
<td>N:L ratio</td>
<td>3.0 ± 0.5</td>
<td>4.2 ± 0.2</td>
<td>2.9 ± 0.3</td>
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<td>Haematocrit, %</td>
<td>43 ± 0.4</td>
<td>46 ± 0.1</td>
<td>44 ± 0.2</td>
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<td>43 ± 0.2</td>
<td>49 ± 0.5</td>
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</table>
DISCUSSION

Effect of Trailer design on both Behavioural and physiological parameters.
Table (1) and Table (2) indicated that there were significant differences in behavioural patterns during loading among horses transported by the three different design of trailer as horses transported by Lorry displayed highest frequency of occurrences of aversive behaviour during loading (plant, 100%, swing, 87.5%, pull back 50%, kick 12.5%, buck 25%, rear 12.5%, nosing-ramp 62.5%, while the behaviour were less frequently occurred or absent among horses transported by Automatic trailer (AT) (14.3%, 28.6%, 0.0%, 0.0%, 0.0%, 0.0%, respectively).

The loading time was significantly increased for horses transported by lorry than those transported either by commercial truck (CT) or (AT) it was 57, 38, and 25 sec. Respectively. The increased occurrence of these aversive behaviour displayed during loading by horses which transported by lorry and (CT), attributed to the fear responses due to the height of the rear ramp of the trailer. On the other hand, the low frequency of these behaviour in the (AT), may be due to using of Automatic rear ramp which land on the ground and easily lift the horse to the level of the trailer. This result is agree with that reported by (Waran, et al. 1993, Kusunose and Torikai, 1996, Alexander and Irvine, 1998 and Houpt and Lieb 2000).

Regarding the physiological parameters, there was significant elevation at (p<0.05), in the level of cortisol ng/ml, N/L ratio and H %, in horses transported by lorry more than those transported by (CT), and (AT). Their average levels were (68±0.2, 57±0.5, and 51±0.6ng/ml) for cortisol, (4.9±0.5, 4.4±0.3, and 4.2±0.4) for N/L ratio and (50±0.4, 46±0.1, and 45±0.5 %) for haematocrit respectively. The increase in the levels of these physiological parameters among horses transported by lorry and (CT), than those transported by (AT), owing to stress response and it is agree with the result of (Grandin, 1981, Waran and Cuddeford, 1995, and Grandin, 1997).

Since road transport is a complex operation made up of several components including handling, loading, unloading, separation from a familiar environment, isolation, confinement, loss of balance, inadequate ventilation, extreme temperature and humidity, exposure to gases from urine, faeces and diesel and deprivation of food and water, it is
difficult to judge which of these components is responsible for these changes.

**Effect of duration of transportation on physiological parameters.**
As shown in Table (3), there were significant increase at (p<0.05%) in cortisol level, N/L ratio and H% for horses transported for long period than for those transported for short period. The average level was (60±0.3 and 54±0.5ng/ml) for cortisol, (4.7±0.5 and 4.2±0.3) for N/L ratio, and (49±0.6 and 46±0.2%) for H % respectively. These increase indicate that horses transported for long period were more stressed than those transported for shorter period and these agree with (Cregier,1982, Nambo et al.,1996, Friend et al.,1998, and Stull,1999), who concluded that length of journey, the method of transport and the skill of the driver, all contribute to how stressful the journey will be for the horse.

**Effect of body direction (orientation) during transportation on stress indices:**
Concerning the body direction of the horses during transportation ,Table (4), showed that there was a significant effect at (p<0.05%), on physiological parameters as the horses transported facing away from the direction of the travel was less stressful than those either forward or side facing. The highest values of stress indices were recorded among horses transported side facing (65±0.2ng/ml,4.9±0.3, and 49±0.5%), for cortisol, N/L ratio and H % respectively. This result agree to large extent with that reported by (Clark et al.,1993, Smith et al.,1991, ,Smith et al.,1994a, b and c, and Smith et al.,1996).

It can be concluded that the design of trailer must be considered during road transportation of horses as using the Automatic trailer decreased the fear response of horses and aversive behaviour during loading and consequently less stressful. Also, it is advisable to load the horse facing away (backward), from the direction of the travel during transportation. It has been suggested that transporting horses facing away from the direction of travel is less stressful and safer than transporting horses facing the direction of travel. Also tying horses facing away from the direction of travel improved their ability to maintain balance.

The method facing backward possibly has four main advantages over conventional forward facing travel: 1- The horse can be loaded more easily because it is backed into the
Effects of Road Transportation of

trailer and is not faced with a dark entrance, 2-its broad, fleshy hindquarters are presented to the potential impact area during braking and deceleration instead of its fragile head and chest, 3- The horse does not need to carry its head in an unnatural high position, 4- It can be more balanced because it can lean over its forequarters because it no longer fears injury on sudden braking (Cregier, 1982).

REFERENCES


