Development of Stress Score Due to Transportation and Handling in Imported Sheep to Kuwait: Determining the Stress Score System.

T. AL-Sabbagh

Food Resources And Marine Sciences Division Kuwait Institute for Scientific Research

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ABSTRACT

This study was conducted 2006 - 2008. It dealt with the initiation of the stress scoring system that may add to the state of this art. The stress score is meant to measure the stress intensity of the animals that are subjected to stress of any kind. In this study, the stress is due to transportation to the farm, the housing conditions in the farm and finally the transportation to the slaughter house and the accompanying handling procedures. The hypothesized numerical scale was proportional with the stress index that was derived from the stress hormone levels in blood for the stressed animals. The numerical scale is a score of three being 1 is a low level of stress and 3 is the high level of stress. Results showed high correlation of stress score given with serum level of cortisol > 60% with a significance value of <0.0001. Analysis of correlation also showed that the highest effective factor on the score is the location of animal on the ship with more than 72% and a P value of <0.0001. The analysis of variance showed that the mean concentration of the cortisol is higher for those animals that are exposed to higher level of stress group 3 with a mean stress value of 455.05 ng/ml whereas the medium and lower score group (2 and 1) have a mean level of cortisol concentration of 344.19 and 211.92 ng/ml respectively. Those findings showed clearly the effect of the given score on the level of cortisol that is measured.

Key words:

Introduction

Kuwait is importing most of the needed red meat, since local production is slightly more than 5% of the total demand. It is very important to start closing this gap by creating the right procedures in animal handling protocols. Deaths and poor sheep performance are definite loss in this industry. Better handling procedures will end up with better end product of the sheep industry as stressed animals have lower quality of meat [1]. This research is a step towards minimizing this loss by determining base that we can detect stress on sheep by it that is Stress Score System (SSS). Not only that but it could help in improving the end product of the industry by decreasing the stress on these animals.

This type of information drives the breeders and those who have interest in this industry to pay more attention to this loss and spend more efforts to decrease it. Unfortunately, neither in Kuwait nor in the neighboring countries any efforts were spent in this field from the angle of the degree of stress that the animals have gone through in the handling procedures at any time. This project aims at studying the process of initiating the Stress Score System due to transportation and handling after boarding in Kuwait. As the reader can see that all the study is restricted to after arrival to port of Kuwait since it is almost impossible to gain precise information about several parameters before boarding especially in the handling procedures.

More than three thousands animals were sampled for its blood hormonal stress level for the duration of the experiment. Factors addressed for scoring system namely location on the vessel, tide at downloading, flooring of the vessel, calling on vessel, crowd in the cell, number of sick animals or dead ones in location and handling activities, were clearly stated for the team members and they practiced on scoring even earlier in a previous pilot study. Each factor has a maximum score of 2 and a sub score of 0.5 for fine tuning. The recording table of the SSS was finalized to be used in the field and the project’s staffs were trained to use it in assessing the stress status of the transported flocks.

The Project’s team had divided themselves into two groups after they wear their safety cloths and equipments. The first group were positioned on the ship, where they were assessing the status of the sheep in the ships according to SSS table. However
every single detail that had related to the stress subject, were recorded and scored. Also the team on the ship where marking the targeted sheep sample using a canned paint spray. Each marked group contains 10 sheep that represents specifically certain group in the shipped population with different scores according to SSS tables scored on the ship. In each ship a total average of 50 samples were collected. After the recognition of the marked sheep group by the second team group, the marked grouped where restrained in a separate area which was previously prepared by the group for blood collection. Each sheep were handled carefully and softly without any extra stressing. The serum was collected to be tested for cortisol level in their blood as it is a definite index for stress intensity Ali et al., [2].

The sheep were then tagged with a serial number on their ears and marked in the forehead by spray paint before they were loaded to the transportation trucks, to ease their recognition in the farm and the slaughter house for later collection.

In the Animal Physiology Laboratory at the Agriculture and Water Research center, the serum samples were separated from the collected blood via centrifugation at 1000 RPM. The supernatant which is the serum were collected and loaded in 2.5ml Microfuge tubes and stored at – 18 °C till the day of analysis. Scores that had been recorded in the SSS table were then entered in a computer data spread sheet for future statistical analysis. However, the recorded scores in the sea port have ranged as low as 5.5 up to 16 for the collected samples which was summarized into a group of 3 (1, 2 and three) to facilitate the numbering system and to make it easier on the team for the decision making without affecting on the scoring result.

Cortisol concentrations in serum samples were detected using enzyme linked immuno-sorbert Assay (ELISA) technique. A special ELISA kits had been used, commercially known as Active Cortisol EIA DSL-10-2000. The Port’s identified sheep (sprayed sheep with paint) were traced to the sheep farm of the clients company in Kabid, in which 15 blood samples of 50 samples in each group were collected and recorded in our records as previously mentioned above in period of 25-30 days. All animals were downloaded in the farm. Performance of sheep was traced by checking the level of cortisol in the serum. Serum samples were analyzed to measure cortisol concentrations as previously mentioned above. Weekly samples and for four times samples were taken for the hormonal analysis to see that performance to the housing period in the farm. The fourth sampling time will be at the slaughter house.

After the housing period ten animals that were in the study of the farm at each transporting load were loaded in a special transporting trailer that take the animals to the slaughter house. Research team will have the access to these animals during the transportation trip. Animals were sampled for blood at different distances 0, 10, 20, 30 and 40 Km. These represent different distances to the slaughter houses that the company is using in addition to the distance from the port to the farm. At each distance the animals were sampled for blood and follow the same old procedure for the serum analysis as it is believed the road affect on stress level Ruiz et al 2001. Same measures of stress intensity were added in handling and transportation and being used for each animal transported.

Results and Discussion

Statistical analysis system [4] was applied and a final system of scoring was followed. Different procedures have been practiced to analyze the data like the general linear model, the correlation analysis and the repeated measures and any necessary measures that is appropriate at that level to form the final report of initiating an effective stress score system that hopefully help the decision maker in this business to take the right measures for the benefit of this industry.

A team of very well trained members were assigned to watch the downloading process of the lambs from the carrying vessel in the port. One of the team members is on-board with a continuous communication with the ground members. The on-board member is giving the information to the ground members about the location, type of flooring on the ship, intensity of the sheep crowd in the cell (pen), number of sick or dead animal in the cell as well as the handling of sheep. The ground members will fill this information in a provided table. They will assess the handling on the ground, intensity of the crowd in the ground in addition to the score of tide and season. Season score is fixed for any single visit whereas the score of tide is proportional to it (tide). Any single factor is given a score of two points and the total score will be the addition of all these scores together. The score is not for individual lamb but it is for group of animals that are downloaded together.

The team were repeating this activities every single visit of any loaded vessel to Kuwait port. The repeatability of the scores become very high and the score of the stress of any group of animals is almost identical when was given by two different team members which reflects the accuracy of the given scores.

Scores for any single factor is a total of two points graded into 5 units as follows: 0, .5, 1, 1.5 and 2. any score that is given is fixed and can not be debatable which gives us solid base to have a total stress score number.

Scoring system:
1- Tide: high tide is 2, low tide is 0 and in between (high tide time-low tide time)/5 (score units).

Example: the high tide as per may 12th 2008 is 6 am, the low tide is at 10am and you are downloading at 9am.

1- 10 am- 6 am = 4
2- 4/5 = 0.8 hr (45min decreases 0.5 unit)

3- So that at 9 am which is 1 hr from the low tide (0) = 0.5 (ss).

The level of tide is affecting on the steepness of the downloading channel. The higher the tide the more steep the channel will be.

The steepness of the downloading channel is one important factor in measuring the stress.

2- Location of animals on-board:

<table>
<thead>
<tr>
<th>Deck/altitude</th>
<th>Low 1-2</th>
<th>Mid 3-5</th>
<th>High 6-7</th>
<th>Front and back</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>Front</td>
</tr>
<tr>
<td>Side</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>Front</td>
</tr>
<tr>
<td>Mid</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>Mid</td>
</tr>
<tr>
<td>Side</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>Mid</td>
</tr>
<tr>
<td>Mid</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>Back</td>
</tr>
<tr>
<td>Side</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>Back</td>
</tr>
</tbody>
</table>

3- Season:

The seasons in Kuwait are as follows long summer with a score of 2 and very short spring with a score of 1 and short winter with a score of 0.

4- Flooring on the ship:

Kuwait Livestock Transport and Trading Company has three carrying vessels with three types of flooring. Myseelah vessel, with iron flooring with a score of 2. Shuwaikh and Kuwait vessels with a combination of wood and steel flooring and given a score of 1.5.

5- Crowd of animals per cell on the ship or on the ground:

Animals have a proper space to be kept in each cell or pen site on the ship. The proper size for each single sheep should be about 1.5 sqm. Any increase
in that space considered to be 0 score and any decrease will be subjected to higher stress score. Anything lesser than a squared meter will be considered to be stressful and was given a stress score of 2.

6- Handling of animals on the ship and ground:

Calling and moving the animals is a technique and it is hard to follow but should be followed for the favor of the animals. Any physical hit by any kind during that process is given the score of 2 while high noise was given 1 whereas the proper calling and moving being behind the animals without exposing them to high noise or physical hit or kick was given a score of 0.

7- Sick or dead animals:

Sick or dead animals are thought to be stressful to animals accompanying them. Cells with no sick or dead animals were given the score of zero. Group of animals that has 1-5 sick or dead animals were given a score of 1 and any numbers above that considered to be very stressful and were given 2.

Statistical analysis using the general linear model of SAS system with Student Neuman Kuel to separate the means showed very well accuracy in our hypothesized numerical scores. For the purpose of simplification scores were grouped into 3 figures. Those with score 1 are low stressed animals, score 2 are those with medium stress and score 3 that are highly stressed animals Graph 3. Correlation analysis using Pearson method showed that stress scores were highly correlated to cortisol concentration > 60% with a significance value of <0.0001. Analysis of correlation also showed that the highest effective factor on the score is the location of animal on the ship with more than 72% and a P value of <0.0001.

The analysis of variance showed that the mean concentration of the cortisol is higher for those animals that are exposed to higher level of stress group 3 with a mean stress value of 455.05 whereas the medium and lower score group (2 and 1) have a mean level of cortisol concentration of 344.19 and 211.92 respectively. Those findings showed clearly the effect of the given score on the level of cortisol that is measured Table 1.

These results again confirmed the accuracy of the given numerical scores that we gave to the different experimental groups and we called stress score system (SSS). At this level we are not going to stress on the weights of different parameters of the system rather than considering the whole system as one effective unit that lead to differences in levels of stress that the animals are exposed to due to handling procedures.

In repeated measures that were conducted in the farm, several groups of fifteen animals were tested for their stress performance during their residency in the farm for not more than 4 weeks. The animals were tested for their stress hormone level repeatedly every week and the 4th week will be at the slaughter house. This was to check the recovery behavior of these animals during housing (in the farm) time. Results showed that animals were gradually had a drop in the cortisol level showing a recovery in energy source.

The last part that we tested in the stress system is the transporting distance that we felt we should test its effect on the stress intensity of the animals. Animals are transported to different distances to different slaughter houses. The longest is about 40 km from the Kuwait Livestock Transport and Trading Company’s farm. So that in a small experiment with about two hundred animals that were transported different distances at 0, 10, 20, 30 and 40 Km. a special trailer was designed for that purpose were the staff have the access on the animals without downloading them from the trailer. At each distance animals were tested for the level of the stress hormone and the result was in 146.65, 160.14, 170.21, 172.68 and 171.71ng/ml respectively. Although there was a clear trend that the more the distance the more the animal will be stressed as reflected by the stress hormone, the significance were absent statistically. This could be due to the low sample size.
Table 1: The Least Square Means of Cortisol Hormone Levels mg/dl as Affected by the Stress Score System 1-3 Levels

<table>
<thead>
<tr>
<th>Stress score system level</th>
<th>Cortisol Level</th>
<th>SE</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>240.24</td>
<td>24.19</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>2</td>
<td>356.11</td>
<td>25.61</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>3</td>
<td>558.70</td>
<td>34.27</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

In short animals which are downloaded in Kuwait port and being transported from Australia are exposed to levels of stress that is considered to be a major factor in both mortality and meat quality. In a step toward helping the decision makers in the livestock transport and trading company to direct the transported animals to the right destination (meat factory, customers or the farm) this project was conducted. Having the ability to score the stress that animals are exposed to (1-3), one can direct the highly stressed animals either to the meat factory where the animals are slaughtered and the meat is processed or to the farm where they are being housed to recover the loss of the energy source and hence improve the meat quality of the animal before sending it to the customer. The animals with a lower stress the decision maker can directly send it to the market either to the butchers or directly to the customers who prefer the live animals with confidence of the meat quality as we have seen earlier in the last project with the company FA047K.

<table>
<thead>
<tr>
<th>Distance traveled by the animals (Km)</th>
<th>Cortisol level ng/ml</th>
<th>SE</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>146.65</td>
<td>11.20</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>10</td>
<td>160.14</td>
<td>11.20</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>20</td>
<td>170.21</td>
<td>11.20</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>30</td>
<td>172.68</td>
<td>11.20</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>40</td>
<td>171.7</td>
<td>11.20</td>
<td>&lt; 0.0001</td>
</tr>
</tbody>
</table>

Acknowledgements

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References