EFFECT OF DIFFERENT SLAUGHTERING METHODS ON DEATH TIME OF DAGLIC BREED LAMBS*

In this study, 80 Daglic race, male 8-month-old sheep were used as material. The sheep were separated in 4 groups. The sheep in the group 1 were slaughtered in horizontal position and non–stunned. The sheep in group 2 were slaughtered in vertical position and non–stunned. The head-only stunning procedure was applied to the third group and the sheep were stunned in horizontal position. Group 4 sheep were slaughtered in vertical position after the head-only stunning procedure was applied. According to the obtained results, bleeding time, total blood amount, live weight, and percent of total blood parameters were significantly different among the groups. It is important to apply stunning applications for the welfare of the slaughtering farm animals. Also, the quality of meat and its products is directly related with the bleeding time and total amount of bleeding parameters.

Key words: lamb daglic breed, slaughtering methods

Introduction / Uvod

The European Community Council reports to provide animal welfare conditions of slaughtering animals in all parts of the slaughtering procedure. Also, the Council reports that the staff must avoid inflicting pain to the slaughtering animals by Directive 93 / 119 / EEC accepted on 22nd of December, 1993 [8]. In most developed countries, the procedures that will be applied both before and after slaughtering are prescribed by law [1, 6, 9, 14, 21]. According to the laws of the USA, slaughter without using humane applications is not legal [20]. Failure to provide humane slaughtering conditions,
causes a lot of problems regarding staff safety, ethic rules and has a negative effect on the efficiency of the plants. The violation of consumer rights is another problem related to this subject [6, 10, 11, 12].

Consumers increasingly demand that the breeding, transport, and slaughter of slaughtering animals is carried out with humane applications [4, 6, 10, 22, 23]. Some revisions are neccessary for developing and developed countries to resolve international trade problems and avoid economic losses [20, 24].

A lot of painless slaughtering methods have been developed by scientists to prevent the pain of the animals during the slaughtering processes [27]. Head-only stunning is an easy to apply and economic method for the plants. Also, it is suitable for the religious beliefs of our country because it is a reversible stunning method for the animals [5, 13, 18, 27]. It is pretty important to restrain the animals in the special traps designed for slaughtering to provide the staff’s safety and to prevent stress for the animals [8, 10, 14, 21].

Another important point is the reversible effect of the stunning methods on animals [3, 7]. Death situation occurs by cutting Arteria carotis communis or Vena jugularis or both of them, hypovolemic shock takes shape after the occurrence of cerebral ischemia and, finally, death takes place [7, 15]. Normal brain activities and pain feeling are restored soon after stunning, so that it is important to take into consideration the time interval between stunning and slaughtering, and suitable processes must be applied for painless slaughtering [2, 3].

The objective of this study is to determine the death time of lambs for different slaughtering methods. Furthermore, it provides scientific information for using humane slaughtering processes in the industry.

Materials and methods / Materijal i metode

Eighty male 8-month-old Daglic race sheep were used as material. The sheep were procured from the Istanbul Metropolitan Municipality Sheep Sales Centre. The sheep were seperated into 4 different groups and transported to the slaughterhouse of the Istanbul Metropolitan Municipality. After transportation, the sheep were weighed (Baster, Model BK, 5-300 kg) and homogeneous groups were formed according to the live body weight parameter. Lairaging was applied 24 hours, and feeding was stopped 6 hours before slaughtering. After 24 hours, antemortem examination was performed and the animals were transported to the slaughtering line. Sheep in the stunning group were stunned by the head-only stunning method by applying 220 – 250 Volt, 1.0 – 1.3 ampere alternative current. After stunning, the sheep were restrained from their right back leg and elevated to the monorail line. Slaughtering was applied between the 17th – 20 th second of the tonic phase.
Experiment groups / Eksperimentalne grupe

Group 1: The first group was the control of group 3. 20 sheep were included in group 1 (n=20). This group was slaughtered non – stunned in a horizontal position. *Arteria carotis communis, trachea and oesophagus* were cut.

Group 2: The second group was the control group of group 4 (n=20). Vertical non – stunning slaughtering procedure was applied by cutting *Arteria carotis communis, trachea and oesophagus*.

Group 3: After application of the head-only stunning method, *Arteria carotis communis, Vena jugularis, trachea and oesophagus* were cut. The traditional horizontal slaughtering technic was applied to this group.

Group 4: After application of the head-only stunning method, the vertical slaughtering technic was performed by cutting *Arteria carotis dextra, Arteia carotis sinistra, trachea, oesophagus, Arteria pulmonaris* and *Aorta*.

The blood of the animals was gathered in cleanable plastic buckets and weighed for the determination of the total blood amount of each sheep. From the beginning of the slaughtering process, various reflexes were checked to fix the exact time of death, and all the slaughtering processes were recorded for further examinations. To determine the exact death time of the sheep, palpebral reflexes, arhythms in respiration, stopping of respiration and pupillar reflexes were checked in order.

**Results / Rezultati rada**

Duncan one way variance analysis was applied to all the parameters. The tables below show the values of the analysis results.

### Table 1. Duncan Anova (one way variance analysis) values of the parameters

<table>
<thead>
<tr>
<th></th>
<th>Group 1 / Grupa 1</th>
<th>Group 2 / Grupa 2</th>
<th>Group 3 / Grupa 3</th>
<th>Group 4 / Grupa 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live Weight (kg) / Zrava težina (kg)</td>
<td>37.27</td>
<td>38.22</td>
<td>36.30</td>
<td>39.02</td>
</tr>
<tr>
<td>Bleeding Time (sec) / Vreme iskrvarenja (sek)</td>
<td>168ab</td>
<td>177.6a</td>
<td>161.4b</td>
<td>144.6c</td>
</tr>
<tr>
<td>Total Blood Amount (cc) / Ukupna količina krvi (cc)</td>
<td>1454.15b</td>
<td>1435.10b</td>
<td>1621.35ab</td>
<td>1884.40a</td>
</tr>
<tr>
<td>Percent of Total Blood (%) / Procent ukupne krvi (%)</td>
<td>3.90b</td>
<td>3.70bc</td>
<td>3.99b</td>
<td>4.582a</td>
</tr>
<tr>
<td>Time of Death (sn) / Vreme smrti (sn)</td>
<td>138.00</td>
<td>111.75</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>
Spearman correlation analysis for all the parameters are indicated in the table 2.

<table>
<thead>
<tr>
<th></th>
<th>Live Weight / Živa težina (kg)</th>
<th>Bleeding Time / Vreme iskrvarenja (sec)</th>
<th>Total Blood Amount / Ukupna količina krvi (cc)</th>
<th>Percent of Total Blood / Procenat ukupne krvi (%)</th>
<th>Time of Death / Vreme smrti (sn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live Weight (kg) / Živa težina (kg)</td>
<td>1.000</td>
<td>0.014</td>
<td>0.626**</td>
<td>0.87</td>
<td>0.013</td>
</tr>
<tr>
<td>Bleeding Time (sec) / Vreme iskrvarenja (sek)</td>
<td>0.014</td>
<td>1.000</td>
<td>-0.171</td>
<td>-3.99**</td>
<td>-0.161</td>
</tr>
<tr>
<td>Total Blood Amount (cc) / Ukupna količina krvi (cc)</td>
<td>0.626**</td>
<td>-0.171</td>
<td>1.000</td>
<td>0.391**</td>
<td>0.064</td>
</tr>
<tr>
<td>Percent of Total Blood (%) / Procenat ukupne krvi (%)</td>
<td>0.087</td>
<td>-3.99**</td>
<td>0.391**</td>
<td>1.000</td>
<td>0.220</td>
</tr>
<tr>
<td>Time of Death (sn) / Vreme smrti (sn)</td>
<td>-0.013</td>
<td>-0.161</td>
<td>0.064</td>
<td>0.220</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Eighty Daglic race, male, 8-months-old sheep were used in our study. The sheep were separated into 4 groups. After slaughtering, palpebral reflexes, the breakdown and stopping of the respiration rhythm, and pupillary reflexes were checked in order to determine the exact time of death. After the stopping of the functions above in order, the pupillary reflex test was applied to the sheep, and after the losing of the pupilla reflex due to accommodation paralysis it was decided that the death situation took shape.

According to the studies related with the time of death, scientists report that brain death takes shape in order to stop respiration and the loss of the pupillary reflexes (generally midriasis, occasionally miosis). Hip reflexes are rarely used as a helper parameter [27]. According to a study performed on rats, Stephen et al. [25], reports that the brain death occurs because of cerebral perfusion and the decrease of the arterial blood pressure and these situations cause the collapse and loss of corneal reflexes. Newhook and Blackmore [22], determined the exact time of death of 8 calves, by the losing of the corneal and palpebral reflexes and they indicated that the first insensibility existed 65 – 85 seconds after slaughtering and palpebral reflexes were not lost up to the 300th second after slaughtering was applied. The same scientists performed a similar study like us and they showed the reversible insensibility lasted after 18 – 42 seconds in sheep after the
head-only stunning procedure was applied (23). Parallel to Newhook and Black-borne, we determined that the reversible insensibility lasted 25 – 35 seconds after head only stunning technic was applied to the sheep. This situation takes about 15 seconds in pigs [2].

In our study, the determination of the exact time of death was based on the losses of the palpebral reflexes, arhythmies and stopping of the respiration, and lastly the inhibition of the pupillar reflexes due to accommodation paralysis in order. The processes were also recorded for recovery.

Taking shape of the exact time of death was about 138 seconds on the average for the first group according to the criteria indicated above. For the second group, this time interval was about 111,75 seconds on the average. These periods include the moment of inhibition of the last reflexes (pupillar reflexes) according to our criteria for the exact time of death. The inhibition of palpebral reflexes was about 70 seconds on the average and the stopping of respiration was about 118 seconds on the average for the first group. These values were 60 and 93 seconds in order for the second group.

Because the first two groups were the control groups of the 3rd and 4th group, and because the head-only stunning method was not applied to the 1st and 2nd group, the losses of the reflexes and the arhythmies and the stopping of the respiration could be observed clearly. However, a reversible insensibility situation took shape in group 3 and group 4 because the head-only stunning method was applied. The sheep in group 3 and 4 were slaughtered when they were insensible of pain so the reflexes that determine the exact death time could not be observed clearly, unlike in group 1 and group 2.

The sodium – potassium pump is responsible for the sodium and potassium gradients at both sides of the cell membrane. While the sodium is pumped out of the cell, the concentration of sodium in the cell is decreased fast, but the potassium concentration in the cell increases at the same speed of the decreasing concentration of sodium because of the pumping of potassium directly into the cell. This reaction moves ahead within the cells or neurons like a wave and transmission of the impulses is formed [16]. The autonomous nervous system controls the reflex arcs, and its working principle is based on electrical stimulation because of the repolarization and depolarization mechanisms existing in the sodium – potassium pump. We think that we could not determine the exact time of death of the groups to which the head-only stunning method was applied, because of the electrical current that is given to the animals. We believe that the autonomous nervous system was affected by the extra, non-physiologic and high voltage electric current and transmission problems occurred in the reflex arcs.

We found significant differences in some parameters according to the Duncan one way variance analysis and Spearman correlation analysis results. According to our results; we did not observe any significant differences in the live weight parameters among the groups. We attempted to form all the groups at the
most homogenous form for gathering the accurate data from the other parameters.

Significant differences were observed in the bleeding time parameter between group 1 and group 4. There were also significant differences between group 2 and group 3, group 2 and group 4, and, finally, between group 3 and group 4. We concluded that lowest value was analysed in group 4 because the vertical slaughtering method was applied and also the arteries close to the heart were cut. An another point according to our findings, there was no spasm in the sheep, included in group 4, because of pain insensitivity. So we believe that the bleeding time and total amount of blood parameters are inversely proportional each other.

In the total blood amount parameter, there are significant differences between group 1 and group 3, group 2 and group 3, group 1 and group 4, and, finally, group 2 and group 4. The total amount of blood values in group 3 was higher than in group 2. We think these results are due to the head only stunning method applied to group 3. When the stunning processes are applied, no spasms are observed in the white muscles, and no pain is perceived [17]. This procedure is in keeping with the directive of the European Council prepared for the welfare of the slaughtering animals accepted on the 22nd of December under the number 93/119/EEC, 1993 [8].

When considering the percent of the total amount of blood parameter, group 4 can be observed as the group that has the highest average level. Also, significant differences were determined between group 1 and group 4, and group 2 and group 4. These values strengthen our opinion that the slaughtering procedure must be combined with stunning.

In the time of death parameter, group 1 has the average time of 138 seconds, group 2 has the average time of 111.75 seconds. Unfortunately, the exact death times could not be determined clearly because of the head-only stunning application. Due to this situation, we cannot compare all the groups for this parameter.

For the Spearman correlation analysis among the parameters, negative and positive correlation results were revealed. According to these results;

A positive correlation result and a significant difference was found between live weight and the total blood amount. Because the blood amount of the body and live weight parameters are directly proportional each other, we think that this result is logical. Also, we observed a positive correlation between bleeding time and and live weight parameters.

A negative correlation existed between live weight and time of death parameters. According to Guyton [16], calcium is released from the synaptic terminals. The conditions causing the decrease of the calcium ions entering to the presynaptic terminals, will decrease the transmitters that are set free, too. Thus, there would exist the problem of the stepped up transmission of the impulses or the existing defects. The decreasing of the transmitters that are set free is due to
the depolarization of the presynaptic terminal by a weak action potential or a decrease in the permeability of the presynaptic terminal to the calcium ions, or a decreasing the calcium concentration in the extracellular liquid. According to all this information given above, we think that the negative correlation between the live weight and time of death parameters is due to the rapidly decreasing calcium ions in the body. We also think that the head-only stunning and slaughtering processes are the important parameters that effects the calcium concentration and the permeability of the presynaptic terminals.

We determined a positive correlation between the bleeding time and total amount of blood parameters. The total amount of blood would be increase due to bleeding time. We also determined a negative correlation between the bleeding time and time of death parameters. These correlation results are logical, in our opinion, in spite of the differences not being significant.

We observed a positive correlation and significant difference between the total amount of blood and the percent of the blood to the live body weight parameters. We were expecting a direct proportional result between these two parameters. A negative correlation existed between the total amount of blood and time of death parameters, but the difference was not significant.

There was a positive correlation between the percent of the blood to the live body weight and time of death parameters, but the difference between these parameters was not significant, either. We attribute this situation to the inhibition the synaptic transmitters of being set free due to decreasing calcium ions.

According to the obtained results, there are strong relationships between the parameters we analysed and the slaughtering processes. It is important to apply stunning applications both for the welfare of the slaughtering farm animals and the parameters like, bleeding time, time of death, total amount of bleeding. Also, the quality of meat and its products is directly related with the bleeding time and the total amount of bleeding parameters. The application of vertical slaughtering technics with stunning processes would be useful for the welfare of farm animals.

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References / Literatura


UTICAJ RAZLIČITIH METODA KLJANJA NA VREME SMRTI JAGNJADI DAGLIC RASE

E. Dümen, T. Kahraman

Materijal u ovom dobijen je od 80 mužjaka ovaca Daglic rase starih 8 meseci. Ovce su bile podeljene u 4 grupe. Ovce prve grupe zaklane su u horizontalnom položaju i bez omamljivanja. Ovce druge grupe zaklane su u vertikalnom položaju i bez omamljivanja. Procedura omamljivanja samo preko glave primenjena je kod treće grupe i ovce su omamljivane u horizontalnom položaju. Ovce četvrte grupe su zaklane u vertikalnom položaju pošto
je primenjena metoda omamljivanja samo u predelu glave. U skladu sa dobijenim rezultatima, vreme iskrvarenja, ukupna količina krvi, živa težina, i procenat ukupnih parametara krvi značajno su se razlikovali izmedju grupa. Važno je primenjavati postupak omamljivanja zbog dobrobiti farmskih životinja koje se kolju. Takodje, kvalitet mesa i proizvoda od mesa je u direktnoj korelaciji sa vremenom iskrvarenja i ukupnom količinom parametara iskrvarenja.

Ključne reči: jagnjad daglik rase, metode klanja

ВЛИЯНИЕ РАЗЛИЧНЫХ МЕТОДОВ УБОЯ НА ВРЕМЯ СМЕРТИ ЯГНЯТ ДАГЛИЦ ПОРОДЫ

Е. Думен, Т. Кахрамана

Материал в этом получен из 80 самцов овец Daglic породы им 8 месяцев. Овцы были разделены в 4 групп. Овцы первой группы убиты в горизонтальном положении и без обольщения. Овцы второй группы убиты в вертикальном положении и без обольщения. Процедура обольщения только поверх головы применена у третьей группы и овцы обольщены в горизонтальном положении. Овцы четвёртой группы убиты в вертикальном положении после того как применён метод обольщения только в пределах головы. В соответствии с полученными результатами, время окровавления, совокупное количество крови, живой вес, и процент совокупных параметров крови значительно различались среди групп. Важно применять поступок обольщения из-за благосостояния ферменных животных, убиющих. Также, качество мяса и продуктов из мяса в прямой корреляции с временем окровавления и совокупным количеством параметров окровавления.

Ключевые слова: ягнят daglic породы, методов убоя