# EFFECTS OF DRY AND WET AGING ON MICROBIAL QUALITY OF FRESH BEEF

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**Abstract – The objective of this experiment was to determine the effects of dry and wet aging techniques on microbial quality of fresh meat. Plate, ribeye rolls and short loins from 270-360 kg live weight (n=30) carcasses were assigned and after 24 h postmortem at 4 ˚C samples were divided into two group to be aged dry and wet aged for 7,14,21 and 28 d. Aging conditions were set at 1.0 ± 2.0ºC, relative humidity 83 ± 11 %. To determine the microbiological quality the analyses of total aerobic plate counts, yeast and molds, *Staphylococcus aureus, Escherichia coli O157 H7, Salmonella* and *Listeria monocytogenes* were performed. During the aging period total aerobic plate counts, yeast and molds were increased (p<0,05), *E.coli(O:157 H:7), S aureus, Salmonella* ve *Listeria monocytogenes* were not determined in the samples. The samples that aged during 28 d were unable to eat. As a result it is determined that aging technique and aging time affected microbial characteristic of meat.**

**Key Words – Beef, Dry aging, Microbial quality, Wet aging**

- INTRODUCTION

The most important beef attributes that are encompassed within the term "palatability" are flavor and tenderness and fresh meat is aged to enhance the palatability of the product [1]. Holding meat for an extended period in a chilled state immediately after slaughter is known as aging and, results in flavor development and more tender meat [2, 3, 4, 5, 6]. Changes occurring with aging are the sum of a number of biochemical reactions, principally proteolysis, which can continue at chilled temperatures [7].

There are two fundamental methods of aging: wet aging, is storing beef cuts in vacuum packages and dry aging refers to storing beef carcasses or wholesale cuts without any type of protective packaging [8, 9, 10].

Although there have been some reports about aging there is still little information about the microbial quality of dry yor wet aged beef. Therefore in this study it is aimed that to determine the microbial effects of dry and wet aging process.

## MATERIALS AND METHODS

### *Samples*

Plate, ribeye rolls (*M.longissimus dorsi*) and short loins from 270-360 kg live weight (n=30) carcasses were assigned and after 24 h postmortem at 4 ˚C samples were divided into two group to be aged dry and wet aged for 7,14,21 and 28 d. Sample group designated for dry aging were placed on stainless steel shelves with bones and without any packing. Those designated wet aging were vacuum packed with appropriate material for food and at every analyse day vacuum packed again after taking the needed amount of sample. All the samples were achieved to be transferred with cold chain.

### *Aging Conditions*

Aging conducted at temperature of 1.0 ± 2.0ºC, and humidity 83 ± 11 %. Both group aged for 28 d. Analyses were performed 0., 7., 14., 21. and 28. day of aging .

*Microbial Analyses*
Microbiological analyses were performed according to FDA BAM 2001/2002/2003 and ISO 6579:2002 (11,12,13,14). 25 g of sample from the fat and lean surfaces, were removed aseptically for microbial testing diluated in 225 mL sterile peptone water and plated to determine total aerobic plate counts, yeast and molds, *Staphylococcus aureus, Escherichia coli O157 H7, Salmonella* and *Listeria monocytogenes.* Results of counts were given in terms of log10 cfu g−1 of product.

*Total Aerobic Plate Counts*

For total aerobic plate counts, 1 ml of inoculum
was transferred in PCA using pour plate technique and incubated at 35 ˚C for 48 h at aerobic conditions. After incubation *Total Aerobic Plate Counts* were determined considering dilution factor [11].

*Yeast Moulds*

0,1 ml of homogenized mix prepared 25 g of sample and 225 ml pepton water was transferred in DRBC using pour plate technique. After incubation at 25˚C 5 d colonies were counted. [11].

*Staphylococcus aureus*

BPA was used and incubation was at 35 ℃'de 48 h. using pour plate technique[11].

*Escherichia coli O157 H7*

225 ml of modified soy broth was added 25 g of sample. After VCCS supplement was added, using Mcconcey, incubated at 35 ˚C for 24 h. and examined typical colonies of *Escherichia coli O157 H7* [12].

*Listeria monocytogenes*

25 g of sample were diluted 225 g of Froser Broth and incubated at 30℃'de 16-24 h. 0,1 ml of sample was transferred in ready BLEB tubes 10 ml. After incubation at 30℃'de for 16-24 h. 2 ml of sample was placed in water bath at 80 C for 20 min [13].

*Salmonella*

For isolation of *Salmonella* the rest *of* homogenized mixture was incubated at 35 ˚C for 24 h. for pre-enrichment. Then 1 ml of homogenized mixture was transferred in MKTT and incubated at 35 ˚C for 24 h, 0,1 ml of sample was transferred in RVS and incubated at 41-42 ℃' for 24 h. Typical colonies of *Salmonella* have a black centre and a lightly transparent zone were examined grown on XLD and BGA [14].

*Statistical Analyse*

The experiment was designed with 3 replications. The treatment structure was a 3x2x5 factorial design with three different muscle (plate, ribeye rolls and short loins) two aging methods (dry aging and wet aging) and five aging periods (0, 7, 14, 21, and 28 d). SPSS (1999) was used to perform the effects of the variables and mean comparisons when effect

was significant (P < 0.05), were done by Duncan [15].

- RESULTS AND DISCUSSION

As a result of microbiological analyses that we carried out *E.coli(O:157 H:7), S aureus*, *Salmonella* ve *Listeria monocytogenes* were not detected.

The aerobic mesophilic count datas in dry and wet aged samples at different aging days were given at Table 1. It is observed that all application factors and interactions affected the total number of mesophilic bacteria (p<0,001) and during the aging period aerobic mesophilic loads were increased. The aerobic mesophilic count ranged from 3,06 to 8,63 log10 cfu $g^{-1}$ in dry aged samples, from 3,06 to 9,47 log10 cfu $g^{-1}$ .

The aerobic mesophilic loads of ribeye rolls at 28. d of aging were not countable. All the samples at 28. d of aging were not consumable and the loads were higher than the rescript of microbiology criterias. It is thought that the natural structure of meat cause this. In addition high moisture content, being rich in minerals and nutrigenous nutrients, to some extend fermented carbohydrates content and convenient pH value for microorganism developing meat can easily spoilage was stated by Alperden (1993) [16].

Microbial growth on the surface of fresh meat is the most important reason decrease the quality of meat. In this study total aerobic mesophilic count of dry aged samples were lower than the wet aged. It is thought that this is resulted from drying and stratification on the surface of dry aged samples. Kayaardı (1999) stated that microorganisms grown on the surface of meat can protective effect for the interior [17].

High total aerobic mesophilic count of wet aged samples is related to easy spoilage of meat at anaerobic conditions. Öztan, (1999) mentioned that however *Pseudomonas* initiate proteolitic activitate and effect the free amino acid and carbohydrate degredation, they also change the microbial properties too [18]. All application factors and interactions affected the yeast and moulds (p<0,001). The ranges for yeast and moulds in dry and wet aged samples were 2,60-4,00, 2,30-4,20 $\log_{10}$ cfu $g^{-1}$.

Table 1 Results of total aerobic mesophilic count in the dry aged samples analyzed during aging period

| | *0* | *7* | *14* | *21* | *28* |
|---|---|---|---|---|---|
| (*M.multidus dorsi)* | $3,06^{a,A}$ | $3,47^{a,B}$ | $4,32^{a,C}$ | $7,88^{D}$ | - |
| *M.longissimus dorsi)* | $3,31^{b,A}$ | $3,85^{b,B}$ | $4,93^{b,C}$ | $7,92^{D}$ | $8,63^{b,E}$ |
| *Plate* | $3,74^{c,A}$ | $3,98^{c,B}$ | $4,25^{a,C}$ | $7,81^{D}$ | $7,93^{a,E}$ |

$^{a,b,c}$Means in the same column with different superscripts differ significantly at P < 0.05

$^{A,B,C}$Means in the same row with different superscripts differ significantly at P < 0.05

Table 2 Results of total aerobic mesophilic count in the wet aged samples analyzed during aging period

| | *0* | *7* | *14* | *21* | *28* |
|---|---|---|---|---|---|
| (*M.multidus dorsi)* | $3,06^{a,A}$ | $4,45^{b,C}$ | $4,28^{b,B}$ | $8,95^{b,D}$ | - |
| *M.longissimus dorsi)* | $3,31^{b,A}$ | $3,83^{a,B}$ | $4,98^{c,C}$ | $8,91^{b,D}$ | $9,03^{a,D}$ |
| *Plate* | $3,74^{c,A}$ | $3,84^{a,A}$ | $4,06^{a,B}$ | $8,69^{a,C}$ | $9,47^{b,D}$ |

$^{a,b,c}$Means in the same column with different superscripts differ significantly at P < 0.05

$^{A,B,C}$Means in the same row with different superscripts differ significantly at P < 0.05

In general yeast and moulds increased during the aging period in both dry and wet aged samples except at 14. day. and similar results were found by other researhers (19) It is associated with the exterior layer ormed during aging. Dry aging decrease the microbial load of carcass surface (20, 21). In their study 265 head of beef were sampled from Twenty-two very small state-inspected beef processing facilities. The interventions studied included dry aging (multiday refrigeration without water spray-chilling), acid spray, Fresh BloomTM spray, and 2 typesof hot water washing for determining *E. coli*, coliforms, Enterobacteriaceae, and aerobic plate count.
The 4-d dry aging treatment was the most effective at reducing the prevalence of *E. coli*, although only 9 carcasses were treated this way. Dry-aging resulted in the largest decrease of coliform too.

Table 3 Results of yeasts and moulds in the dry aged samples analyzed during aging period

| | *0* | *7* | *14* | *21* | *28* |
|---|---|---|---|---|---|
| (*M.multidus dorsi)* | <1 | $4{,}30^{b,C}$ | $4{,}00^{c,B}$ | $3{,}00^{a,A}$ | - |
| *M.longissimus dorsi)* | <1 | $3{,}78^{a,C}$ | $2{,}60^{a,A}$ | $3{,}30^{b,B}$ | $3{,}95^{b,C}$ |
| *Plate* | <1 | $4{,}30^{b,D}$ | $3{,}36^{b,A}$ | $3{,}60^{c,B}$ | $3{,}75^{a,C}$ |

$^{a,b,c}$Means in the same column with different superscripts differ significantly at $P < 0.05$

$^{A,B,C}$Means in the same row with different superscripts differ significantly at $P < 0.05$

Table 4 Results of yeasts and moulds in the wet aged samples analyzed during aging period

| | *0* | *7* | *14* | *21* | *28* |
|---|---|---|---|---|---|
| (*M.multidus dorsi)* | <1 | $4{,}30^{c,C}$ | $2{,}30^{a,A}$ | $3{,}82^{3B}$ | - |
| *M.longissimus dorsi)* | <1 | $3{,}84^{b,B}$ | $3^{b,A}$ | $3{,}83^{3B}$ | $4{,}30^{a,C}$ |
| *Plate* | <1 | $3{,}30^{a,A}$ | $3{,}78^{c,A}$ | $3{,}91^{3A}$ | $4{,}51^{b,B}$ |

$^{a,b,c}$Means in the same column with different superscripts differ significantly at $P < 0.05$

$^{A,B,C}$Means in the same row with different superscripts differ significantly at $P < 0.05$

- CONCLUSION

Microbial quality of the samples dry and wet aged for 28 d was decreased. However the aerobic mesophilic count was decreased after 14. d. partially at 28. d no sample was consumable.

It is known that consumers are willing to pay more for guaranteed tender beef products,especially spesific meat consumers find dry or wet aged meat more tender and palatable and tend to pay more for this choice (22,23). Nevertheless they are suspicious about the propriety of microbial quality of these aging methods.

Finally, it is stated that researchers should continue to study to improve microbial quality of dry and wet aging techniques .

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