EFFECT OF SLAUGHTERING METHODS ON MEAT QUALITY INDICATORS, CHEMICAL CHANGES AND MICROBIOLOGICAL QUALITY OF BROILER CHICKEN MEAT

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ABSTRAK

Penyembelihan adalah proses mematikan binatang untuk penghasilan daging. Ia melibatkan pengaliran darah keluar dan jumlah darah yang tertinggal bergantung kepada keberkesanan penyembelihan. Eksperimen telah dijalankan untuk menentukan kesan kaedah penyembelihan pada petunjuk kualiti daging dan perubahan yang berlaku pada daging ayam semasa penyimpanan sejuk. Sebanyak enam puluh ayam daging yang lebih kurang sama berat nye dan kategori umur yang boleh dipasarkan telah disembelih menggunakan kaedah Halal (HM) dan kaedah yang tidak halal (NHM). Dalam eksperimen pertama, kesan kaedah penyembelihan dinilai pada petunjuk kualiti daging umum seperti pH, warna (L *, a*, b*), kehilangan "drip" dan tekstur. Adalah diperhatikan bahawa daging dada ayam yang disembelih menggunakan NHM menunjukkan dengan berkesan ($P \leq 0.05$) pH yang lebih tinggi (6.17) pada 24 jam"post mortem", nilai L * (52.07), a* (8.36), b* (19.20) yang lebih tinggi dan kehilangan "drip" yang lebih besar (0.58%) daripada ayam yang disembelih menggunakan HM. Tiada perbezaan yang ketara ($P \geq 0.05$) dicatatkan bagi tekstur (daya ricih) dan kehilangan memasak menggunakan kaedah penyembelihan yang digunakan. Semua parameter yang diukur menunjukkan bahawa, ayam yang disembelih kaedah NHM mengalamai tekanan penyembelihan dan pH yang tinggi dan nilai a* yang tinggi merupakan petunjuk sisa darah dalam daging ayam yang disembelib secara NHM. Kesan penyembelihan HM dan NHM terhadap perubahan kimia semasa 9 hari penyimpanan daging ayam pada 4°C menunjukkan bahawa kandungan zat besi hem menurun dengan masa penyimpanan tetapi nilai-nilai yang diperolehi bagi HM ternyata ($P \leq 0.05$) lebih rendah berbanding NHM. Nilai bahan reaktif asid thiobarbituric (TBARS) iaitu nilai yang digunakan untuk menentukan sejauh mana pengoksidaan lipid dalam sampel daging semasa 9 hari penyimpanan sejuk menunjukkan nilai yang ketara ($P \leq 0.05$) lebih rendah untuk HM berbanding NHM. Degradasi protein sampel daging semasa penyimpanan sejuk dinilai menggunakan SDS-PAGE menunjukkan corak yang sama pada kedua-dua HM dan NHM dengan berat molekul yang terdiri dari 44 kepada 146.8KDA pada hari pertama. Walau bagaimanapun, garis protein tambahan telah diperolehi pada hari 9 penyimpanan dari kedua-dua sampel HM (dari 29.1 kepada146.8KDa) dan NHM sampel (dari 7.7 kepada 146.8KDa). Kualiti mikrobiologi sampel daging ditentukan daripada jumlah kiraanjumlah bakteria aerobik dan jumlah bakteria asid laktik menunjukkan bahawa sampel daging NHM mencatat lebih tinggi ($P \leq 0.05$) kiraan mikrob semasa tempoh penyimpanan 9 hari berbanding dengan sampel daging HM. Identifikasi genotip bakteria asid laktik yang merupakan bakteria perosak utama dalam sampel daging ayam sewaktu penyimpanan pada 4°C menunjukkan *Enterococcus* spp. sebagai genus paling utama dalam sampel NHM. Keputusan yang diperolehi daripada kajian ini menunjukkan bahawa kaedah penyembelihan mempunyai pengaruh yang besar ke atas daging dan kualiti daging dari ayam daging.

ABSTRACT

Slaughtering is the process of killing an animal for meat production. It involves blood drainage and the amount of blood retained is dependent on the effectiveness of slaughter. Experiments were conducted to determine the effect of slaughtering methods on meat quality indicators and changes that occur in broiler chicken meat during refrigerated storage. A total of sixty broiler chickens of approximately the same weight and of marketable age were slaughtered using the Halal method (HM) and the Non-halal method (NHM). In the first experiment, the effect of slaughtering methods was evaluated on the general meat quality indicators such as pH, colour (L*, a*, b*), drip loss and texture. It was observed that breast meat of chicken slaughtered using the NHM showed significantly ($P \leq 0.05$) higher pH (6.17) at 24 h post mortem, higher L*(52.07), a*(8.36), b*(19.20) values and greater drip loss (0.58%) than those chicken slaughtered using the HM. No significant differences ($P \geq 0.05$) were recorded for the texture (shear force) and cooking loss as a result of method of slaughtering used. All these parameters measured showed that the birds slaughtered by NHM experienced slaughter stress and high pH and high a* value is an indicator of residual blood in the poultry meat slaughtered by NHM. The effect of slaughtering by HM and NHM on chemical changes of chicken meat during 9 d storage at 4°C showed that haem iron content of chicken meat decreased with storage time but the values obtained for HM were significantly ($P \leq 0.05$) lower compared to NHM. The thiobarbituric acid reactive substances (TBARS) value which was used to determine the extent of lipid oxidation in meat samples during 9 days refrigerated storage showed a significantly ($P \leq 0.05$) lower value for HM compared to NHM. Protein degradation of meat samples during refrigerated storage evaluated using the SDS-PAGE showed similar patterns in both HM and NHM with molecular weight ranging from 44 to 146.8KDA at day 1. However, additional protein bands were obtained at day 9 of storage from both HM samples (from 29.1 to 146.8KDa) and NHM samples (from 7.7 to 146.8KDa).The microbiological quality of the meat samples determined from total aerobic and lactic acid bacteria counts indicated that NHM meat samples recorded significantly higher ($P \leq 0.05$) microbial count during the 9 days storage period compared to HM meat samples. Genotypic identification of lactic acid bacteria which is a major spoilage bacteria in chicken meat samples under storage at 4°C showed *Enterococcus* spp as the most predominant genera in NHM samples. The results obtained from this study showed that methods of slaughtering had a significant influence on the meat and keeping quality of meat from broiler chicken.

الملخص

الذبح هو عملية قتل الحيوان لإنتاج اللحم. أنها تنطوي على تصريف الدم وكمية الدم الاحتفاظ يعتمد على فعالية الذبح. وقد أجريت تجارب لتحديد تأثير أساليب الذبح على مؤشرات جودة اللحوم والتغيرات التي تحدث في لحم الدجاج اللاحم خلال التخزين المبرد. تم ذبح ما مجموعه وطريقة (HM) ستين الدجاج اللاحم حوالي نفس الوزن والعمر للتسويق باستخدام طريقة الحلال في التجربة الأولى، تم تقييم تأثير طرق الذبح على مؤشرات جودة اللحوم .(NHM) غير حلالا ، و*، ب *)، وفقدان بالتنقيط والملمس. ولوحظ أن * L) العامة مثل الرقم الهيدروجيني، اللون أعلى درجة (P≤0.05) بشكل ملحوظ NHM لحم الصدر من الدجاج ذبح باستخدام أظهرت ، و* (8.36)، (ب) * (52.07) * L الحموضة (6.17) في 24 ساعة بعد الوفاة، أعلى لم .HM (19.20) والقيم خسارة أكبر بالتنقيط (0.58٪) من تلك الدجاجة المذبوحة باستخدام للنسيج (قوة القص) وفقدان الطهي نتيجة (P≥0.05) تسجل أية فروق ذات دلالة إحصائية لطريقة الذبح المستخدمة. وأظهرت كل هذه العوامل التي تم قياسها أن الطيور المذبوحة من قبل شهدت الإجهاد الذبح ودرجة الحموضة العالية وارتفاع قيمة * هو مؤشر على الدم NHM أظهر تأثير ذبح من قبل صاحب الجلالة .NHM المتبقي في لحوم الدواجن المذبوحة قبل أن محتوى °C على التغيرات الكيميائية من لحوم الدجاج خلال 9 د التخزين في 4 NHMو الحديد هيم من لحوم الدجاج انخفض مع مرور الوقت التخزين ولكن كانت القيم التي تم الحصول أظهرت قيمة حمض .NHM أقل مقارنة (P≤0.05) بشكل ملحوظ HM عليها عن التي تم استخدامها لتحديد مدى أكسدة الدهون في (TBARS) المواد المتفاعلة thiobarbituric مقارنة HMانخفاض قيمة لل (P≤0.05) عينات اللحوم خلال 9 أيام المبردة تخزين ومعنويا SDS- أظهر تدهور البروتين في عينات اللحوم خلال التخزين المبرد تقييمها باستخدام .NHM مع الوزن الجزيئي تتراوح ما بين 44 إلى HM وNHM أنماط مماثلة في كل من PAGE في اليوم 1. ومع ذلك، تم الحصول على العصابات البروتين إضافية في يوم 9 من 146.8KDA من 7.7 إلى) NHM وعينات (KDaعينات (من 29.1 إلى 146.8 HM التخزين من كلا وأشارت الجودة الميكروبيولوجية لعينات اللحوم تحدد من العدد الكلى للبكتريا .(146.8KDa العد (P≤0.05) سجلت أعلى بكثير NHM حمض اللاكتيك الهوائية وأن عينات اللحوم أظهر تحديد الوراثي للبكتريا .HM الميكروبي خلال فترة التخزين 9 أيام مقارنة عينات اللحوم حمض اللاكتيك التي هي نوع من البكتيريا فساد كبيرة في عينات لحم الدجاج تحت التخزين في وأظهرت النتائج المتحصل .NHM المعوية النباية باعتبارها جنسا أكثر السائد في عينات 4oC عليها من هذه الدراسة أن أساليب الذبح كان لها تأثير كبير على اللحوم وحفظ نوعية اللحوم من الدجاج اللاحم

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LIST OF ABBREVIATIONS AND SYMBOLS

µL	microliter
^0C	Degree Celsius
a*	redness
AC	Alternate current
AChE	Acetylcholine esterase
AMPK	Activated protein kinase
APS	Ammonium persulfate
ATP	Adenosine triphosphate
b*	yellowness
BSA	Bovine serum albumin
C*	Chroma
$CaCO_3$	Calcium carbonate
CAS	Control atmosphere stunning
cfu/cm^2	colony forming unit/centimeter squared
CFU/g	Colony forming unit/grammie
CIE	International Commission on Illumination
cm	Centimetres
CO_2	Carbon dioxide
DC	Direct current
ddH_2O	Distilled water
DFD	Dark firm dry
dH_2O	Deionised water
DNA	Deoxyribonucleic acid
FAO	Food and Agricultural Organization
FG	Fast glycolysing
FTG	Fast twitch glycolytic

FTO	Fast twitch oxidative glycolytic
g	Grammes
G6P	Glucose 6 phosphate
GAPDH	Glyceraldehyde 3-phosphate dehydrogenase
GC-MS	Gas chromatography-mass spectrometry
h	Hours
H*	Hue
H_2O	Water
H_2O_2	Hydrogen peroxide
HCL	Hydrochloric acid
HM	Halal Method
HNO_3	Trioxonitrate (V) acid
Hz	Hertz
kb	kilobyte
Kcal	Kilocalories
Kcal/kg	Kilocalories/kilogramme
KDa	Kilodalton
Kg	Kilogramme
Kg/g	Kilogramme/gramme
Km	Kilometers
L*	Lightness
mA	milliampere
MDA	Malonaldehyde
MDA/kg	Malonaldehyde/kilogramme
Mg	Milligramme
mg/g	Milligramme/gramme
mg/kg	Milligramme/kilogramme
mg/ml	Milligramme/milliliter
MJ/kg	Megajoules per kilogram

ml	millilitres
mL/kg	millilitres/kilogramme
mM	millimollar
Mmol/g	millimole/gramme
MRS	Man, Rogosa and sharpe agar
N	Newton
NG	Normal glycolysing
NHM	Non-Halal Method
nm	Nanometre
NMJ	Neuromuscular junction
PCA	Plate count agar
PCR	Polymerase chain reaction
pH_u	Ultimate pH
ppm	part per million
PSE	Pale Soft Exudate
PSS	Porcine stress syndrome
PUFA	Poly-unsaturated fatty acid
rDNA	Recombinant Deoxyribonucleic acid
rpm	revolution per minute
SDS	Sodium Dodecyl Sulphate
SDS-PAGE	Sodium Dodecyl Sulphate Polyacrylamide Gel Electrophoresis
sec	Seconds
STO	Slow-twitch oxidative
TBA	Thiobarbituric acid
TBARS	Thiobarbituric Acid Reactive Substances
TCA	Trichloroacetic acid
TEMED	Tetramethylethylenediamine
TVC	Total Viable Count
WBP	Water binding potential

WHC	Water holding capacity