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Effect of Different Periods of Feed Withdrawal Before Slaughtering in Two Broiler Strains on Meat Quality

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ABSTRACT

The purpose of this study was to evaluate the effects of different feed withdrawal (FW) periods(0, 4, 8 and 12 h) on live broiler weight loss, dressed chilled carcass yields, and meat chemical composition in both breast meat and thigh of two broiler strains(Ross-308 and Hubbard) , A total number of 64 broiler chickens at 36 days were used equally in two strains Ross-308 and Hubbard , each strain contains 4 treatments and 8 replicates. Broiler chickens in control group (T1 without feed withdrawal, T2 , T3 and T4 were fasted to 4 , 8 and 12 hours before slaughtering respectively .

The effect of feed withdrawal before slaughtering in broilers is presented significantly Percentages of SFW increased($P<0.05$) linearly with time, from 1.65% at the FW period of 4 h to 3.50% at 12 h, The initial pH1 values of the meat were determined immediately after slaughtering and the final pH2 values after a 24 hour cooling period. were determined in the both strains Ross-300 and Hubbard in spite of reduce pH2 values with compared pH1 values, While the results showed no significant differences in each part of carcass percentage and meat chemical composition among treatments and between the two strains (Ross 308 and Hubbard).

تأثير تجويع الطيور لفترات مختلفة لسلالتين فروج اللحم في نوعية اللحم

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الخلاصـة

أجريت هذه التجربة في حقل دجاج فروج اللحم في كردتةشة بكلية الزراعة –جامعة صلاح الدين– أربيل (كردستان العراق) للفترة من 2011/10/1 ولغاية 2011/11/6 على سلالتين في فروج اللحم Ross-308 و Hubbard بعمر 36 يوما. هدفت هذه التجربة الى دراسة تأثير تجويع الطيور لفترات المختلفة (0 ، 4 ، 8 ، 12) ساعة على فقدان وزن الجسم الحي و نوعية الذبيحة و تقدير pH1 بعد الذبح مباشرة و pH2 بعد 24 ساعة من التجميد اللحم لسلالتين من فروج اللحم أضافة الى ذلك تأثيرها على التركيب الكيمياوى للحم .

أظهرت النتائج إرتفاعا معنويا ($p<0.05$) في فقدان وزن الجسم مع زيادة فترة التجويع من 1.65 % الى 3.5 % للفترات الزمنية المختلفة (4و 12) ساعة . ولم توجد أية فروق معنوية بين السلالتين Ross-300 و Hubbard و المعاملات في صفة نسبة كل جزء من اجزاء الذبيحة و التحليل الكيمياوي للحم عضلات الصدر و الفخذ .

الكلمات المفتاحية :
تجويع ، الطيور ، فترات مختلفة ، فروج اللحم ، نوعية اللحم .

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Introduction

Poultry sector is one of the most vibrant segments of agriculture sector in Iraq. Currently, Removal of feed and water from market-aged broilers before catch and live haul is a standard management practice that has been used by the poultry industry for more than 40 years. During this feed withdrawal time, broilers will evacuate their digestive tracts, and carcass contamination in the plant will be reduced.(Northcutt , *et al* , 2000) Although 10 to 12 h of FW is sufficient to minimize carcass contamination and yield loss (Veerkamp, 1986).

Weight loss by the birds during the period between FW and processing called as live shrink or shrinkage (Bilgili, 2002). After broilers have been without feed for more than 6 h, they begin to draw moisture and nutrients from their own body tissues and this weight loss may then affect edible yield (Northcut, *et al.* 2000). The degree of shrinkage caused by FW (SFW) affected by bird age, gender, diet density, house environmental control, ambient temperature, length of FW, transportation, and plant holding conditions (Bilgili, 2002). Feed withdrawal periods linearly correlate with carcass yields before, and after carcass chilling (Lyon *et al*., 1991). Broiler dehydration during FW and transport, besides causing weight loss, may affect the physical and chemical characteristics of the meat. Several events pre slaughter have an influence on poultry processing efficiency including feed and water withdrawal, catching methods, transportation system, distance to the plant and plant holding conditions, which are significant factors effecting poultry slaughter quality (Bilgili, 1995). Because of the increase in volume of deboned chicken cuts and further processing, the effects of FW on fillet pH, and chemical composition have become the focus of attention for several researchers (Ali *et al*., 1999; Berri, 2000; Castillo *et al*., 2007).

evaluated the relation between glycogen and pH and found that chicken meat with high glycogen concentration presented pH 6.2 therefore the highest glycogen level was related to more acid meat as low pH 24 post mortem is related to PSE (pale, soft, exudative) meat. According to Kotula and Wang (1994) glycogen levels decrease as fasting time increases as they found that 0 hour and 36 hours of fasting resulted in glycogen values at 0 hour post mortem of 7 mg/g and 3.5 mg/g respectively.

the present study investigated the influence of varying lengths of starving periods on quality attributes of chicken meat and to define the best FW period and their effect on meat chemical composition .

Materials and methods

The experiment was conducted with 32 thirty two at 36 day old broiler chicks (Ross 308) and 32 thirty two at 36 day old broiler chicks (Hubbard). In each strain the chicks were used for 4 treatments, the treatments contain 4 replicates (8 chicks). in Ross-308 and Hubbard chicks fasted to 0 , 4, 8 , 12 hours before slaughter respectively , when T1 control treatment in both strain. Feed and water were supplied ad libitum, its content 3003 , 2968 , 2985 kcal/kg metabolic energy, 21 , 19.75 , 20.35% crud protein

Throughout the experiment, feeding regimen was similar for all groups, except at the day before slaughter. At the 36th day, birds were withdrawn from feed for 0, 4, 8, and 12 hours, respectively. Slaughter took place at the same time for all birds. For every single bird the time of feed withdrawal was calculated. In order to exclude a possible influence of stress, the chickens were stunned and slaughtered immediately after being taken out of the pens. At the end of the bleeding process the body weight was determined. Subsequently , inner organs and the abdominal fat pad were removed. Afterwards carcasses were weighted again to get the eviscerated weight (warm) with inner organs . After a 24 hour cooling period eviscerated weight(cold) with inner organs were recorded.

The initial pH1 of the breast meat were determined immediately after slaughtering and the final pH2 after a 24 hour cooling period. According to (Olivo *et al* ,2001)

Carcass Yields
The percentages of weight loss during FW, and the dressed carcass yield (DCY) and chilled carcass yield (CCY) were calculated as shown below:
SFW (%) =□(WBFW −□WAFW)/WBFW*100
DCY (%)=□DCW/WAFW *100 and
CCY (%) =□CCW/WAFW *100
where WBFW is live broiler weight before FW WAFW is live weight after FW, DCW is dressed carcass weight, and CCW is chilled carcass (Castillo, 2007)
All data were analyzed by using the General Linear Models procedure (SAS, 1996) to study the effect of treatments and strains according to Factorial –CRD (4*2) experiment (two way with interaction), significant differences among the means of the levels of each factor were determined by Duncan multiple range test .

Results and Discussion

The effect of feed withdrawal before slaughtering on broiler strains is presented in Table (1) no significant difference ($P<0.05$) in body weight before feed withdrawal and body weight after feed withdrawal among treatments at 36 days and also between two strains Ross-308 and Hubbard , indicating that the different batches of broilers used in the replicates of the study were approximately similar , at the same table showed that shrinkage percentage due to feed withdrawal differ significantly ($P<0.05$) among treatments, better shrinkage percentage was found in T4 and lower in treatment T1 the result was agreement with the findings of (Castillo, *et al*, 2007) , Live SFW over the first hours of the FW periods was probably attributable to the loss of gastrointestinal contents, gradual and significant ($P \leq 0.05$) increase in SFW was observed as the hours of FW increased. Percentages of SFW increased linearly with time, from 1.65% at the FW period of 4 h to 3.50% at 12 h , the results showed none significant differences in warm carcass weight and cold carcass weight and their dressing percentages among treatments , it is accepted by (Turkyilmaz *et al*, 2006) and also there were no significant differences between the two strains Ross-308 and Hubbard in previous traits .

The higher SFW values at the 12 and more FW periods might be due to broiler dehydration and to the metabolism of body tissues to obtain energy for maintenance, as hypothesized by(Salmon , 1979) .
In Table (2) showed none significant differences among treatments in pH1 and pH2 , but the pH1 values is higher than PH2 According to (Delezie *et al* , 2007) . evaluated the relation between glycogen and pH and found that chicken meat with high glycogen concentration presented pH 6.2 therefore the highest glycogen level was related to more acid meat as low pH 24 post mortem is related to PSE (pale, soft, exudative) meat. According to Kotula and Wang (1994) glycogen levels decrease as fasting time increases as they found that 0 hour and 36 hours of fasting resulted in glycogen values at 0 hour post mortem of 7 mg/g and 3.5 mg/g respectively.

Table 1. effect of feed withdrawal on broiler body weight and dressing percentage .

Strains	Treat-ments	WBFW	WAFW	SFW %	Warm Carcass weight /g	Cold carcass weight /g	DCY %	CCY %
Ross-308	T1	2123.29	2123.29	0 d	1590	1645	74.883	77.47
	T2	2128.28	2093.27	1.61 c	1491	1553.3	71.22	74.20
	T3	1993.31	1940.12	2.66 b	1416.7	1473.3	73.021	75.93
	T4	2113.34	2041.21	3.41 a	1500	1570	73.48	76.91
Hubbard	T1	1983.31	1983.31	0 d	1495	1516.7	75.37	76.47
	T2	2173.36	2134.36	1.79 c	1590.7	1633.33	74.52	76.52
	T3	2174.87	2123.34	2.36 b	1603.21	1639	75.50	77.18
	T4	2313.28	2230.05	3.59 a	1623.3	1706.7	72.79	76.53
	S.E	163.05	162.46	0.16	120.17	129.47	1.21	0.89
Treatment effect	T1	2053.28	2053.28	0 d	1542.50	1580.85	75.12	76.99
	T2	2150.78a	2113.81a	1.65 c	1540.85	1593.31	72.89	75.37
	T3	2084.21	2031.73	2.53 b	1509.95	1556.15	74.31	76.59
	T4	2213.30	2135.63	3.50 a	1561.65	1638.35	73.12	76.61
	S.E	144.77	107.12	1.44	104.39	110.27	0.95	0.20
Strains effect	Ross-308	2089.58	2049.47	2.56 a	1499.42	1560.40	73.16	76.13
	Hubbard	2161.25	2117.76	2.58 a	1578.05	1623.93	74.51	76.68
	S.E	70.81	70.87	0.14	60.94	64.16	0.11	0.11

T1: control , T2 :feed withdrawal 4 hours before slaughtering , T3 : feed withdrawal 8 hours before slaughtering and T4 : feed withdrawal 12 hours before slaughtering .
Different letters in the same column indicate a statistical difference ($P < 0.05$).
WBFW = weight before feed withdrawal; WAFW = weight after feed withdrawal; SFW = shrinkage due to feed withdrawal;
DCY = dressed carcass yield; CCY = chilled carcass yield; DCW = dressed carcass weight; and CCW = chilled carcass weight.

Table 2. effect of feed withdrawal before slaughtering on pH1 and pH2 .

Strains	Treatments	pH 1	pH2
Ross-308	T1	6.29	5.35
	T2	6.43	4.77
	T3	6.23	4.84
	T4	6.45	5.06
Hubbard	T1	6.45	4.93
	T2	6.53	4.63
	T3	6.34	5.17
	T4	6.68	5.41
	S.E	0.56	0.54
Treatment effect	T1	6.39	5.14
	T2	6.48	4.77
	T3	6.28	5.01
	T4	6.56	5.23
	S.E	0.28	0.43
Strains effect	Ross-308	6.35	5.01
	Hubbard	6.51	5.05
	S.E	0.19	0.04

pH 1: The initial pH of the meat was determined immediately after slaughtering .
pH 2: the final pH after a 24 hour cooling period was determined .

In Table(3). Showed no significant differences among treatments in each part of carcass percentage but there was significant differences (P<0.05) in liver percentage among treatments , and also there were no significant differences between broiler strain in each parts of carcass percentage such as breast % , thigh % , wings % , back % ,neck % , heart % and gizzard expected heart percentage . according to (Veerapen and Driver ,1999) percentage

Table 3. effect of feed withdrawal on percentage of each part of carcass (%) .

Strains	Treat-ments	Breast %	Thigh %	Wings %	Back %	Neck %	Liver %	Heart %	Gizzard %
Ross-308	T1	39.60	28.03 ab	10.48	10.84	3.90 abc	3.92 abc	0.67 ab	1.79
	T2	38.54	26.80 ab	10.33	12.14	5.16 a	4.16 abc	0.71 ab	1.77
	T3	39.84	27.44 ab	10.23	11.19	3.73 bc	3.73 bc	0.52 b	1.67
	T4	40.79	26.79 ab	10.46	11.54	3.32 c	3.29 c	0.43 b	1.97
Hubbard	T1	41.27	25.93 b	10.14	10.97	4.67 ab	4.67 a	0.99 a	1.90
	T2	38.73	28.34 a	9.91	11.84	4.30 abc	4.30 abc	0.77ab	1.47
	T3	41.03	26.67 ab	10.13	11.76	3.56 bc	3.56 bc	0.58 ab	1.56
	T4	38.63	27.33 ab	10.01	11.15	4.13 abc	4.16 abc	0.84 ab	2.01
	S.E	2.09	1.93	0.18	0.53	1.05	0.97	0.21	0.212
Treatment effect	T1	40.43	26.98	10.31	10.91	4.37	4.29 ab	0.83	1.84
	T2	38.63	27.57	10.12	11.99	4.56	4.73 a	0.74	1.62
	T3	40.41	27.06	10.18	11.48	4.99	3.65 b	0.55	1.63
	T4	39.71	27.08	10.24	11.34	5.26	3.73 b	0.64	1.99
	S.E	2.08	0.66	0.19	1.09	0.97	1.24	0.29	0.43
Strains effect	Ross-308	39.69	27.26	10.37	11.43	4.79	4.04	0.58 b	1.80
	Hubbard	39.92	27.07	10.05	11.41	4.80	4.17	0.79 a	1.74
	S.E	0.55	0.47	0.80	0.07	0.029	0.31	0.51	0.14

Different letters in the same column indicate a statistical difference (P < 0.05).

In Table(4). Showed no significant differences among treatments in meat chemical composition such as moisture % , protein % , fat % and ash % in breast and thigh among treatments , also there were no significant difference in meat chemical composition between two broiler strains according to(Amin , 2007).

Table 4. effect of feed withdrawal on meat chemical composition (%) .

Strains	Treat-ments	Breast Chemical Composition				Thigh Chemical Composition			
		Moisture %	protein%	Fat %	Ash %	Moisture %	Protein%	Fat %	Ash %
Ross-308	T1	73.13	22.75	2.61	1.41	75.01	20.08	5.61	1.38
	T2	74.32	23.21	2.72	1.48	73.05	21.13	5.07	1.40
	T3	74.81	23.20	2.43	1.23	75.73	21.19	5.39	1.22
	T4	74.64	21.83	2.09	1.58	74.01	19.71	5.58	1.32
Hubbard	T1	76.09	21.23	2.79	1.46	73.81	19.17	5.74	1.37
	T2	75.06	20.46	2.03	1.26	75.25	19.09	5.51	1.42
	T3	76.12	21.92	2.83	1.46	74.42	19.57	5.75	1.25
	T4	75.05	22.60	2.06	1.54	73.13	20.10	5.43	1.49
	S.E	0.96	1.87	0.58	1.01	1.55	1.75	0.26	0.11
Treatment effect	T1	74.61	21.99	2.70	1.44	74.42	19.59	5.17	1.37
	T2	74.96	21.83	2.38	1.36	74.17	19.56	5.28	1.48
	T3	74.92	22.56	2.63	1.35	75.08	20.38	5.07	1.28
	T4	74.38	22.21	2.01	1.56	73.57	19.91	5.01	1.40
	S.E	0.72	0.76	0.78	1.02	1.02	0.93	0.31	0.31
Strains effect	Ross-308	74.41	22.75	2.41	1.42	74.45	20.55	o.29	1.33
	Hubbard	75.01	21.55	2.43	1.44	74.17	19.17	5.60	1.38
	S.E	1.44	1.09	0.09	0.67	0.67	1.65	0.15	0.28

CONCLUSIONS

1. The weight losses of live broilers were positively correlated with FW periods, confirming that increasing FW times will result in higher live broiler shrinkage.
2. The different FW periods did not affect the quality attributes.

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