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EFFECT OF FEED WITHDRAWAL TIME ON PRE-SLAUGHTER CHICKEN WEIGHT LOSS, CARCASS YIELD AND TECHNICAL QUALITY PARAMETERS

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Introduction

Feed withdrawal for chicken prior to slaughter has a significant effect on meat hygiene and safety. It has been well documented that the prime source of pathogenic contaminations of chicken meat such as Salmonella and Campylobacter are originated from gastro intestinal content and its excrement. The pathogenic microorganisms reside in gastro intestinal track, and cause cross contamination of meat during the process of slaughter (Corrier et al., 1999). In addition, feed restriction affects chicken quality. Chicken contains a limited glycogen in muscle tissue compared to cattle and pig. If feed withdrawal is enforced too far extend, that results in depletion of energy source in muscle. This consequently shortens time cause of rigor onset and results in unfavorable meat quality (Lyon and Buhr, 1999). Feed withdrawal also affects carcass yield through its effect on moisture loss and fat decomposition. In general, weight loss caused by feed withdrawal is in proportion to the length of fasting time, its loss in earlier period is related to excrement of gastro internal content and does not have a significant effect on final yield. However, extended feed restriction can lead to reduction in final weight and economic loss due to moisture loss and fat decomposition(Veercamp, 1986). Weight loss is influenced by age, sex, energy content in feeds, length of time, and transport condition(Duke et al., 1997; Randall et al., 1994). For the reason, chicken industry across world has determined the optimum length of feed withdrawal to compromise the least detrimental effect on quality and weight loss. On the other hand, feed withdrawal program between countries varies due largely to difference in final weight, feed composition, feeding program and regulation.

Objectives

The current study was conducted to identify industrial practice for chicken feed withdrawal prior to transport to slaughter plant and estimate optimum time.

Methodology

Three hundred chickens (1.5 or 2.5 kg) were sampled and enforced feed withdrawal for 0, 3, 6, 9 and 12 hours, without free access to water. Body weight was determined just prior to the treatment. Average body weight after the feed restriction, carcass weight and

gastro intestinal content weight were determined from 15 chickens which were randomly selected for each treatment. Body weight and yield loss were calculated from weight difference after feed withdrawal and expressed as percentage. pH was measured at brest fillet at 1, 3, 12 hours postmortem using a portable pH meter (pH*K21, NWKCo. Germany) and noted as pH1, pH3 and pHu. Meat color was determined using a Chroma meter (CR301, Minolta Co, Japan), standardized on the white boad of Y=92.4, x=0.3136 and y=0.3196, on the surface of chest filled and drum stick. The data was assessed using a SAS package (1999) by applying Duncan procedure at the probability level of 0.05.

Results & Discussion

Body weight and carcass yield loss are presented in Table 1. Weight loss was increased as length of feed withdrawal was extended from 0 to 12 hours. An average loss per hour was approximately 11.5 g for both class of body weight, and resulted in 138 g loss after 12 hours of the experimental period. When length of feed withdrawal is same, higher weight group showed a greater weight loss; 1.5 and 2.5 kg groups resulted in 116 and 153 g loss after 12 hours, respectively. Carcass yield decreased with feed withdrawal time extended regardless of body weight; where 1.5 and 2.5 kg groups showed significant reductions in yield after 9 and 6 hours feed withdrawal, respectively. Weight loss for carcass can be affected by various factors, but previous study showed that reduction occurred after 6 hours treatment(Bigili, 2002). After the time, weight loss is associated with glycogen depletion in muscle tissue takes place, followed by fat decomposition (Reisfeld et al., 1981). Based on the current data, 6-9 hours feed withdrawal for 1.5 kg chicken appeared to be the optimum practice under the Korean industry situation. The prime reason for the assumption was driven from the fact that longer than 9 hours leads to economic loss under the Korea situation. Table 2 presents changes in gastro intestinal content as affected by the length of feed withdrawal. Net weight of crop and gizzard were significantly ($P<0.05$) reduced by 6 hours feed restriction, but there was no noticeable changes after the time. On the other hand, crop and preventriculus showed a considerable reduction by 3 hours, and there were no significant changes after the time. In the case of cecum and recum, there was a tendency to be decreased in weight over the withdrawal period, but that was not statistically significant. pH of breast fillet within one hour postmortem was not affected by the treatment. A 3 hours feed withdrawal had a significantly higher pH at 3 and 12 hours postmortem than that for control group, but the other treatment showed a similar tendency of resulting in a similar pHs at the time of all measurements. Lyon and Buhr(1999) reported that feed withdrawal reduced the time course of rigor development, and Kotula and Wang(1994) showed that a 36 hour treatment slowed down the rate of rigor development; there results are in consistence with our current data. Objective meat color varied depending on the length of treatment; suggesting that feed withdrawal within 12 hours had a limited effect on meat color. Table 4 presents quadratic and linear regress function and their coefficients of determination between fasting period and weight loss. Coefficients of determination for the developed final models containing quadratic and linear function for fasting period live weight resulted in the higher values, ranging 0.76-0.75 for 1.5 kg chickens, and 0.77-0.73 for 2.5 kg chicken, respectively. It was thought that the prime reason for the improvement of prediction by including quadratic function was related to the greater weight loss at early

period of feed withdrawal, which was largely contributed to weight loss of gastro intestinal content.

Conclusions

The current study demonstrated that an available fasting time for pre-slaughter broiler differentiated to slaughter weight groups. In general, postmortem pH and breast fillet color were not affected until 12 hour. Also, quadratic and linear model functions were presented to predict weight loss during fasting period.

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Table 1. Means and SE of weight loss and carcass yield during fasting periods

	0 hr	3 hr	6 hr	9 hr	12 hr
Weight loss(g)					
Overall	0.00±0.00^{e}	68.37±24.39^{d}	87.77±27.49^{c}	112.8±31.61^{b}	138.4±42.45^{a}
1.5kg	0.00±0.00^{e}	50.37±17.60^{d}	70.43±17.61^{c}	91.46±22.91^{b}	115.96±31.8^{a}
2.5kg	0.00±0.00^{e}	74.48±23.43^{d}	97.10±27.46^{c}	129.12±27.48^{b}	153.14±42.45^{a}
Carcass yield(%)					
Over all	69.5±2.13^{a}	69.39±2.15^{a}	69.38±2.21^{a}	68.53±1.69^{b}	67.84±2.59^{b}
1.5kg	68.24±2.15^{a}	66.93±1.47^{a}	67.40±2.39^{a}	67.76±1.67^{a}	65.21±1.63^{b}
2.5kg	69.98±1.95^{ab}	70.00±1.84^{ab}	70.19±1.53^{a}	69.01±1.54^{c}	69.19±1.84^{bc}

Table 2 Comparisons of gastro intestinal content during fasting periods

	0 hr	3 hr	6 hr	9 hr	12 hr
Crop	12.57±14.18^{a}	11.26±31.56^{ab}	0.57±1.58^{b}	0.05±0.12^{b}	0.12±0.43^{b}
Gizzard	19.68±9.22^{a}	16.23±4.61^{ab}	14.49±6.51^{b}	13.54±5.72^{b}	11.5±4.08^{b}
Preventriculus	1.15±1.04^{a}	0.52±0.6^{b}	0.38±0.38^{b}	0.18±0.27^{b}	0.31±0.48^{b}
Small intestine	36.04±11.32^{a}	12.71±8.21^{b}	10.57±5.28^{b}	10.4±5.14^{b}	8.75±3.58^{b}
Cecum	4.36±2.84	5.05±3.98	4.76±3.01	3.95±2.42	3.46±2.24
Recum	0.78±0.63	0.81±0.6	0.55±0.25	0.6±0.52	0.58±0.42

Table 3. Influences of fasting periods on chicken breast fillet pH and color

	0 hr	3 hr	6 hr	9 hr	12 hr
pH					
pH_1	6.00±0.09	6.17±0.10	5.99±0.12	6.00±0.17	6.09±0.25
pH_3	5.74±0.18^{b}	6.05±0.15^{a}	5.93±0.15^{ab}	5.86±0.21^{ab}	5.97±0.14^{ab}
pH_u	5.72±0.18^{b}	5.97±0.21^{a}	5.96±0.10^{a}	5.77±0.19^{ab}	5.77±0.09^{ab}
Color					
L	49.56±2.34	49.16±2.73	48.67±2.81	48.45±1.38	47.10±4.20
a	-0.03±1.12	-0.32±0.81	-0.60±1.03	-0.46±1.20	0.75±1.64
b	10.47±1.41	12.06±2.33	11.18±2.69	9.75±2.38	9.07±3.68

Table 4. Regression and coefficients of determination between fasting period and weight loss

	Intercept	x^2(Fasting time)	x1(Fasting time)	x2(Weight)	R-square
Overall					
	-49.22902	-0.61081	18.53020	0.02376	0.7566
	7.44266	-0.65002	18.52831	-	0.7047
	-39.70899	-	11.19760	0.02457	0.7292
	19.64591	-	10.70795	-	0.6735
1.5kg					
	26.64381	-0.27995	12.33905	-0.01221	0.7624
	6.30807	-0.27036	12.27174	-	0.7612
	26.16112	-	8.96700	-0.00881	0.7533
	11.36727	-	9.00212	-	0.7527
2.5kg					
	-34.56649	-0.76086	21.19715	0.01572	0.7757
	6.49634	-0.78029	21.23505	-	0.7650
	-24.03033	-	12.08930	0.01714	0.7379
	11.36727	-	9.00212	-	0.7527