



Effect of different slaughter weight on percentage yield and proximate composition of broiler parts

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ABSTRACT

Commercially reared mixed sex broilers were utilized to determine the effect of dress carcass weight on percentage yield of broiler parts, breast meat yield in weight category of <1.0, 1.0-1.2, 1.2-1.4, 1.4-1.6, 1.6-1.8, 1.8-2.0 and <2.0 kg. Then pH, cooking yield and moisture content of the breast meat with different time intervals (0 hours, 12 hours, 24 hours, 36 hours, 48 hours) and proximate compositions of meat were measured. Percentage yield of whole leg, thigh, breast, back and rib, neck, wings, gizzards, heart, liver, drumstick and total giblet were significantly affected by dress carcass weight at $P < 0.05$. Yield of body components changed with the increasing body weight. pH values was significantly affected by time after slaughtering and finally it's reduced up to 5.69 at 48 hr after slaughtering. Suitable breast processing weight category of broiler carcass to gain maximum breast yield is <2.0 kg weight category which could be obtained highest fillet yield. To gain highest cooking yield, carcass should be cooked immediately after slaughtering. Broiler live weight had exhibited significant relationship with dress weight among with giblets and without giblets, different transport distance, starvation period, lifetime, cage system and live weight category.

Key words: Breast meat yield, Broiler parts, Regression, Weight category

The consumption of chicken meat is one of increasing significance in Sri Lanka and per head consumption (5.02 Kg per capita per year) is still rising (Department of Animal Production & Health 2010). Chicken meat is sold as a whole as well as cut-up into parts that give different cooking and taste choices (Yavuz *et al.* 2004). So, demand for high quality cut-up parts have driven the poultry industry to change its marketing practices. Today, with the vast majority of poultry being marketed in this manner, yield of high value items such as breasts and broiler fillets have become critical to processors (Khosravanian *et al.* 2006). Oluyemi and Roberts (2000) observed that at day old (42 g live weight), the broiler dressed carcass weight expressed as live weight was 30% while at 3000 g live weight, the dressed carcass percentage rose to 57%. In a similar pattern, the meat yield of any animal increased with increasing slaughter weight. Some yield of meat parts such as thigh, drumstick and breast have increased with birds age (Young *et al.* 2001). So, the percentage yield of body parts is important to define the age and slaughter weight and to predict the weight of parts. Therefore it is

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important for the poultry product manufactures to anticipate yield patterns over a wide range of rearing conditions.

For these reasons, the present study was undertaken to determine the percentage yield of parts at different slaughter weight and also to investigate different slaughter weight on broiler breast yield. We further investigated proximate composition, pH, cooking yield and moisture content of breast meat at each weight category and different time interval after slaughtering. As dress value parameters are difficult to obtain based on the live animal basis except after slaughter, therefore reliable and indirect methods for the estimation of dress value using equation is a necessity. Thus to develop regression formula between live weight and dress weight of broiler chicken that could be used to predict dress weight as affected by with and without giblets, starvation interval, transport distance, different life span, rearing system and live weight categories.

MATERIALS AND METHODS

Samples (34) were randomly selected at each slaughtering weight category ranging 1.2-1.4, 1.4-1.6, 1.6-1.8, 1.8-2.0, <2.0 kg. After evisceration, the defeathered birds were weighed, dissected all internal and external organs (head, neck, leg, wing). The viscera were removed as for the usual dressing of poultry carcasses. Heart, liver (minus the gall

bladder), empty skinned gizzard were trimmed of extraneous tissue and weighed individually and sum of weights giblets was taken. The dressed weights obtained were expressed as a percentage of the live weights and yield parts expressed as a percentage of dress carcass weight. Moisture content, pH, and cooking yield of breast meat were measured in every weight category and immediate after slaughtering, 0, 12, 24, 36, 48 and 56 h respectively. Proximate analyses were carried using the procedures of AOAC on meat and meat products. Proximate results were recorded as total solid, crude fat, crude protein and ash in breast, drumstick, thigh and wings.

Percentage of drip loss and cooking yield were calculated as follows;

$$\text{Drip loss} = \frac{(\text{Drip weight of carcass})}{(\text{Raw weight before drip})} \times 100$$

$$\text{Cooking yield} = \frac{(\text{cooked breast weight})}{(\text{Raw breast weight})} \times 100$$

Chickens (180) were randomly selected according to transport distance (>50, 50–100, 100–150, <150 km), life time (>35, 35–40, 40–45 days), starvation time (>14, 16–18, 24–26 h) rearing system (open and close) and at different live weight category (1200–1400, 1400–1600, 1600–1800, 1800–2000, <2000 g). All birds from each group were processed at the same time. Each birds was weighed at time of slaughter, killed by exsanguinations, allowed for bleeding, scalded at 63°C for approximately 120 s, placed in a rotary drum for 30s, processed by removing head, neck, shank, eviscerated and individually weighed to obtain the dressed weight.

Statistical analysis

All data were expressed as a percentage of live weight. Effect of dressed carcass weight on percentage yield of parts was determined using CRD design with 32 replicates.

The data was then analyzed by regression between live and dress weight using the SPSS 10.0 software. Regression equations for live weight and dress weight data in the

starvation period, transport distance, life span, rearing system and live weight categories were fitted to the following regression model: linear function of $DW = B_0 + B_1 LW$. If the linear was non significant, then quadratic function was fit.

RESULTS AND DISCUSSION

Weight of body components are shown in Table 1. There was a significant ($P < 0.05$) effect of weight category observed for percentage yield of parts. Oluyemi and Roberts (2000) reported the body parts of the birds fall into 3 groups in respect of their stages of development. These stages are the early maturing organ, the intermediate and the late maturing parts. The weights of the heart, liver and gizzard were highest in the less than 1.0 kg weight bracket (Table 1). This indicated that these organs are early maturing ones, in agreement with Oluyemi and Roberts (2000). The weight of total giblets were decreased ($P < 0.05$) as the weight of the animal increased.

Most of the other primal cuts (breast, thigh and back) increased linearly ($P < 0.05$) as the slaughter weight of the bird increased. Musa *et al.* (2006) reported that live weight was significantly ($P < 0.01$) correlated (0.759 to 0.840) to breast muscle weight. Breast meat yield is the carcass component with the highest economic value, if the bird is considered as a whole. During the production cycle, breast meat continuously increased as a percentage of body weight. Similar pattern have been noted by Acar *et al.* (1993). Therefore, the success of poultry meat production is strongly related to improvements in growth and carcass yield by increasing breast proportion. De boned breast muscle weight occupied the greatest share in the total weight as it is apparent from the results of the proportion of part weights (Table 2). The weight of the neck and wing was significantly reduced by slaughter weights (Table 1). Those neck and wing parts have more bone could be the reason for this result.

Results concerning the percentage distribution of part weights are compatible with the data in the literature (Moran *et al.* 1969, Orr *et al.* 1984). Amongst the groups, the de

Table 1. Effect of body weight category on percentage yield of parts

Means of parts %	Weight category (kg)						
	< 1.0	1.0 – 1.2	1.2 – 1.4	1.4 – 1.6	1.6 – 1.8	1.8 – 2.0	> 2.0
Whole leg	31.21 ^a ±2.32	32.49 ^b ±2.85	32.22 ^{ab} ±1.51	32.20 ^{ab} ±2.62	33.00 ^b ±1.99	33.21 ^b ±1.23	32.58 ^b ±1.82
Drumstick	12.87 ^a ±1.01	12.94 ^{ab} ±1.17	12.94 ^{ab} ±0.81	13.14 ^{ab} ±0.97	13.19 ^{ab} ±1.25	13.53 ^b ±1.07	13.49 ^b ±1.24
Thigh	18.08 ^a ±2.03	19.99 ^b ±1.48	19.53 ^b ±1.13	19.72 ^b ±1.71	19.66 ^b ±1.56	19.93 ^b ±1.71	19.30 ^b ±1.84
Breast	25.28 ^a ±2.74	25.82 ^{ab} ±1.86	26.23 ^{ab} ±1.87	26.17 ^{ab} ±1.99	26.35 ^{ab} ±1.43	27.61 ^c ±2.03	26.79 ^{bc} ±1.68
Back and rib	21.33 ^{ab} ±1.97	20.96 ^{ab} ±2.01	20.47 ^a ±1.51	20.44 ^a ±3.17	20.21 ^a ±1.64	20.22 ^a ±1.52	21.59 ^b ±1.88
Neck	3.72 ^b ±0.62	3.46 ^a ±0.37	3.22 ^a ±0.46	3.20 ^a ±0.46	3.25 ^a ±0.46	3.22 ^a ±0.50	3.25 ^a ±0.43
Wings	11.98 ^c ±1.00	11.03 ^b ±0.58	11.06 ^b ±0.61	10.87 ^b ±0.67	10.18 ^a ±1.94	9.97 ^a ±1.04	10.22 ^a ±0.45
Gizzard	2.30 ^c ±0.44	1.92 ^b ±0.44	1.90 ^b ±0.47	1.77 ^b ±0.32	1.84 ^b ±0.40	1.57 ^a ±0.25	1.54 ^a ±0.33
Liver	3.89 ^e ±0.87	3.17 ^d ±0.77	2.93 ^{cd} ±0.36	2.84 ^{bc} ±0.43	2.77 ^{bc} ±0.52	2.58 ^{ab} ±0.32	2.39 ^a ±0.51
Heart	1.11 ^d ±0.29	0.76 ^c ±0.11	0.73 ^{bc} ±0.16	0.62 ^a ±0.15	0.66 ^{ab} ±0.14	0.69 ^{abc} ±0.077	0.62 ^a ±0.086
Total giblets	7.31 ^d ±1.22	5.86 ^c ±0.98	5.57 ^{cb} ±0.75	5.25 ^{bc} ±0.75	5.29 ^{ab} ±0.62	4.85 ^b ±0.66	4.55 ^a ±0.43
Drain loss	7.64 ^c ±5.90	5.79 ^{ab} ±5.19	6.82 ^{bc} ±2.22	6.98 ^{bc} ±1.88	6.89 ^{bc} ±2.22	5.48 ^{ab} ±2.05	4.87 ^a ±3.11

Table 2. Effect of body weight category on different percentage yield of breast

Means of parts%	Weight category (kg)						
	< 1.0	1.0 – 1.2	1.2 – 1.4	1.4 – 1.6	1.6 – 1.8	1.8 – 2.0	> 2.0
Debone breast muscle weight	60.30 ^a ± 0.10	65.33 ^b ± 2.49	69.08 ^c ± 1.71	67.01 ^{bc} ± 2.90	67.03 ^{bc} ± 1.30	65.96 ^{bc} ± 2.80	69.08 ^d ± 1.36
Av. total breast weight % per dress carcass	25.28 ^b ± 2.74	25.82 ^a ± 1.86	26.23 ^b ± 1.87	26.17 ^b ± 1.99	26.36 ^b ± 1.43	27.62 ^a ± 2.03	26.80 ^a ± 1.68
Av. total breast weight (g)	243.20 ^a	282.92 ^b	346.00 ^{bc}	393.02 ^c	443.30 ^{cd}	522.86 ^{de}	533.35 ^e

Table 3. Effect of weight category on proximate component of various parts

Component	Weight category (kg)						
	<1.0	1.0–1.2	1.2–1.4	1.4–1.6	1.6–1.8	1.8–2.0	>2.0
<i>Drumstick</i>							
Total solid	24.46 ^b (±0.14)	25.62 ^{ab} (±0.44)	25.29 ^{ab} (±1.22)	25.48 ^{ab} (±1.49)	24.71 ^{ab} (±0.58)	26.82 ^a (±0.46)	25.23 ^{ab} (±0.67)
Crude protein	17.21 ^a (±0.05)	21.00 ^a (±0.25)	18.90 ^a (±0.31)	22.52 ^a (±0.28)	18.60 ^a (±0.58)	18.01 ^a (±0.47)	19.65 ^a (±0.24)
Fat	13.77 ^a (±0.57)	8.78 ^a (±5.38)	17.25 ^{ab} (±1.16)	16.75 ^{ab} (±1.76)	17.95 ^{ab} (±0.21)	25.56 ^b (±0.95)	14.59 ^a (±0.45)
Ash content	1.24 ^{ab} (±0.09)	1.70 ^b (±0.30)	1.36 ^b (±0.09)	1.36 ^b (±0.02)	0.69 ^a (±0.28)	1.78 ^b (±0.42)	1.78 ^b (±0.27)
Moisture content	67.78 ^b (±0.13)	62.52 ^{ab} (±0.44)	62.49 ^{ab} (±1.23)	59.37 ^{ab} (±1.50)	62.76 ^{ab} (±0.58)	54.65 ^a (±0.46)	63.98 ^{ab} (±0.67)
<i>Thigh</i>							
Total solid	25.45 ^a (±1.69)	25.77 ^a (±0.27)	26.38 ^a (±0.13)	24.51 ^a (±0.13)	25.37 ^a (±0.42)	25.10 ^a (±1.55)	25.37 ^a (±0.80)
Crude protein	17.28 ^a (±0.70)	18.36 ^{ab} (±0.33)	20.23 ^c (±0.15)	19.79 ^c (±0.95)	18.38 ^{ab} (±0.79)	17.66 ^a (±1.28)	17.17 ^a (±0.20)
Fat	21.67 ^a (±0.11)	24.19 ^{abc} (±0.24)	25.37 ^{bc} (±3.02)	26.57 ^c (±0.49)	25.88 ^{bc} (±0.17)	22.85 ^{ab} (±0.80)	25.00 ^{bc} (±0.30)
Ash content	1.13 ^a (±0.39)	1.80 ^b (±0.07)	1.37 ^a (±0.07)	1.37 ^a (±0.07)	1.29 ^a (±0.03)	2.09 ^b (±0.07)	1.35 ^a (±0.01)
Moisture content	59.92 ^a (±1.67)	55.65 ^a (±0.28)	53.03 ^a (±0.13)	52.27 ^a (±0.13)	54.45 ^a (±0.42)	56.59 ^a (±0.55)	56.48 ^a (±0.80)
<i>Breast</i>							
Total solid	26.67 ^a (±0.48)	25.27 ^{ab} (±1.23)	25.84 ^{ab} (±1.00)	25.64 ^{ab} (±0.20)	24.32 ^a (±0.27)	26.42 ^{ab} (±0.40)	27.16 ^{ab} (±1.10)
Crude protein	22.34 ^{cd} (±0.28)	22.97 ^d (±0.32)	19.00 ^a (±0.20)	22.52 ^{cd} (±0.29)	21.75 ^{bc} (±0.50)	21.10 ^b (±0.48)	21.07 ^b (±0.70)
Fat	7.22 ^a (±0.83)	9.68 ^a (±0.76)	5.99 ^a (±0.32)	7.34 ^a (±0.04)	8.43 ^a (±0.78)	6.36 ^a (±1.42)	7.74 ^a (±2.05)
Ash content	1.72 ^{bc} (±0.01)	0.37 ^a (±0.50)	1.43 ^b (±0.07)	1.43 ^b (±0.07)	0.74 ^a (±0.43)	2.19 ^c (±0.05)	1.55 ^b (±0.02)
Moisture content	69.26 ^a (±0.48)	66.98 ^{ab} (±1.24)	73.58 ^{ab} (±1.00)	68.71 ^{ab} (±0.40)	69.08 ^b (±0.28)	70.35 ^{ab} (±0.40)	69.64 ^a (±1.10)

bond breast muscle weight share in the total weight was increased depending on the carcass weight, while the breast bone share decreased.

Proximate component of drumstick, thigh, breast and wings are presented in Table 3. The highest crude protein value was observed in breast part and lowest in thigh and wing portion. Total solid content did not vary with different

weight categories. The highest fat contents is observed in thigh; lowest is from breast. Cooking yield was significantly affected by dress carcass weight and highest cooking yield (85.93±0.93) was observed in more than 2 kg of weight category that was almost due to meat yield. There was a significant difference ($P<0.05$) observed for cooking yield at 0 hr and 48 hr after slaughtering. pH values were

Table 4. Variation of cooking yield, moisture content and pH of breast meat in different weight category

Weight category (kg)	Cooking yield	Moisture content	pH
< 1.0	71.28 ^c ± 1.78	74.86 ^b ± 0.39	5.62 ^d ± 0.03
1.0 – 1.2	79.88 ^b ± 6.96	75.26 ^a ± 0.36	5.72 ^b ± 0.03
1.2 – 1.4	82.21 ^a ± 1.88	74.47 ^c ± 0.35	5.62 ^d ± 0.04
1.4 – 1.6	85.07 ^a ± 1.85	74.83 ^{bc} ± 0.23	5.73 ^c ± 0.01
1.6 – 1.8	83.63 ^{ab} ± 1.41	75.16 ^{ab} ± 0.31	5.72 ^c ± 0.02
1.8 – 2.0	84.90 ^a ± 1.49	74.81 ^{bc} ± 0.52	5.78 ^a ± 0.00
> 2.0	85.93 ^a ± 0.93	75.19 ^{ab} ± 0.54	5.80 ^a ± 0.00

Table 5. Variation of cooking yields, moisture content and pH of breast meat at different time

Time after slaughtering	Cooking yield	Moisture content	Mean pH
0 hr	83.55 ^a ± 0.96	74.94 ^b ± 0.43	5.79 ^a ± 0.00
12 hr	82.64 ^{ab} ± 1.90	74.63 ^c ± 0.27	5.67 ^e ± 0.00
24 hr	83.30 ^a ± 1.56	75.45 ^a ± 0.21	5.70 ^d ± 0.03
36 hr	81.41 ^{ab} ± 1.65	74.63 ^c ± 0.58	5.76 ^{bc} ± 0.04
48 hr	79.74 ^b ± 5.57	75.04 ^b ± 0.44	5.69 ^d ± 0.04

significantly affected by time duration after slaughtering but there was slight decline (Table 5). This result is in agreement with Ali *et al.* (1999), that low rate in pH decline indicates that the animals were not under stress when slaughtered. Moisture contents were not significantly affected by dress carcass weight or time duration at $P < 0.05$ (Tables 4, 5).

Regression analyses were derived to obtain the relationship between dress weight and live weight. The reported relationship between broiler live weight and dress weight with giblets and without giblets were $-34.63 + 0.8$ LW ($R^2, 0.957$) and $-83.81 + 0.78$ LW ($R^2, 0.954$) respectively fig 1&2. Both were significant at 0.01 level.

Starvation period, life span, transport distance, rearing

Table 6. Regression equations for dress weight of broiler

Variable	Equation	R ²	Significance ¹
<i>Distance</i>			
< 50 km	= $-111.26 + 0.84$ LW	0.983	**
50–100 km	= $62.96 + 0.75$ LW	0.968	**
100–150 km	= $-22.02 + 0.80$ LW	0.967	**
>150 km	= $-2177.94 + 2.78$ LW – 2.41 LW ³	0.643	**
<i>Starvation time</i>			
<14 h	= $-40.26 + 0.81$ LW	0.996	**
16 – 18 h	= $-54.23 + 0.81$ LW	0.968	**
24 – 26 h	= $79.14 + 0.73$ LW	0.844	**
<i>Life span</i>			
<35 days	= $-40.256 + 0.81$ LW	0.996	**
35–40 days	= $-59.60 + 0.81$ LW	0.943	**
40–45 days	= $39.37 + 0.76$ LW	0.962	**
<i>Rearing system</i>			
Open	= $-30.89 + 0.796$ LW	0.948	**
Close	= $-40.26 + 0.81$ LW	0.996	**
<i>Weight categories</i>			
1200–1400g	= $-40.26 + 0.81$ LW	0.996	**
1400–1600g	= $-59.61 + .81$ LW	0.944	**
1600–1800g	= $39.37 + 0.76$ LW	0.962	**
1800–2000g	= $16.66 + 0.84$ LW	0.957	**
>2000g	= $-101.4 + 0.83$ LW	0.948	**

system and live, dress weight categories affected the final dress weight of the broilers. Regression equations are presented in Table 6 to assist the calculation of dress weight based on live weight for different variables. The broiler dress weight from different categories can be determined by following different equations. The trait of economic importance is the dressing percentage and this tends to increase as the slaughter weight increased up to 2.0 kg live weight. Based on the dressing percentage, weight of total edible meat, it may be concluded that broiler chickens are optimally slaughtered up to 2.0 kg live weight. Live and dress

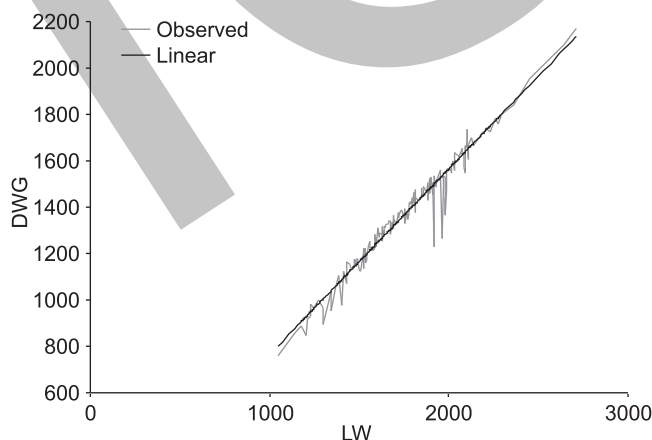


Fig 1. Relationship of live weight and dress weight of broiler with giblets.

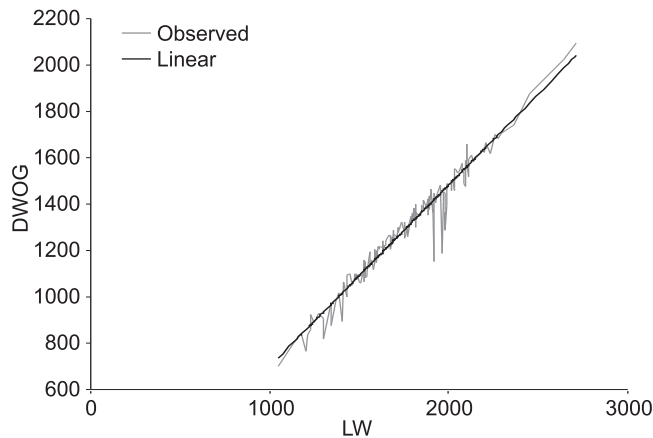


Fig 2. Relationship of live weight and dress weight of broiler without giblets.

weight had significant relationship with the transport distance, starvation period, life time, cage system and live weight category.

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