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Effect of age on slaughterhouse by-products of indigenous cattle of Bangladesh

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Abstract

The present study was conducted to investigate the effect of age on slaughterhouse by-products and their chemical composition of indigenous cattle of Bangladesh. Live weight, warm carcass weight and dressing percentage of different age group (T_1= 0 Tooth, T_2= 2 Teeths, T_3= 4 Teeths, T_4= 6 Teeths and T_5= 8 Teeths) of indigenous cattle were estimated. Average live weight and warm carcass weight of indigenous cattle was 167.64±79.93 kg and 84.83±47.88 kg, respectively on which age has significant effect. The average dressing percentage of indigenous cattle was 48.99±4.84. The average weight (kg) of inedible by-products eg. blood, hide, tail, scrotum, penis, cannon, horn, ear and tail was 6.35±0.69, 14.02±1.66, 0.34±0.03, 0.27±0.02, 0.28±0.03, 2.74±0.22, 0.33±0.04 and 0.17±0.02, respectively on which age has significant effect. The average weight (kg) of edible by-products eg. liver, heart, kidney, lung, brain, spleen, empty stomach, empty intestine, head and tongue was 2.40±0.22, 0.55±0.06, 0.35±0.04, 1.43±0.14, 0.33±0.01, 0.46±0.04, 6.32±0.74, 4.77±0.52, 8.21±0.78 and 0.48±0.04, respectively on which age has significant effect. The chemical composition of edible by-products was more or less similar to the main products of meat industry.

Key words: Cattle, chemical composition, slaughterhouse by-products

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Introduction

By-products of slaughterhouse may be defined as everything from the abattoir or normal bucher's shop that is not sold directly as food (Gracey 1986). The slaughterhouse by-products may be divided into edible and inedible by-products but this distinction is not rigid. Examples of edible by-products are offals such as liver, heart, kidney, thymus, pancreas, spleen, lungs and edible fat, while inedible by-products include feet, inedible raw bone, horns, hooves, bile, blood and inedible fat (Aberle et al. 2001). In rural areas of developing countries like Bangladesh the slaughtering of animals for meat is often carried out under less than ideal conditions and where there are limited facilities, slaughtering is likely to under a tree where an animal can be hoisted for skinning and evisceration. The supply of meat in Bangladesh in term of handling, slaughtering, and dressing of food animals take place in a very disorganized way. The animals are slaughtered randomly and indiscriminately. There are few slaughterhouses confined to the big cities. Since there is no lairage, animals generally do not receive antemortem care (Rahman 2001). The hygienic practice of antemortem examination is rarely conducted. There is very limited enforcement of slaughtering Act, 1983 and Act relating to the hygienic production of meat, as a result this type of highly nutritious food is handled, produced and distributed in a very unsanitary condition. Most of the public slaughterhouses are governed by the municipal authorities. In a few slaughterhouses, either a veterinarian or a sanitary inspector is deputed to make supervision of the eviscerated carcass. There is no practice of humane slaughtering method in Bangladesh. Aged and sick animals and on the contrary very immature and some healthy animals are also slaughtered. Only one Act is enforced which states that is not permitted on particular days of a week in Bangladesh although there is relaxation which necessitates prior permission from the concerned authorities (Animal Slaughter Restriction and Meat Control Act 2011). The highest percentage of slaughtering in Bangladesh is cattle. This is due to more availability and comparatively low price of the imported animals (Rahaman 2001). The site for a slaughtering facility must be on the ground that is higher that its surroundings to facilitate drainage. Animal Slaughter and Meat Control Act (2011) was placed in the parliament making provisions today for ensuring availability of quality meat to the people by slaughtering animals in a hygienic environment. Fisheries and Livestock Minister of Bangladesh also tabled a bill authorizing by the department of Livestock Services for visiting the slaughterhouse, meat shops or inspects the

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vehicles carrying the animals or meat when necessary. They would be able to take action against the concerned person or institutions if any inconsistencies with the law are found. In Bangladesh the largest proportion of cattle destined for the meat stalls are slaughtered by butchers at location of their convenience. An accepted religious person is employed to perform the Halal ritual slaughter and the butcher employees perform the tasks of flaying, dressing the carcass and offal preparation. There is a little research work related to uses of slaughterhouse by-products of cattle in Bangladesh. Therefore, the present study is undertaken to investigate the weight of slaughterhouse by-products in relation to age of indigenous cattle and to investigate the chemical composition of slaughterhouse by-products of indigenous cattle.

Materials and Methods

The experiment was conducted in the slaughterhouse under the Department of Animal Science, Bangladesh Agricultural University, Mymensingh. The data was collected to satisfy the objectives of the study. Sex of slaughtered animals was determined by visual observation. Age of the animal was estimated through dentition (Miller and Robertson 1959). Teeths were determined visually. Country method of casting (Hossain and Akhter 1999) and Halal method of slaughtering was applied during research work. Live weights of animals were measured by Shaeffer's formula (McNitt 1983). Shaeffer's formula ($W = L \times G^2/300$ lb) where, W=Weight of animal in pound, L = Length from the point of shoulder to pin bone in inch and G = Heart girth in inch. Then the weight in lb is converted to kg dividing by 2.2. Hygienic environment was followed in every steps of slaughtering in the slaughterhouse. Carcass weight was measured in kilogram. It was excluded from the weight of head, blood, horns, hooves, stomach, rumen content, intestine, gall bladder, hides, genital organ and feet. Weight of various slaughterhouse by-products was measured in kilogram and recorded properly in previously prepared data collection sheet. Average price of cattle by-products was recorded. Each edible by-product samples were taken in airtight poly bags for further analysis in laboratory. Proximate composition such as Dry Matter (DM), Ether Extract (EE), Crude Protein (CP) and Ash were determined according to the methods (AOAC 1990). All determination was conducted in triplicate and the mean value was recorded by SPSS software, Version 16. After completion of slaughtering the various slaughterhouse edible and inedible by-products were collected scientifically. Then calculated the percentage of by-products. Boggs et al. (1996) stated that hot carcass weight is always 1.5 to 3% higher than or 102% of chilled carcass weight. Accordingly, we conducted our experimental carcass weight to chilled carcass weight. Dressing percentage was estimated using the following formula:

Dressing percentage =

$$\frac{\text{Weight of the chilled carcass weight}}{\text{Live weight during slaughtering}} \times 100$$

pH measurement

The pH value of meat was measured using pH meter from meat homogenate. The homogenate was prepared by blending 10 g of sample with 50 ml of distilled water.

Result and Discussion

Live weight, warm carcass weight and dressing percentage

Live weight, warm carcass weight and dressing percentage of slaughtered cattle on the basis of age are given in Table 1. Significant difference ($p<0.05$) was observed in live weight, carcass weight and dressing percentage among the different age group of cattle. Similar effect of age on live weight and carcass weight were obtained by Robertson et al. (2001) who conducted an experiment on the carcass and meat quality of farmed elk. Yagoub et al. (2008) reported that carcass weight increased with the increase of dietary level and age. There was significant ($p<0.05$) difference in live weight and carcass weight among different age group level. Highest dressing percentage (51.72%) was obtained in the four permanent teeths and lowest in two permanent teeths (46.74%). Cattle of six and eight permanent teeths are not available in the market in Bangladesh.

Table 1. Effect of age on live weight, warm carcass weight and dressing percentage (n=13)

Parameters	T_1	T_2	T_3	Total
Live wt. (kg)	126.28^{e} ±24.0	135.40^{d} ±22.9	185.00^{c} ±40.9	167.64 ±79.93
Carcass wt. (kg)	60.09^{d} ±16.08	63.83^{d} ±15.45	96.47^{c} ±27.09	84.83 ±47.88
Dressing %	46.93 ±4.29	46.74 ±3.34	51.72 ±4.27	48.99 ±4.84

T_1, 0 teeth (n=8); T_2, 2 teeths (n=2); T_3, 4 teeths (n=3); means with different superscripts within the raw are significantly different ($p<0.01$)

Percent of by-products

The average percent of various by-products according to live weight was determined by slaughtering of fifteen bulls from Bangladesh Agricultural University slaughterhouse. A similar percent of by-products of cattle were found by Rahaman et al. (2001) who conducted an experiment on determination of various by-products of cattle on live weight. Among the edible by-products liver is the highest percent and among the inedible by-products hides is the highest percent on basis of live weight were estimated (Hossain et al. 2002).

Table 2. Relationship between live weight and by-products of indigenous cattle (n=15)

Parameters	LW%	T_1	T_2	T_3	T_4	T_5
Carcass	50.70	60.08	63.83	96.47	161	213.4
Dressing %	48.99	46.93	46.74	49.56	56.6	54.22
Blood	4.40	4.94	5.96	6.60	10.54	13.5
Hides	8.36	10.93	10.91	15.17	22.04	32
Liver	1.43	1.97	2.10	2.87	3.64	4.45
Heart	0.32	0.44	0.43	0.63	0.8	1.25
Kidney	0.2	0.28	0.29	0.37	0.4	0.84
Lungs with trachea	0.90	1.17	1.17	1.45	1.8	3
Brain	0.2	0.31	0.33	0.35	0.37	0.44
Spleen	0.25	0.38	0.48	0.49	0.7	0.75
Empty stomach	3.76	4.76	4.9	7.32	11.4	13.5
Empty intestine	2.85	3.63	3.88	5.48	8.6	9.7
Head	4.9	6.61	6.9	9.43	12.22	15.98
Tail	0.19	0.28	0.34	0.35	0.44	0.6
Scrotum	0.16	0.22	0.25	0.35	0.32	0.45
Penis	0.16	0.24	0.17	0.36	0.38	0.5
Cannon	1.65	2.25	2.42	3.26	3.78	4.7
Horn	0.2	0.25	0.24	0.39	0.53	0.72
Tongue	0.29	0.41	0.45	0.59	0.65	0.25

LW, live weight (x ± y); T_1, 0 teeth (Under two years); T_2, 2 teeths (Two years three months); T_3, 4 teeths (Three years old); T_4, 6 teeths (Three years six months); T_5, 8 teeths ((four years old)

Chemical composition of edible by-products of cattle

The proximate composition of edible by-products of cattle is shown in Table 3. A similar result was obtained by Okanovic et al. (2009) who conducted an experiment on chemical characteristics of cattle slaughtering by-products for technical processing. A similar result of edible by-products was also found by Adeniyi et al. (2011). The proximate composition of edible by-products of cattle is more or less similar to beef. Florek et al. (2002) conducted an experiment on slaughter value of young bulls and heifers carcass depending on EUROP conformation and fatness class. From their experiment it was also found that chemical compositions were increased with the advances of age of cattle.

Table 3. Chemical composition of edible by-products of different ages of cattle (n=13)

Age	By-products	DM%	CP%	EE%	ASH%
T_1	Liver	26.4	20.25	3.6	0.8
	Heart	21.84	18.16	3.7	0.48
	Kidney	22.44	15.98	2.3	0.74
	Lungs	21.68	19.15	3.7	0.84
	Spleen	24.3	18.26	2.0	1.02
	Brain	20.16	10.02	3.75	1.14
T_2	Liver	26.6	20.34	3.70	0.88
	Heart	20.98	18.24	3.71	0.48
	Kidney	22.26	16.17	2.35	0.78
	Lungs	21.70	20.34	3.71	0.90
	Spleen	24.34	19.20	2.20	1.05
	Brain	20.19	11.20	3.80	1.16
T_3	Liver	26.67	21.44	3.83	0.90
	Heart	21.00	19.30	3.72	0.51
	Kidney	22.27	17.32	2.36	0.81
	Lungs	21.73	21.10	3.77	0.93
	Spleen	24.37	19.40	2.40	1.09
	Brain	20.21	11.28	3.91	1.19

T_1, 0 teeth (under 2 years); T_2, 2 teeths (2-3 years): T_3, 4 teeths (above 3 years)

The relationship between age and by-products of indigenous cattle

Effect of age on weight of slaughterhouse by-products is shown Table 4 and Table 5. A similar relationship was obtained by Terry et al. (1990) who conducted an experiment on yields of by-products from different cattle types. The result shows that weight of edible and inedible by-products have a significant effect on the live weight of cattle received from different group of age. The result also shows that edible and inedible by-products were positively correlated and live weight was increased with the advances of age which is consisted with the findings of Hasan et al. (2004). Significant difference ($p<0.05$) was observed in various edible and inedible by-products of among the different age group of cattle.

Table 4. Effect of age on slaughterhouse by-products (inedible) (n=13)

Parameter (kg)	T_1	T_2	T_3	Mean ±SEM
Blood	4.94^{e} ±0.87	5.98^{d} ±1.87	6.60^{c} ±1.77	6.35 ±0.69
Hides	10.93^{d} ±2.9	10.91^{d} ±1.17	15.68^{c} ±3.54	14.02 ±1.66
Tail	0.28^{d} ±0.09	0.34^{c} ±.17	0.35^{c} ±0.17	0.34 ±0.03
Scrotum	0.22^{d} ±.06	0.24^{d} ±0.03	0.35^{b} ±0.02	0.27 ±0.02
Penis	0.24^{d} ±0.08	0.17^{e} ±0.01	0.36^{c} ±0.08	0.28 ±0.03
Cannon	2.25^{e} ±0.50	2.42^{d} ±0.25	3.26^{c} ±0.46	2.74 ±0.22
Horn	0.26^{d} ±0.08	0.24^{d} ±0.06	0.39^{c} ±0.04	0.33 ±0.04
Ear	0.12^{e} ±0.02	0.14^{d} ±0.02	0.17^{c} ±0.06	0.17 ±0.02

T_1, 0 teeth (n=8); T_2, 2 teeths (n=2); T_3, 4 teeths (n=3); means with different superscript differ significantly (p<0.05)

Table 5. Effect of age on slaughterhouse by-products (edible) (n=13)

Parameter (kg)	T_1	T_2	T_3	Mean ±SEM
Liver	1.97^{d} ±0.43	1.77^{e} ±.38	2.87^{c} ±.04	2.40 ±0.22
Heart	0.44^{d} ±.11	0.43^{d} ±.01	0.63^{c} ±.12	0.55 ±0.06
Kidney	0.28^{d} ±.04	0.29^{d} ±.07	0.37^{c} ±.07	0.35 ±0.04
Lungs	1.17^{c} ±.25	1.17^{c} ±.04	1.65^{b} ±.35	1.43 ±0.14
Brain	0.31^{e} ±.04	0.33^{d} ±.04	0.35^{c} ±.01	0.33 ±0.01
Spleen	0.38^{d} ±.14	0.48^{c} ±.08	0.49^{c} ±.06	0.46 ±0.04
Empty stomach	4.76^{d} ±.77	4.90^{d} ±.37	7.32^{c} ±1.81	6.32 ±0.74
Empty intestine	3.63^{d} ±.58	3.88^{d} ±.44	5.48^{c} ±1.19	4.77 ±0.52
Head	6.61^{d} ±1.31	6.90^{d} ±.42	9.43^{c} ±2.26	8.21 ±0.78
Tongue	0.4^{d} ±.09	0.37^{e} ±.12	0.59^{c} ±.21	0.48 ±0.04

T_1, 0 teeth (n=8); T_2, 2 teeths (n=2); T_3, 4 teeths; means with different superscript differ significantly (p<0.05)

Price of the edible by-products

Price of edible by-products is same to beef. Sometimes the price is fluctuated. Sometimes liver is sold at higher price than the main products in meat selling centres.

Table 6. Price of slaughterhouse product and edible by-products at conventional slaughterhouse

Product/By-products	Price BDT/kg
Beef	280
Liver	280
Heart	280
Kidney	280
Lungs	150
Spleen	240
Brain	80/piece
Tongue	180
Head	180
Tail	280
Shank(Paya)	200/4pieces
Stomach	140
Intestine	100

Animal by-products also serve as an extra means for packers to earn revenue or as a cushion to cover losses should the cost of purchasing the live animal exceed the selling price of the carcass. Average market price of edible by-products was ranges from 250-280 BDT per kg.

Conclusion

Age of indigenous cattle has a profound effect on the weight of different slaughterhouse by-products (edible and inedible). The chemical composition of slaughterhouse by-products was more or less similar to meat. Further, in depth study should be taken to see the effect of age on different aspects of slaughterhouse by-products of indigenous cattle.

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