Philippine Journal of Science
146 (4): 411-423, December 2017
ISSN 0031 - 7683
Date Received: 28 Jun 2017

Evaluation of Pre-slaughter and Slaughter Data from *Lechon*-size Black Tiaong and Kalinga Native Pigs (Organic Farm) and Landrace, Large White and their F_1 Crosses (Conventional Farm)

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This study aimed to compare pre-slaughter and slaughter data from 40 *lechon*-size pigs belonging to native breeds (i.e., Black Tiaong and Kalinga) raised in an organic production system and commercial breeds (i.e., Landrace, Large White, and their F_1 crosses) obtained from a conventional swine breeding farm. Native breeds had significantly (p<0.01) longer head and snout, shorter ears and body length, wider shoulders but narrower rump width, lower rump height, and larger neck circumference than commercial breeds. Native breeds had significantly lower live weight (p<0.05) but were older at slaughter (p<0.01) than commercial breeds. Hot carcass weight including the head, hot dressing percentage, and % chilled carcass yield were lower in native breeds. Weight of head, stomach, female reproductive organs, and blood were significantly heavier (p<0.01) in native breeds than commercial breeds. Weight of liver, kidneys, spleen, and small intestines were however, significantly heavier (p<0.01) in commercial breeds. The % edible internal organs and body parts in native breeds was significantly higher in terms of head, ears, stomach, visceral fats, and female reproductive organs but significantly lower (p<0.05) in terms of the liver, kidneys, and small intestines compared to commercial breeds. The slaughter parameters above may have direct implications on production targets of those involved in our country's *lechon* value chain. No significant differences (p>0.05) were found between types of production system in terms of weight loss during transit, tail length, wither height, heart girth, midriff girth, and flank girth, chilled carcass weight and drip loss percentage, and weight of ears, tail, heart, lungs, large intestines, and visceral fats.

Key words: Lechon-size pigs, native/commercial breeds, organic/conventional pig production systems, slaughter data

INTRODUCTION

Originally introduced as a Spanish pork dish, the *lechon* refers to a suckling pig (2-6 weeks old) that is slow-roasted, although nowadays *lechon* sizes may vary from *lechon de leche* (5-10 kg), small (10-15 kg), medium (15-20 kg), large (20-25 kg), and extra-large (25-30 kg). Pork offals (i.e., lungs, kidneys, intestines, and heart) and lean meat are simmered in a rich, gravy of pork blood and vinegar and sautéed with garlic, onion, and long sweet peppers – popularly known as *dinuguan* (pork blood stew). Pork offals are relatively cheap and used together with other edible body parts in common Filipino dishes such as *sisig, bopis, kilawin, isaw, adobo*, etc.

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While it remains the best dish to top a Filipino feast, *lechon* from native breeds is fast becoming popular, often claimed to be tastier and healthier. The local *lechon* industry recognizes the genetic differences that may exist between native or commercial breeds and this could have important implications on production targets of those involved in the entire lechon value chain including pig breeders, growers, processors, slaughterhouse, and food establishment personnel. Adapted native breeds are also preferred to be used in the emerging organic livestock farming sector (Bondoc 2015). Although native pigs may have long been the source of livelihood in smallholder production system, their numbers are perceived to be declining at an alarming rate as the commercial sector continues to grow, thereby making them more expensive if at all available (e.g., Bondoc et al. 2017).

While there have been local researches on the slaughter of 90-120 kg commercial pigs, there is scarce information to compare native pigs versus commercial breeds for *lechon* production. This study, therefore, is aimed to evaluate pre-slaughter and slaughter data from *lechon*-size pigs belonging to native breeds (i.e., Black Tiaong and Kalinga) obtained from an organic pig production farm and commercial breeds (i.e., Landrace, Large White and their and F_1 crosses) purchased from a private, conventional pig breeding farm. While the study may not benefit from the controlled conditions of an experiment that may be able to draw firm conclusions about cause and effect, the benchmark data in this study may demonstrate significant association (or no association) of pre-slaughter and slaughter data with important factors such as type of production system (also confounded as genetic effect of breed groups), breed within a particular production system, sex, weight group, age, and slaughter weight. Such information will not only be important in the design of selection (genetic improvement) programs within the native pig breeds, but also for their conservation and utilization in local *lechon* production.

MATERIALS AND METHODS

This study was conducted in compliance with the requirements of the Institutional Animal Care and Use Committee (IACUC) of the University of the Philippines Los Baños, in collaboration with the National Swine and Poultry Research and Development Center, Bureau of Animal Industry (BAI), Department of Agriculture.

Data

A total of 40 *lechon*-size pigs, divided equally by sex (i.e., 20 barrows and 20 gilts), from two native breeds (i.e., Black Tiaong and Kalinga) and four commercial pure breeds and F_1 crosses [i.e., Landrace (LDR), Large White (LRW), F_1 LDR x LRW cross, and F_1 LRW x LDR cross] was used in the study. Native samples (n=24) from the organic swine farm were divided equally into two weight classes i.e., <20 kg and >20 kg. Group total per sex for each native breed (n=6) consisted of 3 pigs per weight class. Commercial pigs (n=16) from the conventional/ commercial breeding farm were all more than 20 kg at slaughter. Pig samples were randomly chosen for each breed, representing the typical *lechon*-size pigs available from existing organic and conventional production farms (see comparisons of pig production systems in Table 1). In the former, *lechon*-size pigs belong to the pure native breeds; in the latter farm, pigs sold for *lechon* production commonly consist of "defective" market hogs weighing at least 7 kg at weaning. Commercial stocks are not usually slaughtered for *lechon* production since they have the potential to be slaughtered more profitably at heavier weights with less effect on carcass merit and (or) feed conversion efficiency. The effect of type of farm – with respect to housing and feeding under real production conditions – may be confounded with genetic effects, since native pigs are not yet produced under a high level of management practiced in commercial production systems. On the other hand, breeding and production of commercial pure breeds and their F_1 crosses are not intended for organic production systems.

Experimental animals were transported from the farm a day before slaughter and fasted for at least 12 h prior to slaughter at the university abattoir of the Institute of Animal Science, College of Agriculture and Food Science, University of the Philippines Los Baños. Pre-slaughter data consisted of live weight at purchase, weight loss at transit (kg and %), and external body measurements (i.e., length of head, snout, ears, body, and tail; width of head, shoulder, and rump; wither and rump height; and neck circumference, heart girth, midriff girth, and flank girth).

Animals were slaughtered according to standard slaughtering practice (Ibarra 1983). About 6-8 pigs were slaughtered in six slaughter dates during Apr-Jun 2016. Pigs were stunned prior to bleeding. Pigs were then scalded by dipping in hot water vat with water temperature of 60-80^{o} C and dehaired manually. Subsequent to evisceration, head, feet, and leaf fat were removed.

Slaughter data consisted of slaughter weight, age at slaughter, dressing percentage (i.e., hot carcass weight, chilled carcass weight, hot dressing percentage, % carcass yield, % drip loss), weight and % (of live weight) edible internal organs and other body parts [i.e., head, ears, tail, heart, lungs, liver, kidney, spleen, stomach, small intestines, large intestines, visceral fats, female reproductive organs (uterus and ovaries), and blood]. Hot carcass without viscera, head, feet and leaf fat were

Table 1. Comparison of types of production system.

	Organic production system	Conventional swine breeding farm
Location	NSPRDC, BAI, DA, Lagalag, Tiaong, Quezon (approx. 13º56'36.96"N, 121º22'22.97"E)	INFARMCO, San Isidro, Cabuyao, Laguna (approx. 14º14'49.69"N, 121º8'34.41"E)
Breeds used	Black Tiaong, Kalinga	Landrace (LDR), Large White (LRW), F_1 LDR x LRW cross, F_1 LRW x LDR cross
Housing system	Semi-confined system that provides a house with adjoining fenced-off roaming/ loafing area for breeder animals (i.e., 15 m x 20 m pen with wallowing area) and pregnant and lactating sows (i.e., 2 m x 2 m individual pens with small openings allowing piglets free access to roaming area). Flooring material is made of garden soil, coconut husk, coconut coir, rice hull, and salt. Complete confinement for growers (i.e., 5 m x 3m) with cement flooring.	Indoors, using elevated cast iron slatted floors in lactation pens from day 1 to weaning (i.e., 30 days old) and in group pens (i.e., up to 8 pigs per 3 m x 3m pen) with solid concrete floor from post-weaning (31-77 days old) and growing-finishing (78-180 days old).
Feeds	Specially-formulated feed concentrate rations for boars, sows, and growers containing corn, soybean, rice bran, copra meal, molasses, salt, and limestone. Fresh fodder from "madre de agua" (*Trichantera gigantea*), "malung-gay" (*Moringa oleifera*), sweet pota-to (*Ipomea batatas*),"gabi" (Coloca-sia esculentum), "kulape" (*Paspa-lum conjugatum*), water fern (*Azolla filiculoides*), and vegetable wastes from the wet market i.e., carrots (*Daucus carota*), eggplant (*Sola-num melongena*), cabbage (*Bras-sica oleracea*), and cucumber (*Cucurbita maxima*).	Commercial feed rations are given i.e., yoghurt (3-10 d old), booster (7-42 d old), booster - pre-starter (43-50 d old), pre-starter (51-70 d old), starter (78-98 d old), grower (99-133 d old) and gilt developer (134-180 d old) for gilts, and performance test rations for boars (99-180 d old).
Breeding methods	Natural mating	Artificial insemination using fresh diluted semen
General herd and health management practices	Male piglets are castrated at weaning. Navel cutting, teeth clipping, and tail docking is not practiced. All pigs are vaccinated against hog cholera. Mange, scabies, and lice are treated using "Kakwate" (*Gliricidia sepium*). Common swine flu and diarrhea are treated using decoction of guava (*Psidium guajava*) and star apple (*Chrysoplyllum cainito*).	Male piglets are castrated as early as 3 d old. All pigs are injected with iron injection (3 d old) and vaccine-ted against Porcine Respiratory Syndrome or PRRS (21 d old), hog cholera (56 d old), and pseudo rabies (70 d old). Anti-scouring/diarrhea agents in oral suspension

weighed and the hot dressing percentage was calculated relative to the live weight of the fasted animal. Carcass yield was calculated based on chilled carcass (3-4° C).

Statistical analysis

For the statistical analysis of each trait, the individual slaughtered pig was considered an experimental unit. The general least squares procedures for unbalanced data were used to examine the principal sources of variation affecting each trait. The following linear "fixed effects" model was used to determine, using an F-test (SAS 2009), the appropriate model that would best describe each trait:

$$y_{ijklmn} = \mu + PS_i + Breed_j(PS_i) + Sex_k + WtClass_l + Age_m \text{ or } SLWt_m + e_{ijklmn}$$

where y_{ijklmn} is the dependent variable (i.e., pre-slaughter and slaughter data associated with each slaughtered pig); μ is overall mean; PS_i is fixed effect of the i^{th} type of production system (i.e., organic and conventional swine production system); $Breed_i(PS_j)$ is fixed effect of the j^{th} breed of pig [i.e., Landrace (LDR), Large White (LRW), "F_1 LDR x LRW cross", and "F_1 LRW x LDR cross"] nested within the i^{th} farm type; Sex_k is fixed effect for the k^{th} sex of the pig (i.e., barrow and gilt); $WtClass_l$ is fixed effect for the l^{th} weight class of the pig (i.e., <20 kg and >20 kg); Age_m or $SLWt_m$ is covariate effect of m^{th} age of pig at slaughter (in days) or slaughter weight (in kg); and e_{ijklmn} is error term assumed to be normally distributed with variance of errors as constant across observations.

Only those significant ($p<0.05$) fixed effects and covariates including the main effect of type of production system and breed nested within the production system were included in the final linear models. The least square means and standard error for each trait were then computed to represent the "breed standard" and used to compare between breeds in a particular production system.

The Pearson product moment correlation coefficients were also computed to measure linear relationships among significant pre-slaughter and slaughter data parameters for a particular production system using CORR procedure of SAS (2009).

RESULTS AND DISCUSSION

Least square means and standard error for slaughter data – by type of production system for pre-slaughter and slaughter data – are summarized in Tables 2 and 3, respectively. Breed standards within the pig production system for pre-slaughter and slaughter data are summarized in Tables 4 and 5, respectively. Significant correlations of pre-slaughter and slaughter parameters with hot carcass weight, hot dressing percentage, and carcass yield for each production system are shown in Table 6.

Table 2. Least square means (LSM) ± standard error (S.E.) for pre-slaughter data, by type of production system.

Pre-slaughter data	Organic farm (n=24)	Conventional farm (n=16)	Difference
Live weight at purchase, kg	22.20 ± 0.55	26.09 ± 0.67	-3.89 **
Weight loss at transit, kg	2.00 ± 0.14	2.13 ± 0.17	-0.13 ns
Weight loss at transit, %	8.97 ± 0.56	8.11 ± 0.68	0.86 ns
External body measurements			
- Head length, cm	23.33 ± 0.32	19.57 ± 0.45	3.76 **
- Snout length, cm	12.63 ± 0.22	10.41 ± 0.27	2.22 **
- Ear length, cm	9.10 ± 0.24	12.44 ± 0.30	-3.34 **
- Tail length, cm	18.25 ± 0.58	18.88 ± 0.71	-0.63 ns
- Body length, cm	59.58 ± 1.26	69.06 ± 1.54	-9.48 **
- Head width, cm	14.14 ± 0.18	15.31 ± 0.22	-1.17 **
- Shoulder width, cm	24.21 ± 1.75	19.69 ± 2.41	4.52 **
- Rump width, cm	19.90 ± 0.35	21.91 ± 0.43	-2.01 **
- Wither height, cm	41.29 ± 0.65	41.94 ± 0.84	-0.65 ns
- Rump height, cm	39.94 ± 0.77	48.00 ± 0.94	-8.06 **
- Neck circumference, cm	50.14 ± 0.78	47.85 ± 1.09	2.29 **
- Heart girth, cm	63.14 ± 0.78	60.38 ± 1.00	2.76 ns
- Midriff girth, cm	70.10 ±1.03	67.72 ± 1.27	2.38 ns
- Flank girth, cm	64.19 ± 1.10	62.91 ± 1.35	1.28 ns

ns No significant difference between type of production system (p>0.05).
* Significant difference between type of production system (p<0.05).
** Highly significant difference between type of production system (p<0.01).

Pre-slaughter data

Purchase weight
The purchase weight of *lechon*-size pigs was significantly lower (p<0.01) for native pigs obtained from the organic farm (22.20 kg) than commercial breeds purchased from the conventional pig breeding farm (26.09 kg). The price of lechon-size pigs depends on its live weight during purchase. *Lechon*-size native pigs are usually sold at ₱1,000 per 10 kg pig plus ₱100 per kg live weight in excess of 10 kg, regardless of breed. On the other hand, *lechon*-size commercial pigs were purchased more expensively at ₱2,400 per 10 kg pig plus ₱140 per kg live weight in excess of 10 kg, regardless of breed.

Weight loss during transit from farm to abattoir
Average loss of weight during transit was 2.05 ± 0.71 kg (or 8.62 ± 2.73% of live weight) and was not significantly different (p>0.05) between types of production system and between breeds within the type of production system. The organic pig farm is about 25 km away from the UPLB abattoir, while the private pig breeding farm is about 20 km south of the UPLB abattoir. Weight loss during transit was also not affected (p>0.05) by sex, weight group, and age and weight at slaughter.

Live measurements for length of body parts
Lechon-size native pigs raised in an organic production system had significantly (p<0.01) longer head, longer snout, shorter ears, and shorter body length than commercial pigs produced in a conventional swine breeding farm. Tail length was not significantly different (p>0.05) between pigs raised in different types of production system. Furthermore, head length was found to be positively correlated with age at slaughter (r=0.37, p<0.05). Length of head, snout, ears, and tail were not significantly affected (p>0.05) by sex, weight class, and slaughter weight.

Head length which is the distance between the nasal bone and occipital proturberance was longer in *lechon*-size native breeds (23.33 cm) than commercial pigs (19.57 cm), by about 3.76 cm. There was no significant difference in head length between Black Tiaong and Kalinga breeds. Among commercial pigs raised in the conventional breeding farm, the F_1 LDR x LRW cross had the longest head (21.16 cm), followed by F_1 LRW x LDR cross (19.51 cm), Large White (19.46 cm), and Landrace (18.14 cm).

Snout length measured between frontal nasal suture and upper part of the snout was also longer in native pigs (12.63 cm) than commercial breeds (10.41 cm), by about 2.22 cm. However, there was no significant difference in snout length between Black Tiaong and Kalinga breeds (p>0.05) and among commercial breeds

Table 3. Least square means (LSM) ± standard error (S.E.) for slaughter data, by type of production system.

Slaughter data	**Organic farm** (n=24)	**Conventional farm** (n=16)	**Difference**
Slaughter weight, kg	20.39 ± 0.26	21.45 ± 0.41	-1.06 *
Age at slaughter, days	168.79 ± 5.11	86.69 ± 6.26	82.10 **
Hot carcass weight, kg	14.04 ± 0.14	14.67 ± 0.18	-0.63 *
Chilled carcass weight, kg	13.63 ± 0.12	14.06 ± 0.16	-0.43 ns
Hot dressing percentage, %	64.74 ± 0.57	67.30 ± 0.70	-2.56 **
Carcass yield, %	62.73 ± 0.48	64.68 ± 0.59	-1.95 *
Drip loss, %	5.46 ± 0.81	3.19 ± 0.97	2.27 ns
Weight of edible internal organs and body parts			
Head, kg	2.35 ± 0.03	2.05 ± 0.03	0.30 **
Ears, g	134.5 ± 9.4	120.0 ± 14.3	14.5 ns
Tail, g	212.4 ± 10.9	236.3 ± 16.6	-23.9 ns
Heart, g	110.1 ± 3.3	119.0 ± 5.2	-23.9 ns
Lungs, g	410.4 ± 15.5	447.5 ± 20.0	-8.9 ns
Liver, g	484.6 ± 20.1	651.2 ± 24.6	-166.6 **
Kidneys, g	92.1 ± 3.8	128.1 ± 4.6	-36.0 **
Spleen, g	47.1 ± 3.2	65.0 ± 3.9	-17.9 **
Stomach, g	261.7 ± 9.1	180.6 ± 11.1	81.1 **
(Small intestine - length, cm)	1339.6 ± 32.1	1559.1 ± 38.5	-219.5 **
Small intestines, g	568.8 ± 17.4	885.0 ± 21.4	-316.2 **
Large intestines, g	637.9 ± 26.2	703.8 ± 32.0	-65.9 ns
Visceral fats, g	391.0 ± 17.8	333.4 ± 28.2	57.6 ns
Female reproductive organs, g	113.3 ± 9.3	66.2 ± 11.4	47.1**
Blood, g	818.1 ± 61.5	435.0 ± 85.4	383.1 **
Edible internal organs and body parts - as % of slaughter weight			
Head, %	11.03 ± 0.12	9.43 ± 0.15	1.60 **
Ears, %	0.65 ± 0.04	0.46 ± 0.05	0.19 **
Tail, %	1.00 ± 0.03	0.98 ± 0.04	0.02 ns
Heart, %	0.51 ± 0.02	0.55 ± 0.02	-0.04 ns
Lungs, %	1.96 ± 0.07	2.00 ± 0.08	-0.04 ns
Liver, %	2.40 ± 0.08	2.73 ± 0.10	-0.33 *
Kidneys, %	0.46 ± 0.02	0.53 ± 0.02	-0.07 *
Spleen, %	0.24 ± 0.01	0.27 ± 0.02	-0.03 ns
Stomach, %	1.30 ± 0.03	0.76 ± 0.04	0.54 **
Small intestines, %	2.83 ± 0.07	3.70 ± 0.09	-0.87 **
Large intestines, %	2.96 ± 0.13	2.87 ± 0.16	-0.09 ns
Visceral fats, %	1.91 ± 0.08	1.65 ± 0.09	0.26 *
Female reproductive organs, %	0.60 ± 0.05	0.27 ± 0.06	0.33**
Blood, %	3.86 ± 0.35	3.17 ± 0.34	0.69 ns

ns No significant difference between type of production system ($p>0.05$).
* Significant difference between type of production system ($p<0.05$).
** Highly significant difference between type of production system ($p<0.01$).

Table 4. Least square means (LSM) ± standard error (S.E.) for pre-slaughter data, by breed within the type of production system

Pre-slaughter data	**Native pig breeds**		**Commercial pig breeds**			
	Black Tiaong (BT), n=12	**Kalinga** (KAL), n=12	**Landrace** (LDR), n=4	**Large White** (LRW), n=4	**F_1 cross** (LDR x LRW), n=4	**F_1 cross** (LRW x LDR), n=4
Purchase weight, kg **	23.07 ± 0.78	21.34 ± 0.78	28.42 ± 1.35	26.45 ±10.35	24.40 ± 1.35	25.10 ± 1.35
Weight loss at transit, kg ns	2.13 ± 0.20	1.87 ± 0.20	2.58 ± 0.35	1.88 ± 0.35	1.64 ± 0.35	2.45 ± 0.35
Weight loss at transit, % ns	9.28 ± 0.79	8.65 ± 0.79	9.01 ± 1.37	7.00 ± 1.37	6.72 ± 1.37	9.69 ± 1.37
External body measurements						
- Head length, cm **	23.15 ± 0.35	23.51 ± 0.41	18.14 ± 0.70	19.46 ± 0.61	21.16 ± 0.54	19.51 ± 0.63
- Snout length, cm ns	12.71 ± 0.31	12.56 ± 0.31	10.50 ± 0.54	10.12 ± 0.54	10.50 ± 0.54	10.50 ± 0.54

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- Ear length, cm **	10.38 ± 0.34	7.82 ± 0.34	13.12 ± 0.60	10.62 ± 0.60	13.00 ± 0.60	13.00 ± 0.60
- Tail length, cm ns	18.04 ± 0.82	18.46 ± 0.82	18.50 ± 1.43	18.25 ± 1.43	20.75 ± 1.43	18.00 ± 1.43
- Body length, cm ns	59.50 ± 1.78	59.67 ± 1.78	70.12 ± 3.08	68.88 ± 3.08	69.00 ± 3.08	68.25 ± 3.08
- Head width, cm **	14.38 ± 0.26	13.92 ± 0.26	15.12 ± 0.45	16.25 ± 0.45	14.00 ± 0.45	15.88 ± 0.45
- Shoulder width, cm ns	23.18 ± 2.02	25.23 ± 2.20	16.72 ± 3.69	20.42 ± 3.38	22.62 ± 3.16	19.00 ± 3.72
- Rump width, cm ns	19.96 ± 0.50	19.83 ± 0.50	22.00 ± 0.87	21.25 ± 0.87	22.12 ± 0.87	22.25 ± 0.87
- Wither height, cm ns	41.14 ± 0.84	41.44 ± 0.94	40.73 ± 1.65	41.49 ± 1.54	43.35 ± 1.44	42.17 ± 1.44
- Rump height, cm ns	40.21 ± 1.09	39.67 ± 1.09	49.25 ± 1.88	47.25 ± 1.88	48.25 ± 1.88	47.25 ± 1.88
- Neck circumference, cm ns	50.60 ± 0.91	49.68 ± 0.99	46.78 ± 1.66	50.23 ± 1.52	47.63 ± 1.42	46.74 ± 1.67
- Heart girth, cm ns	62.15 ± 0.99	64.13 ± 1.11	59.80 ± 1.95	60.88 ± 1.82	59.79 ± 1.71	61.05 ± 1.70
- Midriff girth, cm ns	71.50 ± 1.46	68.71 ± 1.46	68.75 ± 2.53	67.38 ± 2.53	65.25 ± 2.53	69.50 ± 2.53
- Flank girth, cm ns	64.83 ± 1.55	63.54 ± 1.55	64.25 ± 2.69	64.50 ± 2.69	61.88 ± 2.69	61.00 ± 2.69

ns No significant difference between breeds in the same type of production system (p>0.05).
** Highly significant difference between breeds in the same type of production system (p<0.01).

Table 5. Least square means (LSM) ± standard error (S.E.) for slaughter data, by breed within the production system.

Slaughter data	Native pig breeds		Commercial pig breeds			
	Black Tiaong (BT), n=12	**Kalinga** (KAL), n=12	**Landrace** (LDR), n=4	**Large White** (LRW), n=4	**F_1 cross** (LDR x LRW), n=4	**F_1 cross** (LRW x LDR), n=4
Slaughter weight, kg **	20.91 ± 0.37	19.87 ± 0.37	23.33 ± 0.69	22.08 ± 0.69	20.25 ± 0.69	20.14 ± 0.69
Age at slaughter, days **	165.08 ± 7.22	172.5 ± 7.22	77.25 ± 12.51	90.75 ± 12.51	102.75 ± 12.51	76.00 ± 12.51
Hot carcass weight, kg ns	14.13 ± 0.18	13.95 ± 0.20	14.67 ± 0.36	15.17 ± 0.33	14.73 ± 0.31	14.11 ± 0.31
Chilled carcass weight - total, kg ns	13.69 ± 0.16	13.57 ± 0.17	14.32 ± 0.31	14.22 ± 0.28	14.20 ± 0.27	13.51 ± 0.27
Hot dressing percentage, % ns	65.02 ± 0.80	64.45 ± 0.80	67.13 ± 1.39	69.30 ± 1.39	67.82 ± 1.39	64.97 ± 1.39
Carcass yield, % ns	63.01 ± 0.68	62.44 ± 0.68	65.70 ± 1.18	65.39 ± 1.18	65.41 ± 1.18	62.22 ± 1.18
Drip loss, % ns	5.06 ± 1.12	5.85 ± 1.17	5.84 ± 1.95	2.53 ± 1.94	2.52 ± 1.95	1.86 ± 1.95
Weight of edible internal organs and body parts						
Head, kg *	2.32 ± 0.03	2.38 ± 0.04	1.94 ± 0.07	1.97 ± 0.06	2.14 ± 0.06	2.16 ± 0.06
Ears, g **	167.8 ± 9.9	101.3 ± 12.2	114.8 ± 20.0	112.0 ± 17.9	129.2 ± 17.9	123.9 ± 21.1
Tail, g ns	203.3 ± 11.4	221.6 ± 14.2	244.7 ± 23.1	209.1 ± 20.7	234.3 ± 20.7	257.2 ± 24.5
Heart, g ns	113.3 ± 4.6	106.8 ± 4.6	129.0 ± 8.7	104.0 ± 8.7	124.0 ± 8.7	119.0 ± 8.7
Lungs, g **	356.4 ± 19.8	464.4 ± 22.1	403.5 ± 39.0	436.6 ± 36.4	534.2 ± 34.1	415.6 ± 34.0
Liver, g ns	506.7 ± 28.4	462.5 ± 28.4	690.0 ± 49.2	640.0 ± 49.2	570.0 ± 49.2	705.0 ± 49.2
Kidneys, g **	93.3 ± 5.4	90.8 ± 5.4	177.5 ± 9.3	110.0 ± 9.3	105.0 ± 9.3	120.0 ± 9.3
Spleen, g ns	47.5 ± 4.5	46.7 ± 4.5	72.5 ± 7.8	57.5 ± 7.8	72.5 ± 7.8	57.5 ± 7.8
Stomach, g ns	252.5 ± 12.8	270.8 ± 12.8	180.0 ± 22.1	167.5 ± 22.2	195.0 ± 22.2	180.0 ± 22.2
(Small intestine - length, cm **)	1332.6 ± 228.6	1146.6 ± 107.0	1521.0 ± 84.0	1700.8 ± 56.0	1393.5 ± 107.7	1621.2 ± 94.2
Small intestines, g **	648.3 ± 24.7	489.2 ± 24.7	820.0 ± 42.7	1045.0 ± 4.27	792.5 ± 42.7	882.5 ± 42.7
Large intestines, g ns	674.2 ± 113.4	601.7 ± 172.9	630.0 ± 96.9	767.5 ± 98.7	680.0 ± 82.9	737.5 ± 56.8
Female reproductive organs, g*	95.0 ± 13.2	131.7 ± 13.2	55.0 ± 22.8	90.0 ± 22.8	65.0 ± 22.8	55.0 ± 22.8
Visceral fats, g *	325.0 ± 25.1	457.0 ± 25.3	380.2 ± 47.1	305.2 ± 47.1	327.7 ± 47.1	320.2 ± 47.1
Blood, g ns	901.1 ± 90.0	735.0 ± 83.8	566.9 ± 133.5	359.4 ± 133.5	461.9 ± 133.5	351.9 ± 133.5

ns No significant difference between breeds in the same type of production system (p>0.05).
** Highly significant difference between breeds in the same type of production system (p<0.01).

Table 6. Significant correlations among pre-slaughter and slaughter parameters in native pig breeds (organic) and commercial breeds and crosses (conventional).

	Native pig breeds (organic), n=24			Commercial breeds/crosses (conventional), n=16		
	Hot carcass weight	**Hot dressing percentage**	**Carcass yield, %**	**Hot carcass weight**	**Hot dressing percentage**	**Carcass yield, %**
Hot carcass wt.	-	ns	ns	-	ns	0.64**
Hot dressing %	ns	-	0.84**	ns	-	0.73**
Slaughter wt.	0.94**	ns	ns	0.94**	ns	ns
Body length	0.50**	ns	ns	ns	ns	ns
Head width	0.65**	ns	ns	ns	ns	ns
Rump width	0.51 *	0.54**	ns	ns	ns	ns
Rump height	0.50 *	ns	ns	ns	ns	ns
Neck circum.	0.54**	ns	ns	ns	ns	ns
Head, kg	0.81**	ns	ns	0.52 *	ns	ns
Liver, kg	0.49**	-0.42 *	ns	ns	-0.58 *	ns
Kidney, kg	0.69**	ns	ns	ns	ns	ns
Stomach, kg	ns	-0.44 *	ns	ns	ns	ns
Small intest., kg	0.45 *	ns	ns	ns	ns	ns
Blood, kg	ns	ns	-0.53*	0.55 *	ns	ns
Head,%	0.57**	ns	ns	-0.55 *	ns	ns
Liver, %	ns	ns	ns	ns	-0.66**	-0.64**
Stomach, %	ns	-0.52**	ns	-0.62 *	ns	ns
Small intest., %	ns	-0.46 *	ns	ns	ns	ns

N is number of paired observations.
ns Correlation coefficient (r_{XY}) is significantly different from zero, P<0.05.
* Correlation coefficient (r_{XY}) is significantly different from zero, P<0.05.
** Correlation coefficient (r_{XY}) is significantly different from zero, P<0.01.

in the conventional swine breeding farm (p>0.05). The longer head and snout (and larger head weight and head percentage) in native pig breeds may indicate their close association with the characteristics of their wild ancestors, which have bigger heads and snouts in proportion to their body size that allow them to obtain food by rooting to sustain their omnivorous dietary habits (Graves 1984; Skewesa et al. 2008).

Ear length measured between base of the ear and tip of the ear was longer in commercial breeds (12.44 cm) than native breeds (9.10 cm), by about 3.34 cm. Black Tiaong pigs had significantly (p<0.01) longer ears than Kalinga pigs (i.e., 10.38 cm and 7.82 cm, respectively). Among commercial breeds, Landrace (13.12 cm) had the longest ears, followed by F_1 crosses (13.00 cm) and Large White (10.62 cm). The smaller ears in native pigs especially in the Kalinga breed may suggest a well-developed sense of hearing to which they rely more than their sight, similar to the observations made on the social and aggressive behavior of wild or feral swine (Conley et al. 1972 and Eisenberg and Lockhart 1972 as cited by Graves 1984).

Body length measured from occipital proturberance and pin bone was longer in commercial breeds (69.06 cm) than native breeds (59.58 cm), by about 9.48 cm. However, there was no significant difference (p>0.05) in body length between breeds raised in the same production system.

Tail length measured from the tip to the base of the tail was slightly longer in commercial breeds (18.88 cm) than native breeds (18.25 cm), although the difference was not statistically significant (p>0.05). No significant difference in tail length was also found between breeds raised in the same production system (p>0.05).

Live measurements for width of body parts

Significant differences (p<0.01) in width of head, shoulder, and rump were found between native pigs raised in an organic production system and commercial pigs produced in a conventional swine breeding farm.

Commercial breeds had wider head (15.31 cm) than native breeds (14.14 cm). Head width as measured between the two zygomatic arches was also significantly different between breeds within a particular production system (p<0.01). Among commercial breeds raised in the conventional breeding farm, Large White (16.25 cm) had the largest head width, followed by F_1 LRW x LDR cross (15.88 cm), Landrace (15.12 cm), and smallest in F_1 LDR x LRW cross (14.00 cm). Black Tiaong pigs had a larger head width (14.38 cm) than Kalinga pigs (13.92 cm). Head width was not significantly different (p>0.05) between sex, weight class, and age and weight at slaughter.

Lechon-size commercial breeds had narrower shoulder width (19.69 cm) than native breeds (24.21 cm), by about 4.52 cm. The width of shoulders – as measured between the points of the shoulder – was also found to be positively and significantly affected by (p<0.01) by age at slaughter, but not significantly influenced (p>0.05) by breed in a particular production system, sex, weight class, and slaughter weight.

On the other hand, commercial breeds had wider rump (21.91 cm) than native breeds (19.90 cm). Rump width as measured between the external iliac tuberosities was not significantly affected (p>0.05) by breed in a particular production system, sex, weight class, and slaughter weight.

Live measurements for height
Withers height measured between the highest part of wither and the ground was not significantly different (p>0.05) between native breeds (41.29 cm) and commercial breeds (41.94 cm). Commercial breeds, however, were significantly (p<0.01) taller at the rump (48.00 cm) than native breeds (39.94 cm), by about 8.06 cm. Slaughter weight was positively correlated with withers height (r=0.58, p<0.01), but not related to rump height (p>0.05). Both withers height and rump height as measured between the highest point of the hip bone and the ground were not significantly affected (p>0.05) by breed in a particular production system, sex, weight class, and age at slaughter.

Live measurements for neck and body circumference
Neck circumference was significantly larger (p<0.01) for *lechon*-size native breeds (50.14 cm) than commercial breeds (47.85 cm), by about 2.29 cm. Heart girth or body circumference immediately after the foreleg was also significantly larger (p<0.01) in native breeds (63.14 cm) than commercial breeds (60.38 cm), by about 2.76 cm. Slaughter weight was positively correlated with heart girth (r=0.66, p<0.01), but not related to neck circumference (p>0.05). Both neck circumference and heart girth were not significantly affected (p>0.05) by type of production system, breed in a particular production system, sex, weight class, and age at slaughter.

Both midriff girth or body circumference at the level of the umbilicus (69.15 cm) and flank girth or body circumference of the pelvic region (63.68 cm) of *lechon*-size pigs were not significantly affected (p>0.05) by type of production system, breed in a particular production system, sex, weight class, and age and weight at slaughter.

The longer body size – as well as wider head and rump – and greater rump height of lechon-size commercial breeds may have been the result of an improved understanding of nutritional requirement and through selective breeding for lean types run by private breeding companies (e.g., Wood & Whittemore 2006; Simm et al. 2009). This is in contrast to native breeds, which had no history of purposive selection program for highly heritable traits associated with pork quality.

The wider shoulders, larger neck circumference and heart girth of *lechon*-size native pigs may be suggestive of the bigger torso commonly associated with the more aggressive and free roaming wild pigs (Graves 1984) and their immediate domesticated relatives. On the other hand, the smaller shoulder width and bigger rump width of commercial breeds may suggest their less aggressive stance when raised in complete confinement. Such information will be useful in determining the width of a feeder space or trough length for liquid feeding systems.

Slaughter data

Weight and age at slaughter
The average slaughter weight of *lechon*-size pigs used in the experiment was 21.70 ± 3.13 kg. Slaughter weight was significantly different between types of production system (p<0.05), between breeds in a particular production system (p<0.01), and between weight classes (p<0.01). Slaughter weight was however, not significantly different between sexes (p>0.05). Pigs belonging to the high weight class had significantly higher (p<0.01) weight at slaughter (23.44 kg) than those in the low weight class (18.40 kg), by about 5.04 kg.

Slaughter weight was significantly higher (p<0.05) in commercial breeds purchased from the conventional farm (21.45 kg) than native breeds obtained from the organic farm (20.39 kg). In particular, *lechon*-size Black Tiaong pigs used in the experiment were heavier (20.91 kg) than Kalinga pigs (19.87 kg). Among commercial breeds, Landrace (23.33 kg) were heaviest at slaughter, followed by Large White (22.08 kg), F_1 LDR x LRW cross (20.25 kg), and F_1 LRW x LDR cross (20.14 kg). On the other hand, age at slaughter was significantly different between types of production system (p<0.01), but not significantly affected (p>0.05) by breed in a particular production system, sex, and weight class. *Lechon*-size native pigs obtained from the organic farm are older at slaughter (168.8 days) than commercial breeds purchased from the conventional farm (86.7 days), by about 2.7 months.

Hot dressing percentage

Hot carcass weight and hot dressing percentage in *lechon*-size pigs were significantly different between types of production system, but not significantly affected (p>0.05) by breed in a particular production system, sex, weight class, and age at slaughter. Slaughter weight was positively correlated with hot carcass weight (r=0.96, p<0.05) but not related to hot dressing percentage (p>0.05). In contrast, as observed by other researchers (García-Macías et al. 1996; Candek-Potokar et al. 1998; and Latorre et al. 2003), there were significant increases in hot carcass weight and carcass yield as especially for heavy pigs weighing more than 100 kg.

Hot carcass weight was significantly higher (p<0.05) in commercial breeds (14.67 kg) than native breeds (14.04 kg). Significantly higher hot dressing percentage (p<0.01) was also observed for commercial breeds (67.30%) than native breeds (64.74%), by 2.56 percentage points.

Carcass yield (%)

Chilled carcass weight and carcass yield were significantly different between the types of production system (p<0.05), but not significantly affected (p>0.05) by breed in a particular production system, sex, weight class, and age at slaughter. Slaughter weight was positively correlated with chilled carcass weight (r=0.97, p<0.05) but not related to carcass yield percentage (p>0.05).

Chilled carcass weight was significantly higher in commercial breeds (14.06 kg) than native breeds (13.63 kg). Higher carcass yield was also recorded for commercial breeds (64.68%) than native breeds (62.73%).

Drip loss (%)

Drip loss is another measure of processing or technological attributes of meat quality (Andersen 1999). Drip loss is associated with the firmness and water-holding capacity of the meat. Not only is high drip loss unattractive, it can result in excessive cooking losses and drying of meat during cooking. Drip loss may thus be related to sensory parameters of fresh product as well. For example, a high degree of drip loss would tend to be lighter in color, be less tender, have less pork flavor, and have more off-flavor (Huff-Lonergan et al. 2002). In this study, drip loss was slightly higher in carcass obtained from native breeds (5.46%) than those from commercial breeds (3.19%), although the difference was not statistically significant (p>0.05). The % drip loss was also not significantly different (p>0.05) between breeds in a production system nor related to sex, weight class, and age and weight at slaughter.

Weight of edible body parts and internal organs

The top six largest edible parts or internal organ as % of body weight of a *lechon*-size pig included the head, blood, small intestines, large intestines, liver, and lungs (see Figure 1).

Edible body parts

Head weight of *lechon*-size native breeds (2.35 kg) was significantly heavier (p<0.01) than commercial breeds (2.05 kg), by about 300 g. The head of Kalinga pigs (2.38 kg) was significantly heavier (p<0.05) than Black Tiaong (2.32 kg). Smaller head weights were recorded for F_1 LRW x LDR cross (2.16 kg), F_1 LDR x LRW cross (2.14 kg), Large White (1.97 kg), and Landrace (1.94 kg). Head weight as % of body weight was also significantly higher (p<0.01) in the native breeds (11.03%) than commercial breeds (9.43%). Both head weight and head percentage were significantly different (p<0.05) between breeds in a particular production system, but were not significantly influenced (p>0.05) by sex, weight class, and age at slaughter. Slaughter weight was positively correlated with head weight (r=0.72, p<0.01), but not related to head percentage (p>0.05).

Weight of ears was not significantly different (p>0.05) between native breeds (134.5 g) and commercial breeds (120.0 g). Ear weight as a percentage of body weight was however significantly bigger (p<0.01) in native breeds (0.65%) than commercial breeds (0.46%). In the organic production system, Black Tiaong had larger ears (167.8 g) than Kalinga pigs (101.3 g), by about 66.5 g. In the conventional production system, the ears of the F_1 LDR x LRW cross (129.2 g) were largest, followed by F_1 LRW x LDR cross (123.9 g), Landrace (114.8 g), and Large White (112.0 g). Both ear weight and ear percentage were significantly different between breeds in a particular production system (p<0.01) and positively correlated with age at slaughter (r=0.42, p<0.05), but were not significantly influenced (p>0.05) by sex and weight at slaughter.

Average tail weight was 214.5 ± 31.3 g, representing 0.99 ± 0.15% of a pig's body weight. Weight of tail was not significantly different (p>0.05) between production systems, and between breeds in the same production system. Although positively correlated with slaughter weight (r=0.63, p<0.05), tail weight was not significantly influenced (p>0.05) by sex, weight class, and age at slaughter.

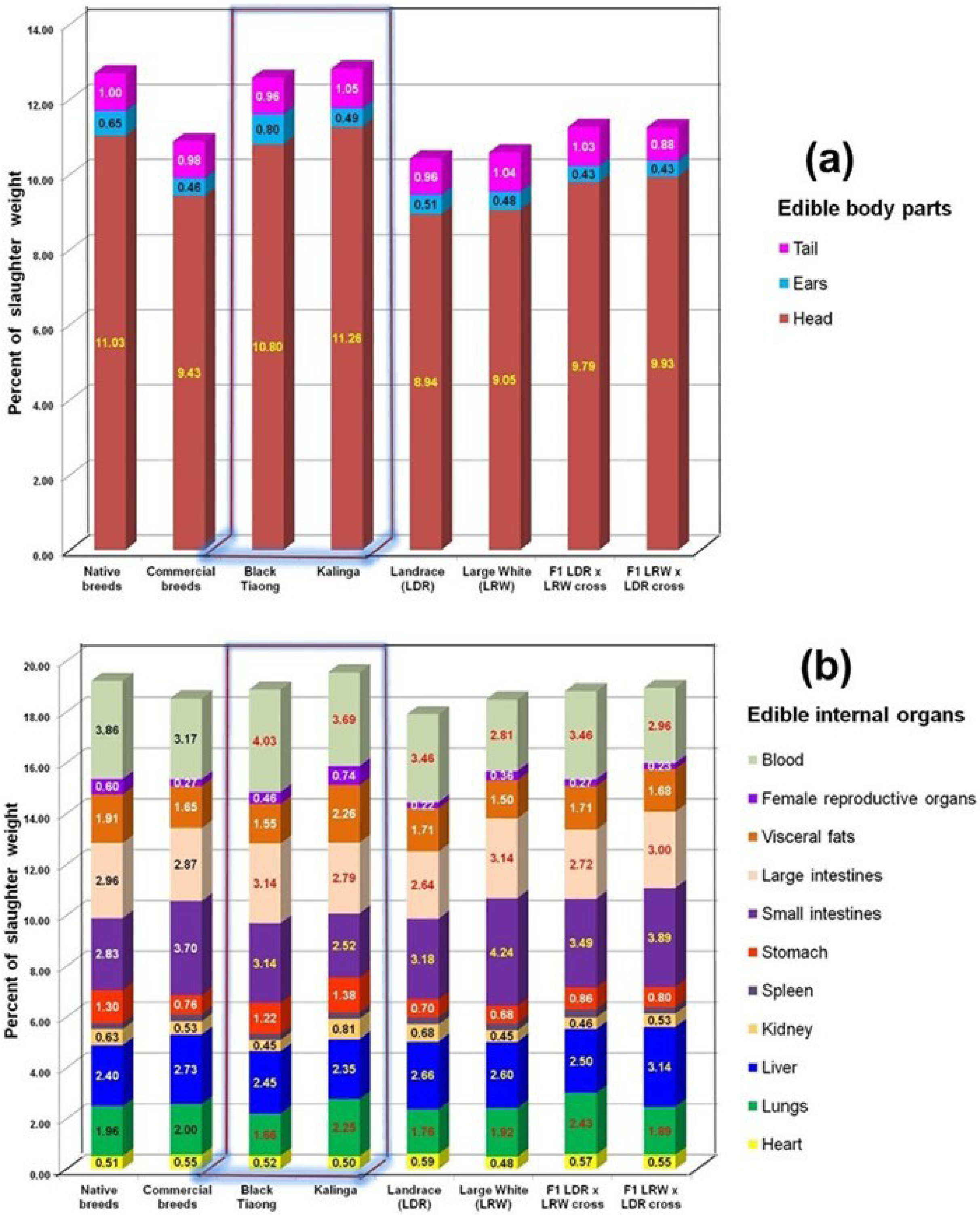

Figure 1. Weight of edible body parts (a) and edible internal organs (b) as percent of slaughter weight.

Edible internal organs

Overall, the weight of liver, kidneys, spleen, and small intestines were significantly higher (p<0.01) in commercial breeds obtained from the conventional swine breeding farm than native breeds raised in an organic production system. On the contrary, *lechon*-size native breeds had significantly larger (p<0.01) stomach and female reproductive organs, and more blood extracted than the commercial breeds.

Liver weight was significantly higher (p<0.01) in commercial breeds (651.2 g) than native breeds (484.6 g), by about 166.6 g. However, average weight of liver (551.2 g) and when expressed as % of body weight (2.53%) was not significantly influenced (p>0.05) by breed in the same production system, sex, weight class, and age and weight at slaughter.

In other studies that considered wild pigs, Muller et al. (2000) and Skewesa et al. (2008) reported that weight of stomach, intestines, liver, heart, lungs, and blood volume was higher in wild boars as compared to crossbreds, suggesting that domestication and evolution of domestic pigs is associated with reductions of the relative weight of some tissues and organs.

Weight of kidneys was significantly higher (p<0.01) in commercial breeds (128.1 g) than native breeds (92.1 g), by about 36.0 g. Average weight of kidneys and when expressed as % of body weight was also significantly higher (p<0.05) in *lechon*-size native breeds (0.53%) than commercial breeds (0.46%). In the organic production system, Black Tiaong had bigger kidneys (93.3 g) but lower proportion to total body weight (0.45%) than Kalinga pigs (i.e., 90.8 g or 0.47%, p<0.01). In the conventional production system, kidneys of the Landrace (177.5 g) were largest, followed by F_1 LDR x LRW cross (120.0 g), Large White (110.0 g), and F_1 LRW x LDR cross (105.0 g). Both weight of kidneys and when expressed as % of body weight, were not significantly influenced (p>0.05) by sex, weight class, and age and weight at slaughter.

Spleen weight was significantly higher (p<0.01) in commercial breeds (0.27 g) than native breeds (0.24 g). However, average weight of spleen (54.2 ± 17.7 g) and when expressed as % of body weight (0.25 ± 0.07%) was not significantly influenced (p>0.05) by breed in a particular production system, sex, weight class, and age and weight at slaughter.

Weight of small intestines was significantly higher (p<0.01) in commercial breeds (885.0 g) than native pig breeds (568.8 g), by about 316.2 g. The length of the small intestines was likewise significantly longer (p<0.01) in commercial breeds (1559.1 cm) than native breeds (1339.6 cm), by about 219.5 cm. However, average weight of small intestines (695.2 ± 197.0 g) and when expressed as % of body weight (3.08 ± 0.53%) was not significantly influenced (p>0.05) by sex, weight class, and age and weight at slaughter.

On the other hand, the weight of stomach was significantly higher (p<0.01) in native breeds (261.7 g) than commercial breeds (180.6 g), by about 81.1 g. Stomach weight may reflect capacity of the stomach and physical limits of feed intake (Kyriazakis & Whittemore 2006), which in turn could be influenced by the bulk of the diet. Bulkier feeds given in organic production systems are thus expected to lead to bigger stomachs of native pigs than those in conventional pig production systems where feed concentrates are regularly used. However, average weight of stomach (229.2 ± 58.6 g) and when expressed as % of body weight (1.08 ± 0.32%) was not significantly influenced (p>0.05) by breed in a particular production system, sex, weight class, and age and weight at slaughter.

The larger and longer small intestines but smaller stomach in commercial breeds may be related to higher feed efficiency based on the utilization of dense concentrate rations in conventional swine breeding farms as most feed nutrients are digested and absorbed in the small intestines than in the stomach (Pluske et al. 1997). In contrast, bigger stomachs are noted for the less efficient native pigs in the organic production system where they thrive mostly on bulky (high density) forage-based and low concentrate feed rations.

Weight of female reproductive organs was also significantly higher (p<0.01) in native breeds (113.3 g) than commercial breeds (66.2 g), by about 47.1 g. However, average weight of female reproductive organs (94.5 ± 40.3 g) and when expressed as % of body weight (0.47 ± 0.25%) was not significantly influenced (p>0.05) by breed in a particular production system, weight class, and weight at slaughter. The larger female reproductive organs in native breeds may be attributed to older gilts (about 164.1 days old) compared to younger gilts belonging to the relatively late maturing commercial breeds (about 91.2 days old), which are yet to be fed with grower mash at 99-133 days old and gilt developer mash at 134-180 days old.

More blood (p<0.01) was also extracted during slaughter from native breeds (818.1 g) than commercial breeds (435.0 g), by about 383.1 g. More blood (p<0.01) was also obtained for pigs more than 20 kg (954.6 g) than those weighing below 20 kg at slaughter (298.5 g), by about 656.1 g. However, average weight of blood (776.4 ± 323.0 g) and when expressed as % of body weight (3.50 ± 1.30%) was not significantly influenced (p>0.05) by breed in a particular production system, and age and weight at slaughter.

On the other hand, weight of heart, lungs, large intestines, and visceral fats were not significantly different (p>0.05) between native and commercial breeds.

Average weight of heart was 119.2 ± 24.3 g, representing 0.55 ± 0.08% of the *lechon*-size pig's body weight. The pig's heart is a hard-working muscle and is high in protein. The heart may be stewed, poached, braised, or made into sausage. Heart weight was significantly higher (p<0.01) for pigs weighing more than 20 kg (130.5 g) than those weighing below 20 kg at slaughter (98.6 g), by about 31.9 g. However, heart weight was not significantly influenced (p>0.05) by breed in a particular production system, sex, and age and weight at slaughter.

Average weight of lungs was 425.2 ± 91.9 g, representing 1.98 ± 0.42% of the pig's body weight. Lung weight (assumed to be associated with lung capacity or volume to breathe air) was significantly different between breeds in a particular production system (p<0.01) and between sex (p<0.05). In the organic production system, *lechon*-size Kalinga had bigger lungs (464.4 g) than Black Tiaong pigs (356.4 g), by about 108.0 g. In the conventional production system, lungs of the F_1 LDR x LRW cross (534.2 g) were largest, followed by Large White (436.6 g), F_1 LRW x LDR cross (415.6 g), and Landrace (403.5 g). Lungs were heavier in the *lechon*-size barrows (458.4 g) than in gilts (408.9 g), by about 49.5 g. However, weight of lungs was not significantly influenced (p>0.05) by type of production system, weight class, and age and weight at slaughter.

Average weight of large intestines was 664.2 ± 131.7 g, representing 3.08 ± 0.53% of a pig's body weight. The large intestines perform the vital task of absorbing water and vitamins while converting digested food into feces. Pig intestines are prepared in a similar manner to pork rinds known locally as *chicharon bulaklak*. Weight of large intestines was significantly higher (p<0.01) for pigs more than 20 kg (718.8 g) than those weighing below 20 kg at slaughter (543.1 g), by about 175.7 g. However, weight of large intestines was not significantly influenced (p>0.05) by breed in a particular production system, sex, and age and weight at slaughter.

Average weight of visceral fats was 389.8 ± 106.7 g, representing 1.80 ± 0.46% of the pig's body weight. Visceral fat that occurs in the abdominal cavity is also called "soft fat" and leaf lard. It is rendered pork fat that has a high smoking point, which makes it an excellent choice for frying, pan searing, and grilling. Weight of visceral fats was significantly different between breeds in a particular production system (p<0.05) and between weight class (p<0.01). Kalinga had more visceral fats (457.0 g) than Black Tiaong pigs (325.0 g), by about 132.0 g. In the conventional production system, visceral fats of the Landrace (380.2 g) were biggest, followed by F_1 LDR x LRW cross (327.7 g), F_1 LRW x LDR cross (320.2 g), and Large White (305.2 g). Weight of visceral fats was significantly higher (p<0.01) for pigs more than 20 kg (424.4 g) than those weighing below 20 kg at slaughter (299.9 g), by about 124.5 g. Weight of visceral fats however, was not significantly influenced (p>0.05) by sex, and age and weight at slaughter.

Significant correlations among pre-slaughter and slaughter data

Table 6 shows that in both production systems, hot carcass weight was positively related to slaughter weight, head weight, and head percentage. Hot dressing percentage was positively associated with carcass yield but negatively correlated to the weight of the liver.

For native pig breeds raised in organic production system, hot carcass weight was also positively correlated with body length, head width, rump width, rump height, neck circumference, weight of the liver, kidney, and small intestines. Hot dressing percentage among native pig breeds was also positively associated with rump width but negatively correlated with weight and % stomach, and % small intestines.

For all pre-slaughter and slaughter parameters found to be significantly different between the production systems (Table 2 and 3), hot carcass weight, hot dressing percentage and % carcass yield were not significantly correlated (p>0.05) with age at slaughter, head length, snout length, ear length, shoulder width, weight of spleen and female reproductive organs, length of small intestines, % kidney, % visceral fats, and % female reproductive organs.

ACKNOWLEDGMENT

The authors gratefully acknowledge the valuable assistance of the following persons for all kinds of assistance extended to them during data collection: MM Lapie, NP Bandian, AA Velasco, EJC Agsunod, VKB Alag, AA Rayos, PP Sanghel, RSA Vega, and RF Sandoval of the Institute of Science, College of Agriculture and Food Science, University of the Philippines Los Baños. The authors would also like to thank Dr. Rene C. Santiago and his staff at the National Swine and Poultry Research and Development Center (NSPRDC), Bureau of Animal Industry – Department of Agriculture (BAI-DA), Lagalag, Tiaong, Quezon for providing the native pig samples. The authors are likewise grateful to Mr. Tony Chua and Mr. Jimmy N. Chua of INFARMCO Swine Breeding Farm, San Isidro, Cabuyao, Laguna for the commercial pure breeds and F_1 crosses used in the study.

CONFLICT OF INTEREST

The authors declare no conflict of interest in this study.

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