EVALUATION OF BODY SCORES AND SLAUGHTER WEIGHT AS VARIABLES FOR THE ESTABLISHMENT OF GRADES AND STANDARDS FOR LIVE HOGS FOR PHILIPPINE USE

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INTRODUCTION

Rationale

At present, marketing of hogs in the Philippines is mainly on a liveweight basis. Price of hog is derived by multiplying its liveweight with the prevailing market price. According to Ibarra (1983), the recommended slaughter weight of hogs for fresh meat retailing and meat processing is 80- 110 kilograms. Optimum carcass yield and quality is obtained from the animals slaughtered within this weight range. However, hogs weighing even below 70 kg are being slaughtered elsewhere in the country. In the current livestock situation in the country, it is usually the commercial raisers who are able to meet this standard or even better. Nowadays, commercial raisers are able to come up with the right combinations of breed and nutrition that could produce animals that could grow up to115 kilograms yet still yield carcasses with thin backfat. On the other hand, backyard hog raisers mainly depend on swill feeds and/or ordinary commercial feeds in nurturing their animals. Thus, they are usually limited to produce hogs with the maximum of 90 kilogram slaughter weight, and the quality is not as good as the commercial-produced hogs. Animals exceeding this weight value are usually considered overweight and are given lower prices since they are expected to produce carcasses with thick backfat.

The “Establishment of Grades and Standards for Live Hogs for Philippine Use” is a project that aims to formulate grade classification of hogs. This proposed grading system intends to attain more orderly and fair livestock market transaction. With this proposed grading system, farmers will be encouraged to produce more and better livestock since not only liveweight will be considered but the total value of the resulting carcass. Along with this proposed grading system is a plan of setting price differential among the graded animals. Those animals that are graded superiors will be valued higher than the inferior ones. Also through this, hog raisers could demand a higher price for their produce, a thing that they cannot do in the present livestock trading set up where there is a common price for all hogs regardless of the quality of the animal.

Proposed grades and standards for hogs is a primary step towards marketing efficiency, improvement of hog economic status, and eventually global competitiveness.

Objectives

The main objective of the project is to provide basis for the formulation of grading standards for market hogs in the Philippines that will determine price differential in the local markets. This will encourage the farmers to produce more uniform and high quality hogs that are competitive nationally and internationally.

This project specifically aims to:

1) Identify the appropriate indicators of the total value of the pork carcass;
2) Determine the most suitable variables that can be used basis for live hog grading; and,
3) Formulate grade classification of hogs to be recommended for the setting of the Philippine National Standards for Live Hog Grading.

METHODOLOGY

Preliminary Phase

Prior to the actual data gathering, the Grades and Standards Team underwent a 5-day "Special Training Course on Live Animal and Carcass Evaluation" to further enhance their technical capability. This was conducted by then Institute of Animal Science now Animal and Dairy Science Cluster, University of the Philippines Los Baños (ADSC, UPLB). The course was composed of series of lectures and practicum which are relevant and useful to the study such as live and meat quality evaluation, animal selection for slaughter, slaughtering and meat fabrication procedures and other related topics.

In order to obtain data on livestock population, list of abattoirs and other necessary data for the study, Bureau of Animal Industry (BAI) worked in coordination with the different agencies of the Department of Agriculture (DA) such as the National Meat Inspection Services (NMIS) and the Bureau of Agricultural Statistics (BAS).

Other activities include informal dialogue with the farm owners and livestock traders/viajeros, visitation in Livestock "Oksyon" Markets (LOMs), and observation of slaughtering procedures in selected abattoirs. Finally, a dry- run of data collection was conducted in Monterey Food Corporation Slaughterhouse located in Dasmariñas, Cavite.

Collection of Data

The project was divided into two studies. The Study 1 was about estimation of carcass yield of pigs with different body scores (BS) using various carcass measurements, while the Study 2 dealt on determination of the relationships between slaughter weight, BS and the amount of intramuscular fats and sensory properties of pork.

In study 1, 112 hogs coming from different selected slaughterhouses were used as experimental samples. The liveweight of hogs ranged from 70 to 120 kg. Meanwhile,

study 2 used 30 pigs with the same weight range and also from different selected slaughterhouses.

Samples were obtained from Luzon provinces using the database of livestock, poultry and by-products' handlers. The purposive sampling was used in the conduct of the study. The criteria for the selection of the slaughterhouses were as follows: (1) volume of hog slaughtered (not less than 50 heads per day); (2) fabrication procedure used wherein the loin-eye-area must be intact to be used as sample; and (3) the willingness of the owner to use their animals as samples. Samples were identified from the abattoirs and followed through up to the final destinations such as public markets.

Study 1: Estimation of Carcass Yield of Pigs with Different Body Scores and Liveweights

Live Animal Traits

Prior to the slaughtering, variables such as sex, liveweight and body score were taken. These activities were done while the animals were still in the holding pens. These parameters serve as live grade estimators for carcass yield and quality since we are interested to obtain or predict the total economic value of the carcass that will be produced.

***Liveweight*.** A digital livestock weighing scale (Mettler-Toledo) was used in the study. Since the study has no control of slaughtering process, weights of the animals were gathered regardless of whether they are fasted or not.

***Body score*.** The relative shapes or conformations of ham, jowl, neck, underline and top of hogs were evaluated. Body scores were based on the body conformation observed on the animal's side, rear, top and the whole body. Pictures of the hogs' side, rear and top views were also taken for future reference. Descriptions of each body score are presented in Annex 1.

Carcass Traits

***Carcass weight*.** This was taken after the entrails were removed and the carcass was washed with the head intact (head on) and unchilled. The hanged carcasses were weighed using a digital weighing scale.

***Dressing percent*.** In this study, the dressing percent was based on hot carcass weight of the hogs. Dressing percentage was calculated using the formula:

$$\text{Dressing Percent} = \frac{\text{Hot Carcass Weight}}{\text{Slaughter Weight}} \times 100$$

***Backfat thickness*.** Backfat thickness was measured in the left side of the carcass at the point opposite the first rib, last rib and last lumbar vertebrae using a caliper. The average of the three readings represent the backfat thickness .

***Loin-eye-area*.** The loin-eye-area (LEA) was measured at the loin region between the 10^{th} and 11^{th} ribs of the left side of the carcass. It was traced on an acetate paper and the total area was determined using a grading grid. A grading grid is placed at

the bottom of the tracings on an acetate paper and the number of dots was counted. Twenty dots are equivalent to a square inch.

***Fat depth*.** At the same place where loin-eye-area was measured, fat depth was measured at the ¾ of the distance of the length of the rib eye from its chine bone side using a metal ruler (Burson, 2001).

***Percent fat-free lean*-** The percent fat-free lean (% FFL) predicts the proportion of fat-free pork in a carcass. The % FFL was computed by dividing the pounds of fat-free lean (LbFFL) by either liveweight or carcass weight expressed in pounds. The LbFFL was computed based on the formula published by National Pork Producers Council in United State (Burson, 2001):

$$\begin{aligned} \text{LbFFL} = 8.588 &+ (0.465 \times \text{hot carcass wt., lb.}) \\ &- (21.896 \times 10^{th} \text{ rib fat depth, in.}) \\ &+ (3.005 \times 10^{th} \text{ rib loin muscle area, sq. in.}). \end{aligned}$$

Study 2: Determination of the Relationships between the Liveweight and Body Scores and the Amount of Intramuscular Fat and Sensory Properties of Pork

Sensory Traits

Loin samples from 9th to 11th rib region of the right side of the carcass were obtained for sensory evaluation. Samples were packed in polyethylene bag and kept frozen at chest type freezer until ready for analysis.

Prior to cooking, frozen samples were thawed in the chiller (2-4^{0}C) for about 24 hours. Samples were cooked by roasting in an oven with cooking temperature of 135^{0}C to 150^{0}C until the core temperature of 82^{0}C was reached. The cooked LD muscle was separated from the other tissues, trimmed off with external fats, and then cut into bite size. Samples were served to experienced panel consisting of 12 members. The sensory quality such as flavor, off-flavor, tenderness, juiciness and general acceptability were evaluated using a 9-point hedonic scale. Annex 2 shows the 9-point hedonic scale used in the sensory evaluation tests.

Fat Analysis

Samples for fat analysis were obtained from 9th to 10th rib region of the *logissimus dorsi* (LD) muscle at the left side of the carcass. The external fat and epimysial tissues were remove prior to the homogenization. Samples were homogenized by passing through a meat grinder three times. The fat content of the muscle was determined using the procedures described by AOAC (1990) with little modification to adapt to the laboratory condition and properties of the meat.

Statistical Analysis

All data were analyzed using Analysis of Variance in completely randomized design wherein a P value less than or equal to 0.05 is considered significant. Means

were compared using Least Significant Difference test. Correlation and regression analyses were done to determine the relationships between slaughter weight and percent intramuscular fat.

RESULTS

Study 1: Carcass Yield and Characteristics of Pigs with Different Body Scores and Liveweight

Effect of Body Score on Carcass Yield and Characteristics

The effect of live body conformation on dressing yield was determined. The result of this study showed that pigs with BS 3 had significantly higher dressing percent ($P<0.001$) than those pigs with BS 1 and BS2 (Table 1). Pigs with BS 1 and BS 2 had similar dressing percent.

Meanwhile, pigs with BS 3 had the thickest backfat (1.14 inch), followed by pigs with BS 2 (0.89 inch), then by BS 1 (0.69 inch). This result can be expected because BS 3 pigs have fat body conformation, while BS 1 pigs are expected to be lean type. The loin eye area was similar among different body scores. Consequently, the computed percent fat-free lean (% FFL) was highest in pigs with BS 1 and lowest in pigs with BS 3 and the effect was statistically significant. This effect was observed both when the FFL was expressed as percent of liveweight (% FFL_{lw}) and percent of dressed weight (% FFL_{dw}).

Effect of Liveweight on Carcass Yield and Characteristics

The animals with the same body condition scores were classified into three groups according to their liveweight (< 90 kg, 90-110 kg and >110 kg). However, the study found difficulty of getting animal samples for BS 1 weighing > 110 kg and BS 3 weighing less than 90 kg. Nonetheless, the nine weight groups were compared across BS groups. The present study found no specific trend with regards to the effect of liveweight on dressing yield within the same body score. However, results have shown that pigs belonging to BS 3 with >110 kg liveweight had the highest dressing yield (80.57%), while those pigs belonging to BS 2 with <90 kg liveweight had the lowest dressing yield (80.41%). The above mentioned groups were significantly different.

Within the same BS, the values for backfat thickness, fat depth, and loin eye area tended to be highest in > 110 kg weight group and lowest in < 90 kg weight group. In terms of computed % FFL, increasing value of % FFL was observed together with increasing liveweight group in pigs belonging to BS 3 group. For pigs belonging to BS 1 and BS 2 groups, no effect of liveweight on % FFL were observed. Pigs with BS 1 and > 100 kg tended to have lower % FFL than the rest of the weight groups with BS 1. However, the effect was not statistically significant ($P>0.05$).

Table 1. Carcass yield and characteristics of slaughter pigs with different body scores and liveweight[1]

BS	LW (kg)	N	DY (%)	BF (inch)	FD (inch)	LEA (inch^2)	% FFL (lw)	% FFL (dw)
1		25	82.08±3.23b	0.69±0.24a	0.59±0.26a	6.42±1.15	45.19±4.17a	55.00±3.96a
	< 90	12	81.85±2.98^{bcd}	0.59±0.20^{f}	0.54±0.15^{d}	5.72±0.77^{cd}	45.41±3.07^{a}	55.46±2.77^{a}
	90-110	11	82.62±3.66^{abc}	0.75±0.24^{ef}	0.56±0.31^{cd}	7.06±1.06^{b}	45.84±5.00^{a}	55.39±4.57^{ab}
	> 110	2	80.46±3.11^{abcd}	0.94±0.28^{abcde}	0.94±0.28^{abc}	7.05±1.77^{abc}	40.29±3.06^{abc}	50.18±5.74^{abcd}
2		59	81.31±3.26b	0.89±0.20b	0.81±0.23b	6.82±1.75	42.34±3.90b	52.01±3.38b
	< 90	22	80.41±4.21^{d}	0.80±0.14^{de}	0.71±0.14^{bcd}	5.29±1.06^{cd}	41.64±3.64^{bc}	51.73±2.79^{c}
	90-110	26	82.32±2.65^{bc}	0.93±0.23^{cd}	0.85±0.28^{ab}	7.17±1.48^{b}	43.43±4.43^{ab}	52.67±4.12^{bc}
	> 110	11	80.71±1.44^{cd}	0.98±0.16^{bc}	0.96±0.17^{a}	7.34±1.31^{ab}	41.17±2.34^{bc}	50.99±2.22^{c}
3		28	84.04±1.55a	1.14±0.27c	0.98±0.33c	6.45±2.07	40.97±4.71b	48.73±5.22c
	< 90	3	83.14±1.26^{abc}	1.05±0.05^{abcd}	1.08±0.10^{a}	4.83±1.14^{d}	37.57±1.41^{c}	45.18±1.32^{d}
	90-110	15	83.86±1.74^{ab}	1.12±0.25^{ab}	0.97±0.27^{a}	5.27±0.87^{cd}	39.74±3.68^{c}	47.36±3.87^{d}
	> 110	10	84.57±1.23^{a}	1.21±0.34^{a}	0.97±0.46^{a}	8.71±1.56^{a}	43.84±5.43^{ab}	51.83±6.34^{c}
Total/ Average		**112**	**82.16±3.11**	**0.91±0.28**	**0.81±0.30**	**6.63±0.30**	**42.63±4.39**	**51.86±4.55**
BS P value			< 0.001	< 0.001	< 0.001	0.511	0.001	< 0.001
LW P value			0.004	< 0.001	< 0.001	< 0.001	0.001	< 0.001

[1]Data are presented as means ± standard deviation. Means in the same column with different superscript or letters are significantly different.

Study 2: Relationships between the Liveweight and Body Scores and the Amount of Intramuscular Fat and Sensory Properties of Pork

Effect of Slaughter Weight on Marbling

The effect of slaughter weight on marbling was determined. The result of this study shows that the slaughter weight of pigs had significant effect on the amount of intramuscular fat (IMF) or marbling (Table 2). Pigs weighing more than 110 kg had significantly higher percent IMF in loin (*longissimus dorsi*) muscle than those pigs weighing 70 to 90 kg. Pigs belong to 90-110 kg weight group were not significantly different from the other weight groups.

The result of correlation analysis shown in Table 3 indicated that the percent IMF in the loin muscle was positively correlated to the slaughter weight ($r=0.644$, $P<0.01$). Figure 1 shows the scattered graph showing the relationship between slaughter weight and marbling.

Table 2. Effect of slaughter weight on marbling of slaughter pigs

Slaughter Weight (kg)	N	% Intramuscular Fat
< 90	10	2.07 ± 0.99^{a}
90-110	16	2.67 ± 1.06^{ab}
>110	4	3.64 ± 0.61^{b}
Mean	30	2.60 ± 1.08

*Means with different superscript are significantly different (P=.04)

Table 3. Correlation coefficient of percent intramuscular fat with the slaughter weight of pigs

Parameter	Slaughter Weight	% Intramuscular Fat
Slaughter weight	1	.644**
% Intramuscular Fat	.644**	1

[1] The slaughter weight of pigs ranged from 63 kg to 125 kg (N=30)
** Correlation is significant at the 0.01 level (2-tailed)

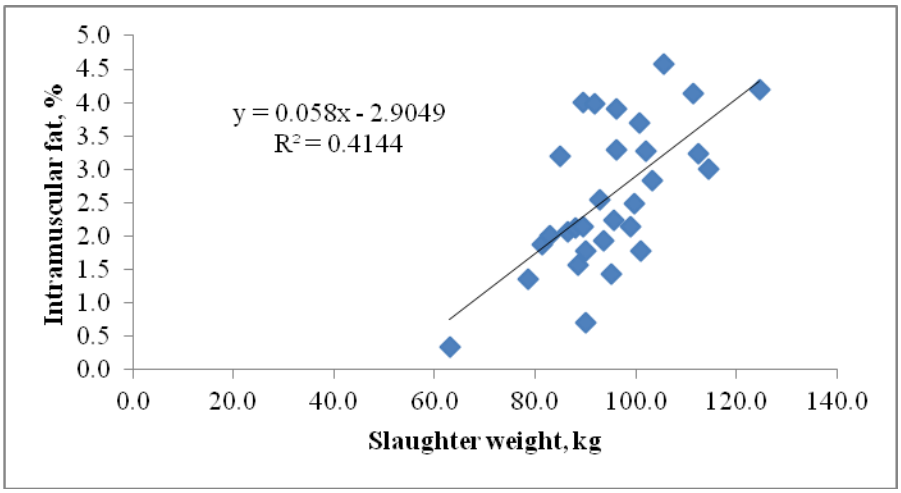

Figure 1. The relationships between slaughter weight and amount of intramuscular fat in *longissimus dorsi* of pigs. The slaughter weight of pigs ranged from 63 kg to 125 kg.

Effect of Body Score on Marbling

The body score (BS) had significant effect on percent IMF in LD muscle (Table 4). Pigs with BS 3 had significantly higher percent IMF (3.26%) than pigs with BS 1 (1.30%). Pigs with BS 2 had intermediate amount of IMF (2.01%) and not significantly different than those pigs with BS 1 and BS 3.

Table 4. Effect of body score (BS) on marbling of slaughter pigs

BS	N	% Intramuscular Fat
1	5	1.30 ± 0.75^{a}
2	8	2.01 ± 0.55^{ab}
3	17	3.26 ± 0.83^{b}
Mean	30	2.60 ± 1.08

*Means with different superscript are significantly different (P<.001).

Effect of Slaughter Weight on Sensory Characteristics of Pork

There are no significant differences detected in the sensory characteristics of roast loin samples from the different weight groups (Table 5). The slight differences in IMF did not reflect on the palatability attributes of the pork samples.

Table 5. Sensory characteristics of roasted pork loin from different weight groups

Slaughter Weight (kg)	N	Flavor	Off-Flavor	Tenderness	Juiciness	General Acceptability
< 90	3	6.63	1.13	6.07	4.96	6.10
90-110	3	6.77	1.00	5.73	3.90	6.10
>110	3	6.67	1.07	6.10	3.93	6.17
Mean		6.69	1.07	5.97	4.03	6.12

DISCUSSION

Body condition score has been widely used as production tool for selecting breeding animals and evaluating the nutritional status or condition of animals that are related to their productivity. This parameter allows specifications on performance target, management regime and genotype choice. On slaughter animals, body shapes have been found related to carcass composition (Doeschl et al., 2004). Animal traders, through experience, have developed skills in estimating the yield of animals based on ocular observation of the conformation and size of the animal. The use of live body conformation scoring for slaughter animals is no longer new. The illustration depicting live body conformation and carcass grade of pork in United State was presented decades ago in the book authored by Romans and Ziegler (1977). In the Philippines, trade standard specification for pork carcasses was created in 1969. However, the implementation of the said standard has not been successful and it was not revised until this date. The knowledge on live animal evaluation particularly in visual assessment of yield and quality of pork remained in the hands of traders and is transferred from one generation to another through experience or norms.

In this study, various yield indicators of hogs such as dressing percentage, backfat thickness, loin eye area and predicted percentage of fat-free lean were found influenced by live body score (BS). The body scoring system used in this study seems effective in classifying pigs into groups that have distinct characteristics in terms of yield and carcass quality. Therefore, the BS used in this study can be used as marketing tool that can benefit all the stakeholders of the animal industry such as farmer producers, traders, meat processors, retailers and consumers.

The result of this study showed that liveweight has no significant effect on dressing yield and carcass lean yield (% FFL) of slaughter pigs at least in BS 1 and BS 2 groups. However, for those pigs that have BS 3, dressing yield and % FFL tended to increase with liveweight. Latorre et al. (2004) reported that dressing percent increases as the slaughter weight of pig increases from 116 to 133 kg. Similar observation was reported by Correa et al. (2006) in pigs slaughtered 107 to 125 kg liveweights. At present study, effects of liveweight on dressing yield and lean yield were observed only in pigs with fatter conformation (BS 3) and not in those with lean type or average body conformation (BS 1 and BS 2). The previous two studies did not consider the body condition of the animals used. However, it can be speculated that the size of the pigs they used had body conformations close to BS 2 and BS 3 because the present study found difficulty of getting pig samples in the field with BS 1 at the same time weighing more than 110 kg.

The effects of liveweight on carcass traits such as backfat thickness, 10th rib fat depth and loin eye area observed in this study were consistent with the findings of previous studies (Latorre et al., 2004; Piao et al., 2004; Correa et al., 2006). Both backfat thickness and loin eye area showed increasing trend with liveweight. The equation that is being used to predict fat-free lean is based on the fact that as the fat thickness increases, percent lean decreases; as loin eye area increases, percent lean increases; and as carcass weight increases, percent lean decreases (Carr et al., 2010). The increase in backfat thickness together with the increase in liveweight may be compensated by the increase in the size of loin eye as the animal gets bigger. Thus, the % FFL is the ideal indicator of the true value of the carcass with regards to yield. However, local meat retailers in the public markets prefer pork carcasses with thinner backfat regardless of overall lean yield, while meat retailers in supermarkets and high end meat shops prefer larger size of loin. Therefore, the results of this study can be used as buyers' guide for satisfying preferences for carcass quality in terms of backfat thickness, size of loin muscle as well as overall lean yield.

The overall value of carcass does not rely solely on yield. Meat traits that are related to palatability are of equal importance. One of the meat traits that can be controlled by production management and has significant influence to the value of the meat is marbling or the amount of intramuscular fat. Marbling affects flavor, juiciness and tenderness of meat. In this study, the effects of BS and liveweight on the amount of intramuscular fat in *longissimus dorsi* muscle are determined. The results of the second study indicated that both BS and slaughter weight can affect the amount of marbled fat. As expected, pigs with BS 3, which have fatter body condition, have significantly higher amount of intramuscular fat than those with BS 1. If the carcass lean yield will not be considered, then those pigs with BS 3 can potentially give better carcass quality. Therefore, the preferences for quality and yield have to be considered in giving value to the animal.

The amount of intramuscular fat generally increases as the animals become heavier. Pigs belonging to >110kg group had significantly higher amount of intramuscular fat than those belonging to < 90 kg group. The results of this study are in agreement with the findings of Shuler et al. (1970) and Cisneros et al. (1996). Shuler et al. (1970) found significant increase in marbling due to slaughter weight in pigs weighing 45 to 114 kg, while Cisneros et al. (1996) reported linear increase in percent fat of loin muscle in pigs weighing 100 to 160 kg.

The value of intramuscular fat obtained in this study can be described as *devoid* to *trace* if compared to Canadian marbling standard for pork and beef (Jones et al., 1992). The marbling in pork with BS 1 can be described as *devoid*, BS 2 as *devoid* to *trace*, while BS 3 as *trace*. Pigs weighing < 90 kg have *devoid* marbling, 90-110 kg have *devoid* to *trace*, while those weighing >110 kg have *trace* marbling. According to Jones et al. (1992), marbling in Canadian pork ranged from devoid (1% to 2.5%) to small (5% to 6.5%).

The differences in the amount of marbling as an effect of slaughter weight did not reflect on the sensory properties of as evaluated by experienced taste panel. There were no significant differences among weight groups in terms of flavor, off-flavor, tenderness, juiciness and general acceptability. In contrast, Piao et al. (2004) found no significant effect of liveweight on marbling score but they observed significant differences in terms of flavor, juiciness, tenderness and overall taste on pork obtained from pigs having 100,

110, 120 and 130 kg liveweight. They reported that all the palatability attributes were highest in pigs weighing 110 kg. There is possibility that the margin of marbling in the present study is not wide enough for it to give significant effect on sensory attributes.

RECOMMENDATION

Based on the results of this study, considering the effects of BS and slaughter weight on carcass yield, carcass characteristics and marbling, a grading system for slaughter pigs can be recommended. Slaughter hogs will be classified into three general grades designated as 1, 2, and 3 using body scores and liveweight as grade factors. The main basis for these classification is the computed % $FFL_{(lw)}$. Then, Grade 1 will be further subdivided into 1- and 1+ according to their liveweight and the corresponding differences in backfat thickness and loin eye area. The Grade 2 will be further sub-grouped to 2-, 2^0 and 2+ with the same reason as Grade 1 plus their differences in percent intramuscular fat (% IMF). The proposed live grading system for slaughter pigs is presented in Table 6.

Table 6. The proposed grading system for live market hogs for Philippine use, together with the carcass characteristics of pigs classified according to the grade.

Grade Designation	Grade Factors		Carcass Characteristics*				
	Body Score	Liveweight (kg)	% $FFL_{(lw)}$	IMF (%)	BF	LEA	DY (%)
1-	1	< 90	45.41 ± 3.07^{a}	1.21 ± 1.22^{c}	0.58 ± 0.20^{d}	5.73 ± 0.77^{c}	81.85 ± 2.98^{ab}
1+	1	90 - 110	45.83 ± 5.00^{a}	1.36 ± 0.61^{c}	0.75 ± 0.24^{cd}	7.06 ± 1.06^{b}	82.62 ± 3.66^{a}
2-	2	< 90	41.64 ± 3.64^{bc}	2.02 ± 0.64^{c}	0.80 ± 0.14^{bc}	5.29 ± 1.06^{c}	80.41 ± 4.21^{b}
2^{0}	2	90 -110	43.43 ± 4.43^{ab}	1.95 ± 0.25^{bc}	0.93 ± 0.23^{b}	7.72 ± 1.48^{ab}	82.32 ± 2.65^{a}
2+	1 2 3	> 110 > 110 > 110	42.25 ± 4.13^{b}	3.64 ± 0.61^{a}	1.08 ± 0.28^{a}	8.10 ± 1.50^{a}	82.37 ± 2.43^{a}
3	3	≤ 110	39.38 ± 3.47^{c}	3.14 ± 0.87^{ab}	1.16 ± 0.23^{a}	5.17 ± 0.90^{c}	83.74 ± 1.66^{a}

*Means with different superscript are significantly different (P<0.01)

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ANNEXES

Annex 1. Description of different body parts of hog according to body score

Parameters	BS 1	BS 2	BS 3	Utility
Side View				
Ham	Perfectly rounded	Slightly rounded	Bulging	Thin and angular
Jowl	Flat/ straight	Plump	Sagging	Flat/ straight
Neck	Flat/ straight	Plump	Sagging	Flat/ straight
Underline	Straight	Straight	Convex/ sagging	Straight/ convex
Rear View				
Center width of the ham	Wide and expressively muscled	Slightly wide and moderately muscled	Wide and over fat	Narrow
Top View				
Top Appearance	Well defined butterfly-shaped	Flat	Flat/ smooth	Prominent backbone
Whole Body				
Overall muscling	Thickly muscled	Averagely muscled	Averagely muscled but tend to have more fat	Thinly muscled

Annex 2. Hedonic scale used for the sensory evaluation of the roasted pork loin.

Score	Flavor	Off-Flavor	Tenderness	Juiciness	Over-all Acceptability
9	Very Rich	Very Strong	Very Tender	Very Juicy	Very Acceptable
8	Rich	Strong	Tender	Juicy	Acceptable
7	Moderatel y Rich	Moderately Strong	Moderately Tender	Moderatel y Juicy	Moderately Acceptable
6	Slightly Rich	Slightly Strong	Slightly Tender	Slightly Juicy	Slightly Acceptable
5	Neither Rick nor Weak	Perceptible	Neither Tender nor Tough	Neither Juicy nor Dry	Neither Acceptable nor Unacceptable
4	Slightly Weak	Slightly Perceptible	Slightly Tough	Slightly Dry	Slightly Unacceptable
3	Moderatel y Weak	Moderately Perceptible	Moderately Tough	Moderatel y Dry	Moderately Unacceptable
2	Weak	Very Low	Tough	Dry	Unacceptable
1	Very weak	None	Very Tough	Very Dry	Very Unacceptable