Determination of the Carcass Characteristics of Breeding Pigs in Côte D'ivoire

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Abstract— *The purpose of this study is to determine the characteristics of the carcass of pigs reared in the south of Côte d'Ivoire. The work involved 320 pigs from pig farms in the district of Abidjan and around Abidjan, and a few pig farms in the provinces of Côte d'Ivoire. The animals are left on fasting in the SIVAC slaughterhouse park on the eve of slaughter. On the day of slaughter, the animals are weighed on the ground and after slaughter; the pigs are gutted, split before the carcass weight is determined. The lean meat content of the carcasses is determined by the manual method, using the grading slider ZweiPunkt (ZP), and then the carcasses are classified according to the EUROP grid. The study reveals that the pigs slaughtered at the SIVAC slaughterhouse have an average live weight of 89.1 ± 13.6 kg. The average carcass weight is 66.5 ± 11.2 kg and the average carcass efficiency is 74.71 ± 4.5 %. Most pig's carcasses are in class E where the estimated lean meat content is greater than or equal to 55%. Female pigs are predominantly less fatty than castrated male pigs, with estimated lean meat content greater than or equal to 55 %. These results confirm that the pigs reared in Côte d'Ivoire are less fat and partially meet the nutritional needs of the population.*

Keywords— *pigs, lean meat, carcass, Côte d'Ivoire.*

I.   INTRODUCTION

Côte d'Ivoire has significant agricultural potential for ensuring appreciable food production for an estimated population of 23 million [1] .However, it has a significant gap between production and demand for animal protein. The food balance sheet for Côte d'Ivoire (2001-2007) shows a low availability of animal products which is 12.5 kg on average per inhabitant and per year for meat, against 35 kg on average per *capita* per year. According to [2], Côte d'Ivoire is highly dependent on imports of animal and animal products, apart from eggs. The production of meats from ruminants and poultry, alone, cannot fill the growing protein deficit, given the current and especially future constraints linked to these farms [3]. A development strategy for the pig sector can be an alternative to protein feeding problems. It can play an important role in improving the nutritional status of the population. However, the pork sector presents today many challenges, namely the acceptability of the product by society and its response to consumer requirements in terms of price, quality and safety [4]. In Côte d'Ivoire, people tend to consider pork too fatty and incompatible with good nutrition. The objective of this work is to determine the characteristics of the carcass of pigs slaughtered at the Abidjan SIVAC slaughterhouse.

II.   MATERIAL AND METHODS

2.1   Material

The present work involved 320 pigs composed of 183 males and 137 females from pig farms in and around Abidjan, and from a few pig farms in the interior of Côte d'Ivoire. The age of these animals varied between 8 and 10 months, and consist of Large White, Land race, Piétrain, hybride, Duroc and Korhogo pigs. The material of the slaughterhouse consisted of an individual monitoring sheet pigs, an EXA brand mechanical scale, Roman type, weighing 300 kg to weigh cattle. A marker was used to identify live pigs, and methylene blue for the identification of pig carcasses. An electronic load cell incorporated into the rails made it possible to weigh pig carcasses. The ZweiPunkt (ZP) slide, version 2006, was used to determine the lean meat content of the carcasses for grading pigs.

2.2   Live weight and carcass weight

The study was carried out from March to May 2017, at the Société Ivoirienne d'Abattage et de Charcuterie (SIVAC), based in the halltown of Yopougon, in Abidjan. The sampling method used is the empirical, non-probabilistic method in which all breeders who come to slaughter pigs are kept. A maximum of 10 pigs were kept each day, by farmer. These animals were identified on the ground using markers, and methylene blue for carcasses. The pigs were weighed on the foot using an EXA brand mechanical balance, Roman type, with a 300 kg capacity for weighing cattle. After the slaughter of the pigs,

evisceration and slitting, the carcasses were weighed using an electronic load cell incorporated into the slaughterhouse rails.

2.3   Determination of muscle level

The carcasses are graded using the ZweiPunkt (ZP) strip (Figure 1). The grading method for pig carcasses using the ZP slider is a manual grading method based on the measurement of fat and muscle. The Muscle Piece Prediction Equation (PMR) hot, expressed in millimeters, is:
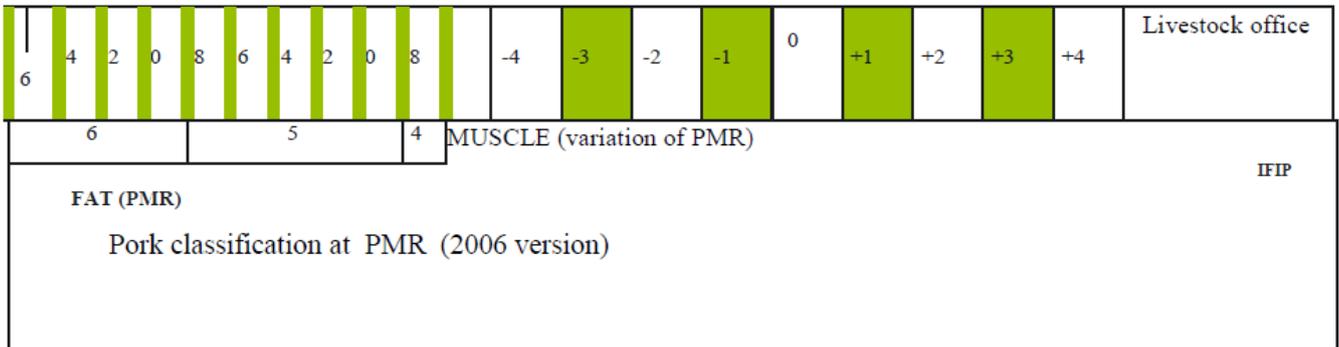
$$Y = 55.99 - 0.514\ G + 0.157\ M$$

FIGURE 1: ZweiPunkt (ZP) grading strip

According to [5], the use of the slider is carried out in a sequence in several operations (Figure 2). fat is measured. The minimum fat thickness zone is immediately identified visually. The zero of the ZP strip (top left corner) is positioned on the border between the *gluteus medius* muscle and the subcutaneous fat and perpendicular to the rind and the air (Photograph 1). The highest value of the estimated lean meat content is memorized.

Measuring the minimum muscle thickness was done in several steps. The minimum thickness area of the lumbar muscle is visually identified. The zero of the slide (left top corner) is positioned on the dorsal side of the spinal canal at the minimum muscle thickness (Photograph 2). An adjustment of the strip is made so that its upper edge is in contact with the anterior end of the *gluteus medius* muscle. The variation of PMR located under the anterior end of the *gluteus medius* muscle is read. As in the case of fat measurement, the lowest value read is stored. The calculation of the PMR was done by a mental calculation by summing the value of PMR due to fat and the variation of PMR due to muscle and the marking on the carcass.

2.4   Carcass classification

The piece muscle ratio (PMR) or lean meat content obtained made it possible to classify pig carcasses according to the EUROP grid. According to [5], each letter corresponds to a class which is based on the estimated lean meat content of the carcass. The higher the lean meat content of the carcass, the less fat the pork (Table 1). Carcass yield is the ratio of carcass weight to live weight, all multiplied by 100.
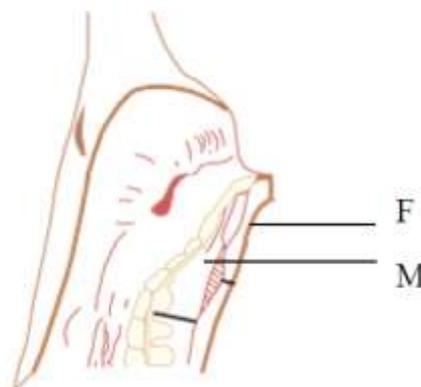

FIGURE 2: Manual method measurement sites
F: Fat; M: Muscle

PHOTOGRAPH 1: Measurement of the minimum fat thickness

PHOTOGRAPH 2: Measurement of the minimum muscle thickness

TABLE 1
EUROP GRID

Estimated lean meat content	Classes
55 and over	E
50 to less than 55	U
45 to less than 50	R
40 to less than 45	O
less than 40	P

Source: Daumas (2006)

2.5   Data processing

Data entry was carried out by Access software and data processing was carried out using Excel software and Statistical Package for the Social Sciences Personal Computer (SPSS / PC) software.

III.   RESULTS

3.1   Average weight and carcass yield of slaughtered pigs

According to Table 2, pigs slaughtered at the SIVAC slaughterhouse have an average live weight of 89.1 ± 13.6 kg with an average carcass weight of 66.5 ± 11.2 kg. The lowest recorded live weight is 59 kg and the highest weight is 128 kg. The minimum carcass weight is 42 kg and the maximum is 96.4 kg. The average carcass yield of slaughtered pigs is 74.71 ± 4.5 % with a minimum of 71.19 % and a maximum of 75.31 %.

3.2   General classification of pig carcasses by estimation of lean meat content

According to Figure 3, the carcasses of pigs slaughtered at the SIVAC slaughterhouse belong to classes E, U and R of the EUROP grid. Most pig carcasses (64.69 %) are in class E where the estimated lean meat content is greater than or equal to 55 %. This class is followed by class U which includes 30.94 % of pig carcasses with lean meat content between 50 and less than 55 %. The lowest proportion of pig carcasses (4.37 %) falls to class R with estimated lean meat content between 45 and less than 50 %. There are no pig carcasses belonging to classes O and P.

TABLE 2
WEIGHT AND CARCASS YIELD OF PIGS SLAUGHTERED AT SIVAC

Criteria	Average value	Minimum value	Maximum value
Live weight (kg)	89.1 ± 13.6	59	128
Carcass weight (kg)	66.5 ± 11.2	42.0	96.4
Carcass efficiency (%)	74.71 ± 4.5	71.19	75.31

Number of pigs slaughtered: n = 320;
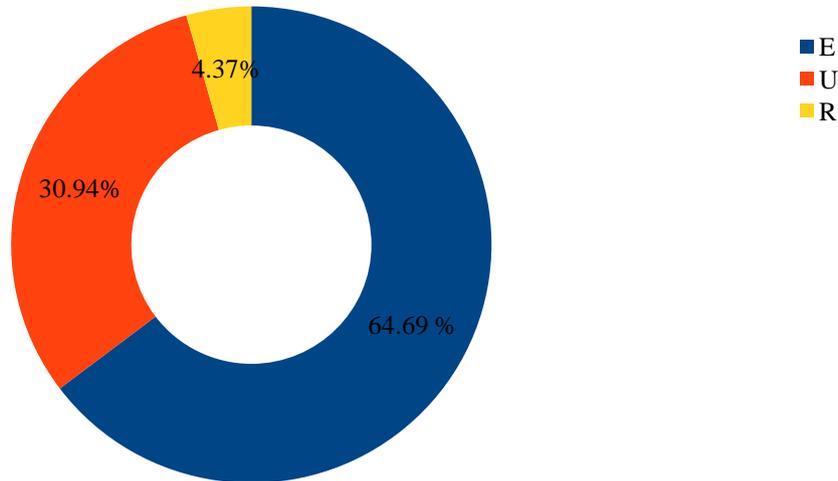*Carcass efficiency (%) = (Carcass weight x 100) / Live weight*

FIGURE 3: General classification of the pig carcass according to the lean meat content using the ZP slider

Number of pigs slaughtered n = 320
Class E: lean meat content estimated at 55 % and more
Class U: estimated lean meat content of 50 to less than 55 %
Class R: estimated lean meat content from 45 to less than 50 %

3.3   Sex classification of pig carcasses

According to Figure 4, the carcasses of female pigs are essentially in class E with a proportion of 49.3 %. Unlike females, castrated male pig carcasses generally belong to class R with a proportion of 78.6 %. Female pigs are therefore mostly less fat compared to castrated males.
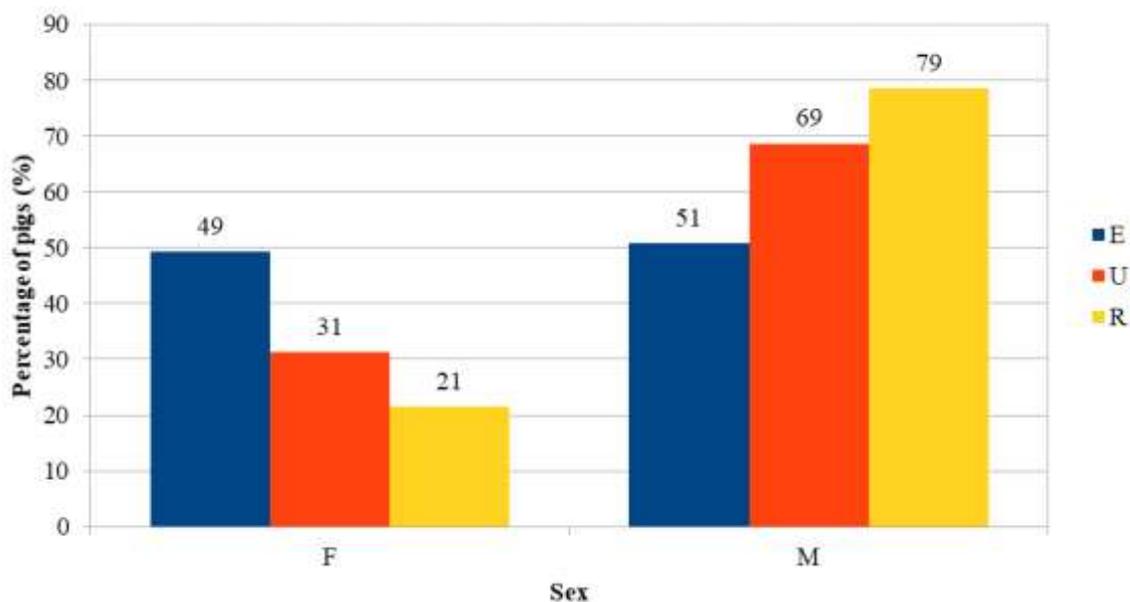

FIGURE 4: Classification of pigs by sex according to lean meat content

Number of pigs slaughtered n = 320

Class E: lean meat content estimated at 55% and more

Class U: estimated lean meat content from 50 to less than 55

Class R: estimated lean meat content from 45 to less than 50

F: Female

M: Male

IV.   DISCUSSION

Pigs slaughtered at the SIVAC slaughterhouse have an average live weight of 89.1 ± 13.6 kg with an average carcass weight of 66.5 ± 11.2 kg. This average carcass weight is lower than that obtained by [6] where the average carcass weight was 84.35 kg. The average carcass yield for slaughtered pigs is 74.71 ± 4.5 % with a minimum of 71.19 % and a maximum of 75.31 %. These results are lower than those of [7] who have an average carcass yield of 80.1 ± 1.1 %

Most pig carcasses (64.69 %) are in Class E where the estimated lean meat content is greater than or equal to 55%, indicating that the majority of pigs slaughtered at SIVAC are less fat. These results are similar to those mentioned in the report of the [8] where the lean meat content of pigs varies between 60.2 % and 61.2 %. This could be explained by the fact that pig farming in Côte d'Ivoire is dominated by the semi-intensive system where animals are rationed and fed on a more or less balanced diet. The food ingredients used by pig farmers in Côte d'Ivoire are very varied. The main sources of protein used in most farms are soybean meal, fishmeal, palm kernel meal and copra meal. The dosage of feed for pigs in the southern zone has revealed levels in energy and protein identical to the standard values. These results agree with those of [9] who emphasized that among the factors of breeding influencing the quality of pork meat, diet plays a central role. The level and distribution profile of the ration (restriction then replenishment) influence the speed and composition of the weight gain (proteins / lipids) at body and tissue level, and therefore, the composition of the carcass and tissues. The sensory quality of the meat can thus be modified, in particular via the content of intramuscular lipids. These same authors indicate that the balance between the main nutrients, in particular proteins and the energy of the ration, also condition the speed and the nature of tissue deposits, which can thus affect the sensory quality of meats. Nutrition is a powerful lever for modifying the lipid profile of pig meat, the fatty acid content (polyunsaturated n-3 in particular), and their nutritional value.

These results are in agreement with those of [10] who showed that in the castrated, the food restriction must be important to allow a significant reduction in adiposity. The distribution of a protein-deficient diet is accompanied by an increase in the adiposity of the animal and in the content of inter and intramuscular lipids [11]. These results also agree with those obtained by [12] who indicate that pork is often considered fatty by the medical profession or consumers, due to a confusion made between the overall adiposity of the carcass and the lipid content of the lean fraction of the meat. In reality, the largest muscles in the pig are low in fat. This lipid content is 1.5 to 2 % in the longissimus of pigs, against 5 to 6 % in the equivalent muscle in cattle.

Female pigs are mostly less fat with estimated lean meat content greater than or equal to 55% compared to castrated males having estimated lean meat content between 45 % and less than 50 %. These results are consistent with those of [13] who revealed that castration has the effect of increasing food consumption in animals, decreasing nutritional efficiency and increasing the adiposity of carcasses, thus acting on the chemical composition of adipose tissue. The adipose tissues of castrated males contain more lipids and less water than those of whole males, and females to a lesser extent [14, 15, 16, 17].

V.   CONCLUSION

Most pig carcasses with an average carcass yield of 74.71 ± 4.5 % are in class E where the estimated lean meat content is greater than or equal to 55 %. Compared to castrated males, female pigs are predominantly less fat with an estimated lean meat content greater than or equal to 55 % .These results confirm that pigs reared in Côte d'Ivoire are less fat and partly respond to nutritional needs of the population.

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