Asian Journal of Applied Science and Technology (AJAST)

(Quarterly International Journal) Volume 3, Issue 4, Pages 142-150, October-December 2019

Effects of Pineapple Waste Based-Diet on The Growth and Quality of Carcasses Mixed Pig (Large White X Pietrain) in Burkina Faso

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Article Received: 09 June 2019 Article Accepted: 11 September 2019 Article Published: 28 November 2019

ABSTRACT

The study aims to evaluate the effects of a diet incorporating pineapple feed on the growth and quality of carcasses of mixed pig (Large White X Pietrain) in Bobo-Dioulasso, Burkina Faso. Methods: For this purpose, an experimental ration incorporating pineapple feed (PD) was tested in comparison with a so-called standard control diets (SCD). Two batches of 8 pigs each (4 castrated males and 4 females) /lot received the diets at random for 10 weeks. Results: The ADG for PD diet (416.67 g) was significantly comparable to that of SCD (477.98 g) ($p>0.05$). The ratio muscle/total fat (M/F) and HCY of PD diet (4.71) were significantly homogeneous ($p>0.05$) to and SCD (4.65). The feed costs to produce 01 kg of meat (FCkgLW) of the rations increased with pineapple waste, 797.90F and 786.23 F CFA, respectively for pineapple and Standard Control. Pineapple wastes can be incorporated into the diet of growing pigs.

Keywords: Pineapple waste, Weight Change, Growing Pigs, Burkina Faso

1. INTRODUCTION

Livestock farming occupies a major economic position in Burkina Faso. This sector employs more than 80% of the working population and generates nearly 30% of exports revenues. It contributes nearly 18% to the formation of GDP [1]. In addition, it contributes to the dietary and nutritional balance of populations by providing products of high nutritional value (meat, milk, egg) and to the fight against poverty by increasing livestock farmers' incomes [1] However, this activity is subject to enormous constraints, especially food, health and technical constraints affecting the productivity of animals and livestock. Within the livestock sector, pig production has been growing rapidly in terms of numbers for nearly three decades. Indeed, between the last two national livestock population surveys (ENEC) in 1993 and 2003, the calculated growth rate of pig numbers is around 18.6%/year [2]. However, this numerical growth is not coupled with good livestock productivity due mainly to food constraints, which result in low availability and high feed costs [3], [4], [5]. In the breeding of monogastric animals, including pigs, the food constraint is further aggravated by competition between animal species around the most widely used agricultural products (maize, millet, etc.) [5]. In the search for solutions to make feed more available and less expensive for pig farms, investigations have focused on non-conventional feeds. In this perspective, research has focused on the valorization of mango and cassava by-products [6], [7] and their use to feed pigs and poultry [8] [9].

In Burkina Faso, pineapple is a fruit imported from Côte d'Ivoire and Benin. It is increasingly sold in slices after peeling on tray carts along some streets in Bobo-Dioulasso. This form of marketing generates by-products consisting of fruit downgraded from sale and pineapple peels. These by-products are sold to other customers for various other uses. It is therefore necessary to investigate the possibility of using these by-products in pig feed. In

this perspective, the study aims to evaluate the "Effects of pineapple marketing waste diets on growth parameters and quality of mixed pig carcasses (Large white X Pietrain) in Burkina Faso".

2. MATERIAL AND METHODS

2.1 Study site

The study was conducted at the Farako-Bâ research station, one of the stations of the Regional Directorate of Environmental and Agricultural Research (DRREA) of the Institute of Environment and Agricultural Research (INERA). It is located 15 km south of the municipality of Bobo-Dioulasso on the Bobo-Banfora road. It covers an area of 475 hectares. Four scientific departments carry out work there, namely Plant Production (DPV), Environment and Forestry (DEF), Animal Production (DPA) and Natural Resources Management/Production System (DGRN). The geographical coordinates of Farako-Bâ Station are 04°20' west longitude and 11°06' north latitude. The highest temperatures were recorded in April (31.04°C) and May (32.0°C) and the lowest averages were recorded in January (21.5°C) and December (23.5°C) (Meteorological data from the Farako-Bâ station on 2015).

2.2 Animals housing

The piggery at Farako-Bâ station was used as habitat for animals. It has an area of 128m², divided into 10 boxes of 9m² each. The box are arranged in two rows of five, separated by a service corridor 0.90m wide. The roof is made of sheet metal and has a double slope. The ground is concreted to facilitate the cleaning of the boxes and the drainage of manure and wastewater. A septic tank collects the cleaning water.

2.3 Animal material

Sixteen (16) mixed piglets (large White X Pietrain) including 08 castrated males and 08 females were used for the test. These animals come from the Farako-Bâ research station. The piglets were the offspring of four females of Large White breed crossed with a male of Pietrain breed. They were identified by loops, weighed and grouped into 3 homogeneous average weight batches ($p>0.05$).

2.4 Processes for the production of feed based on pineapple by-products

Damage to pineapples removed from human consumption and peels purchased from retailers are first cut and then crushed. Subsequently, the crushed pulp and peels were mixed with wheat bran in the respective proportions of 75% fresh matter and 25% dry matter according to the mango feed production method developed by [6]. According to this process, the fresh feed obtained is then dried in the sun on tarpaulins until a dry product can be preserved in 3-4 days in accordance with the humidity level of 14% maximum for a good conservation of tropical products stated by [10].

2.5 Formulation of rations

The experimental diets consist of two rations, one based on pineapple feed (PD) and the other on a standard control ration (SCD). The percentage composition and nutritional values of the rations are presented in Table 1. The two rations were allocated to the lots by random draw, which resulted in the following distribution: (i) lot 1 PD and (ii)

lot 2 SCD. Food was served twice a day, in the morning at 8am and in the evening at 2pm. The quantities of food distributed per day ranged from 1.5kg/animal to 2.7kg/animal. Before the experiment itself, a 14-day adaptation period was observed and the water was given *ad libitum*.

Table 1: Centesimal composition (percent), Energy, nutritional contents and food production cost

Centesimal composition		
Parameters	**Distributed diets**	
	PD	**SCD**
Maize	38	66.5
Pineapple food	42	0
Wheat bran	0	14.5
Fish meal	5	5
Cotton cake	10.8	9.85
Oyster shells	1.5	1.5
Salt	0.3	0.3
Methionine	0.25	0.25
Lysine	0.4	0.35
Premix	1.75	1.75
Total	**100**	**100**
Nutritional and Energy values and feed cost		
DE (Kcal/kg)	2 873.54	3 151
CP	16.38	16.04
CF (%)	12.44	10.37
NDF	8.22	7.08
ADF	21.2	26.98
ADL	0.12	0.17
Lysine (%)	0.83	0.83
Methionine (%)	0.53	0.55
Calcium (%)	0.99	1.02

 Online ISSN: 2456-883X

Phosphorus (%)	0.3	0.36
FC/kg DM (FCFA)	174.85	188.13

PD= Peanaple diet**; SCD=** standard control diet**, DE=** Digestible energy**: CP=** Crude protein: **CF**= Crude fiber; **NDF**= neutral detergent fiber; **ADF**= acid detergent fiber; ADL=acid detergent lignin; FC/kg DM (FCFA)= food cost per kg of dry matter

2.6 Data collection and parameters studied

2.6.1 Growth and economic parameters

Ponderal evolution: The weight evolution of the pigs was determined by weekly individual weight of animals using a 150 kg electronic scale before the distribution of the 8am meal. A 2-week adaptation period was observed before the start of weighing. These data were used to calculate initial average weights (IW), final weights (FW), average daily gain (ADG) and consumption index (CI).

The Average Daily Gain (ADG): is a parameter that measures the growth rate of subjects. It obtained according to the formula: ADG (g) = (FW-IW) / (ND), where IW= initial weight, FW= final weight and ND= duration in days.

The Consumption Index (CI): was calculated according to the formula: CI= DFC (g)/ADG(g), with DFC = daily food consumption obtained by the difference between the amount of food distributed and the refusal and ADG defined above. It makes it possible to calculate the cost of weight gain for each ration based on the purchase prices of the feeds it contains and the level of intake by the animals. The consumption index (CI) also reflects the efficiency of food processing; the lower CI means that food is better valued

FCkgLW (FCFA): Production Food Cost of 1 Kg of meat (FCkgLW) = CI x Price per kg of food

2.6.2 Estimation of the quality of the carcass

The carcass quality was estimated on 12 pigs obtained by random selection. Four pigs per ration (02 male and 02 female) were collected and fasted for 24 hours before being slaughtered for carcass quality assessment. The pigs were weighed alive before slaughter. After slaughter and evisceration, the fifth quarter was separated from the carcass. The carcass and each of the organs (kidney, liver, head, lungs, heart, spleen, and stomach, small intestine, large intestine full and then emptied of their contents) were then weighed one by one. The cutting was done according to the Paris method [11]. Indeed, the carcass was split in two (02) equal parts along the line of the spine. The thickness of the bacon on each half of the carcass was measured. The loin, boiler, ham, purse, breast, front and rear leg, were weighed before and after bleeding the half-carcass at 5˚C for 24 hours. The parameters evaluated were:

- The total fats (TF) according to the equation TF= (-860+1.63bardier+1.43pane+0.52chest) (the weight of the different parts) with R2 =0.94

- The ratio Muscle / Total fat (M/TF) is obtained according to the equation: M /TF= (-0.18+0.82 (Loin/boiler) (the weight of the different parts) with R2 =0.94 [11].

2.7 Statistical analyses

The raw data collected were entered into the Excel 2013 software to set up a database and to produce the various graphs and curves. The Statistical analyses were performed using XLSTAT software version 2014. Analyses of variance (ANOVA) using the Fisher model (Smallest Significant Difference" or LSD at the threshold of ($p<0.05$) were performed to separate the means of the different measured parameters.

3. RESULTS

3.1 Weight evolution of pigs

The weight evolution of pigs subjected to PD and SCD was continuous from the beginning to the end of the test (Figure 1). Table V shows that the average weekly weights of pigs were homogeneous between PD and SCD ($p>0.05$). In absolute terms, the average initial weight (IW) of 38,51±5,63kg and final weight (FW) of 72,45±12,18kg recorded with SCD were higher than those obtained with PD (34,64±4,90kg and 64,41±8,03kg). The total weight gain at the end of the experiment was 30.11 kg for SCD and 26.25 kg for PD. No significant differences in weekly mean weight were noted between males and females in each of the rations ($p>0.05$).

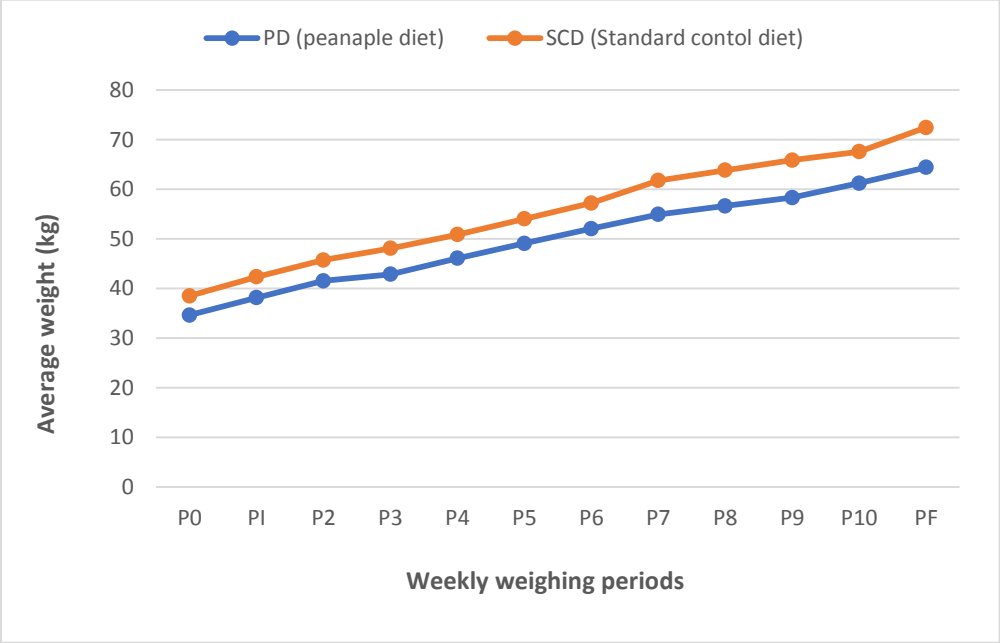

Figure 1 : Ponderal evolution of pigs

3.2 Average daily gain (ADG), consumption index (CI) and food cost of production of one kg of meat (FCkgLW)

Table VII shows that the ADGs, CIs and FCkgLWs were not significantly different between SCD and PD rations ($p>0.05$). However, in absolute terms, SCD's ADG was higher than that of PD. The PD FCkgLW was slightly higher than that of SCD. This is also the case for the PD CI, which was higher than that of SCD.

Between males and females, no significant differences in ADG, IC and FCkgLW were recorded for each ration (Table VIII). It is noted that females in the DB ration grew less quickly with a high CI and FCkgLW, unlike the SCD ration where females had fewer ADGs with a higher CI and FCkgLW.

Table 2: Average daily gain (ADG), Consumption Index (CI) and Food Production Cost of 1 kg of live weight (FCkgLW) by sex and diet

Parameters	Comparison within diets		Comparison within sex according the diets			
	PD	SCD	PD		SCD	
			Female	Male	Female	Male
ADG (kg)	417±55a	478±116a	404±32	429±75a	438±98a	518±133a
IC	4,97±0,69a	4,51±1,31a	4,97±0,59	4,96±0,88a	4,85±1,57a	417±1,12a
FCkgLW (FCFA)	798 ±109a	7 86±223a	813±69	782±149a	842±217a	730±246a

- The averages with the same letter in the same column are not significantly different at the 5% threshold depending on the comparison between rations and sex

- **PD=** Peanaple diet**; SCD=** standard control diet; **FCkgLW (FCFA):** the food cost of producing one kg of live weight

3.3 Yield and carcass quality

Average live weight, hot carcass weight (HCW), and fresh carcass weight (CCW), hot carcass yields (HCY) and fresh carcass yields (CCY), total fat percentage (TF) and total muscle / fat ratio show no difference between rations ($p < 0.05$). However, it can be noted that numerically the PD LW, HCW, CCW, Muscle / Fat were higher than those of the SCD. Between males and females, no significant differences in HCW, CCW, HCY, CCY, GT, and M/FT ratio of PD and SCD were noted for each diet. In PD female who had a higher LW in absolute value, a lower HCW was obtained as well as a higher FW and Muscle/Fat ratio. The CCY of SCD animals was significantly ($p < 0.05$) different between sex (Table 4)

Table 3: Characteristic carcasses quality parameters by diet

Diets/ Significance.	Parameters						
	LW (kg)	HCW (kg)	CCW (kg)	YCC (%)	YCC (%)	TF (%)	M/TF
PD	68.50a	46.25a	38.17 a	67.14 a	55.41 a	9.57 a	4.71 a
SCD	66.58 a	45.48 a	37.40 a	68.02 a	56.41 a	9.64 a	4.65 a
Pr > F	0.855	0.925	0.908	0.704	0.822	0.969	0.941
Significance	Non	Non	Non	Non	Non	Non	Non

- The average values for the same parameter carrying the letter in the same column are not significantly different at the 5% threshold

 Online ISSN: 2456-883X

- **LW**= life weight; **HCW**= hot carcass weight; **CCW**= cold carcass weight; **HCY**= hot carcass yield; **CCY**= cold carcass yield; **TF**= total fat; **M/TF**= muscle/total fat ratio; **PD=** Peanaple diet**; SCD=** standard control diet

Table 4: Characteristic carcasses' quality parameters by diet and sex

Diets	Sex/Significance	Carcass characteristics						
		LW (kg)	HCW (kg)	CCW (kg)	HCY (%)	CCY (%)	TF (%)	M/TF
PD	Female	69.500 a	46.500 a	38.730 a	66.276 a	55.643 a	9.500 a	5.227 a
	Male	67.500 a	46.000 a	37.600 a	68.011 a	55.182 a	9.635 a	4.189 a
	Pr > F	0.91	0.973	0.924	0.746	0.888	0.964	0.476
	Significant	Non	Non	Non	Non	Non	Non	Non
SCD	Male	66.750 a	45.950 a	32.720 a	68.536 a	49.641 a	10.035 a	4.850 a
	Female	66.400 a	45.000 a	42.080 a	67.509 a	63.179 b	9.250 a	4.452 a
	Pr > F	0.987	0.953	0.422	0.703	0.042	0.849	0.753
	Significant	Non	Non	Non	Non	Oui	Non	Non

- The average values for the same parameter carrying the letter in the same column are not significantly different at the 5% threshold

- **LW**= life weight; **HCW**= hot carcass weight; **CCW**= cold carcass weight; **HCY**= hot carcass yield; **CCY**= cold carcass yield; **TF**= total fat; **M/TF**= muscle/total fat ratio; **PD=** Peanaple diet**; SCD=** standard control diet

4. DISCUSSION

4.1 Weight evolution of pigs

The increase in live weights of all pigs was continuous during the test. The relatively low weight of the animals in the PD compared to those of SCD diet can be explained by the fact that pigs cannot value food well given the high CF rate (12.44%). The weight gain of pigs in the two diets is close to that of 28.2kg of pigs fed a diet containing 20% cocoa shells [12]. However, the comparative performance of the two rations can be understood when referring to the results obtained by [3] who estimated that for the energy needs of local pigs, it was possible to reduce by 20% the usual recommended standard of 3400 kcal/kg DE. In view of the evolution and comparable weight gains we can say that this DE content of the PD is sufficient to cover the needs of mixed pigs.

4.2 Average daily gain and consumption index of pigs

The ADG obtained from the PD diet (416.67 g) is close to that of 466 ± 103 g reported by [13] [12] for fattening pigs fed a ration based on mango waste. Despite the lack of a significant difference between diets tested, SCD pigs had, in absolute terms, a higher ADG and a lower consumption index than PD. This shows that the SCD ration has been a little better valued. This is also explained by the actual digestible energy (DE) intake of 2873.54 kcal

compared to 3176 kcal expected from the PD, which proved to be lower than that of the SCD ration (3151 kcal). The ADG of PD is higher than that of 399 ± 81g pigs fed a diet based on mango skin and more or less concordant with a ADG of 412 ± 81 g of another skin + mango pulp based diet reported by [9]. It also higher than the ADG of 226 ± 26g of growing pigs fed a diet based on cassava by - products and *dolo* dill [14] [13]. The higher levels of 2.07 points of CF and 1.14 points of ADF of PD diet may explain the slightly lower importance of its ADG compared to the SCD diet. All of the above shows that growing pigs can make the most of pineapple marketing waste and that its use is needed to increase feed availability for pigs while decreasing competition with humans.

4.3 Carcass yield and meat quality

The carcass yield of pigs fed by the pineapple diet (67.14%) is slightly lower than that obtained by Royer et *al*., (2010) by incorporating one type of faba bean into the diet of the growing pigs that was 79%. The total fat content of 9.57% of PD animals is lower than those of 30.6% and 30.7% for pigs fed the respective diets of mango skin and skin + mango pulp reported [9]. This rate is higher than that of 9±1% and lower than 12±1% for growing pigs carcasses fed respectively with diets based on mango + rice (9.1%) and mango + corn bran reported by [13]. The low Total Fat (GT) for carcasses of animals fed the PD diet implies a relatively high M / TF. This means that the pineapple waste diet, in addition to reducing competition with humans around cereals, has better quality carcasses and better carcass yields in fattening pigs. The carcasses of lower fat content are all the more sought after because they are better adapted to the transformation methods dominated by baking in Burkina Faso [2].

4.4 Economic performances

The food cost of production of the kg of meat (FCkgLW) for the experimental diet on PD (797,902 FCFA) taken in absolute value is higher than that of SCD (786,234 FCFA). This small difference is also noticeable by comparing the consumption indices. However, it is lower than the 977FCFA reported by [13] for the ration based on mango waste. This inferiority of FCkgLW pigs fed PD could be explained by the fact that the use of pineapple by-products in livestock in the city of Bobo-Dioulasso is not well known as that of the by -products of mango.

5. CONCLUSION

The results show that PD and SCD diets had significantly similar effects on pig growth, consumption index, ADG and carcass yield were statistically similar for both treatments at the 5% threshold. The PD and the SCD have given average life weight that do not differ statistically. The PD diet was technically competitive with standard formulations. Pineapple waste can therefore be used to incorporate. So we can use pineapple waste in the diet of pigs growing and growing-finishing. This would help to make food more available, less competitive with food for human consumption such as maize and reduce production costs.

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