Castration: Its economic implications on swineherd profitability

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Abstract

A 16-week trial was conducted to investigate the effect of castration on the profitability of the weaning to finishing operation of the swine enterprise. Eighteen pigs were allotted into three treatments comprising the male castrates (MC), the intact males (IM) and the intact females (IF), respectively. The pigs were exposed to the same management and environmental conditions throughout the duration of the trial. Total costs per treatment were N67,583.14, N68,256.34 and N67,583.14 for the I.M, M.C and I.F and did not show any significant difference ($P > 0.001$). The gross margin per treatment however gave values (revenue) of N85,268 $\pm$ 40.62 for the intact male group, N68,962 $\pm$ 26.56 for the male castrate group and N69,588 $\pm$ 35.38 for the I.F. group with statistical significant differences ($P < 0.001$) between the I.M group and the other two groups. 97.08 cycles or 32.35 years were needed as the pay back period for the M.C. group, 33.67 cycles or 11.22 years for the I.F. group and 3.82 cycles or 1.27 years for the I.M. group. The calculated return on capital employed (ROCE) gave values of 1.03 %, 26.17% and 2.97% for the M.C., I.M and I.F groups respectively. The study revealed an enormous economic damage that could be inflicted by castration as a management practice on the profitability of the weaning to finishing operation of the pig enterprise. The study also unlocked the huge economic benefit that could accrue to farmers when intact males as opposed to their male castrate counterparts are used in this line of pig production enterprise.

Keywords: Castration, Economic implications, Profitability, Pig production.

Introduction

The ills of castration as a management practice under livestock production have been highlighted by several authors (Walstra and Verner, 1993; Koohmarie *et al.*, 1996; Schneider *et al.*, 1998 and Aro, 2006). The conclusion of these authors ranged from the attendant economic losses as a direct result of castration to loss of protein accretion in the castrated males with a concomitant reduction in growth rate and thriftiness of farm animals. The main reason often canvassed in support of castration especially in pig husbandry is that it helps to remove the offensive taint often perceived when pork from intact males are consumed (Babol *et al.*, 1996). The work of Bonneau *et al.* (1994); Schneider *et al.* (1998) and Aro (2006) have suggested ways

of circumventing this boar taint while at the same time profiting from the numerous advantages that the use of intact males offer especially for pig designated for slaughter at the end of their rearing period. Many research works conducted on castration have been on its effects on the growth rate of young animals while little emphasis has been placed on investigating how it impacts positively or negatively on the major determinant of the success and survival of any enterprise i.e. its profitability. Coupled with profitability are the payback periods and returns on capital employed, which are both the economic indicators that decide the choice of an enterprise among competing and potentially feasible alternatives. These indicators are regarded as the potential investor's pathfinders in the seemingly

unpredictable business climate (Berry and Jarvis, 1991). Lumby (1997) emphasized on "speed of return" and the criteria for selecting a project which pays back quickest from a series of alternatives. He explained the best appraisal method as the one that involves choosing the least risky project i.e. the one that reaches break-even point most quickly. Returns on Capital Employed (ROCE), also called rate of return focuses on the overall profitability or otherwise of the enterprise and serves as an inducement or incentive for prospective entrants, creditors or shareholders into the business because in a situation of mutually exclusive investment choices, the best alternative is the project with the highest ROCE (Lumby, 1997). The exploration of these economic indices has been grossly inadequate in the pork trade especially in this part of the world and has narrowed the people's choice on which line of production to employ and which class of animals to rear that will enhance maximum returns on capital employed and improved productivity and profitability. The objective of this trial was to explore some of these economic indicators as they relate to pork production and measuring their implications on this enterprise when castrated and intact males or intact females are used as the animal model.

Materials and Methods

Eighteen weanling pigs, obtained from a cross between Large White Sows and Pietrain Boars were used for this trial. They were randomly selected from a pool of weaners comprising intact males, intact females and male castrates that have been batch-weaned at eight weeks of age. They were divided equally into the three groups; each group was replicated six times with one animal per replicate. These animals were individually housed and given access to feed (5 kg/body wt/day) and water throughout the sixteen weeks that this trial lasted.

Records on the costs of feeding, medication, castration, labour, procurement of weaners and depreciation on buildings for each group were taken. Records of weight of individual animals and sales per group at the end of the experiment were also taken. The costs, sales (revenue) and other investment appraisal parameters like the pay-back period, return on capital employed, and operating expense ratio (OER) were determined per group or per pig as follows:

1. Estimation of total cost per group

$$TC_g = TC_a + b + c + d + \dots + n \dots \dots \dots eqn_1$$

(where TC_g = Total cost per group, $TC_a + b + c + \dots + n$ = Total cost of all items in a group).

2. Estimation of total cost per pig

$$TC_p = \frac{TC_g}{n} \dots \dots \dots eqn_2$$

(where TC_p = Total cost per pig, TC_g = total cost of all items in a group and n = number of pigs in a group).

3. Estimation of revenue per group

$$R_g = WK \dots \dots \dots eqn_3$$

(where R_g = Revenue per group, K is a constant and is the Naira value of 1 kg of pork, W = total weight of all pigs in a group).

4. Estimation of revenue per pig

$$R_p = \frac{WK}{n} \dots \dots \dots eqn_4$$

where R_p = Revenue per pig, WK = revenue per group and n = number of pigs in a group.

5. Estimation of net margin per group

$$NM_g = R_g - TC_g \dots \dots \dots eqn_5$$

$$WK = TC_g \dots \dots \dots eqn_6$$

(where NM_g = Net margin per group, R_g = revenue per group and TC_g = total cost per group).

6. Estimation of net margin per pig

$$NM_p = R_p - TC_p \dots \dots \dots eqn_7,$$

$$= \frac{WK}{n} - \frac{TC_g}{n} \Rightarrow \frac{WK - TC_g}{n} \dots \dots \dots eqn_8$$

(where NM_p = net margin per pig, R_p = revenue per pig and TC_p = total cost per pig).

7. Estimation of net margin ratio per group

$$NMR_g = R_g - TC_g \times 100 \dots \dots \dots eqn_9$$

$$= \frac{WK - TC_g \times 100}{WK} \dots \dots \dots eqn_{10}$$

(where NMR_g = net margin ratio per group, R_g = revenue per group and TC_g = total cost per group).

8. Estimation of net margin ratio per pig

$$NMR_p = \frac{R_p}{n} - TC_g \times 100 \dots \dots \dots eqn_{11}$$

which is equivalent to equation 10 above.

9. Estimation of operating expense ratio

10. Estimation of return on capital employed (ROCE)

11. Estimation of number of operating cycles (NOC).

12. Estimation of the pay back period (PBP) where PBP = pay back period, NOC = Number of operating cycles and 0.33 is the duration of

the weaning to finishing operation i.e. 4 months (1/3 of a year).

13. Calculation of depreciation on building was by the straight-line method as given by Berry and Jarvis (1991) as:

$$\text{Depreciation} = \frac{\text{Cost of building} - \text{Residual life}}{\text{Useful life}}$$

14. Estimation of efficiency of production

This was calculated following the procedure described in FAO (2004) Yearbook and taking cognizance of the dressing percentage of the pigs of these categories as described by Aro and Tewe (2007). Data were subjected to one-way analysis of variance and using the SPSS (2001) package, while differences between means were separated using the Bonferroni t-test of the same package.

Results and Discussion

Cost analysis

Table 1 shows the cost analysis of the three groups of pigs. The total cost profile of the trial revealed a value of N68, 256.34 for the MC group and N67, 583.14 for both the IM and IF groups. These cost profiles, though not statistically significant, were higher in the castrated male group. The difference in the values was as a result of the additional cost of castration imputed in the MC group. This insignificant difference was succinctly depicted in Figure 1.

Revenue analysis

Table 2 reveals the investment appraisal and profit analysis for the pigs. The revenue per group gave values of N68,962.00+26.56, N69,588+35.38 and N85,268 + 40.62 for the MC, IF and IM groups, respectively. These values showed that the lowest monetary gain from the sales of the pigs was realized when castrated males were used in the weaning to finishing operation of the swine

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Fig. 1: Revenue, expenses and profit margins for the three groups of pigs.

Table 1: Cost analysis for the pigs per one cycle of production*

Parameters	IM	MC	IF
Weanling pigs at ₦200/kg live weight	14,400	14,400	14,400
Feed @ ₦35/kg	38,818.15	38,818.15	38,818.15
Cost of castration	0.00	660.00	0.00
Medication	822.94	822.94	822.94
Labour	12,000	12,000	12,000
Depreciation on building	216.89	216.89	216.89
Miscellaneous (@ 2%)	1,325.16	1,338.36	1,325.16
Total cost per group	67, 583.14	68, 256.34	67, 583.14
Cost per pig	11, 263.86	11, 376.06	11, 263.86

*= ₦100 = ₦0.004 = \$0.007 as at April 2006; one cycle of production = 4 months.

IM = Intact male, MC = Male castrate, IF = Intact female.

enterprise. According to Pandey (2000), the volume of revenue can be used as a predictor of the efficiency of production of any enterprise. The higher the revenue, the higher the efficiency of production and vice versa. It also predicts the ability of the enterprise to produce at a low cost in order to remain competitive in the market.

The profit margins obtained under this trial were ₦705.66, ₦2,004.86 and ₦17,684.86 for the MC, IF and IM groups respectively. These were calculated following the Matching Principle postulate of Berry and Jarvis (1991). The lowest profit margin was again shown by the MC group and helped to bring to the fore, the heavy economic blows that castration could unleash

on livestock production especially, the swine husbandry. This is a revelation of the fact that not only is castration inimical to the growth rate of young animals, but also has devaluating economic consequences on the over-all profitability. This effect of castration on profitability was also further elucidated by Figure 1.

The net margin ratios (NMR) for the three groups of pigs were 20.74% for the IM group, 2.88% for the IF group and 1.02% for the MC group. The value of net margin ratio has a wide range of economic applications. It determines the firms ability to withstand harsh economic climate, ability to achieve satisfactory returns on shareholders fund and better opportunity to use favourable conditions like high selling price and low cost of inputs to the fullest advantage. (Pandey, 2000). To enjoy these economic advantages, the NMR must remain relatively high. The lowest value of this economic appraisal yardstick obtained in the MC group would mean that the choice of castrated males for this type of venture would then translate to relative inability to withstand harsh economic climate like falling prices of finished products, high cost of inputs

etc. Such a venture will lose prospective investors and hence fail to be an investors' haven. Low NMR also means that a weaning-finishing operation that utilizes castrates as its stock of animal inputs will fail to accelerate profit at a fast rate like those with high NMR. This also lent credence to the lowest profit profile of MC group.

Operation Expense Ratio (OER) was also determined for the three groups of pigs and as presented in Table 2. The highest value (0.97) was obtained for the MC group, followed by 0.95 for the IF group while the lowest value (0.78) was obtained for the IM group. Since high values of OER denotes unfavorable operating efficiency because very small amount of profit will be left to service all other expenses like interest on loans, castration has once more shown to be a management practice with the tendency of eroding the operating efficiency of the pork production enterprise. Its (castration) contribution to operative ineffectiveness was appreciated better still by the comparative nature of this study. Table 2 and Figure 2 depict the direct relationships that exist between the pay back period and the number of operating cycles on one hand and the inverse relationship that

Table 2: Investment appraisal and profit analysis for the pigs for one cycle of production

Parameters	IM	MC	IF
Final wt. for 6 pigs (kg)	426.34	344.81	347.94
Final wt./pig (kg)	71.06	57.47	57.99
Revenue @ ₦200/kg body wt.	85,268.00 ^a	68,962.00 ^b	69,588.00 ^b
Expenses (₦)	67,583.14	68,256.34	67,583.14
Profit (₦)	17,684.86 ^a	705.66 ^c	2,004.86 ^b
Net margin ratio (%)	20.74	1.02	2.88
Operating expense ratio	0.79	0.99	0.97
Pay-back period (in years)	1.27	32.35	11.22
No of operating cycles			
per payback period	3.82	97.08	33.67
Return on capital employed	26.17	1.03	2.97

a, b, c = Means on the same rows with different superscript are significantly different ($p < 0.001$)

Fig. 2: Payback period, operating cycles and ROCE for the three groups of pigs.

exist between the duo (pay back period and number of operating cycle) and ROCE on the other hand.

The calculated pay back period was longest (32.35 years) with the MC group and shortest (just over a year) for the IM group. The IF was intermediate (just over 11 years) among the three groups. In making a choice of investment among these three lines of swine enterprise, the choice would be the one with the shortest payback period. This would stand out as the surest economic indicator for the peasant farmers in Africa where capital is scarce or in short supply. Also in the words of Lumby (1997), if consideration is made for the "time value of money", the IM group is preferable as money received nearer in time is more valuable than money received later in time. This was also corroborated by Sanni and Ogundipe (2005), that production modules with shorter cycles tend to generate higher returns on investment. Lumby (1997) suggested a minimum payback period of 5 years, which was met only by the I. M group. Return on capital employed (ROCE) also highlighted the negative impact of castration on this economic index. The value obtained for the

castrated male group was the lowest (1.03%) while the IM group had the highest value (26.17%). The M.C. and I F values fell below the recommended value of at least 12% for project acceptability as given by Lumby (1997). It is saddening to note that these two common rearing methods (the MC and IF) for pigs meant for slaughter fell below this recommended criterion.

Cash flow and estimated payback period for the IM, MC and IF group of pigs.

Table 3 shows the cash flow and predicted pay back period for the three groups of pigs. A projection of a ten-year period was made for the groups from which the total money recoverable was estimated. Values of ₦21,169.80, ₦60,145.80 and ₦530,545.80 were computed for the MC, IF and IM groups, respectively with a corresponding outstanding balances of – ₦47,086.64, – ₦7,437.34 and ₦462,962.66. The import of these values is that even after operating for ten years, the MC group would not have been able to attain the break-even point (all things being equal). The reasons for these are not far fetched and include, the reduced growth rate of the castrates, which resulted in lower slaughter

Table 3: Cash flow for the first ten years and predicted pay back period for the pigs*

Years	IM	MC	IF
0	67,583.14	68,256.34	67,583.14
1	53,054.58	2,116.98	6,014.58
2	53,054.58	2,116.98	6,014.58
3	53,054.58	2,116.98	6,014.58
4	53,054.58	2,116.98	6,014.58
5	53,054.58	2,116.98	6,014.58
6	53,054.58	2,116.98	6,014.58
7	53,054.58	2,116.98	6,014.58
8	53,054.58	2,116.98	6,014.58
9	53,054.58	2,116.98	6,014.58
10	53,054.58	2,116.98	6,014.58
Total recoverable for 10 years	530,545.80	21,169.80	60,145.80
Outstanding balance (+ve or -ve)	+462,962.66	-47,086.54	-7,437.34
Payback period	< 2 years	> 32 years	> 11 years

*All values except those of payback period are in Naira.

weight and hence lowered market value of the finished product, all as a result of castration.

Conclusion

The economic implications of castration as a management practice in livestock production have been revealed by this trial. The castrated male pigs gave the poorest performance on all investment appraisal and profitability indices explored.

Most pork production venture that utilizes castrated males and intact females could be operating under unfavorable efficiency of production judging from the fact that these categories of animals used under this study could not attain the minimum requirement of 5 years back period and 12% ROCE.

Better profits could be realized if intact males are used in order to take advantage of better rate of

growth, leaner carcass attributes, better return on capital employed and shorter pay back period among other economic benefits portrayed by this study.

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