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Factors influencing choice of feed adopted by pig farming households amid high cost of feed in southwestern Nigeria

Olaniyi Oluwatosin OJO, Janet Chinwe OLOWOYEYE and Abimbola Moji EZEKIEL *

Department of Agricultural Science and Technology, Bamidele Olumilua University of Education, Science and Technology, Ikere-Ekiti, Ekiti State, Nigeria.

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Abstract

This study investigates the factors influencing response strategies adopted by pig farming households in southwestern Nigeria to mitigate the high cost of feed. Employing a multistage sampling procedure, data were collected through structured questionnaires and interviews. Descriptive analysis revealed a predominance of male participants, individuals in their active age, and married households with considerable farming experience. Key findings indicate that gender significantly affects the likelihood of opting for compounded feed, with male-headed households more inclined to adopt this cost-effective alternative ($p < 0.1$). Membership in farmers' groups also positively influences this choice ($p < 0.01$), as it facilitates bulk purchasing of feed ingredients and the exchange of production information. Experienced farmers and those who frequently attend training sessions are more likely to choose compounded feed, highlighting the importance of knowledge and practical training in this decision-making process ($p < 0.01$). Conversely, households lacking farmers' group membership or with minimal experience are more likely to resort to rationing as a cost-saving measure, possibly due to a lack of awareness of the associated long-term costs. Overall, the research underscores the significance of gender, group membership, experience, education, and training in shaping effective responses to rising feed costs in pig farming, suggesting that targeted capacity-building initiatives could enhance decision-making capabilities among farmers.

Keywords: Feed; Pig; High Cost; Southwestern; Household

1. Introduction

Pig farming plays a critical role in the global livestock industry, contributing significantly to food security, employment, and income generation [1]. Feed is a primary determinant of pig productivity, accounting for up to 70% of total production costs [2]. The choice of animal feed directly affects growth rates, feed conversion efficiency, reproduction, and overall farm profitability [3]. However, pig farmers' feed choices are influenced by multiple factors, ranging from economic constraints to environmental and policy considerations.

Economic factors, such as feed cost and availability, play a significant role in determining feed choice. Farmers often balance between commercial feeds, homemade rations, and alternative feed sources based on their financial capacity and access to raw materials [4]. Additionally, nutritional composition and perceived effectiveness influence decision-making, as farmers seek to optimize growth performance while minimizing feed wastage [5].

Apart from economic factors, farm-specific characteristics such as farm size, farmer experience, and production system impact feed choices [6]. Larger farms may have better access to high-quality commercial feeds, while smallholder farmers often rely on locally available or self-formulated feeds [7]. Moreover, government policies, extension services,

* Corresponding author: Abimbola Moji EZEKIEL

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and feed industry regulations shape farmers' decisions by determining feed affordability, safety standards, and subsidies [8].

Environmental concerns have also gained prominence in feed selection, with farmers increasingly considering sustainable feeding practices, such as incorporating agro-industrial by-products and alternative protein sources [9]. These choices help reduce feed costs and mitigate environmental impact, aligning with global sustainability efforts.

Given the complexity of factors influencing feed choices, understanding the determinants guiding pig farmers' decisions is essential. This study seeks to explore these factors to provide insights for policymakers, extension agents, and feed manufacturers in designing strategies that enhance feed accessibility, affordability, and efficiency. Identifying key determinants will contribute to improving pig productivity and ensuring the sustainability of the pig farming industry.

2. Methodology

2.1. Study Area

The study was conducted in Nigeria's southwest geopolitical zone, which includes the states of Lagos, Ogun, Oyo, Osun, Ondo, and Ekiti. It features a tropical climate with rainy and dry seasons, as well as a combination of coastal, woodland, and savana landscapes. Latitude 6^0N to 9^0N and longitude 2.5^0E to 6.5^0E are about where it is located. It shares borders with the Republic of Benin to the west, the Atlantic Ocean to the south, the North Central Zone to the north, and the South-South Zone to the east. The estimated population in 2016 was 46,706,662, up from 27,722,432 in 2006 [10]. It is a significant agricultural centre in Nigeria, producing livestock such as cattle, goats, and sheep in addition to cash and food crops.

2.2. Data and sampling procedure

For this study, a systematic questionnaire and interview schedule were used to gather primary data from pig farming households in the study area. The respondents were chosen using a multistage sampling technique. Three states (Ogun, Osun, and Ondo) were chosen at random from the six states that comprised southwest Nigeria in the first stage. Eleven, seven, and six local government areas (LGAs) from Osun, Ogun, and Ondo states, respectively, were chosen at random in the second stage. Five towns or localities were chosen at random from the chosen LGAs for the third stage. In the last phase, four pig farmers were chosen from each of the chosen towns or communities using snowball sampling. A total of 480 pig producers were included in the study area's sample.

2.3. Data analysis procedures

The study used descriptive statistics including tables, frequencies, percentages and mean, and Multinomial Logit Regression model.

2.3.1. Descriptive statistics

The data collected from the respondents were analysed using descriptive statistics such as frequency counts, percentages and mean. This tool was used to describe the socio economic characteristics of the respondents in the study area.

2.4. Multinomial Logit Model

The Multinomial Logit (MNL) Model is a commonly used model in discrete choice analysis. One of its key assumptions is Independence of Irrelevant Alternatives (IIA), that is, the relative odds of choosing between two alternatives are unaffected by the presence or absence of other alternatives [11]. This means that if a new option is introduced, it should not change the odds between the existing choices. MNL was employed in this study because the dependent variable is categorical and polytomous as pig farming households are faced with choosing from a number of feeding strategies based on some factors influencing their choices. Following [12], the MNL model is written as equation 1.

$$\ln\left(\frac{\rho}{1-\rho}\right) = F_1 = a_0 + b_1X_1 + b_2X_2 + \cdots b_nX_n \ldots \mu_i + \cdots \qquad 1$$

Where

Ln = natural logarithm

ρ = likelihood of pig farming household opting for a certain feed strategy

a_0 = regression constant

$X_i = X_n$ denotes independent variables

$$S_0 = P_{01} = a_0 + b_{01}X_{01} + b_{02}X_{02} + \cdots b_nX_n \ldots \mu_i + \cdots \ldots\ldots\ldots\ldots 2$$

$$S_1 = P_{1i} = a_1 + b_{11}X_{11} + b_{12}X_{12} + \cdots b_nX_n \ldots \mu_i + \cdots \ldots\ldots\ldots\ldots 3$$

$$S_2 = P_{2i} = a_2 + b_{21}X_{21} + b_{22}X_{22} + \cdots b_nX_n \ldots \mu_i + \cdots \ldots\ldots\ldots\ldots 4$$

$$S_3 = P_{3i} = a_3 + b_{31}X_{31} + b_{32}X_{32} + \cdots b_nX_n \ldots \mu_i + \cdots \ldots\ldots\ldots\ldots 5$$

The dependent variables (S_i)= pig farming households heads feeding strategy 0 for those who opted for commercial feed, 1 for rationed feed, 2 for alternative feed and 3 for compounded feed. ρ_1, ρ_1, ρ_1 are the likelihood of opting for commercial feed, rationed feed, alternative feed and compounded feed respectively, a_0, a_1, a_2, a_3 denotes the constant terms. S_0 was the base category due to its assumption that it is the best of the feeding strategies. Base on this assumption, commercial feed was used as the reference category, thus giving rise to the following equations (6-8)

$$\ln\frac{\rho_1}{\rho_0} = a_{01} + b_{01}X_{01} + \cdots b_nX_n + \mu_i \ldots\ldots\ldots\ldots 1$$

$$\ln\frac{\rho_2}{\rho_0} = a_{02} + b_{02}X_{02} + \cdots b_nX_n + \mu_i \ldots\ldots\ldots\ldots 2$$

$$\ln\frac{\rho_3}{\rho_0} = a_{03} + b_{03}X_{03} + \cdots b_nX_n + \mu_i \ldots\ldots\ldots\ldots 3$$

The independent variables are: X_1 = Gender, X_2 = Marital status, X_3 = Ownership of phone, X_4 = Membership of farmer's group, X_5 = Frequency of training attendance, $X_6 = Years\ of\ Schooling, X_7 = Age, X_8 = Household\ size, X_9 = Ownership\ of\ means\ of\ transportation, X_{10} = pig\ farming\ experience$. b_1 – b_6 are the coefficients corresponding to independent variables

3. Results and Discussion

3.1. Socioeconomics characteristics of pig farming households

Table 1 presents the results of the socioeconomic characteristics of the respondents. The age of majority of the respondents was below 60years and their average age was about 50years. This implies that they are in economically active age.

Also, majority (87.9%) of the respondents were male. The result suggest that pig farming is a male-dominated enterprise probably due its resource-intensive requirements (land, labour, capital and time) which area are more likely to afford.

Furthermore, average years of schooling of the respondents was about 10years. These suggest that the respondents are educated and are more likely to take informed cost-effective production and marketing decisions. Again, 45% of the households have other source of income in addition to income from their pig farming, this will help them in financing the pig farming enterprise. Similarly, 34% of the households are owners of landed property. Ownership of landed property is an indication of wealth which could be sold to earn money to support in financing the pig farming enterprise. Also, not many (27%) of the households are owner of means of transportation. This may not encourage them to choose alternative feed as their preferred feed. Also, 23% have access to remittance which they can spend on the pig farming enterprise in addition to their capital.

Table 1 Socioeconomic characteristics of pig farming households

Variables	Frequency	Percentage	Mean
Age (years)			
Less than 40	62	12.9	
41-50	202	42.1	50.13
51-60	148	30.8	
Above 60	68	14.2	
Sex			
Female	58	12.1	
Male	422	87.9	
Education (years)			
Less than 6	106	22.1	
7-12	244	50.8	9.88
13 and above	130	27.1	
Nature of other source of income			
Pension	40	8	
Government salaried employment	22	5	
Crop farming	88	18	
Self-employment	20	4	
Private salaried employment	48	10	
No other source	262	55	
Ownership of land			
Yes	164	34	
No	316	66	
Ownership of means of transportation			
Yes	128	27	
No	352	73	
Access to remittance			
Yes	110	23	
No	370	77	

Source: Computed from field data, 2021

3.2. Distribution of pig farming households by choice of feed strategies

The figure 1 below presents the distribution of pig farming households by choice of feed strategies they adopted. The figure reveals that pig farming households who adopted feed rationing (skipping meals time for their pigs or reducing meals) constitute the largest percentage (38%), while pig farming households who adopted alternative feed strategies constitute the smallest percentage (8%). This suggests that almost half of the sampled pig farming households grappled with inability to afford the ideal feed for their pigs as a result of the high cost of feed.

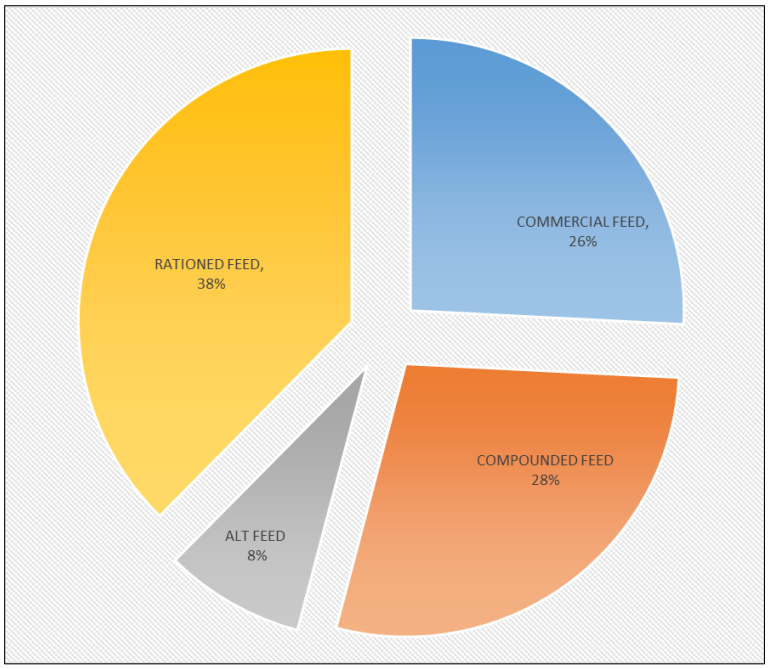

Figure 1 Distribution of pig farming households by choice of feeding strategies

Source: Computed from field data, 2021

3.3. Distribution of households' herd size, frequency of training attendance and other source of income by feed strategies

Table 2 presents the distribution of pig farming households' herd size, frequency of training attendance and other source of income by feed strategies. The result shows that an average household that adopted compounded feed and commercial feed in feeding their pigs has about 105 and 103 pig heads respectively while an average household that adopted rationed feed and alternative feeds strategies has about 69 and 58 pig heads respectively. The results suggests that households that adopted commercial and compounded feeds in feeding their pigs have more pigs than households that adopted alternative and rationed feed strategy. This findings may be linked to better performance of the pigs with respect to reproduction due to consumption of quality and balanced feed that has all the ingredients in the right proportion. Furthermore, an average pig farming households who adopted compounded and commercial feeding strategies attended training more (about 11 and 10 times respectively) than an average household that adopted either alternative or rationing feeding strategy. This suggests that households that attended training more frequently were more likely to take informed decisions resulting from access to valuable information related to farm inputs especially feed that would impact their quest for cost-efficiency positively. In terms of obtaining income from sources other than pig farming, 62%, 60%, 48% and 27% of households who adopted compounded, commercial, alternative feeding strategies and rationing respectively reported that they obtained income from other souces. Farming households can leverage the additional income to choose a cost-effective feeding strategy associated with a premium profit for the pig farming enterprise.

Table 2 Distribution of households' herd size, frequency of training attendance and other source of income by feed strategies

Variables	**Frequency (Freq.)**	**Percentages (Perc.)**	**(Freq.)**	**(Perc.)**	**(Freq.)**	**(Perc.)**	**(Freq.)**	**(Perc.)**
Herd size	*Commercial Feed*		*Compounded Feed*		*Alternative Feed*		*Rationed Feed*	
	(N=480)		(N=480)		(N=480)		(N=480)	
≤ 50	36	29	21	15.4	26	65	92	51
51 – 100	21	16.9	41	30.2	12	30	56	31
101 – 150	42	33.9	62	45.6	2	5	32	18
151 – 200	17	13.7	9	6.6	-		-	
> 200	8	6.5	3	2.2	-		-	
Total	124	100	136	100	40	100	180	100
Mean	105		102.5		58		68.6	
Frequency of Training attendance								
≤ 5	18	14.5	16	11.8	12	30	162	90
6 – 10	42	33.9	32	23.5	16	40	18	10
11 – 15	38	30.6	54	39.7	9	22.5	-	
> 15	26	21	34	25	3	7.5	-	
Total	124	100	136	100	40	100	180	100
Mean	10.3		11.1		8.4		4.4	
Other sources of income								
Yes	74	60	84	62	12	30	48	27
No	50	40	52	38	28	70	132	73
Total	124	100	136	100	40	100	180	100

Source: Computed from field data, 2021

3.4. Factors influencing choice of feeding strategy adopted by pig farmers in the study area

Table 3 shows the results of multinomial logit regression model which was used to examine factors influencing factors determining choice of feeding strategy adopted by pig farmers in the study area. The probability greater than chi square is equal to 0.000. This suggests that at least one of the explanatory variables significantly influences the choice of feeding strategy. Also log likelihood -133.73922 meaning that the model fits the data very well and Pseudo r^2 = 0.7954 indicating a very good fit with respect to the model. In order to combat the high cost of feed for their pigs, households are more likely to use compounded feed when the coefficient of gender is positive and significantly ($p < 0.1$) influenced. This suggests that households headed by men are more likely to select compounded feed than the base group. Men are more willing to experiment with less expensive alternative technologies having nutritional balance than to give up, which may be the reason for this decision. [13] discovered that men used higher-quality feed than women, which is in line with this finding.

The household's likelihood of favouring the usage of compounded feed is positively correlated with membership in the farmers' group, with a significant ($P<0.01$) effect. These results are consistent with those of [14], who discovered that farmers who belong to production and marketing groups had easier access to training and less expensive inputs.

The household's likelihood of selecting compounded feed is significantly ($P < 0.01$) influenced by the positive coefficient of pig farming experience (expertise). This implies that households with more pig farming experience are more likely

to select compounded feed compared to the base group. One possible explanation for this decision is that the more, the seasoned pig farmers experiment with feed formulations that are comparable to commercial feed and eventually succeeded in doing so, the higher their inclination towards choosing self-compounded feed. These results are consistent with those of [15], who discovered that farmers would choose a feeding plan that matched their farming goals.

The household's likelihood of selecting compounded feed is positively and significantly ($P < 0.01$) influenced by training frequency. This suggests that households are more likely to select compounded feed over the base category if they attend training more regularly. These outcomes may be explained by the fact that capacity-building training programmes organised for farmers usually accommodate cost-effective feed trainings. This result is consistent with [13] findings that farmers who receive high-quality instruction feed their animals high-quality feed.

A household's likelihood of selecting compounded feed is positively and significantly ($P < 0.01$) influenced by education (years of schooling). This suggests that, in reaction to increased feed costs compared to the base category, educated families are more likely to select compounded feed. This might be feasible as education enables one to make a logical choice after carefully weighing all available options. This finding is consistent with that of [15], who found that educated farmers used less expensive feed to feed their livestock.

A household's likelihood of selecting alternative feed to counteract the high cost of feed is positively and significantly ($P< 0.01$) influenced by ownership of means of transportation. This implies that, in reaction to the high cost of feed relative to the base category, families that possess means of transportation are more likely to select alternative feed. Possession of a vehicle or motor cycle may encourage households to choose to collect agricultural waste from other sites at a comparatively lower cost.

A household's likelihood of selecting alternative feed is positively and significantly ($P < 0.01$) influenced by pig farming expertise. This implies that, in comparison to the base group, households with greater expertise are more likely to select alternative feed. The decision made by the seasoned farming households may have been impacted by the gradual identification of a feed resource combination that can provide the pigs with nutrients that are on par with those found in commercial feed. These results are consistent with those of [15], who discovered that farmers would choose a feeding plan that matched their farming goals.

The household's likelihood of choosing to "ration" the pigs' feed is positively and significantly ($P < 0.1$) affected by age. This implies that young farmers are more likely to ration feed to their pigs relative to old farmers. A possible explanation for this may be due to the fact that young farmers are not likely to have assets (savings, children who support them among others) that they can resort to for financing their farm adequately. This finding is consistent with [16] who found that the elderly receive transfer income from their children.

The household's likelihood of deciding to "ration" the pigs' food is negatively and significantly ($P < 0.1$) impacted by the farmers' group membership. This implies that households outside of the farmers' group are more likely to "ration" their pigs' food in comparison to the base group. One reason for this decision could be that households that raise pigs but are not part of the farmers' group might not be able to take advantage of economies of scale when selecting commercial feed or the advantages of purchasing feed ingredients at comparatively lower costs if they want to formulate feed. These results run counter to those of [14], who discovered that farmers that are part of a production and marketing group benefit from economies of scale and, as a result, will not choose production methods that result in less-than-ideal output.

The likelihood of selecting "rationing" as a reaction to the high cost of feed is negatively and significantly ($P < 0.01$) influenced by pig farming experience. This implies that rationing is more likely to be used by households with little to no experience on pig farms in response to the high price of pig feed in comparison to the base group. One reason for this decision could be that inexperienced farmers are unaware that it can be more expensive to force their pigs to skip meals or eat fewer meals than they would if they were fed regularly. This result runs counter to that of [15], who discovered that farmers would choose a feeding plan that matched their farming goals. This could be the result of a lack of purchasing power to effectively demand for supplies that would enable a farmer to accomplish his profit-driven goal, forcing him to make do with whatever option is available.

The training coefficient is negative and significantly ($P < 0.01$) influenced a household's likelihood of selecting "rationing" feed to counteract expensive feed. This implies that, in comparison to the base group, households that attend training infrequently or not at all are more likely to employ "rationing" to offset the high expense of feed. One explanation for this could be that, as a result of their limited or non-existent exposure to training, they are unaware of a better option in terms of performance and cost-efficiency. This result supports the findings of [13], who found that farmers without training will feed their animal's subpar feed.

Table 3 Result of multinomial logit regression

Variable	Compounded feed			Alternative feed			Rationed feed		
	coefficient	Z-value	p>|z|	coefficient	Z-value	p>|z|	coefficient	Z-value	p>|z|
Constant	-24.1149 (4.7371)	-5.09	0.000***	-15.1445 (7.5163)	-2.01	0.044**	-13.1116 (3.8119)	-3.44	0.001***
Age	-0.0752 (0.0534)	-1.41	0.159	0.0736 (0.0693)	1.06	0.288	0.0784 (0.0466)	1.68	0.093*
Gender	1.7635 (1.0153)	1.74	0.082*	-1.7521 (1.3903)	-1.26	0.208	0.4663 (0.8399)	0.56	0.579
Marital status	-19.9057 (1969.21)	-0.01	0.992	1.1371 (3.7950)	0.30	0.764	-15.9025 (1969.21)	-0.01	0.994
Education	0.2793 (0.1600)	1.75	0.081*	0.3537 (0.2390)	1.48	0.139	-0.0657 (0.1391)	-0.47	0.637
Household size	-0.1735 (0.1762)	-0.98	0.325	0.2416 (0.2146)	1.13	0.260	0.0673 (0.1500)	0.45	0.654
Ownership of means of Transportation	0.5412 (1.0009)	0.54	0.589	2.5707 (1.5215)	1.69	0.091*	0.2833 (0.8803)	0.32	0.748
Membership of farmers' group	3.0199 (0.9164)	3.30	0.001***	1.1837 (1.2896)	0.92	0.359	-1.5691 (0.7876)	-1.99	0.046*
Pig farming experience	0.7487 (0.1039)	7.21	0.000***	-0.7319 (0.1730)	-4.23	0.000***	-0.3187 (0.0808)	-3.95	0.000***
Frequency of training attendance	2.5417 (0.2818)	9.02	0.000***	-0.3692 (0.3438)	-1.07	0.283	-1.7371 (0.2445)	-7.10	0.000***
Phone	17.4180 (1969.21)	0.01	0.993	-1.5764 (1.9355)	-0.81	0.415	15.7242 (1969.21)	0.01	0.994
Number of observation = 480; Prob > chi^2 = 0.0000; Log likelihood = -133.73922; Pseudo r^2 = 0.7954									
Base categorical variable	Commercial feed								

*, **, *** represent 10%, 5% and 1% level of significance respectively; standard errors are in parenthesis Source: Computed from field data, 2021

4. Conclusion

This study highlights significant factors influencing pig farming households' choice of feeding strategy adopted amid high cost of pig feed in southwestern Nigeria. The findings indicate that the majority of respondents were male, married, and in their middle age. The findings revealed further that gender (being male), membership in farmers' groups which facilitates bulk purchases and information exchange, farming experience, and the frequency of training attended had a positive and significant influence on the likelihood of choosing compounded feed as a response option, which is a cost-effective response to the high price of commercial feed. On the other hand, education had a significant but negative influence on the probability of selecting compounded feed. Regarding alternative feed preferences, ownership of means of transportation and pig farm experience positively and significantly impacted the likelihood of adopting alternative feed. However, for rationing feed (skipping meals or reducing meal portions), membership in farmers' groups, pig farming experience, and the frequency of training attended had a significant but negative influence on the likelihood of preferring "rationing" feed. In other words, households with limited experience or training are more inclined to ration feed, a strategy that may prove to be costlier in the long run due to its potential negative impact on pig productivity.

This study has provided valuable insights into the factors that influence the feeding strategies adopted by pig farming households in the southwestern Nigeria to cope with the high cost of feed. The findings indicate that socio-demographic factors, such as gender, education, and farming experience, along with membership in farmers' groups, frequency of training, and ownership of transportation, play a significant role in determining whether households opt for compounded feed, alternative feed sources, or resort to rationing.

These results underscore the importance of providing targeted capacity-building programmes, promoting farmers' group membership, and enhancing access to information and training for pig farmers. Such efforts would not only help farmers make more informed and rational decisions regarding feed management but also improve their overall productivity and sustainability in the face of rising feed costs. Addressing these key factors can play a pivotal role in supporting the long-term success of pig farming in southwestern Nigeria.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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