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DETERMINANTS OF WILLINGNESS TO PAY FOR ARTIFICIAL INSEMINATION (AI) AMONG MUTURU CATTLE FARMERS IN IPOKIA LOCAL GOVERNMENT AREA, OGUN STATE, NIGERIA

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ABSTRACT

This study examines the factors influencing willingness to pay (WTP) for artificial insemination (AI) in the Ipokia local government area. A two-stage sampling process was used to select 67 herders in Muturu. Descriptive statistics and logit regression models were used to analyze socioeconomic characteristics, willingness to pay, and related determinants. The results show that muturu cattle raising is mainly male farmers who are married and have relatively large families. The average size of a household is 8 people. The average age of muturu herders is 51 years old and their number of years of experience rearing muturu cattle is 14 years. More than half (56.7%) of farmers bought their own cattle. Only 58.2% participate in the semi-intensive production system. The average herd size is 5 Muturu. Most (77.6%) Muturu farmers have formal education and 70.1% of Muturu farmers are willing to pay for AI. The local name of the muturu in Ipokia is Oni. The factors that determine the willingness of muturu farmers to pay for AI are the muturu herds owned by them, their many years of experience with muturu cattle rearing, their husbandry methods, and their perceptions about the ease of handling muturu cattle. Farmers in Muturu should improve their production system and production scale. It is recommended to organize AI training for muturu cattle breeders because they are willing to pay for AI.

INTRODUCTION

Nigeria currently has an estimated population of 224 million, based on figures published by Worldometer (Worldometer, 2023). On the other hand, a recent national herd estimate of 22.3 million heads has been reported by the Federal Ministry of Agriculture and Rural Development (Gana, 2022). This is considered completely inadequate to meet human domestic demand for meat, milk and other bovine products or to contribute to gross domestic product (GDP). For example, Nigeria's annual production of 0.6 million tons of milk is one of the lowest in the world. This represents about 34% of the estimated annual milk consumption of 1.7 million tons. Therefore, Nigeria has to spend an average of $480 million per year to import milk (PricewaterhouseCoopers Report, 2017). Furthermore, the Bureau of Statistics reports that approximately 40.1% live below the poverty line and 63% of Nigerians suffer from multidimensional poverty (National Bureau of Statistics, NBS, 2022). As a result, low supplies and high costs of livestock and animal products mean that many Nigerians cannot meet the minimum daily intake of animal protein. Cattle production and the beef and dairy industry are important sources of financial revenue for the government as well as farmers and employees involved in livestock production. Cows have a limited reproductive lifespan. Therefore, high reproductive efficiency is essential for profitable beef production. This is important to produce replacement animals in the herd and calves are sold to generate income for farmers.

It is important to note that regular calving is essential to promote lactation and maintain milk production in dairy cows. To achieve these optimal results, dairy cows must conceive three months after calving and give birth to normal calves at a regular interval of 365 days (Opsomer et al., 1998, Gates, 2013). In addition, the use of cows with high genetic potential (e.g. high feed conversion rates and high milk production) and globally recognized application of biotechnology to significantly improve livestock production beef and dairy cow productivity.

In Nigeria, poor nutrition, livestock morbidity, and nomadic practices are associated with low livestock productivity (Ducrotoy et al., 2016;

PricewaterhouseCoopers Report, 2017). In addition, more than 99% of dairy herds raised in Nigeria are of local indigenous breeds such as Bunaji, Rahaji, and Sokoto Gudali, while foreign breeds include Friesians, Jerseys, and Brown Swiss, and hybrids make up just less. 1% (Report by PricewaterhouseCoopers). , 2017). Babayemi et.al (2014) reported that the common cattle breeds in Nigeria are the White Fulani, Red Bororo, Sokoto Gudali, Adamawa Gudali, Wadara, Azawak, Muturu, Keteku, Ndama, and Kuri.

Although local breeds are genetically adapted to tropical environments (Mwai et al., 2015), they produce much less milk than foreign breeds, which is thought to be due to the composition of the cows genetics and to some extent due to dairy cow management practices (Saleh et al., 2016). For example, the average liter of milk produced per day was 30.15 and 1.57 Friesian and Bunaji varieties, respectively; but increased to 22.54 in the Friesian-Bunaji cross (Saleh et al., 2016). Low genetic potential and low livestock productivity are combined with the overuse of modern breeding techniques and the lack of planned and selective breeding to improve genetic potential and maximize yield. Instead, there is the indiscriminate breeding of livestock, leading to reduced fertility and the spread of disease. In addition, the slaughter of breeding cows (pregnancy and lactation) for food is common in Nigeria. As a result, this leads to wasted fertility, reduced livestock productivity, and significant financial losses in Nigeria (Alhaji, 2011; Akpabio and Babalola, 2014).

Although there are many factors associated with this reproductive waste, limited veterinary and extension services in rural areas and a lack of technology to accurately analyze and identify the reproductive status of cattle before slaughter are the main factors (Fayemi and Muchenje, 2013). Therefore, it is time to make greater use of modern livestock and livestock methods if Nigeria hopes to overcome the productivity gaps in livestock and other livestock. Despite the important role the livestock industry plays in the Nigerian economy, its growth and development have not really peaked due to issues such as poor management practices, poor nutrition, and poor efficiency (Ahamefule et al., 2007). High reproductive performance in beef herds is a prerequisite to ensure optimum productivity and economic benefits in livestock production. Cattle farming is necessary in the economies of developing countries, as animals and products play an important role in alleviating the nutritional and economic challenges of these countries. Most cattle in the world found in tropical regions (Africa, Australia and Brazil) and Bos indicus predominates in these areas due to their better adaptability to poor management conditions, harsh climatic conditions and diseases compared to Bos. bulls (Bó et al., 2006).

Muturu strain, a tropical strain of B. indicus, is a trypano tolerant strain in good condition and growing well in southeastern Nigeria. Current approach aims to improve cattle production in Nigeria based on rapid scaling and expansion of trypano-tolerant varieties, such as the Muturu variety, especially in the eastern part of Nigeria where grasslands are more abundant and available. Unfortunately, this breed has declined in number and in danger of disappearing.

B. indicus strains are characterized by long postnatal estrus and short estrus, and high rates of estrus at night (Baruselli et al., 2004). These elements appear are the main causes of changes in reproductive performance of tropical varieties, including Muturu and delay the application of artificial insemination (AI) in livestock program. AI will benefit herds and farmers, but integrating it into breeding programs are limited due to ineffective heat detection (Bó and Baruselli 2014). Detection of estrus in B. indicus tends to be a difficult task to complete due to the fact that "calm heat" or lack of heat is characteristic of B. indicus and stressors such as rain and movement between grasslands, poor management, poor nutrition, and the influence of social hierarchy activities related to mating and estrus (Galina et al., 1996). It's because they affect the activity of the neuroendocrine reproductive axis; seems to be more serious in B. indicus than in B. Taurus (Galina et al., 1996). Farmers want to maintain the 12-month term calving interval and so such procedures should be used to ensure high calving rates of cows (proportion of non-pregnant cows infected with AI). Therefore, the use of a fixed timetable Artificial insemination (IAFT) in beef herds aims to eliminate the need for estrus discovery, putting the best genetics in the herd, and getting more cows pregnant earlier than usual into the breeding season, which will inevitably lead to improved weaning weight and calves more evenly (Baruselli et al., 2004; Bó et al., 2006; Baruselli et al., 2012).

The use of modern biotechnology advances in animal husbandry and reproduction is an essential tool for

improving the reproductive efficiency of beef cattle. Such technology can approved is the simultaneous use of estrus and artificial insemination, which are effective
reproductive and selective management tools to promote genetic improvement and multiplication. However, there is no information on the use of these animal biotechnological tools in the Muturu breed in Nigeria. Willingness to Pay (WTP) is the willingness of individuals to award rewards for the services they receive. WTP analysis was used to determine how much each farmer was willing to pay or spend to compensate for fertilization services on desired terms. Usually, IVF receives operating costs from farmers, but in an indeterminate or voluntary amount. This study did not examine how much muturu cattle farmers were willing to pay, but only whether they were willing to pay. This study further examines the factors influencing the Muturu herder's WTP for AI.

MATERIAL AND METHOD

The study was conducted in the Ipokia Local Government Area (LGA), Ogun State, Nigeria. A two-step sampling process was used to select muturu farmers. The first step was the purposive selection of Ipokia LGA based on the concentration of many muturu farmers in the area). The second step involves the use of snowball sampling. Snowball sampling, also known as sequence reference sampling, is a non-probabilistic technique that allows a researcher to discover variables with rare characteristics. A total of 67 Muturu farmers were interviewed. Information on demographics of muturu farmers, local name of muturu, origin of muturu cattle, number of muturu cows owned, production system, perception of ease of handling muturu and availability willingness to pay (WTP) for artificial insemination (AI).) among other variables collected from muturu farmers using a structured questionnaire. Descriptive statistics and logit regression were used for the analysis. The logit model is the natural logarithm (In) of the probability that Y will happen, and the probability is the ratio between the probability (Pi) Y will happen and the probability that Y will not happen (1-Pi). This will be used to determine the influence of socioeconomic and other variables on willingness to pay for IVF. Logical model: logit [E(Y)] = logit (W) = βXi, where [E(Y)] is the dependent variable (binary variable), logit (W) is the natural logit of odd successes, Xi, which is the independent variable, β is the regression coefficient. The pattern can be explicitly specified as:

$$Y_i = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots \beta_n X_n \quad (1)$$

Where; Y_i is 1, if the farmers are willing to pay for artificial insemination, 0 if otherwise. $X_{i,}$ is the independent variables, β is the regression coefficient. The dependent variable was a dichotomous variable depicting willingness to pay and took the value of 1 if the respondent was willing to pay for artificial insemination and 0 if otherwise. The independent variables were the socio-economic factors. Where:

X_1 = Age (years),

X_2 =Age Square (years),

X_3 = Experience (years),

X_4 = Household size,

X_5 = Education (years),

X_6 = Primary Occupation (Farming=1, otherwise =0),

X_7 = Herds of Muturu cattle owned,

X_8 =Rearing method (extensive=1, otherwise =0),

X_9 = Easy to handle (Yes=1, No=0),

X_{10} = Muturu with other households and

X_{11} = Farmers' Perception on extinction muturu cattle (Yes=1, No = 0)

RESULTS AND DISCUSSION

Demographic Characteristics of Muturu Cattle Farmers in Ipokia

Table 1 shows the distribution of demographic characteristics of farmers in muturu. The mean age of muturu herders is 51 years with a standard deviation of 11.83. This is similar to the findings of Ajayi et al. (2022) found that the average age of cattle herders in Ogun State is 51.2 years. The table shows that people between the ages of 41 and 50 make up the highest percentage at 32.8. A pivotal examination of the table further revealed that the 71.6% of Ipokia muturu cattle herders aged 31-60 in this study outperformed the 69.1% reported by Ajayi et al. al (2022) on muturu herders in southwestern Nigeria. This rate while 23.9 percent are elderly. The reason why a large percentage of elderly people raise muturu cows may be because they consider muturu as an asset. All Muturu farmers in Ipokia are men. This is supported by the findings of Lamidi and Ingweye (2016) and Ajayi et al. (2022) reported that cattle ranching was dominated by men.

This may be because the traditional way of managing muturu is very stressful and forced. The table also shows that more than 62.7% of muturu cattle breeders have more than 10 years of experience raising muturu cattle. The more farming experience he has, the better he understands the nature of this profession. The mean years of experience in muturu farming is 14 years with a standard deviation of 7.78. This is lower than the 20 years of muturu breeding experience reported by Ajayi et al. (2022) Those with 6 to 10 years of experience had the highest rate of 25.4. Years of experience further show that 37.3% of farmers have less than 10 years of experience in the livestock sector. The table further reveals that muturu farming is mainly undertaken by married male farmers. This implies that the farmers in Muturu will have a sense of responsibility towards this cattle trade. It can also be due to the stress of handling the cattles.

The mean household size is 8 people with a standard deviation of 4.05. Ajay et al. (2022) also found that the average household size of muturu herders in southwestern Nigeria is 8 people. The group with household size from 5 to 7 people has the highest rate at 35.8. This implies that muturu herders have relatively large families. 44.8% of muturu farmers in the study area have a household size of more than 7 people. Very few Muturu farmers have small households (19.4%). Most muturu herders (77.6%) in Ipokia have a formal education. This is supported by the findings of Ajayi et al. (2022) who found that 70.6% of Muturu farmers in southwestern Nigeria have formal education. However, 52.3% of herders in Muturu do not have a high school education. Only 14.9% of farmers have higher education. The main activity of muturu farmers is agriculture (41.8%), while 11.0% of muturu farmers are cattle breeders. Other major occupations include carpentry, sewing, merchandising, driving, teaching and photography. The chart also reveals that 70.1% of farmers are willing to pay for artificial insemination. Bahar et al. (2017) reported that very few breeders in Bali are not willing to pay the cost of artificial insemination. This study only asked farmers if they were willing to pay for IVF, not how much they were willing to pay.

Table 1: Distribution of the Demographic Characteristics of Muturu Farmers

Characteristics	Frequency	Percentage
Age Range		
≤30	3	4.5
31-40	12	17.9
41-50	22	32.8
51-60	14	20.9
61-70	15	22.4
≥70	1	1.5
Years of Experience in Rearing Muturu		
<5	8	11.9
6-10	17	25.4
11-15	22	32.8
16-20	14	20.9
>20	6	9.0
Gender/Marital Status		
Sex/male	67	100.0
Single	1	1.5
Married	66	98.5
Household Size		
<4	13	19.4
5-7	24	35.8
8-10	16	23.9
11-13	8	11.9
>13	6	9.0
Educational Status		
No formal education	15	22.4
Primary	20	29.9
Secondary	22	32.8
Tertiary	10	14.9
Primary Occupation		
Farming	28	41.8
Carpentery	4	6.0
Retiry	2	3.0
Pastor	8	11.0
Tailor	3	4.5
Driving	5	7.5
Trading	3	4.5
Photographing	1	1.5
Mechanic	3	4.5
Barbing	3	4.5
Doctor	2	3.0
Teaching	4	6.0
Bricklaying	1	1.5
Secondary Occupation		
Farming	61	91.0
Driving	1	1.5
None	5	7.5
Willingness to Pay for AI	Willingness to Pay for AI	Willingness to Pay for AI
Yes	47	70.1
No	20	29.9

Source: Field Survey, 2022

Distribution of Local Name for Muturu Cattle

Table 2 shows the distribution of local muturu names. The common name for muturu in the local government of Ipokia is Oni. 71.6% of Muturu farmers are Oni. Other names of muturu present in situ are Eni (14.9%), Maolu (11.9%) and Okete (1.5%).

Table 2: Distribution of Local Name for Muturu Cattle

Names	Frequency	Percentage
Oni	48	71.6
Eni	10	14.9
Maolu	8	11.9
Okete	1	1.5

Source: Field Survey, 2022

Distribution of Source of Muturu

Table 3 shows the distribution of muturu resources in the local government of Ipokia. The main source of muturu of the local government of Ipokia is from purchasing (56.7%). The table also reveals that 13.4% get muturu cattle by inheritance, 11.9% get muturu cattle by buy/donate and 7.5% get muturu by donation. Jabbar et al. (1997) reported that 80%, 14% and 5% of livestock owned by farmers were inherited or born from animals inherited, raised and purchased respectively. Nweze and Otuma (2020) report that muturu herdsmen source 5% of their herds through purchasing and non-rather farmers source 60% of their herds through donation/rental agreements.

Table 3: Distribution of Source of Muturu

Source of Muturu	Frequency	Percentage
Inheritance	9	13.4
Purchase	38	56.7
Inheritance/Purchase	1	1.5
Breeding	3	4.5
Purchase/Gift	8	11.9
Gift	5	7.5
None Response	3	4.5

Source: Field Survey, 2022

Distribution of Heads of Muturu Owned

Table 4 shows the distribution of muturu cows owned by farmers. This table shows that muturu cattle are raised only on a small scale by the local government of Ipokia. The mean muturu herd was 5 heads with a standard deviation of 4.17. Ajay et al. (2022) reported that the average herd size varies from state to state, with mean herd sizes being 3, 4 and 4 in Ogun State, Lagos State and Ondo State, respectively. Adoligbe et al. (2020) reported that the average muturu herd size in Adjarra, Adjohoun, Akpro-Misserete and Bonou was 3, 5, 4 and 33 respectively. The table also shows that most (58.2%) muturu farmers have only from 1 to 5 heads.

Table 4: Distribution of Heads of Muturu Owned

Number of Heads of Muturu	Frequency	Percentage
1-5	39	58.2
6-10	21	31.3
11-15	5	7.5
16-20	1	1.5
21-25	1	1.5

Source: Field Survey, 2022

Distribution of Production System and Perceived Ease of Handling Muturu Cattle

Table 5 shows the distribution of muturu breeding methods in the local government of Ipokia. The table shows that most (58.2%) Muturu cattle breeders raise their cattle semi-intensively while 41.8% Muturu herders raise livestock extensively. (Uza et al. (1999) reported that 55% of muturu farmers practice semi-intensive management systems Malusi et al. (2021) reported that farmers with better education often adopt semi-intensive management methods. The table further reveals that 83.6% of muturu farmers feel handling muturu cattle is easy while 14.9% feel handling is not easy.

Table 5: Distribution of Production System and Perceived Ease of Handling Muturu Cattle

Methods of Rearing Muturu	Frequency	Percentage
Extensive	28	41.8
Semi-intensive	39	58.2
Easy to handle	56	83.6
Moderately easy to handle	1	1.5
Not Easy to handle	10	14.9

Source: Field Survey, 2022

Determinants of willingness to pay for Artificial Insemination (AI) in Muturu Cattle

Table 6 shows the WTP determinants for artificial insemination in muturu cows. WTP determinants for AI in muturus in Ipokia LGA include: agricultural experience in raising muturu, the number of muturu cows owned, methods of raising muturu cattle and awareness of the ease of handling muturu cows. The table shows that the probability of CAP for AI is significantly reduced ($p < 0.05$) according to the respondents' experience of raising muturu cows. This is contrary to expectations. This is in contrast to the conclusion of Ozsayin (2020) that dairy experience increases WTP for AI. People who have raised muturu cows for many years may not want to accept AI because they believe that muturu cows are sacred.

The variable herd owned by the muturu farmer has a positive sign and is statistically significant ($p<0.01$). This implies that as the number of herds raised increases, the likelihood that muturu farmers can pay for AI also increases. It may also turn out that these muturu breeders have a good knowledge of the importance of genetic improvement and prevention of genital diseases that AI can bring to their herd and hence CAP selection. This is in contrast to the findings of Setiana et al (2020), who reported that owned herd size was not significant for the decision to adopt innovation (IA) in Brebes. Onoh et al. (2012) believe that farm size affects the extent to which farmers will adopt innovation and are willing to pay for such services. The muturu rearing method varied positively and statistically significant ($p < 0.05$). This implies that as muturu herders continue to farm their muturu extensively, their WTP for AI will increase. Although not expected, this may be due to the influence of the respondents' secondary and tertiary education, as more than 50% of respondents had at least a secondary education. This may have improved their knowledge of the benefits AI brings to livestock. Another reason could be that the characteristics of AI services have been improved to match farmers' preferences, as suggested by Omondi et al. (2016), and that's why they are willing to pay for AI regardless of their muturu cattle breeding system. . The reason for this could be due to muturu farmers' desire to improve their yield in muturu and avoid any diseases associated with natural mating. In addition, the perceived variable about ease of handling muturu cows is positive and statistically significant ($P<0.10$). The implication of this is that muturu cattle farmers find that muturu cattle are easy to manage and are more likely to suffer from CAP with increasing AI. This is to be expected since handling animals in front of the AI can significantly affect their ability to stay calm during the AI process. It has been reported that animals are stressed up to times of AI can detrimentally impact pregnancy rates (Thomas *et.al*, 2003).

Table 6: Determinants of Willingness to Pay (WTP) for Artificial Insemination in Muturu Cattle

Variables	Coefficient	Standard Error	z	P>z
Age	0.250278	0.165537	1.51	0.131
Age square	-0.00208	0.001614	-1.29	0.198
Experience	-0.11439**	0.049251	-2.32	0.02
Household sizes	-0.04446	0.091976	-0.48	0.629
Education	0.70203	0.61192	1.15	0.251
Occupation	-0.33064	0.519708	-0.64	0.525
Herds of muturu owned	0.316332***	0.1143	2.77	0.006
Rearing method	1.535051**	0.751368	2.04	0.041
Easy to handle	1.402359*	0.828266	1.69	0.09
Total income	-1.57E-06	1.75E-06	-0.9	0.37
Muturu owned with other households	-0.29715	0.575265	-0.52	0.605
Farmers' Perception on extinction muturu cattle	0.416175	1.479189	0.28	0.778
Constant	-7.74348	4.387834	-1.76	0.078

*** significant at 1%, ** significant at 5%, * significant at 10%

CONCLUSION

Research shows that Muturu farmers in Ipokia LGA are literate, have relatively large families, and operate on a small scale (with an average of 5 Muturu heads). The production system adopted is semi-intensive. The common name of muturu in the study area is Oni. Farmers have good Muturu breeding experience (average 14 years). Muturu farmers are willing to pay for artificial insemination. The factors that influence WTP for AI are the production system, the number of Muturu heads owned, and the ease of handling Muturu cows. Muturu cattle breeders should increase their production. The production system also needs to be improved. Scientists should explore possibilities to improve Muturu farming, as farmers are willing to pay for AI and organize training in AI techniques.

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