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Comparative analysis of indigenous and improved small ruminant management techniques among rural households in Iwo Agricultural Zone, Osun State, Nigeria

A.A. Alabi[1], K.M. Idris-Adeniyi[2], A.O. Busari[2]*, K.S. Ayandiran[3] and A.P. Ajuwon[1]

[1]Osun State University, Faculty of Agricultural Production and Management, College of Agriculture, Ejigbo Campus, Department of Agricultural Economics and Agribusiness Management.
[2]Osun State University, Faculty of Agricultural Production and Management, College of Agriculture, Ejigbo Campus, Department of Agricultural Extension and Rural Development.
[3]Osun State University, Faculty of Agricultural Production and Management, College of Agriculture, Ejigbo Campus, Department of Animal Science.

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Abstract. *The study examined the socio-economic characteristics and management practices of small ruminant farmers in the Iwo Agricultural Zone, Osun State, Nigeria, to compare indigenous and improved techniques. Data were collected from rural households actively engaged in small ruminant production. The majority of respondents were middle-aged (49-58 years, 54.17%) with an average age of 52.33 years, predominantly married (84.17%) and having a moderate educational background (mean formal education of 9.60 years). Household sizes averaged five members, and small ruminant farming emerged as the primary occupation for 30.83% of respondents, highlighting its critical role in local livelihoods. The income levels were generally low, averaging ₦58,088.33 monthly, which may limit investment in improved practices. Most respondents raised goats or a combination of goats and sheep, relying heavily on indigenous management practices (62.50%), while only 5% exclusively adopted improved techniques. Indigenous practices primarily involved uncontrolled mating and regular veterinary checks, whereas improved methods emphasized extensive grazing and strategic breeding management. Feeding management showed reliance on traditional routines such as feeding animals three times daily, but improved practices prioritized consistent access to fresh water and colostrum for newborns. Housing practices predominantly depended on natural ventilation and open shade, with limited use of protective measures like fencing. Health management revealed widespread use of medications for parasites and veterinary care, with improved farmers emphasizing professional treatment and vaccination. The study identified mange, diarrhea, and tick infestations as the most prevalent diseases impacting productivity. Constraints to production included limited capital, high feed costs, theft, and poor access to veterinary services. Adoption analysis revealed that 65.5% of farmers moderately adopted improved practices, while 21.67% showed low adoption. Pearson correlation analysis demonstrated significant positive relationships between adoption levels and age (r=0.87, p=0.008), education (r=0.76, p=0.006), and experience (r=0.68, p=0.000). Findings suggest that while indigenous knowledge remains vital, there is a need to enhance adoption of improved techniques through targeted education, credit access, and veterinary support to boost productivity and sustainability in small ruminant production in the study area.*

Keywords: small ruminants, management practices, housing management, feeding management, health management

*e-mail: hamed.busari@uniosun.edu.ng

Introduction

In Nigeria, livestock is a major player in the agricultural sector, contributing around one-third to the agricultural GDP. They offer more than just food; they provide essential income, jobs, manure, fuel, and transport options (Alabi et al., 2019). Livestock also serves as a significant source of revenue for the government. The traditional livestock production system here is quite diverse and complex. Ruminants, especially, are incredibly effective at utilizing uncultivated land, which can really boost crop production (Adegbeye et al., 2020). The impact of livestock on human development is considerable. The protein from livestock is vital for physical and cognitive growth, as well as for building immunity against diseases. Moreover, livestock production is crucial for driving socio-economic change, improving the income and quality of life for farmers, who play a key role in the government's transformation agenda (Enwelu et al., 2015).

Nigeria boasts a staggering population of around 34,453,724 goats and 22,092,602 sheep (Chima and Bowell, 2016). Sheep (Ovis aries) and goats (Capra hircus) are likely among the very first ruminants that humans domesticated (Teletchea, 2019). Domestic sheep can trace their lineage back to wild ancestors like the Mouflon, which roams Europe and Asia, the Urial from Asia, the Argali also from Asia, and the Bighorn found in both Asia and North America. Meanwhile, goats have their roots in the wild bezoar goat. Both of these animals share a lot of similarities and are essential to the socio-economic landscape of Nigeria (Enwelu et al., 2015). They play a crucial role in the food chain and are vital for the livelihoods of rural families, especially among women and their children who predominantly own them (Assan, 2021). Historically, sheep and goats have served as a quick source of cash and a buffer against economic and agricultural hardships (Muthuveni, 2022). The raising of these small ruminants is intricately linked to the cultural practices and agricultural systems of Nigeria's peasant communities (Garba et al., 2015). Data show that sheep and goats are the leading domesticated small ruminants, both in terms of their population and the production of food and fiber products (Al-Araimi, 2019).

This trait can be partly explained by the fact that small ruminants have lower feed needs compared to cattle, thanks to their smaller size. This makes it easier to incorporate them into different farming systems (Enelu et al., 2015). As highlighted by Okoye and Adamade (2016), subsistence animal agriculture, or livestock farming, is vital to Nigeria's meat industry. It consists of small herds and flocks that can be found in rural, urban, and peri-urban areas throughout the country. Their compact size and quick maturity offer several economic benefits for smallholder farmers (Enwelu et al., 2015). Among all types of livestock, sheep and goats stand out, as they have a wider distribution and more dynamic flock behaviors than other species in Africa (Assan, 2015). The sheep and goat breeds in Nigeria mainly focus on meat production and have adapted well to the various eco-zones they inhabit (Ozung et al., 2011; Enwelu et al., 2015).

West African sheep and goats are incredibly versatile, thriving in a range of environments. They seem to have a natural resistance to trypanosomiasis and other diseases, which lets them graze in places where other domestic animals might struggle (Dossa et al., 2015). Even though raising sheep and goats brings numerous economic and cultural advantages, their production mostly stays at a subsistence level, relying on local extensive or free-range systems (Enwelu et al., 2015). Most management practices are still quite traditional. Hegde (2019) pointed out that livestock farmers and government agencies have yet to tap into the full potential of these animals. Many sheep and goat keepers face challenges like limited access to improved breeds and the inability to try out new varieties. Additionally, diseases and a lack of proper nutrition both in quality and quantity create significant hurdles for small ruminant production across Africa (Kahi and Wasike, 2019).

Sheep and goats are vital for rural development in many areas of Nigeria, but unfortunately, their production levels are not enough to meet the population's demand for animal protein (Ojumu et al., 2023). For example, Nigeria has an estimated 22.1 million sheep and 34.5 million goats (Mufwa et al., 2016), with about 70% of these animals being raised by smallholder farmers who rely on semi-intensive and extensive farming practices (Mufwa et al., 2016). This issue largely stems from farmers' lack of interest in raising sheep and goats, coupled with inadequate feed resources that are often of poor nutritional quality and low forage productivity (Alemu, 2020). Additionally, many areas where these animals are kept lack modern, well-built farms. Instead, they are typically housed in rundown structures that leave them exposed to diseases, pests, and predators.

Statement of research problem

Even though raising sheep and goats brings a lot of economic and sociocultural advantages, their production mostly stays at a subsistence level, relying on local extensive or free-range systems (Enwelu et al., 2015). Nigeria has a wealth of livestock resources, but unfortunately, the growth of the human population is outpacing that of farm animals. As a result, the country still depends on imports for about 20% of its livestock production, which is quite a challenge (Gavrilova, 2020). Livestock is vital for providing animal-source foods and generating cash income, particularly through small ruminants, which have become key assets for both men and women in rural households (Desta et al., 2020). Recently, there has been a growing awareness of the need for sustainable and improved management practices to enhance the productivity and welfare of these small ruminants (Ojumu et al., 2023). This recognition has sparked a shift towards modernized approaches, but we still do not fully understand how well these improvements have been accepted or how they impact traditional practices. Sticking to traditional methods, which are deeply embedded in cultural practices and historical norms, might limit productivity, disease management, and resource efficiency (Martins and Oliveira, 2020). On the flip side, embracing better management practices like advancements in nutrition, breeding, healthcare, and housing could offer effective solutions to tackle these challenges.

The gap in indigenous knowledge about sheep and goat farming practices in the Iwo ADP Zone is a significant hurdle. Without a detailed analysis, it is hard to understand what drives farmers' management decisions and why they might resist adopting better techniques. It is also vital to consider the socio-economic, environmental, and cultural factors that influence farming practices in this region. This research seeks to delve into these complexities and provide meaningful insights for policymakers, agricultural extension services, local farmers, and the global animal science community. The results are expected to help shape targeted interventions, educational initiatives, and policies that promote sustainable and effective management practices for sheep and goat farming in the Iwo Agricultural Zone, Osun State, Nigeria, ultimately aiming to enhance food security, improve livelihoods, and support environmental sustainability in the area. The study's primary objectives were to analyze both existing and enhanced management practices for sheep and goats in the Iwo Agricultural Zone of Osun State, Nigeria. Specifically, it aimed to describe the socio-economic characteristics of the respondents, identify the indigenous and improved management practices they adopt, assess the level of adoption of these improved practices, identify common diseases affecting small ruminants, and explore the challenges.

Hypothesis of the study

Ho_1: There is no significant relationship between selected socio-economic characteristics of the respondents and the level of adoption of improved small ruminant production management practices.

Material and methods

Study area

This study was carried out in Iwo Agricultural Zone of Agricultural Development Programme (ADP) Osun State, Nigeria. The Iwo Agricultural Zone is a component of the Osun State Agricultural Development Programme (ADP) in Nigeria (Ajayi et al., 2019). This zone is recognized for its variety of agricultural activities, such as crop farming, poultry, and small ruminant farming (Akintunde et al., 2022). The region features a blend of rural households that participate in different agricultural practices to support their livelihoods (Mustapha et al., 2024).

Population of the study

The population of the study comprised of all small ruminant farmers in Iwo Agricultural Zone of Agricultural Development Programme (ADP) Osun State, Nigeria.

Sampling Technique and sample size

The study was conducted using a three-stage sampling procedure. In the first stage, two Local Government Areas (LGAs) were randomly selected: Ejigbo and Iwo, which together represent about 33.3% of the seven LGAs (Ejigbo, Ola-Oluwa, Iwo, Aiyedire, Aiyedaade, Irewole, Isokan) within the Iwo Agricultural Zone. The second stage involved purposively selecting three villages from each of the two chosen LGAs, resulting in a total of six villages, based on the prevalence of small ruminant production in the region. The third stage utilized a snowball technique to identify 120 small ruminant farmers for the study sample.

Method of data collection

Data for the study were collected using a carefully designed interview schedule. This schedule included both open-ended and closed-ended questions tailored to meet the study's objectives. Additionally, trained enumerators (extension officers) who are residents and knowledgeable about the study areas were engaged to assist with data collection. The structured interview schedule consists of sections specifically designed to capture indigenous and improved management practices among the small ruminant farmers in the study area. Indigenous and improved practices were evaluated based on four key areas: breeding, feeding, housing, and health management, which included 48 specific variables in total. Each variable was assessed using a three-point rating scale: never used (0), occasionally used (1), and always used (2).

Method of data analysis

The data collected was analyzed using both descriptive and inferential statistical methods. Descriptive statistics, such as mean, frequency, standard deviation, and percentages, were used to organize and describe the socio-economic characteristics of the respondents. This analysis also sought to identify both indigenous and improved management practices that were adopted, along with the degree to which these improved practices were embraced. The indigenous and improved practices were assessed across four key dimensions: breeding, feeding, housing, and health management, encompassing a total of 48 specific variables. Each variable was evaluated using a three-point rating scale: *never used* (0), *occasionally used* (1), and *always used* (2). A composite adoption score was generated based on respondents' ratings. To categorize the adoption levels, the mean and standard deviation of the composite scores were computed. Farmers with scores above the mean plus standard deviation were classified as having *a high level of adoption*; those below the mean minus standard deviation were classified as *low adopters*. At the same time, those in between were categorized as having a *moderate level of adoption*. To highlight the significant relationships between the selected socio-economic characteristics of the respondents and their level of adoption of improved management practices, Pearson's Product Moment Correlation (PPMC) was utilized.

Results and discussion

Socio-economic characteristics

Table 1 shows the distribution of respondents according to their socio-economic characteristics.

Age distribution

Most respondents are in the 49-58 years age group (54.17%), followed by those aged 39-48 years (20%), with an average age of 52.33 years (S.D. = ± 8.42). This indicates that the majority of respondents are middle-aged. People in this age range often have more experience and stability, which can improve farming practices and overall productivity. This finding suggests that middle-aged individuals are primarily involved in small ruminant management in the study area, supporting the findings of Otekhile and Verter (2017), Yusuf et al. (2018), Adekunmi et al. (2020) and Ifabiyi et al. (2022), who also reported that middle-aged individuals are active in small ruminant production.

Marital Status

A significant number of respondents are married (84.17%), aligning with global trends that show marriage as a prevalent social institution. The presence of widowed individuals (9.17%) could suggest either a higher life expectancy or cultural factors that contribute to longer marriages. Similarly, Ifabiyi et al. (2022) and Kalu et al. (2021) highlighted the marital responsibilities faced by small ruminant farmers.

Years of formal education

The average years of formal education are 9.60 ± 8.58 years. This points to a relatively low level of formal education among the respondents, which may be common in certain regions or socio-economic groups. Research indicates that lower education levels are often linked to lower income and limited access to resources. This suggests a moderate educational background among the respondents, which could affect their willingness to adopt better management practices. Additionally, studies by Adekunmi et al. (2020) and Kalu et al. (2021) have highlighted the poor educational backgrounds of small ruminant farmers.

Household size

A majority (68.33%) of households consist of 1-5 members, with an average household size of 5 ± 2 persons. Larger households often face greater economic strain due to the need to share resources among more people. However, research indicates that these larger households can also take advantage of economies of scale, allowing them to share costs such as housing and utilities. This suggests a moderate household size in the study area. Similarly, Adekunmi et al. (2020) and Ifabiyi et al. (2022) found a moderate household size among small ruminant farmers in their studies.

Primary occupation

The primary occupation in the area is small ruminant farming, accounting for 30.83%, with trading following at 21.67%. This highlights a significant dependence on agriculture and small-scale trading in the community. Research indicates that these types of jobs are frequently linked to lower income levels and increased susceptibility to economic changes. The findings suggest that small ruminant farming plays an important role in the rural economy.

Primary income

Most respondents earn between ₦10,000 and ₦100,000, accounting for 90% of the total. This indicates that the community generally has a low income level, which could affect their access to healthcare, education, and other vital services. The average income stands at ₦58,088.33, reinforcing the notion of a low income among the respondents. Additionally, Ifabiyi et al. (2022) noted a similar monthly income of over ₦60,000 among small ruminant keepers.

Types of small ruminants kept

A majority of respondents raise goats (39.17%) or both sheep and goats (54.17%). This reflects the significance of small ruminant farming in the area. Goats are frequently favored because they adapt well to challenging environments and require less maintenance than other types of livestock. This observation is supported by Yusuf et al. (2018) and Ifabiyi et al. (2022), who noted that small ruminant farmers typically keep both sheep and goats.

Management practices

Most respondents rely on indigenous management practices (62.50%), while a smaller portion employs improved practices (5%) or a mix of both (32.50%). This trend points to a dependence on traditional methods, possibly stemming from limited access to modern technology or training. It indicates that ruminant farmers in the study area have yet to embrace improved management practices that could boost their productivity and sustainability in small ruminant farming.

Secondary occupation

The data indicates that 48.13% of respondents engage in small ruminant production, with crop production at 19.17% and trading at 13.33%. This is consistent with the findings of Mustapha et al. (2024), who observed that small ruminant production serves as a prevalent secondary occupation for farmers in Nigeria, owing to its flexibility and minimal capital requirements.

Secondary income

A significant portion of respondents (77.5%) report earning a secondary income ranging from ₦0 to ₦30,000, with an average income of ₦24,237.50 for those making between ₦31,000 and ₦50,000. This indicates that although small ruminant production is common, it likely is not the main source of income for the majority of farmers.

Ruminant income

A total of 93.33% of respondents reportedly earn between ₦6,000 and ₦1,000,000 from ruminant keeping, with an average income of ₦355,370.80. This significant income level aligns with the findings of Al-Barakeh et al. (2020), who emphasized the economic value of small ruminant production in rural communities.

Ruminant keeping experience

Most respondents (40%) have between 1 and 12 years of experience, with an average of 15.20 years. This indicates that the farmers likely have the skills necessary to raise small ruminants and are capable of making decisions that optimize profit. Adekunmi et al. (2020) and Kalu et al. (2021) also found that small ruminant farmers typically have over a decade of experience. This points to a relatively high level of expertise among ruminant keepers, which can enhance productivity and income.

Access to farm credits

A significant majority of respondents (80.83%) depend on personal savings for farm credits, with cooperatives providing support to 14.17% and friends or relatives to just 5%. This suggests that personal savings are the main source of credit, but there is also a notable reliance on community support systems. It indicates that farmers in the region primarily use their savings to fund their production and may not actively seek additional credit. Cooperative societies assist 14.17% of respondents, while support from friends and relatives accounts for only 5.00%. Similarly, Adekunmi et al. (2020) and Ifabiyi et al. (2022) highlighted the importance of personal savings as a capital source for small ruminant farmers.

Types of labour used

A majority of respondents (54.17%) rely on a mix of their own labour and that of family members, while 31.67% depend solely on their own efforts. This indicates that small ruminant production tends to be a family-oriented endeavor, allowing for the distribution of tasks and lowering labor expenses.

Objectives of keeping small ruminants

Most respondents (85%) primarily aim for both consumption and commercial purposes, while 10% focus solely on commercial goals. This dual-purpose strategy reflects the socio-economic importance of small ruminants in ensuring food security and generating income. This finding aligns with the reports by Yusuf et al. (2018) and Ifabiyi et al. (2022), which indicate that small ruminant farmers are motivated by both commercial interests and family consumption.

Flock size

Almost half of the respondents (49.17%) reported having a flock size of 1-10 animals, with an average flock size of 15 animals. This suggests that small ruminant production is generally carried out on a smaller scale, making it easier to manage and requiring less capital investment. The data indicates that small to moderate flock sizes are common among these farmers.

Table 1. Distribution of respondents according to socio-economic characteristics of respondents

Variable	Frequency	Percentage	Mean/SD
Age (Years)			
29-38	7	5.83	
39-48	24	20.00	52.33± 8.42 years
49-58	65	54.17	
59-68	20	16.67	
69-78	4	3.33	

Marital status			
Single	3	2.50	
Married	101	84.17	
Separated	3	2.50	
Divorced	2	1.67	
Widowed	11	9.17	
Years of formal education			
0	21	17.50	
1-6	41	34.17	9.60 ± 8.58 years
7-13	35	29.17	
14-20	23	19.17	
Total	120	100	
Household size			
1-5	82	68.33	
6-10	35	29.17	5 ± 2 persons
11-15	3	2.50	
Primary occupation			
Small ruminant	37	30.83	
Crop production	16	13.33	
Civil servant	21	17.50	
Trading	26	21.67	
Artisan	30	16.66	
Primary income (₦)			
10000-100000	108	90.00	
101000-200000	8	6.67	
201000-300000	3	2.50	₦58088.33
301000-400000	0	0.00	
401000-500000	1	0.83	
Types of ruminant kept			
Sheep	8	6.67	
Goat	47	39.17	
Sheep and Goat	65	54.17	
Management practice			
Indigenous	75	62.50	
Improved	6	5.00	
Both	39	32.50	
Secondary occupation			
Small ruminant production	58	48.13	
Crop production	23	19.17	
Civil servants	3	2.50	
Trading	16	13.33	
Artisan	9	7.50	
Others	11	9.17	
Secondary income (₦)			
0-30000	93	77.5	
31000-50000	16	13.33	₦24237.5
51000-80000	9	7.50	
81000-100000	2	1.67	
Ruminant income (₦)			
6000-1000000	112	93.33	₦355370.8
1100000-2000000	7	5.83	
2100000-3000000	1	0.83	
Ruminant keeping experience			
1-12	48	40.00	
13-22	49	40.83	15.20 years
23-32	16	13.33	
33-42	7	5.83	
Access to farm credits			
Personal savings	97	80.83	
Friends and relative	6	5.00	
Cooperatives	17	14.17	
Types of labour used			
Self	38	31.67	
Family	0	0.00	
Hired	4	3.33	
Self and family	65	54.17	
Self and hired	5	4.17	
Family and hired	8	6.67	
Objectives of keeping ruminant			
Consumption	6	5.00	
Commercial	12	10.00	
Both	102	85.00	
Flock size			
1-10	59	49.17	
11-20	34	28.33	15 animals
21-30	17	14.17	
31-40	6	5.00	
41 and above	4	3.33	

Source: Field Survey, 2024

Indigenous and improved breeding management practices

Table 2 shows how respondents are distributed based on their indigenous and improved breeding management practices. In terms of indigenous breeding practices, the most common method is the use of uncontrolled mating strategies for indigenous small ruminants (WMS=0.97). This suggests that many respondents depend on natural, unregulated mating for their livestock. Okpeku et al. (2019) noted that farmers typically do not control mating. Following this, regular veterinary checks for managing reproductive health are also prevalent

(WMS=0.79). This indicates that while mating is often left uncontrolled, farmers are attentive to their animals' health through veterinary care (Lawal-Adebowale, 2020). The next practice involves using performance history to select breeding animals (WMS=0.78), suggesting that some respondents take into account the past performance of animals when making breeding decisions.

For improved breeding practices, the most notable method is extensive grazing (migratory, free-range, pasture, or range grazing) (WMS=0.82). This indicates that farmers allow their animals to graze freely. Nnoruga (2021) mentioned that grazing provides excellent nutrition and other advantages for small ruminants. Following this, the strategic pairing of young males with experienced older ewes and older rams with younger ewes to enhance mating is also common (WMS=0.80). This reflects that farmers possess a sophisticated understanding of animal breeding dynamics. Additionally, the treatment of reproductive diseases by veterinarians (WMS=0.66) highlights a strong reliance on professional veterinary services for managing reproductive health issues.

Table 2. Distribution of respondents according to indigenous and improved breeding management practices

Breeding management practices	WMS	Rank
Indigenous Breeding Practices		
Use of uncontrolled mating strategies for Indigenous small ruminant animals	0.97	1st
Use of regular veterinary checks to manage reproductive health in small ruminants	0.79	2nd
Use of performance history for selection of breeding animals in the Indigenous groups	0.78	3rd
Keeping basic records of breeding activities for small ruminants	0.77	4th
Use of physical characteristics in selecting small ruminants for breeding	0.71	5th
Use of breeding frequency control to manage reproductive health in small ruminants	0.64	6th
Use of controlled mating strategies for male indigenous small ruminant animals	0.55	7th
Use of selective breeding strategies for female indigenous small ruminant animals	0.49	8th
Improved breeding practices		
Extensive (migratory, free range, pasture or range grazing)	0.82	1st
Use of young males to experience older ewes and older rams to younger ewes for better mating	0.80	2nd
Treatment of reproductive disease by a veterinarian	0.66	3rd
Pregnancy diagnosis between 60-90 days after servicing	0.54	4th
Having a goat/sheep served within 90 days after giving birth	0.51	5th
Use of selective breeding for identifying and breeding animals with desirable traits	0.51	6th
Semi-intensive (pasture or range grazing,	0.50	7th
Use of optimal nutrition in providing balanced diets tailored towards the specific nutritional needs of breeding animals to ensure optimal health and reproductive performance	0.50	8th
Timely breeding of animals at appropriate ages and stages of reproductive maturity to maximize fertility and reproductive success	0.49	9th
Regular evaluation and adjustment of breeding strategies based on performance data	0.46	10th
Use of artificial insemination	0.41	11th
The use of one male to 20 females	0.40	12th

Source: Field Survey, 2024
WMS=Weighted Mean Score

Indigenous and improved feeding management practices

Table 3 illustrated how respondents were distributed based on indigenous and improved feeding management practices. The findings revealed that the most prevalent practice among traditional farmers is feeding small ruminants three times a day (WMS=1.27). This feeding routine suggests that farmers are dedicated to providing their flocks with sufficient nutrition throughout the day. According to Ali et al. (2019), inadequate feeding practices can harm the health of small ruminants. Following this, the use of traditional knowledge to assess the nutritional needs of small ruminants was noted (WMS=0.93), along with feeding them twice a day (WMS=0.93). This reliance on traditional knowledge highlights the significance of cultural and experiential learning in livestock management (Eniola et al. 2020). However, the results indicated that farmers do not modify their feeding practices in response to climate change (WMS=0.49). This suggests that animals are fed rigidly twice a day without taking into account the impacts of climate variability.

For improved feeding practices, the most common approach is providing fresh water daily (WMS=1.41). This shows that farmers prioritize keeping their flocks hydrated, demonstrating a solid understanding of the critical importance of their animals' health. With climate change, ensuring access to water for flocks has become increasingly vital. Several studies (Banjoko et al., 2021; Ebere and Blessing, 2021; Ifabiyi et al., 2022) highlight the necessity of this practice for maintaining flock health. Following this, farmers also provide adequate roughage (hay, silage, or pasture) (WMS=0.84) and ensure that newborn ruminant animals receive colostrum within one hour of birth (WMS=0.84). This indicates that farmers recognize the importance of caring for newborn kids and lambs to facilitate smooth management. Research by Hammon et al. (2020), Martins and Oliveira (2020), and Arshad et al. (2021) has emphasized the significance of this practice for the health and productivity of newborns. The least common practice is feeding a balanced concentrate mixture for milk production (WMS=0.38), which may be due to farmers not raising their flocks primarily for milk, making such strategies unnecessary.

Table 3. Distribution of respondents according to indigenous and improved feeding management practices

Feeding management practices	WMS	RANK
Indigenous feeding practices		
Feeding of small ruminants three times a day	1.27	1st
Use of traditional knowledge to determine the nutritional requirements for your small ruminants	0.93	2nd
Feeding of small ruminants twice a day	0.93	3rd
Use of crop residue as the primary source of feed for small ruminants	0.77	4th
Use of random grazing as the primary source of feed for small ruminants	0.70	5th
Feeding of small ruminants once a day	0.61	6th
Use of supplementary feeds as the primary source of feed for small ruminants	0.56	7th
Use of professional advice to determine the nutritional requirements for your small ruminants	0.50	8th
Adjustment of feeding practices based on climate changes	0.49	9th
Improved Feeding Practices		
Provision of fresh water daily	1.41	1st
Provision of adequate roughage (hay, silage or pasture).	0.84	2nd
Feeding of colostrum to new-born ruminant animals within one hour of birth	0.84	2nd
Provision of adequate nutrition (pasture, high quality forage or grains) for brooding ruminant animals	0.67	4th
Feeding of chopped fodders to animals	0.60	5th
Giving special ration to pregnant small ruminant	0.57	6th
Feeding small ruminant with mineral mixture	0.47	7th
Feeding of balanced concentrates mixture for milk production	0.38	8th

Source: Field Survey, 2024
WMS=Weighted Mean Score

Indigenous and improved housing management practices

Table 4 displayed the distribution of respondents based on indigenous and improved housing management practices. It indicated that the primary housing management practice in the indigenous system was ensuring proper ventilation and temperature control through natural means (WMS=0.98). This suggests that farmers heavily rely on natural environmental conditions to maintain animal comfort. Consequently, the animals are exposed to climatic conditions that could be detrimental to them. This contrasts with Kalu et al. (2021), who reported that housing must be monitored for effective management. Following this, the use of open spaces with shade is the next most common practice (WMS=0.93). This indicates that while farmers utilize natural ventilation, they also provide shade for their flocks to protect them from the negative impacts of climate variability, aligning with the findings of Sikiru et al. (2023). The third most prevalent practice is extensive grazing methods, such as migratory, free-range, pasture, or range grazing (WMS=0.82). The least common practice involves employing human guards to protect small ruminants from predators (WMS=0.32), suggesting that farmers do not have significant concerns about losing their animals to predators. For better housing practices, the most common approach is to use well-ventilated shelters that shield animals from harsh conditions like extreme heat. This indicates that farmers who adopt modern housing methods are particularly focused on managing environmental factors to ensure the health and comfort of their flocks. Simoes et al. (2021) reported a strong link between housing and sustainable high-yield production. Following this, the use of semi-covered structures and protective measures, such as fencing and guards to protect sheep and goats from predators, are also prevalent. However, providing environmental enrichment, like elevated platforms or scratching posts to encourage mental stimulation and alleviate boredom, is the least common practice. This suggests that farmers may not fully understand the psychological well-being of animals.

Table 4. Distribution of respondents according to indigenous and improved housing management practices

Housing management practices	WMS	RANK
Indigenous housing practices		
Ensure proper ventilation and temperature control through natural means	0.98	1st
Use of open space with shade	0.93	2nd
Extensive (migratory, free range, pasture or range grazing)	0.82	3rd
Semi-intensive (pasture or range grazing	0.73	4th
Open space with no shade	0.59	5th
Use of fence to protect small ruminants from predators	0.58	6th
Use of guard animals (dogs) to protect small ruminants from predators	0.48	7th
Tethering (small size flocks of 2–10 animals)	0.39	8th
Use of human guard to protect small ruminants from predators	0.32	9th
Improved housing practices		
Use of well-ventilated shelters that protect animals from extreme conditions such as excessive heat among others	0.98	1st
Semi-covered structure	0.68	2nd
Use of protective measures such as fencing, guard man, etc. to safeguard sheep and goats from predators	0.67	3rd
Provision of adequate recommended spacing per animal to allow for optimum productivity	0.58	4th
Use of suitable bedding materials such as straw and wood shavings to provide a clean and comfortable environment for the animals	0.58	4th
Provision of separate housing for different groups according to age, sex, reproductive status, health status among others to prevent aggression and diseases spreading	0.51	6th
Inspection of housing facilities for signs of damage wear and tear for prompt repairs and proper maintenance	0.49	7th
Use of biosecurity measures such as quarantine of newly arrived animals to prevent introduction and spread of diseases within the flock	0.48	8th
Provision of environmental enrichment such as elevated platforms, or scratching post to promote mental stimulation and reduce boredom	0.48	9th

Source: Field Survey, 2024
WMS=Weighted Mean Score

Indigenous and improved health management practices

Table 5 shows the distribution of respondents based on indigenous and improved health management practices. The results indicate that the use of medications to control parasites in small ruminants (WMS=1.22) is the most common health management practice within the indigenous system. This aligns with the findings of Hassan and Jibrin (2022). It demonstrates that even with traditional management methods, farmers understand the importance of keeping their flocks safe to ensure optimal productivity. Following this, the use of veterinary care services (WMS=1.07) is noted, indicating that traditional farmers do seek professional veterinary services for the overall health management of their flocks, contrary to the belief that they solely rely on self-care (Adeyeye et al. 2021). Additionally, they vaccinate their animals annually (WMS=1.03) and conduct regular visual or personal checks to monitor their flocks' health (WMS=1.02). The least common practice observed is the disbudding of small animals (WMS=0.44). For improved health practices, the most prevalent method is the treatment of sick animals exclusively by a veterinary doctor (WMS=1.21). This indicates that modern farmers depend entirely on professional veterinary care for treating illnesses, without considering personal care. This approach ensures that animals receive expert medical attention. Deworming of adult animals (WMS=1.20) ranks as the second most common practice, while vaccination against infectious diseases such as Foot and Mouth Disease and Brucellosis (WMS=1.10) is the third most utilized practice, reflecting a proactive stance on preventing serious health threats through immunization. Pregnancy restriction (WMS=0.47) is the least practiced method, suggesting that modern farmers may not prioritize advanced reproductive management techniques.

Table 5. Distribution of respondents according to indigenous and improved health management practices

Health management practices	WMS	Rank
Indigenous Health Practices		1st
Use of medication (deworming, etc.) to control parasites in small ruminants	1.22	2nd
Small ruminants receive veterinary care	1.07	3rd
Vaccination of small ruminants done annually	1.03	4th
Use of regular visual/personal routine checks for monitoring the health of small ruminants	1.02	5th
Use of on-site first aid as an emergency measure for sudden health issues in small ruminants	0.98	6th
Use of immediate veterinary assistance as an emergency measure for sudden health issues in small ruminants.	0.97	7th
Isolation of affected animals as an emergency measure for sudden health issues in small ruminants	0.86	8th

Use of herbal/traditional remedies for small ruminant's health management	0.85	9th
Use of veterinary health checks for monitoring the health of small ruminants	0.79	10th
Use of both visual and veterinary health checks for monitoring the health of small ruminants	0.73	11th
Use of rotational grazing to control parasites in small ruminants	0.60	12th
Castration of small ruminant animals	0.48	13th
Disbudding of small animals	0.44	14th
Improved Health Practices		
Treatment of sick animals by the veterinary doctor only	1.21	1st
Deworming of adult animals	1.20	2nd
Vaccination against infectious diseases, e.g Foot and Mouth Disease/Brucellosis)	1.10	3rd
Prompt reportage of contagious disease outbreak to the local veterinarian	1.00	4th
Isolation of sick animals from the healthy ones	1.00	5th
Routine inspection of animals	0.86	6th
Quarantine of the newly arrived animals	0.71	7th
Use of vaccines and medication	0.63	8th
Castration of male animals	0.58	9th
Disbudding/dehorning	0.56	10th
Culling of slow growing, weak, unproductive female animals	0.52	11th
Hoof trimming	0.51	12th
Use of sterilized scissors/knife for cutting and application of tincture iodine to the naval cord	0.50	13th
Consulting with veterinary officers for purchasing animals	0.49	14th
Pregnancy restriction	0.47	15th

Source: Field Survey, 2024
WMS=Weighted Mean Score

Level of adoption of improved small ruminant management practices

Table 6 illustrated how respondents were distributed based on their adoption of improved management practices. The findings revealed that over half (65.5%) of the farmers had moderately adopted these practices, while 21.67% were considered laggards, indicating a low adoption of improved technology. Additionally, 15.8% of the farmers demonstrated a high level of adoption. This indicates that there remains a blend of indigenous and improved management practices in the study area.

Table 6. Distribution of respondents according to their level of adoption of improved management practices

Level of adoption	Frequency	Percentage
Low	26	21.7
Moderate	75	62.5
High	19	15.8

Source: Field Survey, 2024

Common diseases among small ruminants in the study area

Table 7 presents the distribution of respondents based on the common diseases affecting small ruminants in the study area. According to the weighted mean score, mange (WMS=0.68) is identified as the most prevalent disease. This suggests that mange poses a significant health challenge for a large number of small ruminants in the region. Mange is a skin condition caused by mites, which can lead to considerable discomfort, weight loss, and reduced productivity in affected animals. Diarrhea (WMS=0.68) and tick infestations (WMS=0.62) are also major health concerns in the area. Diarrhea can arise from various factors, including infections, poor nutrition, and parasitic infestations, all of which can result in dehydration and weakness if not effectively managed. This highlights serious gastrointestinal issues among small ruminants in the study area. Additionally, tick infestations can lead to significant problems for the animals and can diminish their productivity. Adekunmi et al. (2020) noted ticks as a major concern in small ruminant production, among other diseases. Other reported diseases include bloating (WMS=0.32), goat/sheep pox (WMS=0.25), pneumonia (WMS=0.19), hair loss (WMS=0.16), foot rot (WMS=0.16), anthrax (WMS=0.10), helminthiasis (WMS=0.09), brucellosis (WMS=0.06), and black quarter (WMS=0.06).

Table 7. Distribution of respondents according to common diseases among small ruminants in the study area

Diseases	WMS	RANK
Mange	0.68	1st
Diarrhea	0.62	2nd
Tick	0.60	3rd
Bloating	0.32	4th
Goat/sheep pox	0.25	5th
Pneumonia	0.19	6th
Loss of hair (Alopecia)	0.16	7th
Foot rot	0.16	8th
Anthrax	0.10	9th
Helminthiasis	0.09	10th
Brucellosis	0.06	11th
Black quarter	0.06	12th

Source: Field Survey, 2024
WMS=Weighted Mean Score

Constraints to small ruminant production among the respondents in the study area

Table 8 shows how respondents are distributed based on the constraints affecting small ruminant production in the study area. The weighted mean score (WMS) indicates that limited capital (WMS=1.59) is the most significant constraint faced by small ruminant producers. Offor et al. (2018) also highlighted that a lack of funds is a major challenge hindering small ruminant farming activities. This suggests that farmers in the area do not have enough financial resources to enhance their production and invest in modern management techniques. Following this, the high cost of improved feed (WMS=0.83) is another pressing issue. This is related to the first constraint, as access to credit could enable farmers to invest in better feed options. Without this, they may experience suboptimal nutrition and lower productivity. Offor et al. (2018) further noted that feeding is a significant constraint. Theft (WMS=0.81) also poses a serious problem, creating financial risks for farmers. Losing animals can discourage them from expanding their small ruminant enterprises. Other constraints include costly feed (WMS=0.72), predator issues (WMS=0.63), pest and disease infestations (WMS=0.62), complaints from neighbors (WMS=0.59), damage to personal and neighboring crops (WMS=0.59), fluctuating market prices for animal products (WMS=0.55), inadequate housing for the animals (WMS=0.53), scarcity of forage (WMS=0.47), limited access to vaccinations and medications (WMS=0.44), insufficient veterinary services (WMS=0.41), high mortality rates (WMS=0.40), lack of market opportunities for products (WMS=0.38), and insufficient knowledge about small ruminant production (WMS=0.33).

Table 8. Distribution of respondents according to the constraints to small ruminants production among the respondents in the study area

Constraints	WMS	Rank
Limited capital	1.59	1st
High cost of improved feed	0.83	2nd
Theft of small ruminants	0.81	3rd
Costly feed	0.72	4th
Problems of Predators	0.63	5th
Pest and diseases infestation	0.62	6th
Neighbors' complaints	0.59	7th
Damage to personal and outsiders farm crops	0.59	7th
Low/fluctuating market price of animal products	0.55	9th
Lack of housing facilities to keep the animals	0.53	10th
Scarcity of forages	0.47	11th
Inadequate access to vaccination/medication	0.44	12th
Lack of Veterinary services	0.41	13th
High mortality rate	0.40	14th
Inadequate market for the product	0.38	15th
Inadequate knowledge of small ruminant production	0.33	16th

Source: Field Survey, 2024
WMS=Weighted Mean Score

Results of hypothesis testing

Table 9 presents the results of Pearson's Product Moment Correlation (PPMC) analysis, which examines the relationship between selected socio-economic characteristics of respondents and their level of adoption of improved small ruminant management practices. The findings indicate that age (r=0.87, p=0.008), educational level (r=0.76, p=0.006), and years of experience in ruminant keeping (r=0.68, p=0.000) all have a positive and significant relationship with the keepers' adoption of improved management practices. Therefore, we reject the null hypothesis that there is no significant relationship between the selected socio-economic characteristics and the level of adoption of improved small ruminant management practices.

Table 9. Results of Pearson's product Moment Correlation (PPMC) analysis showing relationship between selected socio-economic characteristics of respondents and their level of adoption of improved small ruminant management practices

Variable	R value	P-value
Age	0.87	0.008*
Educational level	0.76	0.006*
Years of experience in ruminant keeping	0.68	0.000*

Source: Field Survey, 2024

Conclusion

The comparative analysis of existing and improved small ruminant management practices in the Iwo Agricultural Zone of Osun State, Nigeria, highlights notable differences in productivity, animal health, and overall household income. Improved management practices, which encompass better feeding, housing, and veterinary care, result in higher growth rates, lower mortality, and increased profitability for rural households. In contrast, traditional practices often lead to less optimal animal performance and economic returns. The adoption of improved practices is also associated with better food security and sustainable livelihoods for rural families in the area. The study finds a moderate level of adoption of these improved management practices, although indigenous methods still prevail in certain areas. However, there is a noticeable shift towards modern practices, particularly in health management. The study suggests that government and related organizations should enhance agricultural extension services to provide rural farmers with ongoing training and support in adopting improved small ruminant management practices. This includes increasing access to quality feed, veterinary services, and housing materials through government subsidies or microfinance schemes, organizing regular workshops and training sessions to inform farmers about the benefits of improved management practices and their implementation, and establishing a strong monitoring and evaluation framework to assess the adoption and impact of these practices, ensuring that feedback is utilized for necessary adjustments and improvements.

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