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A study on sociodemographic profile and goat production system in the Western undulating zone of Odisha

PARAG ACHARYA[1], KUMARESH BEHERA[2], NEELA MADHAV PATNAIK[3]✉, JESSY BAGH[4], ANAND PRAKASH SINGH[5] and LENIN KUMAR GUMPHA[6]

Odisha University of Agriculture and Technology, Bhawanipatna 766 001 Odisha India

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ABSTRACT

The present study aimed to describe socio-demographic aspects, farming practices and production constraints of goat farmers in the western undulating zone of Odisha state of India comprising Kalahandi and Nuapada districts. Ten goat farmers were chosen from each village to gather pertinent information through field visits employing a pre-validated structured questionnaire for a period of around one year from January 2024 to December 2024. The data was collected from experienced (more than ten years, n = 320) goat farmers through personal face to face interview and participatory rural appraisal tools. The majority of goat farmers (90%) reared native Kalahandi goat. Majority of the respondents 76.56% were male and mostly falling within the 40–60 year age group. 33.43% respondents were illiterate, while 61.25% had studied up to 5th grade. Majority of the respondents (85.93%) reported that their goats attained sexual maturity between 8-10 months, while most (72.81%) having a service period of 3 months. The study identified key challenges affecting productivity and profitability, including feed shortage and shrinking of browsing area, disease prevalence, limited access to improved breeding males, lack of technical training program and predator attacks. The finding of this study highlighted the need for targeted interventions to improve goat production in this region particularly by addressing the identified constraints building on the dominance of native Kalahandi type of goats. The present study was undertaken to evaluate the sociodemographic profile and goat production in the western undulating zone of Odisha.

Keywords: Constraints, Kalahandi type goat, Performance, Socio-economic profile, Western undulating zone

Odisha is divided into 10 agro climatic zones, each characterized by distinct geographical features, soil types and rain fall patterns. Among these, the western undulating zone comprising Kalahandi and Nuapada districts has long struggled with challenges such as recurrent droughts, famine and social-economic hardships. Despite the hardships, the major tribal communities of this zone engage in rice and cotton farming and livestock rearing especially goats. The climate of this zone is very conducive for goat rearing. Kalahandi district has a total goat population of 257,495, accounting for 39.8% of the district's total livestock, while Nuapada district has 80,190 goats, representing 28.75% of its livestock population (F&ARD, 2020). Goats play a crucial role in livestock farming due to their high reproductive rate, short generation interval, superior meat quality and strong market demands (Faruque *et al.* 2016). They are also well adapted to challenging environmental conditions, making them a resilient livestock species (Liotta *et al.* 2020). Goats act as disposable readymade source of income through selling of goats used to purchase various house hold essential items. Given their economic and ecological significance, strengthening goat farming practices can further enhance the livelihoods of these goat farmers.

Present address: [1]Scientist (LPM), Regional Research and Technology Transfer Station (RRTTS), Odisha University of Agriculture and Technology, Bhawanipatna 766 001 (paragacharya@ouat.ac.in). [2]Assistant Professor (LPM), College of Veterinary Science and Animal Husbandry, Odisha University of Agriculture and Technology, Bhubaneswar-751003 (kumareshbehera@gmail.com).[3]Scientist (Agricultural Extension), ICAR- Mahatma Gandhi Integrated Farming Research Institute, Motihari, Bihar 845 429 (nmp.agriext1993@gmail.com).[4]Assistant Professor (LPM), College of Veterinary Science and Animal Husbandry, Odisha University of Agriculture and Technology, Bhubaneswar- 751003 (jessybagh123@gmail.com).[5]Assistant Professor, Department of Livestock Farm Complex, College of Veterinary Science, Rampura Phul, GADVASU, Punjab (anandprakash0412@gmail.com). [6]Assistant Professor (LPM), College of Veterinary Science and Animal Husbandry, Odisha University of Agriculture and Technology, Bhubaneswar- 751003 (leningumpha@ouat.ac.in). ✉Corresponding author email: nmp.agriext1993@gmail.com

MATERIALS AND METHODS

Study area: The study included selection of four blocks from each district of Kalahandi and Nuapada, which belong to Western Undulating Zone of Odisha. The region experiences hot, moist, and sub-humid conditions, receiving

an average annual rainfall of 1352 mm. Temperatures fluctuate from 45.8°C in summer to 7.5°C in winter. The soils in this region include Red, Mixed Red and Black, and Black types.

In Kalhandi district, the blocks and their respective villages were selected as follows: (i) Bhawanipatna (Damodarpur, Karlapat, Badili, Malgaon) (ii) Madanpur Rampur: Pandhamal, Dhekunkupa, Madanpur and Alatara (iii) Golamunda: Golamunda, Natikani, Antarla, Bahadurpada) (iv) Thuamul Rampur (Kiapadar, Sirimasha, Saisurni and Badbundel).

In Nuapada district the Block and their respective villages were selected as follows: (i) Nuapada (Godafula, Kotechuan, Bhanpur and Sahipala) (ii) Boden (Sirli, Mahulpada, Amera and Jhirnikhol) (iii) Komna (Nuagaon, Kalamati, Kandetare and Babupali) (iv) Khariar (Birighat, Kodal Dongri , Lanji and Kusmal).

Data collection: Ten goat farmers were chosen from each village to gather pertinent information through field visits employing a pre-validated structured questionnaire for a period of around one year from January 2024 to December 2024. The data collected from experienced goat farmers who are engaged in goat farming for more than ten years (n=320) through participatory rural appraisal. The interview continued for 30 minute per visit and useful information was gathered for further analysis.

Statistical analysis: The completed questionnaires were carefully reviewed manually, prior to being entered into excel spreadsheets for data coding. Subsequent statistical analysis was done using frequency and percentage distribution.

RBQ method to rank 'Motivational factor for goat keeping' and 'Constraints in goat production': Pilot study with open ended questionnaire and focus group discussions were carried out with the goat farmers of the study area to identify their motivation for goat rearing and the key challenges faced by them. The main reasons for goat rearing included income generation, meat and milk consumption, ceremonial sacrifices and gifting during family functions. The major constraints identified were shortage of feed and shrinking of browsing area, prevalence of disease, lack of improved breeding male, lack of technical training and predator attack. Once their motivation and the constraints were identified, it was imperative to rank the constraints for which a standard methodology Rank Based Quotient method (Sabarathnam, 1988) was used.

Rank Based Quotient (RBQ): The quantification of ranking data obtained by each farmer was analysed by calculating the RBQ values as given by Sabarathnam (1988), which is as follows:

$$R.B.Q = \frac{\Sigma\, fi(n+1-i)}{N \times n} \times 100$$

Where,

fi = Frequency of farmers reporting a particular constraint under i^{th} rank

N = number of farmers

n = number of constraints identified to be ranked

RESULTS AND DISCUSSION

Sociodemographic profile of goat farmers: The sociodemographic profile of goat farmers has been presented in Table 1. The study revealed that the semi-intensive system was the predominant goat production system, practiced by 92.5% of respondents, while 7.5% followed an extensive system, and no respondents practiced intensive goat farming. These findings aligned with the observations of Ammar *et al.* (2011) and Chniter *et al.* (2024). The majority of goat farmers (90%) reared the native Kalahandi goat whereas 7.5% raised Jamunapari and 2.5% kept Sirohi goats. Kalahandi is not a registered goat breed. It is characterised by medium sized goats which are extremely hardy, can survive up-to 48°C in summer, body coat colour are black, brown-tan or white, ears are flat, leafy and drooping. Horns are long, flat, curved upward and backward, legs are thin and cylindrical. There is also a distinct facial marking which runs from the base of horns to muzzle. These findings are in line with those of Hammadi *et al.* (2012), who reported that breeders tend to prefer local goat breeds due to their lower feed requirements, resilience to challenging environmental condition and superior ability to cover long distances, compared to other breeds. However, existence of Jamunapari and Sirohi goats in these regions indicated that breeders are keen on enhancing their flocks productivity through introduction of these breeds.

In terms of flock size, the majority (52.81%) of respondents managed herds ranging from 11-20 goats. According to Solomon *et al.* (2010), factors influencing flock size include land and feed availability, the significance of livestock as a primary livelihood source and stability of crop production. The average flock size in our study was 12.26. Tilahun (2023) reported slightly higher flock size of 14.40 goats per house hold in his findings. However, findings by Abraham *et al.* (2017) indicated a considerably larger flock size of 43.67 ± 17.49 goats per household in Begait Goat farming systems. This variation could be attributed to differences in agro-ecological conditions and farming practices. Higher flock size of goats in this study showed the interest of farmers for keeping goats and the importance of goat production in the community. Larger flock sizes, particularly among farmers with limited formal education may pose challenges in herd management, productivity and market efficiency as suggested by Kosgey *et al.* (2006).

Regarding the sex distribution of the surveyed goat farmers, 76.56% were male (245 goats), while 23.43% were female (75 goats). The dominace of male farmers in our study aligned with the finding from earlier studies conducted in the oases of Tunisia (Dhehibi *et al.* 2020; Nafti *et al.* 2021) and Algeria (Laouadi *et al.* 2018). This trend may be attributed to traditional nature of goat farming and prevailing socio-cultural norms highlighting the crucial role that men play in the socio-economic balance in the Western Undulating Zone of Odisha.

Table 1. Details of the sociodemographic profile of goat farmers

Variables	Description	Frequency	% of respondents
Goat production system	Semi-Intensive	296	92.5 %
	Extensive	24	7.5 %
Breed of Goat	Native Kalahandi type goat	288	90.0 %
	Sirohi	8	2.5 %
	Jamnapari	24	7.5 %
Average Flock size	5-10	78	24.37 %
	11-15	169	52.81 %
	16-20	64	20.00 %
	21-25	9	2.81 %
Sex of farmers	Male	245	76.56 %
	Female	75	23.43 %
Age of farmers	20-40	89	27.81 %
	40-60	152	47. 5%
	60 -80	79	24.68 %
Marital status of farmers	Married	224	70 %
	Unmarried	96	30 %
Level of Education of farmers	Illiterate	107	33.43 %
	0-5th	196	61.25 %
	6-10th	17	5.31 %

The age distribution of respondents showed that majority of the respondents (47.5%) belonged to 40-60 years age group. Age plays a crucial role in livestock management as younger people are more adaptable, innovative and receptive to modern practices. The relatively lower participation of individuals below 40 years and above 60 years in this study is suggestive livestock farming being less attractive than other career opportunities to younger generation. Many young individuals tend to seek employment in sectors that offer quicker financial return such as commerce and entrepreneurship (FAO, 2012). This trend may also be linked to rural youth migration or relocation to other state in pursuit of better economic prospects leading to a decline in engagement in traditional livestock farming. To address these challenges, local community leaders in collaboration with civil society organizations can play a vital role in promoting awareness programs that highlight the potential of goat farming as a sustainable livelihood option.

The high proportion of married individuals (70.0%) engaged in goat farming may be attributed to both social and economic factors, as small livestock rearing helps in sustaining their livelihood. Almost 33.43% respondent were illiterate. These findings were consistent with the study by Chniter and co-workers (2024) which reported an illiteracy rate of 35.8% among farmers. The prevalence of illiteracy rate in the region may be attributed to factors such as the inaccessibility of schools and financial constraints all of which could have hindered the advancement of goat farming in this region.

Motivation of the goat farmers for goat rearing: It was clear from the Table 2, that income generation with RBQ value 97.81 was the first motivational factor among the farmers to rear goats. Income generation was crucial for covering social obligations, emergencies, education and household expenses, which aligned with the findings of Tilahun (2023). In our study, goat rearing plays a crucial role in providing cash income to rural households, primarily through the sale of male kids. The reliance on livestock for economic stability is a common trend in developing countries where it is considered an effective way to utilize available resources efficiently (Kosgey *et al.* 2006). During the *Chatar Parab* festival (a local festival) at this region, goat prices experience a commendable surge, contributing to an annual income of approximately Rs. 100,000 from sales. These findings aligned with those of Chniter *et al.* (2024) who reported a similar trend in Southern Tunisia. Their study found that apart from Eid al-Adha, which falls on the 10th day of the Islamic month Dhu al-Hijjah, the majority of kids (58 .5 %) were sold during the summer at an average of 7.7 months age which is also the time when lamb meat declines.

Laouadi *et al.* (2018) opined that 58.5 % of goat farmers prioritized milk and meat for home consumption. Our study also revealed that meat consumption during marriage ceremonies and ceremonial sacrifices during *Chatar parab*, a local festival were second and third cause of goat keeping in this region. The findings highlighted that in mixed crop-livestock systems, small ruminants are primarily kept for income and meat, while milk and manure were not ranked as primary reasons for goat rearing.

Table 2. Motivation of the goat farmers for goat rearing

S .No.	Motivational factor	RBQ values	Rank
1.	Income generation	97.81	I
2.	Meat consumption	82.18	II
3.	Milk consumption	20.00	V
4.	Gifting to relatives	40.00	IV
5.	Ceremonial sacrifices	60.00	III

Flock composition of goats: In the present study, from flock composition (Table 3), it is evident that, breeding does account for the largest proportion of the flock composition at 47.14 %, followed by suckling females, suckling males, doe (> 1 year) and buck (> 1 year). These findings aligned with the observations of Houessou *et al.* (2021), who reported that the proportion of breeding does tends to be higher than other age groups within the flock. A higher proportion of breeding does contribute to increased kid production, which direct influences selection intensity and overall breeding strategies (Tilahun, 2023). Female kids are typically retained for breeding and milk production, leading to their longer stay in the herd. Conversely, the lower percentage of bucks older than one

Table 3: Flock composition of goats

Variables	Description	No. of goats (n=3926)	% of goats
Flock composition of goats	Breeding female	1851	47.14
	Breeding male	85	2.16
	Sulking female	630	16.04
	Sulking male	543	13.83
	Rearing female	546	13.90
	Rearing male	271	06.90

*Potential Breeding female/male (> 12 months); Sulking female/male (<6 months) and Rearing female /male (6-12 months)

year suggested that farmers primarily retain them for a limited duration before selling them to generate immediate income. Male kids are typically sold between 7 -8 months of age. Selling of male kids at a younger age was a common strategy in this zone, as it helps in manging herd size and reduces feeding expense.

Husbandry practices followed by the goat farmers: The husbandry practices followed by the goat farmers in the western undulating zone has been depicted in Table-4. In our study, goats primarily depended on natural grasses, shrubs, tree leaves as their main feed source. These findings aligned with the previous research findings by Tilahun (2023) that highlighted natural pasture served as the primary feed source for goats in the study areas. This suggested that farmers in our study region do not cultivate improved forage and fodder, instead rely entirely on natural grazing. This primary reason for this dependence included resource limitations among farmers, agro-climatic constraints, small land holdings and continued reliance on traditional goat farming practices leading to heavy reliance on natural grazing.

Nearly all respondents in the study area reported facing a severe seasonal shortage of feed, particularly during the dry season. This scarcity was primarily attributed to erratic rainfall patterns in the western undulating zone of Odisha, a region known for its susceptibility to drought and famine. The area experiences a hot, moist, and sub-humid climate, with an average annual rainfall of 1,352 mm. During periods of feed scarcity, most farmers relied on dried tree leaves, bushes, and crop residues to sustain their goats.

In our study, 54.68% of farmers housed their goats within their family dwellings. This observation aligned with the findings of Tilahun (2023). One possible reason for this practice could be the farmers' economic limitations, which prevented them from constructing separate shelters for their goats. Typically, goat housing is located near the entrance of the house. However, Tilahun (2023) suggested that in some cases, goats are kept inside family houses due to the region's humid climate and the high risk of predation, particularly from hyenas. Farmers who provided separate housing mentioned that although they could afford it, the stocking density was quite high, leading to strong ammonia odours, as observed during the investigation. Despite these challenges, keeping goats in separate shelters could be beneficial in reducing the transmission of zoonotic diseases.

A majority of respondents (71.56 %) reported having mud flooring and 11.25 % had elevated wooden flooring in their goat houses. These findings aligned with the observation of Tilahun (2023), who also reported that majorly mud goat houses. Mud floors are difficult to clean and quite prone to parasitic infestation.

In majority of the goat houses surveyed, the housing conditions were sub-optimal having high stocking density, small window, low roof height and poor ventilation which often resulted in darkness inside the shelter and a strong ammonia odour. Such conditions are detrimental goat health and productivity. Therefore, it is essential to educate farmers on improved housing practices to enhance goat productivity and health (Tilahun, 2023).

The majority of the goat farmers (72.50 %) preferred a daily grazing period of 8-10 hours, typically from 8 a.m. to 5 p.m. in winter season while in summer, the grazing period was split into two sessions: 6 to 11 a.m. and 3 to 7 p.m. Farmers preferred to bring back goats from 11 a.m. to 3 p.m. to prevent heat stress. Regarding frequency of drinking water provision to goats, 77.18 % of the respondents reported giving water to their goats twice a day, once during grazing and once after reaching in the house after grazing. Meanwhile, 22.80 % of farmers offered water thrice a day- twice during grazing and once after reaching in the shelter. The primary sources of water were ponds and canals located near grazing areas. In arid and semi-arid regions, local goat breeds are known for their tolerance to high ambient temperature and limited water availability (Kaliber *et al.* 2016). The role rumen is significant in this adaptive mechanism, as it helps in regulating water requirements by storing water during rehydration and gradually releasing it during dehydration. This physiological adaptation enables goats to withstand prolonged periods without water (Jaber *et al.* 2015). As a result, many goats in these regions are capable of thriving even with access to drinking water only once during the day.

Regarding routine health management practices, 61.25 %, 57.81 % and 96.25 % of the respondents practised vaccination, deworming and castration, respectively. Shegaw *et al.* (2021) also reported that about 90.6% of the respondents practiced castration. Castration was mainly carried out to enhance growth and fattening performance, facilitate easier handling by making the bucks more docile, regulate mating practices, and ultimately fetch higher market prices for the fattened animals.

Reproductive performances of native goats: The reproductive performance of native goats has been given in Table 5. The majority of the respondents (85.93%) indicated their goats attained sexual maturity between 8-10 months. Most farmers (83.12%) reported the age at first kidding occurred between 13-15 months. Regarding service period of goats, 72.81% of farmers observed a duration of 3 months. The predominant inter-calving period was 8

Table 4. Husbandry practices followed by the goat farmers

Variables	Description	Frequency	% of respondents
Source of feed	Solely depends on Natural grasses, shrubs, tree leaves	293	91.56
	Natural grass along with Broken rice	27	8.43
	Balanced Concentrate ration	0	0
Type of housing	Family house	175	54.68
	Separate house	145	45.31
Type of flooring	Mud floor	229	71.56
	Cement concrete floor	55	17.18
	Elevated wooden floor	36	11.25
Routine Health management	Vaccination	196	61.25
	Deworming	185	57.81
	Castration	308	96.25
Grazing hour	8-10	232	72.50
	10-12	56	27.50
Frequency of drinking water of goats in a day	Twice	247	77.18 %
	Thrice	55	22.80 %

months as reported by 72.5% goat rearers of this zone. The earlier reported values of reproductive parameters in Black Bengal goats *i.e.* Age of puberty, Age of first kidding, Kidding interval, Gestation period and service period are 208.50 ± 26.20, 373.18 ± 25.67, 191.13 ± 98.49, 150.04 ± 7.96, 282.90 ± 20.64 days respectively (Mondal *et al.* 2023). The delay in puberty and age of first kidding in comparison to black Bengal goat could be attributed to lack of concentrate feeding and practice of flushing, largely due to high feed cost.

According to 80.62% of farmers, the birth weight of kids typically ranged between 2-3 kg. Litter size increased with advancement of parity and it aligned with the findings of Mondal *et al.* (2023) who reported litter size were 1.80 ± 0.07, 1.84 ± 0.07 and 1.90 ± 0.10 at 1st, 2nd and 3rd parity, respectively. The average kidding interval was reported to be 7.4 months and the average litter size per doe increased from 1.3 at first parity to 2.5 by the fourth parity (Houessou *et al.* 2021).

Constraints of goat production: Shortage of feed and shrinking of browsing area emerged as the first constraint with RBQ value 86.81 in this region (Table 6). Several studies have reported similar findings in different regions. Dhaliwal and co-workers (2021) highlighted that in Punjab's extensive goat rearing system, the major constraints were the high prices of concentrate and shrinkage of grazing land. Likewise, Gamit *et al.* (2020) observed that lack of green fodder availability (75.83%) and reduction of grazing land (64.17%) were the major challenges.

Prevalence of disease ranked second constraint in our study. Peste des Petits Ruminants (PPR) followed by goat pox and other major diseases affecting goats were skin diseases, enterotoxemia and diarrhoea in the western undulating zone of Odisha. Similarly, in the Minjar-Shenkora district, Tilahun (2023), reported that pasteurellosis, followed by PPR and diarrhea, were the most common diseases affecting the goats. These results aligned with the findings of Bekalu (2014), who observed that pasteurellosis and PPR were the most common and economically significant diseases affecting goats in the West Gojam zone. The substantial production losses associated with these diseases could be attributed to the prevailing climatic conditions of this zone, which may favour the spread and persistence of infections. Additionally, poor nutritional status of goats

Table 5. Reproductive performances of native goats

Reproductive Traits	Description	Frequency	% of respondents
Age of sexual maturity	6- 8 months	21	6.5 %
	8-10 months	275	85.93 %
	10-12 months	24	7.57 %
Age at first kidding	11-13 months	25	7.81 %
	13-15 months	266	83.12 %
	15-17 months	29	9.07 %
Service period	2 months	22	06.88 %
	3 months	233	72.81 %
	4 months	65	20.31 %
Inter calving period	8 months	232	72.5 %
	12 months	88	27. 5 %
Birth weight of kid	1-2 kg	58	18.12 %
	2-3 kg	258	80.62 %
	3-4 kg	4	1.26 %
Litter size	Single	97	30.31 %
	Double	180	56.18 %
	Triplet	40	12.5 %
	Quadruplate	3	1.01 %

Table 6. Constraints of goat production

S .No.	Constraint	RBQ values	Rank
1.	Lack of Technical training	44.00	IV
2.	Predator attack	29.18	V
3.	Feed shortage and shrinking of browsing area	86.81	I
4.	Prevalence of disease	75.93	II
5.	Breeding problem	64.06	III

and inadequate health management practices by farmers (Table 4) likely to have contributed to the high incidence and impact of these diseases.

Among various constraints, constraint related to breeding ranked third (RBQ value - 64.06) in our study. The most pressing concern in this category were unavailability of quality breeding buck followed by indiscriminate breeding and repeat breeding. These findings aligned with the observation of Gamit *et al.* (2019) who had reported major breeding related challenges included breeding bucks, indiscriminate breeding, lack of knowledge on breeding practices and repeat breeding. A key factor contributing to the issue of indiscriminate breeding in the present study area is the low literacy rate among farmers, leading to lack of scientific knowledge on breeding practices. Similar observation has been reported in other studies as well (Kumawat *et al.* 2017).

To address these challenges, higher number of breeding males need be supplied at this region, which can enhance mating success. Additionally, rotational use of breeding males can help improve conception rates and prevent inbreeding. Strengthening awareness and training programs on scientific breeding methods is crucial to ensuring sustainable goat farming practices.

Various researchers have recommended strengthening resource management- such as promoting the sustainable use of water and enhanced access to advanced technologies. In contrast, for betterment of extensive system, policies should be made to control toxic species and imparting technical training to farmers to enhance the resilience and productivity of these systems (Palomino *et al.* 2024).

The majority of farmers in this zone rear the native Kalahandi type of goat due to its better adaptability and low input requirements. Goat farming predominantly remained male driven, influenced by traditional and socio-cultural factors, with a significant proportion of middle-aged farmers having over a decade of experience in this sector. Most farmers practisd a semi- intensive production system solely depending on road side grass and tree leaves contributing to delayed puberty and first kidding. The study also revealed challenges related to concentrate feed, prevalence of disease, lack of improved breeding male, shrinkage of browsing area and predator attack which impact productivity and profitability. Despite these challenges, goat rearing remains a crucial livelihood activity providing a stable income to the farmers. To enhance productivity and sustainability, interventions such as improved breeding strategies, better feeding practices and youth inclusive development programmes need to be promoted.

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