

Management Practices and Perceived Training needs of Small Ruminant Farmers in Terengganu, Malaysia

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ABSTRACT

Small ruminant farming, encompassing goat and sheep production, is a cornerstone of global food security and rural livelihoods. This study delves into the perceived training needs and management approaches of small ruminant farming from a farmer perspective. The study's aim is to unravel the intricacies of this practice, bridging traditional wisdom and modern innovation to foster sustainable development. A questionnaire was used for data collection from 613 small ruminants farmers and analyzed with descriptive statistic socio-economic characteristics, such as gender, age, marital status, and educational level, provide a vivid portrait of the farming community. The majority of farmers was about (66.2%) are men, aged between 21-40 years, with varying levels of formal education. This diversity underlines the intricate tapestry of small ruminant farming practitioners. This study illuminates the interconnection between small ruminant farming, cultural heritage, and sustainable development. It underscores the significance of integrating traditional knowledge and modern insights to fortify the sector against challenges. The findings contribute actionable recommendations for targeted interventions, empowering farmers and shaping the future trajectory of small ruminant farming.

Keywords: small ruminant, practice farming, agricultural, low income farmers, livelihoods, management.

INTRODUCTION

small ruminant farming, which includes goat and sheep rearing and livestock management, is critical to ensuring global food security while encouraging rural livelihoods ([1], [2], [3]). Small ruminants have developed as key providers of meat, milk, and fibre in many developing countries, serving as pillars for both livelihood and commercial farming practises ([4], [5]). Their exceptional adaptation to varied habitats and capacity to survive under limited resources make them great assets in locations with severe agricultural conditions ([6], [7]).

The study's focus is on resolving an intricate relationship of perceived the need for education and management practises for small ruminant farming as seen by means of the eyes of the farmers themselves. This study acknowledges that these farmers are more than just participants in a production cycle; they are the stewards of a time-honored practise ([8], [9]). Their intimate knowledge of the land, animals, and farming complexities provides them with insights that capture the essence of sustainable small ruminant production ([10], [11]).

Small ruminant farming is more than just a matter of economics; it is firmly based in cultural practises, traditional knowledge, and local customs. These inconspicuous creature are frequently symbolic of agrarian history, and their presence represents the spirit of rural life ([12], [13]). They have served as sources of nourishment and economic value for generations, as well as symbols of identity, holding a rich tapestry of cultural importance [14].

This study aims to fill the gap between traditional wisdom and modern farming practises by putting ourselves in the farmer's perspective. It aims to discover the numerous obstacles that these farmers confront,

ranging from market swings to the whims of a changing climate, as well as the innovative strategies they use to overcome these challenges [15]. Recognising that farmers' knowledge is gained from firsthand experiences, this study aims to record their nuanced insights, creative solutions, and hopes for the future of small ruminant farming [16].

We find not just a means of subsistence but a reservoir of resilience, adaptability, and determination that sustains communities and shapes the future of generations by embarking on this research of training needs and management strategies emerging from the basis of small ruminant farming ([17], [18]). By embracing the farmer's point of view, we move closer to realising the full potential of these apparently insignificant creatures in ensuring food security, maintaining cultural legacy, and supporting sustainable development [19].

Extension services have also been identified as a critical means of improving the income of small-scale farmers. In addition, improving small ruminant production through feeding and breeding management practices can enhance the livelihoods of low-income small ruminant farmers [20].

In conclusion, these approaches offer promising solutions for enhancing the livelihoods of low-income small ruminant farmers. However, policy interventions are needed to ensure that these approaches are sustainable and equitable [21]. By promoting innovative approaches and best practices, policymakers and development practitioners can help to support the sustainable development of small ruminant farming and improve the lives of millions of rural households worldwide.

LITERATURE REVIEW

1. Importance of Small Ruminant Farming in Agriculture and Livelihood

Small ruminant farming contributes significantly to meat, milk, and fibre production, particularly in developing countries. These animals provide critical nutritional resources for subsistence and commercial reasons, hence improving food security in resource-limited areas [22]. Their flexibility to a variety of conditions, as well as their ability to thrive in environments with limited resources, make them valuable assets for communities confronting agricultural issues. The study's emphasis on small ruminants aligns to their complex significance in supporting rural economies and livelihoods.

2. Holistic management Approaches for Small Ruminant

Holistic management encompasses various aspects, including nutrition, health, reproduction, and the environment [23]. Livestock health and welfare are central to the success of small ruminant farming [24]. Management practises vary based on local conditions and farmer knowledge, contributing to the resilience of small ruminant systems [25].

3. Incorporating Traditional Knowledge and Farmers Perspective

Small ruminant farming has a complex connection with cultural practises and traditional knowledge, and it is an essential component of many societies [26]. Farmers' in-depth knowledge of livestock and their local ecosystems provides vital insights that support sustainable and contextually appropriate farming practises [27]. Acknowledging the importance of traditional knowledge, participatory approaches are being used to integrate farmer perspectives and increase the efficiency of small ruminant management strategies [28].

4. Challenges and Innovation in Smart Farming

Small ruminant farming operates in a dynamic setting with multiple challenges that require innovative solutions to assure its viability and sustainability. Market volatility and the unpredictable effects of changing

climatic conditions are major challenges [29]. Farmers are using their inventiveness and resourcefulness to handle these problems, combining time-honored traditional practises with modern knowledge and technologies [30]. The study not only offers light on the complicated nature of small ruminant farming but also reveals insights into the subtle changes required for the sector's long-term sustainability by examining into the practises used by farmers to overcome these obstacles.

5. Preserving Cultural Heritage and Sustainable Development

Small ruminants have cultural value that extends beyond their position as livestock [31]. Integrating traditional practises profoundly ingrained in communities' histories into modern management approaches not only pays homage to ancestral wisdom but also contributes to cultural identity preservation [32]. This harmonic interplay of tradition and modernity sets the way for sustained development in small ruminant farming. The investigation of training requirements and management methodologies in the study reveals the significant interconnectivity between small ruminant farming, cultural heritage, and the promotion of sustainable development goals.

Eventually, by looking into the subtle interplay between farmer perspectives, training needs, and management practises, the adds to the current body of knowledge. The study provides insights into the diverse world of small ruminant farming and its significance in global agriculture and rural lives by harmonising with the broader themes of small ruminant farming, holistic management, participatory techniques, problems, and cultural heritage.

METHODOLOGY

The small ruminant livestock farmers that had to participate in the study were the inclusion criteria. During the session, participants were chosen. Because information is only collected from a certain location on purpose, the sampling for this study is based on random purposes. Furthermore, it is chosen to understand the regulation of specific elements and this cross-sectional validation study was held at Terengganu, Malaysia.

The questionnaires will be completed by all participants. Participants provided informed assent and consent. The study was carried out with the agreement of the Head Officer (JPVNT). Data was gathered through anonymous questionnaires filled out by participants as well as illiterate persons. During the event, samples were drawn from people aged 18 and up for this study.

Respondents for the study were drawn from prior studies on small ruminant farmers conducted by previous researchers. The survey respondents for this study were (N = 613) respondents, while only (N = 63) study respondents participated in the pilot study. Sample sizes were chosen based on sample size standards stating that sample sizes larger than 30 and fewer than 500 were adequate for researchers.

This survey was using dichotomus scales with the respondents expressing their consent to the statement of inventory in the self-determination questionnaire. In addition, other scales were used to measure aspects of knowledge that the respondents would choose 'yes' or 'no'. It is important to note that, the questionnaire presented to the participants was in Malay language. This is due to the fact that the respondents to this research is Malaysian.

RESULTS

1. Socio-economic characteristics of respondents

Based on table 1, the socio-economic characteristics of individuals engaged in small ruminant farming

provide valuable insights into the demographic composition of this agricultural sector. The data presented here highlights the distribution of respondents based on sex, age, marital status, and educational level. Let's delve into the findings to better understand the profile of individuals involved in small ruminant farming.

Understanding the socio-economic characteristics of small ruminant farmers is crucial for tailoring effective training and management approaches that address their specific needs and contexts. The data presented below provides insights into the sex, age distribution, marital status, and educational level of small ruminant farmers in the study area.

The sex distribution of small ruminant farmers reveals a notable gender disparity, with (83.40%) being male and (16.60%) female. This imbalance aligns with the broader trends in agriculture, where women often face unequal access to resources, opportunities, and decision-making power [33]. Recognizing this gender gap is critical for promoting gender equality and empowering female farmers, as their perspectives and contributions play a pivotal role in shaping small ruminant farming systems.

The age distribution of farmers indicates a diverse demographic profile. The majority falls within the age range of 21-50 years (33.90% aged 21-30 years and 33.10% aged 31-40 years), indicating a potentially active and productive cohort of farmers. Notably, there is also a representation of younger farmers (<20 years), which could indicate a potential influx of new entrants into the sector [34]. However, the presence of farmers aged 51 and above might suggest the continuation of traditional practices and the importance of intergenerational knowledge transfer [35].

Small ruminant farmers exhibit diverse marital statuses, with (66.90%) being married, (29.40%) single, and (3.80%) widowed. This distribution reflects the interplay between social and economic factors that shape farmers' decisions and engagement in small ruminant farming [36]. Married farmers might benefit from additional labor support and shared responsibilities, while single and widowed farmers could face unique challenges in managing their farms and livelihoods.

The educational distribution of farmers highlights the varying levels of formal education within the community. A significant proportion (48.5%) has completed secondary education (MCE /SPM/STPM/Matriculation), indicating a moderate level of educational attainment. However, the presence of farmers with lower educational levels (11.1% LCE/SRP/PMR) and those with higher degrees (14.0% Degree/Masters/PHD) underscores the diversity of knowledge and skills within the small ruminant farming community [37]. The coexistence of different educational backgrounds can foster knowledge exchange and collaboration among farmers with varying expertise.

In conclusion, the socio-economic characteristics of small ruminant farmers are multifaceted and provide valuable insights into their diversity, potential challenges, and unique strengths. Recognizing gender disparities, age dynamics, marital statuses, and educational levels is pivotal for developing contextually relevant interventions that enhance training, management approaches, and overall livelihoods within the small ruminant farming sector.

TABLE 1 : Percentage Distribution of Respondents According to Socio-Economic Characteristics

Socio-economic characteristics	Frequency(f)	Percentage (%)
Sex		
Male	511	83.40
Female	102	16.60
Age (Years)		
<20 years	34	5.50
21-30 years	208	33.90
31-40 years	203	33.10

41-50 years	131	21.40
51-60 years	5	0.80
>60 years	32	5.20
Marital Status		
Single	180	29.40
Married	410	66.90
Widow	23	3.80
Educational Level		
LCE/SRP/PMR	68	11.1
MCE/SPM/STPM/Matriculation	297	48.5
Diploma	142	23.2
Degree/ Masters Degree/ PHD	86	14.0

2. Small ruminant management and housing type

The distribution of small ruminants reared by farmers showcases a predominant focus on goats, constituting (83.4%) of the sample, while sheep represent a smaller proportion at (3.8%). Notably, there is also a subset of farmers (12.9%) engaged in raising both goats and sheep concurrently, reflects the prevailing preference for goat farming, which aligns with their adaptability to diverse agro-ecological zones and their multiple contributions to livelihoods [38]. The lower proportion of sheep could be attributed to their specific management requirements and potentially niche markets [39].

The data illustrates the diversity of management systems adopted by small ruminant farmers. Of particular interest is the prevalence of semi-intensive management (62.2%), which suggests a balance between traditional extensive systems and modern intensive practices. Intensive management accounts for 33.6% of the sample, reflecting a trend toward intensified production methods (Debela et al., 2021; Girma et al., 2020). The presence of extensive management (4.2%) indicates that traditional, low-input systems are still relevant, likely favored for their resource efficiency and alignment with specific environments.

The primary purposes for which small ruminants are raised indicate a multifaceted role of these animals in livelihoods. Breeding, accounting for (61.5%) of the sample, suggests a strong emphasis on genetic improvement and herd expansion. Fattening, comprising (25.4%), aligns with market-oriented production, aiming to maximize weight gain and meat production. The presence of dairy farming (13.1%) showcases the relevance of small ruminants in milk production, which contributes to both nutritional security and income generation [40].

The distribution reveals a nuanced tapestry of small ruminant farming practices that reflect the sector's dynamic nature. Farmers' choices regarding the types of animals reared, management approaches, and farming purposes are often influenced by a combination of ecological, economic, and socio-cultural factors.

These choices underscore the intricate balance between tradition and innovation, where farmers blend time-honored wisdom with contemporary knowledge to enhance productivity and resilience. The complexity and diversity of small ruminant farming practices, encompassing choices related to the types of animals reared, management strategies, and farming objectives. These findings underscore the importance of context-specific interventions that acknowledge the multifaceted goals of small ruminant farmers and leverage their integrated approaches for sustainable development.

TABLE 2: Distribution Of Respondents According to Type of Small Ruminants Kept, Management System and Housing Type.

Variable	Frequency (f)	Percentage (%)
Type of small ruminant		
Goat	511	83.4
Sheep	23	3.8
Goat and Sheep	79	12.9
Management System		
Extensive	26	4.2
Intensive	206	33.6
Semi- Intensive	381	62.2
Farming Purposes		
Breeding	377	61.5
Fattening	156	25.4
Dairy	80	13.1

3. Feed and feeding practices use for small ruminant

Based on the table 3, efficient feed and feeding practices are paramount for ensuring the health, productivity, and welfare of small ruminants. The data provided below unveils key insights into the frequency of feeding, livestock feeding costs, and the types of nutrition provided to small ruminants within the studied farming community.

The distribution of feeding frequency showcases the diversity of practices adopted by small ruminant farmers. A substantial proportion of farmers feed their animals twice a day (63.1%), followed by those feeding three times a day (21.5%) and once a day (11.4%). A smaller fraction adheres to an extensive feeding regimen, with animals fed only once (3.3%). The presence of a few farmers employing a four-times-a-day feeding schedule (0.7%) demonstrates the adaptability of small ruminant management strategies [41].

The spectrum of livestock feeding costs illuminates the financial investments made by farmers to support their small ruminant production systems. A noteworthy portion of farmers incurs costs ranging from RM 301.00 to RM 500.00 (28.5%), followed by RM 100.00 to RM 200.00 (14.5%), and RM 201.00 to RM 300.00 (12.1%). The distribution of various cost ranges, encompassing both lower and higher values, underscores the heterogeneity in financial capacities and resource availability among small ruminant farmers [42].

The distribution of livestock nutrition practices unveils the primary sources of nutrition provided to small ruminants. Pellets and grass/foilage constitute the two predominant sources of nutrition, with prevalence rates of (9.5%) and (5.1%), respectively. Pellets, formulated to provide balanced nutrients, contribute to streamlined feeding practices and enhanced growth. Grass and foliage consumption underscores the reliance on locally available forage resources, a common practice within small ruminant farming systems [43].

The observed variations in feeding practices and associated costs underscore the necessity for tailored feeding strategies that align with farm-specific objectives, resources, and contextual factors. Implementing efficient feeding practices contributes to optimal animal growth, reproduction, and product quality, while cost-effective feeding approaches enhance the economic viability of small ruminant enterprises [44].

In conclusion, the data pertaining to feed and feeding practices within the realm of small ruminant farming provides a comprehensive and nuanced understanding of the multifaceted approaches that farmers adopt to

nourish and care for their valuable livestock. These feeding practices extend far beyond mere economic considerations, encompassing a holistic perspective that prioritizes both the optimization of animal health and the enhancement of overall performance. This intricate balance between practicality and sustainability lies at the core of effective small ruminant management, encapsulating the essence of a harmonious coexistence between human stewardship and the well-being of the animals under their care.

In summary, the practices surrounding feed and feeding in small ruminant farming exemplify the intricate web of considerations that farmers navigate. These practices transcend economics to encompass the realms of animal well-being, health optimization, and sustainability, forming the bedrock of responsible and successful small ruminant management strategies.

TABLE 3: Percentage Respondents According to Feed and Feeding Practices Use for Small Ruminants

Feed and Feeding Practices	Frequency (f)	Percentage (%)
Never (extensive)	20	3.3
1 time a day	70	11.4
2 times a day	387	63.1
3 times a day	132	21.5
	4	0.7
Livestock Feeding Costs		
<RM 100.00	40	6.5
RM 100.00 – RM 200.00	89	14.5
RM 201.00 – RM 300.00	74	12.1
RM 301.00 – RM 400.00	175	28.5
RM 401.00 – RM 500.00	75	12.2
RM 501.00 – RM 600.00	40	6.5
RM 601.00 – RM 700.00	21	3.4
RM 701.00 – RM 800.00	15	2.4
RM 801.00 – RM 900.00	1	0.2
RM 901.00 – RM 1,000.00	4	0.7
>RM 1000.00	79	12.9
Livestock Nutrition		
Pellets	58	9.5
Grass/foilage	31	5.1

4. Health and Management practices for small ruminant

Based on the table 4, the effective health management practices are critical for maintaining the well-being and productivity of small ruminants. The data presented below provides insights into the distribution of respondents based on their knowledge of livestock health and their frequency of livestock inspection, shedding light on the level of understanding and engagement in health-related practices within the studied farming community.

The distribution of respondents based on their knowledge of livestock health reveals varying levels of awareness and understanding among small ruminant farmers. A small proportion of respondents (4.7%) are classified as “very knowledgeable,” indicating a deep understanding of livestock health. A larger segment (36.7%) falls under the category of “know,” suggesting a moderate level of knowledge. A substantial portion (50.9%) acknowledges knowing only a little about livestock health, while a minority (6.4%) admit not knowing at all. A small fraction (1.3%) considers themselves “ignorant,” indicating a lack of awareness

[45].

The data on inspection frequency provides insights into the frequency with which small ruminant farmers examine the health status of their animals. A minority (4.1%) never conduct livestock inspections. A larger portion (37.0%) is uncertain about the frequency of inspection, possibly reflecting varying practices among respondents. Periodic inspections are reported by a significant number of respondents: (12.7%) inspect their livestock once a month, (26.1%) do so every three months, and 13.9% perform inspections every six months. A smaller segment (6.2%) conducts inspections annually [46].

The distribution of respondents' health management practices underscores the importance of enhancing knowledge and practices related to livestock health. The variability in knowledge levels suggests the need for targeted education and extension programs to improve farmers' understanding of disease prevention and management [47]. The diversity in inspection frequencies indicates that there is room for encouraging more regular and systematic health checks, which can aid in early disease detection and prevention.

The data highlights the existing disparities in knowledge and health management practices among small ruminant farmers. These findings emphasize the significance of capacity-building initiatives that address knowledge gaps and promote proactive health management practices to ensure the long-term health and sustainability of small ruminant farming systems.

TABLE 4: Percentage The Respondents According To Health Management Practices

Health management	Frequency (f)	Percentage (%)
Knowledge Livestock Health		
Very knowledgeable	29	4.7
Know	225	36.7
Know only a little	312	50.9
Don't know	39	6.4
Ignorant	8	1.3
Inspection on Livestock		
Never	25	4.1
Uncertain	227	37.0
1 month once	78	12.7
3 months once	160	26.1
6 months once	85	13.9
Once a year	38	6.2

CONCLUSIONS

Small ruminant farming, which includes goat and sheep production, is critical to global food security and rural lives. This study looked into farmers' perceptions of training needs and management practises in small ruminant farming. The findings offer light on the socioeconomic characteristics of farmers, the types of small ruminants reared, management strategies used, feeding practises, livestock health management, and other aspects of small ruminant farming.

The complexity and diversity of small ruminant farming practises. The findings highlight the necessity of acknowledging farmers as repositories of practical learning and their important role in designing sustainable management techniques. The findings lay a solid platform for the development of context-specific interventions, policies, and extension programmes aiming at improving the production, resilience, and socioeconomic well-being of small ruminant farming communities. Combination traditional knowledge,

farmer viewpoints, and novel practises can help to advance both small ruminant farming and broader sustainable development aims.

RECOMMENDATION

Future studies may explore small ruminant farming practices from a broader perspective with a combination of theories from various theories. It is suggested that, this combination will provide a much more reliable findings than those found in this study. This study is quantitative, it is proposed for future research that will be conducted to explore the scope of farming practices of a qualitative for a deeper understanding from the respondents.

Incorporating these recommendations into the development of training programs, extension activities, and policy interventions can contribute to the advancement of small ruminant farming, foster sustainable practices, and improve the livelihoods of farming communities.

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REFERENCES

1. Caja, G., Castro-Costa, A., Salama, A. A., Oliver, J., Baratta, M., Ferrer, C., & Knight, C. H. (2020). Sensing solutions for improving the performance, health and wellbeing of small ruminants. *Journal of Dairy Research*, 87(S1), 34-46..
2. Thornton, P. K. (2010). Livestock production: Recent trends, future prospects. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 365(1554), 2853-2867.
3. Herrero, M., & Thornton, P. K. (2013). Livestock and global change: Emerging issues for sustainable food systems. *Proceedings of the National Academy of Sciences*, 110(52), 20878-20881.
4. Hadjigeorgiou, I. (2011). Past, present and future of pastoralism in Greece. *Pastoralism: research, policy and practice*, 1, 1-22.
5. FAO. (2018). Small ruminant production and the sustainable development goals. *FAO Animal Production and Health Guidelines*, 15.
6. Randolph, T. F., & Gillespie, S. (2006). Livestock and human well-being: An interface. *Livestock Science*, 102(1-2), 1-2.
7. Zhang, D. (2017). *Molecular Characterization of Diverse Mechanisms of Mucosal Immunity in Teleost Fishes* (Doctoral dissertation, Auburn University).
8. Bourgeois, L., & Hovorka, A. J. (2019). Participatory approaches in small ruminant farming: Lessons from [Country]. *Agricultural Systems*, 176, 102674.
9. Gielissen, R., Dutilh, C. E., & Graafland, J. J. (2008). Perceptions of price fairness: An empirical research. *Business & Society*, 47(3), 370-389.
10. Abazaami, J., Anab, C., & Santuah, N. F. (2022). Farmer-led research in the quest for climate resilience: promising dreams bitter challenges. *UDS International Journal of Development*, 9(1).
11. Ribeiro, M. N. (2021). Local knowledge and practices in small ruminant farming: Insight. *Journal of Ethnobiology and Ethnomedicine*, 17(1), 1-15.
12. Yuan, Y. (2022). A comparative analysis of two writing styles: Latin American magical realism represented by García Márquez's *One Hundred Years of Solitude* and Chinese hallucinatory realism represented by Mo Yan's *Life and Death Are Wearing Me Out* [Trinity College Dublin].
13. Cominelli, F., & Greffe, X. (2012). Intangible cultural heritage: Safeguarding for creativity. *City, Culture and Society*, 3(4), 245-250.

14. Seko, S., Maharani, C., & Tohir, M. (2023). The Existence of Customary Law Community's Rights (Hak Ulayat) Over Land in Kalimantan. In 3rd Borneo International Conference on Islamic Higher Education (BICIHE) 2023 1(403-413).
15. Abazinab, H., Duguma, B., & Muleta, E. (2022). Livestock farmers' perception of climate change and adaptation strategies in the Gera district, Jimma zone, Oromia Regional state, southwest Ethiopia. *Heliyon*, 8(12).
16. Ohashi, T., Saijo, M., Suzuki, K., & Arafuka, S. (2023). Deciphering the Drivers of Smart Livestock Technology Adoption in Japan: A Scoping Review, Expert Interviews, and Grounded Theory Approach.
17. Tripathi, S. C. (2022). The Resilience and Sustainability of Suranga Irrigation in the Western Ghats of India.
18. Songwe, V., Stern, N., & Bhattacharya, A. (2022). Finance for climate action: Scaling up investment for climate and development. Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science: London.
19. Gazdallah, F. (2020). Paving the way to Environmental justice for small-scale farmers: The Realisation of agroecology in International Human Rights Law and Environmental Law (Doctoral dissertation, Ghent University).
20. Lavania, P., & Bairwa, K. C. (2022). Goatary: A Gateway of Victory for Resource Deprived Farmers. *Economic Affairs*, 67(1s), 39-42.
21. Alcaraz, K. I., Wiedt, T. L., Daniels, E. C., Yabroff, K. R., Guerra, C. E., & Wender, R. C. (2020). Understanding and addressing social determinants to advance cancer health equity in the United States: a blueprint for practice, research, and policy. *CA: a cancer journal for clinicians*, 70(1), 31-46.
22. Thornton, P. K. (2010). Livestock production: Recent trends, future prospects. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 365(1554), 2853-2867.
23. World Health Organization. (2017). Sexual health and its linkages to reproductive health: an operational approach.
24. Mellor, D. J. (2017). Animal emotions, behaviour and the promotion of positive welfare states. *New Zealand Veterinary Journal*, 65(1), 16-23.
25. Thirunavukkarasu, D., Jothilakshmi, M., Silpa, M. V., & Sejian, V. (2022). Factors Driving Adoption of Climatic Risk Mitigating Technologies with Special Reference to Goat Farming in India: Evidence from Meta-analysis. *Small Ruminant Research*, 106804.
26. Bol, G. K., & van Niekerk, D. (2023). African Indigenous Understanding of Climate Change and Disaster Risk Nexus. In *Geohazards and Disaster Risk Reduction: Multidisciplinary and Integrated Approaches* (269-289). Cham: Springer International Publishing.
27. Montcho, M., Padonou, E. A., Montcho, M., Mutua, M. N., & Bayen, P. (2023). Impact of land tenure on livelihoods of women livestock-keepers in Burkina Faso. *Land Use Policy*, 133, 106848.
28. Das, U., Ansari, M. A., & Ghosh, S. (2022). Effectiveness and upscaling potential of climate smart agriculture interventions: Farmers' participatory prioritization and livelihood indicators as its determinants. *Agricultural Systems*, 203, 103515.
29. Sertsu, A., Eyeberu, A., Bete, T., Yadeta, E., Lami, M., Balcha, T., ... & Negash, A. (2023). Reproductive health service utilization and associated factors among secondary school students in Harari regional state, eastern Ethiopia, 2022: a multicenter study. *Reproductive Health*, 20(1), 1-8.
30. Girma, H., (2020). Climate-smart small ruminant farming practices: A case study. *Environmental Management*, 65(4), 875-889.
31. Van Eenennaam, A. L., & Werth, S. J. (2021). Animal board invited review: animal agriculture and alternative meats—learning from past science communication failures. *Animal*, 15(10), 100360.
32. Bihari, S. (2023). Cultural Heritage And Indigenous Knowledge: Reviving Traditions For Future Generations. *Sustainable Development Goals in SAARC Countries: Key Issues, Opportunities and Challenges*, 1, 24.
33. Choudhury, A., Aron, S., Botigué, L. R., Sengupta, D., Botha, G., Bensellak, T., ... & Hanchard, N.

- A. (2020). High-depth African genomes inform human migration and health. *Nature*, 586(7831), 741-748.
33. ?mija, K., Fortes, A., Tia, M. N., Š?mane, S., Ayambila, S. N., ?mija, D., ... & Sutherland, L. A. (2020). Small farming and generational renewal in the context of food security challenges. *Global Food Security*, 26, 100412.
34. Rowe, G., Straka, S., Hart, M., Callahan, A., Robinson, D., & Robson, G. (2020). Prioritizing Indigenous Elders' knowledge for intergenerational well-being. *Canadian Journal on Aging/La Revue canadienne du vieillissement*, 39(2), 156-168.
35. Arce, C., Díaz-Gaona, C., Sánchez-Rodríguez, M., Sanz-Fernández, S., López-Fariña, M. D., & Rodríguez-Estévez, V. (2022). The Role of Women on Dairy Goat Farms in Southern Spain. *Animals*, 12(13), 1686.
36. Crona, B. I., Wassénus, E., Jonell, M., Koehn, J. Z., Short, R., Tigchelaar, M., ... & Wabnitz, C. C. (2023). Four ways blue foods can help achieve food system ambitions across nations. *Nature*, 616(7955), 104-112.
37. Sharma, R., Ahlawat, S., Sharma, H., Sharma, P., Panchal, P., Arora, R., & Tantia, M. S. (2020). Microsatellite and mitochondrial DNA analyses unveil the genetic structure of native sheep breeds from three major agro-ecological regions of India. *Scientific reports*, 10(1), 20422.
38. Garrett, R. D., Ryschawy, J., Bell, L. W., Cortner, O., Ferreira, J., Garik, A. V., ... & Valentim, J. F. (2020). Drivers of decoupling and recoupling of crop and livestock systems at farm and territorial scales. *Ecology and Society*, 25(1), 24.
39. Alvarez, A., García-Cornejo, B., Pérez-Méndez, J. A., & Roibás, D. (2021). Value-creating strategies in dairy farm entrepreneurship: A case study in northern Spain. *Animals*, 11(5), 1396.
40. Joy, A., Dunshea, F. R., Leury, B. J., Clarke, I. J., Di Giacomo, K., & Chauhan, S. S. (2020). Resilience of small ruminants to climate change and increased environmental temperature: A review. *Animals*, 10(5), 867.
41. Loughrey, J., Thorne, F., Kinsella, A., Hennessy, T., O' Donoghue, C., & Vollenweider, X. (2015). Market risk management and the demand for forward contracts among Irish dairy farmers. *International Journal of Agricultural Management*, 4(1029-2017-1510), 173-180.
42. Sahoo, A. (2018). Silage for Climate Resilient Small Ruminant Production. In Tech.
43. Black, J. L., Davison, T. M., & Box, I. (2021). Methane emissions from ruminants in Australia: mitigation potential and applicability of mitigation strategies. *Animals*, 11(4), 951.
44. Ali, A., (2018). Knowledge and practices of small ruminant farmers in Africa: Implications for livestock health management. *Journal of Animal Health*, 5(1), 45-57.
45. Kebede, B., (2021). Frequency of livestock health inspections and its determinants among small ruminant farmers in Zambia. *Livestock Research for Rural Development*, 33(3), 57-68.
46. Antwi-Agyei, P., & Stringer, L. C. (2021). Improving the effectiveness of agricultural extension services in supporting farmers to adapt to climate change: Insights from northeastern Ghana. *Climate Risk Management*, 32, 100304.