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Knowledge, awareness, and perceived risks of zoonotic diseases among livestock farmers in South Garo Hills District of Meghalaya

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Abstract

This study assessed the knowledge, attitudes, and practices regarding zoonotic diseases among livestock farmers in South Garo Hills, Meghalaya. In rural agricultural settings, animals are integral to livelihoods. However, inadequate education and poor awareness pose serious public health risks through zoonotic disease transmission. Demographic analysis revealed that most livestock farmers are middle-aged, reflecting traditional roles in backyard animal rearing. A majority (78%) are small-scale farmers earning below Rs.10,000 monthly, and many have only secondary education. Statistical analysis showed that older farmers tend to have lower education and income, while higher education correlates with better earnings, emphasizing education's role in improving livelihoods. Alarmingly, 74% of respondents had low knowledge of animal husbandry and zoonoses. Only 10% were aware that diseases could be transmitted from animals to humans. Awareness of specific diseases like brucellosis (6%), anthrax (2%), and avian influenza (12%) was especially poor. Preventive practices like vaccination and deworming were inadequate, with only 6% having vaccinated animals against rabies. Hygiene practices were inconsistent, and 20.8% of respondents had experienced zoonotic infections. Additionally, a 25% incidence of livestock abortion often linked to zoonotic pathogens was reported. The findings highlight a significant knowledge gap and the urgent need for community-specific education, improved veterinary outreach, and targeted public health interventions. Empowering farmers, especially women, through education and training is essential to reduce zoonotic disease risks and strengthen rural health systems.

Keywords: Zoonotic diseases, livestock farmers, south garo hills, animal husbandry, rural health, disease awareness

Introduction

According to the South Garo Hills District Administration (SGHDA, 2025), the South Garo Hills district is located in the southern region of Meghalaya and was officially established on June 18, 1992. Geographically, it lies between latitudes 25˚10'N and 25˚35'N, and longitudes 90˚15'E and 91˚00'E. The district shares its borders with East Garo Hills to the north, West Khasi Hills to the east, West Garo Hills to the west, and the international boundary with Bangladesh to the south. Covering an area of 1,887 square kilometers, the district features a predominantly hilly and challenging terrain. Baghmara, the district headquarters, is the only urban centre in the region. As per the 20th Livestock Census (2019), the district recorded a livestock population comprising 74,686 cattle, 34,160 goats, and 53,753 pigs.

A zoonosis is an infectious disease that has jumped from a non-human animal to humans. Zoonotic pathogens may be bacterial, viral or parasitic, or may involve unconventional agents and can spread to humans through direct contact or through food, water or the environment, WHO (2020) [29]. They signify a major public health problem around the world due to our close relationship with animals in agriculture, as companions and in the natural environment. Zoonoses can also cause disturbances in the production and trade of animal products for food and other uses WHO

(2020) [29]. Emerging and reemerging zoonotic diseases having a potentially dangerous impact on human health have brought worldwide attention to them Woolhouse M.E.J. *et al* (2005) [25]. In a study by the C.D.C., 60% of all existing infectious diseases are zoonotic and at least 70% of emerging infectious diseases originate in animals, National Today (2022) [13]. Due to climatic changes, the incidence of emerging and reemerging diseases has increased to a greater degree sing B.B. *et al* (2011). Zoonotic diseases such as brucellosis, rabies, leptospirosis, bovine TB, cysticercosis, hydatidosis, toxoplasmosis and taeniasis need attention of veterinary public health service WHO (2002) [26]. Animal disease such as rabies, anthrax, brucellosis, bovine TB, cysticercosis, and hydatidosis has an important zoonotic potential WHO (2006) [27] Diseases can also be transmitted to humans through contamination during production, processing, and handling of animal products. Other risk factors contributory to zoonotic outbreaks are physical contacts with infected animals, slaughtering of infected animals, improper animal waste disposal, and infective materials of diseases animals. Lack of awareness among livestock farmers is one of the most important causes of zoonotic diseases and it is also an important obstacle in controlling zoonotic diseases, K. Rajkumar *et al* (2016) [7]. Zoonotic diseases significantly impact the livelihoods of livestock holders by compromising animal health and

reducing both the quantity and quality of animal products. This leads to significant economic losses, further weakening the economy and diminishing the livestock product market due to reduced consumer confidence Wastling, J.M *et al* (1999) [24] and McDermott, J.J (2022) [11]. In India, the WHO implemented an extensive rabies control programme, which led to a significant reduction in rabies cases. This decline not only improved public health but also contributed to a reduction in associated economic losses. Similar programmes should also be implemented for other zoonotic diseases such as brucellosis, tuberculosis, and leptospirosis, which are of significant public health and economic importance. Therefore, it is essential to understand existing animal husbandry practices, public knowledge and awareness of zoonotic diseases, as well as the socio-economic conditions of the community, in order to effectively design and implement disease awareness and control programmes. Hence, this study was undertaken among livestock farmers of the South Garo Hills district of Meghalaya to assess the degree of knowledge, awareness and perceived risks related to zoonotic diseases

Materials and Methods
Ethical approval
Ethical approval was not required for this survey-based study; however, informed consent was obtained from all participants prior to data collection.

Sampling area and size
According to South Garo Hills District Village Information Directory of Meghalaya (2025), the South Garo Hills district of Meghalaya comprises a total of 804 villages. For the purpose of this study, a multi-stage random sampling technique was employed. In the first stage, 10 villages were randomly selected from the total. In the second stage, a total of 250 livestock farmers were randomly selected from these 10 villages. Each selected farmer was then personally interviewed using a structured questionnaire designed to gather relevant data for the study.

Data collection
Data were collected through personal interviews using a well-structured questionnaire that included both open-ended and close-ended questions. The questionnaire focused on various aspects related to zoonotic diseases, including respondents' awareness, knowledge, perceived risks, animal waste disposal practices, and personal hygiene. A total of 40 specific questions were framed to assess the source and transmission of zoonotic infections among livestock farmers and to evaluate their knowledge and awareness regarding zoonotic diseases. In addition to disease-specific information, data on several independent variables such as education level, income, age, animal waste disposal methods, and herd size were collected using a structured schedule and appropriate measurement scales. This comprehensive data collection approach ensured a holistic understanding of the factors influencing farmers' awareness and practices related to zoonotic diseases.

Statistical analysis
The data collected through the structured questionnaire were subjected to statistical analysis using the Chi-square (χ^2)

test. This non-parametric test was employed to examine the association between categorical variables. Specifically, the Chi-square test was used to assess the relationship between Age, education level, Income among livestock farmers. Also to analyse the association between the perceived risk of zoonotic diseases such as Rabies and Brucellosis and knowledge about animal husbandry practices. The results of these analyses provided insights into the factors influencing farmers' awareness and risk perception related to zoonotic diseases. Statistical significance was determined at appropriate levels (typically $p < 0.05$), and the findings were interpreted accordingly.

Results
Age, Education and Socioeconomic status of the livestock farmers:
Base on the present survey conducted at South Garo Hills the respondents were categorised into four age groups i.e. up to 25 years, 26 to 40 years, 41 to 60 years above 60 years. It has been found that majority of the respondent (50%) are belonging to the age group of 41-60 years (Table-1). Many of them are women since in this area majority of them are rearing pig and poultry as backyard farming and it is managed by women staying in home.

Table 1: Respondents age

Age (Years)	Frequency (%)	95% Confidence level (Mean)
≤ 25	19(76%)	1.10(21.87)
26-40	82(32.8%)	0.80(32.92)
41-60	125(50%)	0.99(50.18)
≥60	24(9.6%)	0.80(63.15)
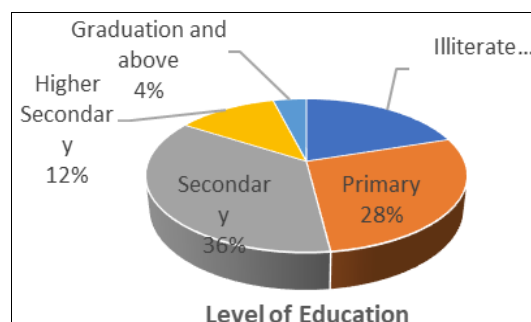
Fig 1: Educational qualification of the respondents

From the survey it has been found that majority of the respondents involved in livestock rearing are having Secondary education (Figure-1). Moreover, majority of the respondent are able to read and write in their mother tongue Garo language. The present study reveals that most of the respondents are small-scale farmers and their monthly income was less than Rs. 10,000 (78%) which makes living more laborious (Table-2). From the present study analysis, it is found that there is significant negative correlation between Age of respondent with year of education (-0.57) and monthly income (-0.26) since most of the aged persons are less educated and having less monthly income. There is a significant positive correlation between education of the respondents and their monthly income (0.37) (Table-3) K. Rajkumar (2016) [7].

Table 2: Monthly income of the respondents

Monthly Income	Frequency (%)	95% Confidence level (Mean)
≤ 10000	195 (78%)	75.10 (9339.88)
10001-20000	45 (18%)	880.04 (14490.75)
>20000	10 (4%)	1775.67 (23905.00)

Table 3: Correlation between age, year of education and monthly income of the respondents.

	AGE	year of Education	Income
Age	1		
Year of Education	-0.569686461*	1	
Income	-0.255640123*	0.371192074*	1

(*$p<0.05$)

Knowledge about animal husbandry practices, awareness and risk factors associated with zoonotic diseases

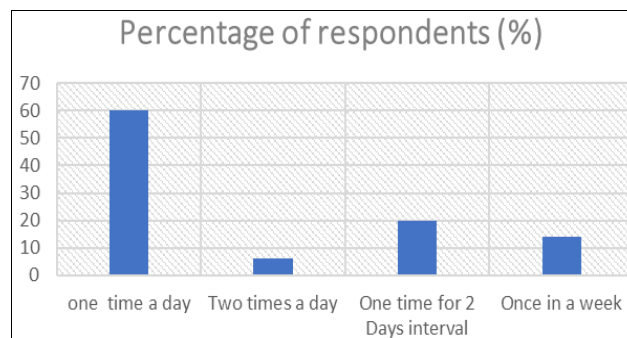From the survey it is found that majority (74%) of the respondents had low level of knowledge followed by medium level of knowledge 23.6%. whereas only 2.4% of the respondent had high level of knowledge about basic animal husbandry practices such as cleaning of shed, balanced feeding, timely vaccination, deworming, hygienic milking and heat stress management Table 4.

Table 4: Respondents according to their level of knowledge in animal husbandry practices.

Variable	Category	Frequency (%)
Knowledge about animal husbandry practices	Low (< 33.33)	74 (74%)
	Medium (33.33-66.66)	59 (23.6%)
	High (>66.66)	6 (2.4%)

From the analysis we found strong positive correlation between knowledge about animal husbandry practices and knowledge related to some of the diseases like rabies and brucellosis This indicates a high risk of diseases for both livestock and persons associated with livestock (Table-5).

Table 5: Correlation between Knowledge about animal husbandry practices, Rabies and Brucella of the respondents.

	Rabies	Brucella	Knowledge about animal husbandry practices
Rabies	1		
Brucellosis	0.375564674	1	
Knowledge about animal husbandry practices	0.428297569*	0.590316497*	1

(*$p<0.05$)

As far as knowledge and awareness of zoonotic diseases are concerned, only 10% of respondents were aware that certain diseases can be transmitted from infected animals to humans. Awareness of specific diseases was also low: only 30% of respondents were familiar with rabies, while just 6% had any knowledge of brucellosis. Furthermore, only 3.6-4% of respondents were aware of the zoonotic importance of tuberculosis, 2% knew about anthrax, and 12% had some awareness of avian influenza. Preventive practices were similarly limited. Only 20% of respondents reported engaging in deworming and vaccination of livestock, and just 6% had vaccinated their animals against rabies (Table 6).

Table 6: Findings on Zoonotic Disease Awareness and Livestock Care Practices

Accomplishments & Key Learnings	Frequency (%)
Diseases can be transmitted from infected animals to humans	25(10%)
Familiar with rabies	75 (30%)
Familiar with Brucellosis	15 (6%)
Tuberculosis can be spread from livestock to human	9 (3.6%)
Tuberculosis can be spread from human to livestock	10 (4%)
Familiar with Anthrax	5 (2%)
Familiar with avian influenza	30 (12%)
vaccination of livestock	50 (20%)
Deworming of livestock	50 (20%)
vaccinated their animals against rabies	15 (6%)

From the survey it is found that under backyard farming, majority (60%) of the respondents clean their animal shed on daily basis and 6% on twice a day basis. Furthermore, only 20% respondents clean their animal shed once at two days interval while only 14% of respondents cleaning their animal shed on weekly basis, indicating their traditional way of maintaining the animals. This also specify the chances of getting infection from many diseases from the animals by the livestock farmer (Figure 2).


Fig 2: Frequency of shed cleaning

Among the respondents 20.8% (n=52) have contracted zoonotic diseases, out of which 37.730.77% stated respiratory infection, 34.62% digestive disturbances, 17.31% had dermatological problem and 17.31% reported indiscrete symptoms such as weakness, fever, headache and body pain, etc (Table 7).

Table 7: Common zoonotic diseases and symptoms acquired by the livestock owners

Parameters	Frequency	Percentage
Respiratory diseases	16	30.77
Skin diseases	18	34.62
Digestive diseases	9	17.31
Other forms of diseases	9	17.31
Total number of respondents infected	52	20.80

From this study it is also found that about 25% of the respondents' farm had an incidence of abortion. Among them, 24%, 32% and 44% of them noted abortions at 1st, 2nd and 3rd trimester of gestation, respectively (Figure 3).
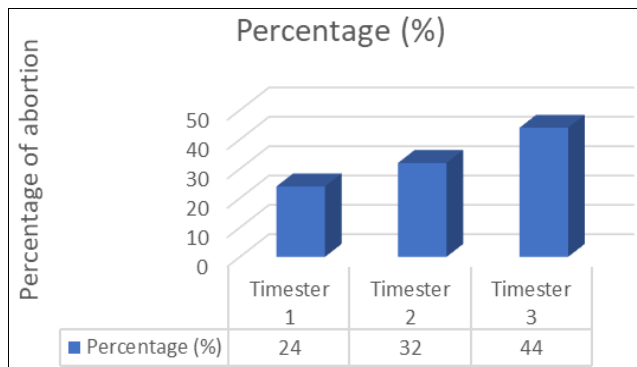
Fig 3: Frequency and stage of pregnancy at the time of abortion in livestock.

Discussion
The interface between humans, animals, and the surrounding environment is particularly close in many developing and developed countries. In these settings, animals serve multiple roles, including companionship, draught power, transportation, and sources of clothing, fuel, and essential nutrition through the provision of milk, meat, and eggs. However, in the absence of adequate animal care, veterinary infrastructure, and public awareness, this close interconnection can pose significant public health risks. Such risks include the transmission of zoonotic diseases and foodborne illnesses, which may lead to substantial economic consequences and strain on healthcare systems, WHO (2010) [30]

Assessing community socioeconomic status, educational background, and perceptions regarding various zoonotic diseases and their associated risks is a critical step in the development and implementation of effective disease prevention and control strategies. A knowledge, attitudes, and practices (KAP) based study in Thailand found that knowledge and attitudes varied across socioeconomic and demographic groups. People with lower income and less education had poorer knowledge and were less willing to pay for vaccines underscoring the importance of public education tailored to socioeconomic status realities. This study is in conjunction with the work of others, Premashthira, S. et al (2021) [15].

Currently, there is a lack of documented evidence regarding the level of awareness about zoonotic diseases among rural communities in the South Garo Hills district of Meghalaya. Therefore, this study was conducted to assess the awareness of zoonotic diseases among livestock farmers in the region.

Age, Education and Socioeconomic status of the livestock farmers
The demographic analysis of the respondents reveals that a significant proportion (50%) fall within the age group of 41-60 years (Table 1). This indicates that middle-aged individuals are predominantly engaged in livestock farming activities in the study area. A notable finding is that a majority of these individuals are women, which can be attributed to the traditional practice in the region where

backyard pig and poultry farming is commonly managed by women who stay at home. This aligns with the broader trend observed in rural agrarian societies, where women play a vital role in household-based livestock management. This study is in conjunction with the work of others, Kristjanson, P. et al (2014) [8].

In terms of educational background, most of the farmers involved in livestock rearing have attained a secondary level of education (Figure 1). Furthermore, the majority are literate in their native Garo language, which enables them to access and comprehend local resources and information pertinent to farming practices. However, the overall education level remains limited, potentially restricting their access to modern farming techniques and market opportunities This study is in conjunction with the work of others, Singh, R. K. et al (2020) [19].

The economic analysis of the respondents highlights that the majority (78%) are small-scale farmers with a monthly income of less than Rs. 10,000 (Table 2). This indicates a relatively low economic status, which could contribute to the challenges they face in sustaining and expanding their farming operations. The low-income levels also reflect the subsistence nature of livestock rearing in the area, where returns are often marginal. This indicates a relatively low economic status, which could contribute to challenges in sustaining and expanding farming operations. The low-income levels also reflect the subsistence nature of livestock rearing in rural India were also reported by other workers, NSSO (2014) & Birthal, P. S. et al (2012) [2].

Statistical analysis reveals a significant negative correlation between the age of respondents and their years of education (-0.57), as well as with their monthly income (-0.26). This suggests that older farmers tend to have lower educational attainment and income levels, which may be due to limited educational opportunities in earlier decades and declining economic productivity with age. Conversely, a positive correlation is observed between the education level of respondents and their monthly income (0.37) (Table 3). This underscores the role of education in enhancing economic outcomes, possibly by improving farm management skills, adoption of improved technologies, and better market engagement.

Overall, the findings suggest that age, gender roles, education, and income are interlinked factors that significantly influence the livelihoods of livestock farmers in the region. Empowering farmers, especially women, through education and targeted skill development programs could potentially improve productivity and economic resilience in rural farming communities. Similar findings are reported by other workers, Kristjanson, P. (2014) [9].

Knowledge about animal husbandry practices, awareness and risk factors associated with zoonotic diseases
The findings of this study reveal a concerning lack of knowledge and awareness regarding basic animal husbandry practices and zoonotic diseases among livestock farmers. A significant proportion of respondents (74%) demonstrated low levels of knowledge, while only 2.4% were classified as having high levels of understanding. This is alarming given the fundamental role that husbandry practices—such as regular cleaning of animal sheds, balanced feeding, timely

vaccination, deworming, hygienic milking, and heat stress management—play in maintaining animal health and preventing the spread of diseases Kumar, S. *et al* (2020) [10] & Singh, R. *et al* (2018) [20].

The observed strong positive correlation between general animal husbandry knowledge and awareness of specific diseases like rabies and brucellosis further supports the notion that informed livestock owners are better equipped to prevent and manage animal health issues. Rabies and brucellosis are not only significant livestock diseases but also critical zoonoses with substantial public health implications WHO (2020) [29] & FAO (2019) [4]. Lack of awareness can delay disease detection and control, increasing the risk of transmission to humans, especially in backyard farming systems where close contact with animals is common.

This study also underscores the poor awareness of zoonotic diseases. Only 10% of respondents knew that diseases could be transmitted from animals to humans, and awareness of specific zoonoses was very low: rabies (30%), brucellosis (6%), tuberculosis (3.6-4%), anthrax (2%), and avian influenza (12%). These figures are consistent with previous research in similar rural or semi-urban settings in India and other developing countries, where poor veterinary outreach and lack of public health education often result in minimal zoonotic disease literacy among farmers, Grace, D. *et al* (2017) [6] & Pathak, H. *et al* (2021) [14].

Preventive practices also appear to be grossly inadequate. Despite the risk, only 20% of respondents reported engaging in regular deworming and vaccination, and merely 6% had vaccinated their animals against rabies. These findings suggest a high vulnerability to both endemic and emerging zoonotic diseases in the region. According to the other workers, WOAH (2021) [31], increasing vaccination coverage and regular deworming are essential strategies for managing animal health and minimizing zoonotic spillover.

Animal housing and hygiene practices were somewhat better, with 60% of respondents cleaning their sheds daily and 6% twice daily. However, 34% of respondents cleaned their sheds only once every two days or weekly. This variation in hygiene practices, especially among those with less frequent cleaning, could contribute to disease propagation within herds and increase environmental contamination. Studies have shown that poor hygiene in livestock housing is a critical risk factor for gastrointestinal, respiratory, and dermatological infections in both animals and humans, Rahman, M. T. (2019) [17].

Notably, 20.8% of the respondents had experienced zoonotic infections themselves, reporting symptoms such as respiratory infections (30.77%), digestive disturbances (34.62%), dermatological issues (17.31%), and general symptoms such as fever and body aches (17.31%). These figures point toward underdiagnosed and possibly underreported zoonotic disease burdens in the community. Similar patterns have been reported in other studies that emphasize the occupational health risks faced by livestock handlers, Swai, E. S., (2012) [23].

Another alarming finding is the 25% incidence of abortion reported in respondent farms, with a majority (44%) occurring in the third trimester. Abortions in livestock, especially in the later stages of gestation, are often associated with infections such as brucellosis, leptospirosis,

or listeriosis—all of which have zoonotic potential Radostits, O. M. (2007) [16]. Given the low awareness and limited preventive measures among respondents, this may indicate the silent circulation of these pathogens in the community

Conclusion
This study highlights a critical gap in knowledge, awareness, and practices related to zoonotic diseases among livestock farmers in the South Garo Hills district of Meghalaya. The close human-animal-environment interface, while vital for rural livelihoods, also presents significant public health risks in the absence of adequate veterinary infrastructure, education, and disease prevention measures.

Demographic analysis reveals that middle-aged women primarily manage livestock, reflecting traditional gender roles in rural farming systems. However, limited formal education and low-income levels constrain their ability to adopt modern husbandry practices. A statistically significant relationship between higher education and increased income further underscores the potential of education to improve economic and health outcomes.

Alarmingly, only a small fraction of respondents demonstrated a high level of knowledge regarding animal husbandry or zoonotic diseases. Preventive practices such as vaccination and deworming were also grossly inadequate, despite known benefits. The low awareness of critical zoonotic diseases such as brucellosis, anthrax, and avian influenza poses a serious risk not only to animal health but also to human health, especially given the close contact in backyard farming systems.

The reported incidence of zoonotic infections and livestock abortions suggests underdiagnosed and possibly endemic circulation of infectious agents within the region. This situation highlights an urgent need for targeted educational campaigns and veterinary public health interventions to raise awareness, improve animal husbandry practices, and promote early detection and prevention of zoonotic diseases. Strengthening the capacity of local veterinary services and integrating zoonotic disease awareness into community health programs will be essential for protecting both animal and human health in the region.

Conflict of Interest
All authors declared no conflict of interest

Data availability Statement
The Data that supports the finding of this study are available from the corresponding author upon reasonable request.

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