



Hygiene hands in livestock care: Evaluating the effect of interventions on hand hygiene practices among goat and sheep handlers

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Abstract

Goat and sheep farming is an important source of livelihood in India, and animal farms are the most common setup for animal-human interactions, which could contribute to zoonosis. However, in the absence of reports on the effect of intervention on hand hygiene practices among this set of animal handlers, this work aimed to evaluate the effectiveness of interventions on hand hygiene practices among goat and sheep handlers. A total of 20 goat and sheep farms located in the peri-urban area of Bangalore, India, were included in the study. A convenient sampling method was employed inviting farm workers present on day one of the study at that farm to participate voluntarily. Data were collected by pre- and post-intervention observation on hand hygiene practices among goat and sheep handlers. The intervention was delivered through manual demonstration and posters. The obtained data were assessed by the McNemar test. Pre-intervention data for safety parameters showed that employees consistently performed hand washing before having food and after handling animal waste. The intervention led to significant improvement in handwashing technique, safety practices, and other parameters ($P < 0.001$). This work advocates the availability of guidelines for hand hygiene practices among animal handlers as a part of a One Health approach to reduce zoonoses.

Introduction

Livestock farming is critical in the Indian agrarian setup as it significantly contributes to food safety and rural livelihood, thus employing millions across the country. During 2024-2025, India ranked 4th in the world in terms of total meat

production by producing 10.50 million tonnes of meat, of which goat and sheep have contributed 15.0% and 11.0%, respectively. Further, during the same period, India produced 247.87 million tonnes of milk, of which goat contributed to 3.32%, and sheep contributed towards total wool production of

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34.57 million kilograms. These factors significantly benefit small-scale farmers due to their low input requirements, adaptability, and high market value (1). Despite the economic value, the occupational health and safety of the farm workers who are in regular contact with the animals and animal products are often compromised (2).

Reports suggest that about 60.0% of human diseases have animal origins, and animal farms are the most common setup where intense animal-human interaction occurs (3-4). Livestock farm workers often encounter hundreds of animals daily, which serves as the root cause for occupational health hazards in animal husbandry (5). Major zoonotic diseases like Anthrax, Bovine tuberculosis, Brucellosis, Q fever, Salmonellosis, Leptospirosis, and certain parasitic diseases are transmitted through either direct contact with the animals or their products (6). There are reports on the occupational hygiene practices among health care workers and animal clinic workers (7-8). Animal handlers need targeted educational interventions on hygiene practices to break the chain of zoonosis. However, there are no reports on the same among goat and sheep farm workers. In developing countries like India, hygiene practices regarding occupational health and hazards receive little or no attention due to the lack of training (9). This may result in normal unsafe work practices among livestock farm workers. Thus, this study aimed to determine the effect of intervention on hand hygiene practices among goat and sheep farm workers in the peri-urban area of Bangalore, India.

Materials and Methods

A total of 20 goat and sheep farms located in the peri-urban area of Bangalore, India, were included in the study. A convenient sampling method was employed; where farm workers present on day one of the study at that farm were invited to participate voluntarily. The study was conducted entirely by the authors from August 2025 to November 2025.

The study was approved by the university ethics committee (35/AHS/2023). Informed consent was obtained from each participant, along with their demographic information, such as age, gender, education, and years of service in goat and sheep farming.

The goat and sheep farm workers were directly observed by the trained authors in real-time before and after administering interventions regarding hand hygiene parameters during their working hours. However, the participants were not informed regarding the observation. A standardised checklist was used by the observers to ensure consistency and reliability for hand hygiene practices (Table 1). The checklist was designed as described in the WHO observation sheet. In addition, the checklist was modified to include safety and other hygiene parameters based on the guidelines of the Centers for Disease Control and Veterinary infection control procedure (10-12). To minimize the Hawthorne effect, the observers were transposed between pre-intervention and post-intervention observation. The Intervention was developed based on the existing evidence (7, 13). The intervention was administered twice in each farm, which included manual demonstration of hand washing, and the importance of hygiene and other safety parameters regarding hand hygiene were described using posters. The duration of each intervention session was approximately 15-20 minutes. All instructions were administered in the regional language.

The pre-intervention observation was performed in August 2025. The first and second interventions were administered in September 2025 and October 2025, respectively. Post-intervention observation was carried out in November 2025, 30 days after the second intervention. Statistical analysis: Impact of periodic interventions on hand hygiene and safety practices was assessed by the McNemar test using SPSS 30.0 version.

Table 1: Effect of intervention on hygiene practices among goat and sheep farm workers

Safety parameters	Compliance rate (n)		P value
	Pre intervention	Post intervention	
Hand washing before entering the shed	20	96	0.001
Hand washing before exiting the shed	52	91	0.001
Hand washing before lunch	150	150	No change
Hand washing after touching animals	33	105	0.001
Hand washing after handling animal waste	150	150	No change
Hand washing after removing gloves	26	99	0.001
Hand washing after removing mask	16	84	0.001
Hand washing after changing the dress	58	90	0.001
Other Hygiene parameters			
Touching various parts of face while working in the farm	84	22	0.001
Workers wearing finger rings / bracelets	94	30	0.001
Workers with long nails	45	19	0.001
Handwashing steps			
Wetting of hands with water	150	150	No change
Use of soap	150	150	No change
Rubbing right palm to left palm	150	150	No change
Rubbing right palm over left dorsum and left palm over right dorsum	56	99	0.001
Rubbing Palm-to-palm contact with fingers interlocked	28	86	0.001
Rotational rubbing of thumbs	3	78	0.001
Rotational rubbing of fingertips	4	73	0.001
Rubbing of back of fingers against opposing palms	30	102	0.001
Rinsing thoroughly after use of soap	150	150	No change
Hand drying using towels	42	108	0.001
Workers following all the steps of hand washing	3	73	0.001

Results

A total of 150 goat and sheep farm workers participated in this study, and all participants were males. Of the 150 farm workers, twenty-two, forty-four, fifty-six, and twenty-eight workers were aged between 21-30 years, 31-40 years, 41-50 years, and 51-60 years, respectively. Fifty-one, fifty-four, and forty-five participants had graduated from primary school, higher primary and secondary school, respectively.

In the post-intervention phase, no change in the compliance rate was observed for safety parameters such as hand washing before lunch,

hand washing after handling animal waste, wetting of hands with water, use of soap before the hand wash, rubbing right palm to left palm while hand washing, and rinsing thoroughly after use of soap (Table 1).

The compliance with hand washing before entering the shed significantly increased from 13.3% to 64.0% ($P < 0.001$). Similarly, there was significant improvement in the compliance rate of other safety parameters such as hand washing after touching animals (22% to 70.0%, $P < 0.001$) and hand washing after removing the mask (10.7% to 56.0%, $P < 0.001$).

There was a significant transformation in the other hygiene parameters including touching various parts of the face while working in the farm, wearing finger rings/bracelets and having long nails, in the post-intervention phase as compared to the pre-intervention observation ($P<0.001$). Further, it was also noted that, in the post-intervention phase, a significant improvement in the compliance rate ($P<0.001$) was observed for hand washing steps such as rubbing palm-to-palm contact with fingers interlocked (18.7% to 57.3%), rotational rubbing of thumbs (2.0% to 52.0%), and rotational rubbing of fingertips (2.7% to 48.7%).

Discussion

Livestock farmers are at increased risk of zoonotic diseases due to their direct and frequent contact with farm animals in the work setting (14). Lack of understanding of cross-transfer of pathogens between animals and humans, and their prevention strategies among livestock workers increases the risk of zoonosis among them, which may later spread into the community (15). Effect of intervention on hygiene practices among healthcare workers has been reported in several studies (7, 16-17). However, in the absence of reports regarding the effect of intervention on hygiene practices among animal handlers working in animal farms, this work made an effort to investigate the effect of intervention on hygiene practices among goat and sheep farm workers.

Bloomfield et al. (2007) have reported that hand hygiene, along with appropriate hand washing and sanitation measures, has proven to be effective in mitigating the spread of infections in the community (18). In the present study, it was observed that there was a low compliance rate in regard to hand hygiene practices among the goat and sheep handlers in the pre-intervention stage. This may be attributed to the absence or limited knowledge about hand hygiene among the animal handlers, as the majority of the participants in this study had completed only up to secondary school education. In the post-intervention phase, a

significant improvement in the rate of handwashing before entering and after exiting the animal shed and after contact with the animal was observed, indicating the effectiveness of the intervention among goat and sheep handlers. Further, it was also noted that the employees frequently washed their hands before lunch and after handling the animal waste (100% compliance) likely due to the regular practice rather than safety concerns.

Use of masks and gloves in animal farming improves personal hygiene practices and public health by preventing major zoonotic disease outbreaks (19-21). The data from the current study showed a significant rise in the use of personal protective equipment (PPE) among goat and sheep handlers in the post-intervention stage as compared to the pre-intervention stage. Workers touching their face, eyes, or mouth during their work at the farm are unhygienic practices that significantly increase their risk of contracting zoonotic pathogens such as *Escherichia coli*, *Salmonella*, etc (22-24). The frequency of workers touching their faces during the farm activities dropped significantly after the intervention. Further, a significant reduction in the high-risk personal factors such as long fingernails and wearing finger rings/bracelets was also observed. These behavioural changes along with the PPE discipline may have been attributed to the knowledge obtained through intervention on the risk of transmission of zoonotic pathogens and the diseases they cause.

The Centers for Disease Control and Prevention (CDC) recommends appropriate handwashing steps to be followed after touching an animal, animal feed or waste (25). As compared to the pre-intervention stage where the farm workers often evaded certain hand-washing steps, the percentage of them following all the recommended steps of hand washing as described in Table 1 significantly increased from 2% to 48.6% following intervention. The workers may have skipped the

steps of handwashing probably due to time constraints and lack of training.

This study had several limitations. Firstly, this study had a relatively smaller sample size. Second, this study did not assess the animal handler's knowledge, attitude, and practice regarding hand hygiene. Finally, the study was focused only on goat and sheep handlers; large-scale studies on hygiene practices in other livestock handlers are essential.

Conclusion

This study showed that interventions on hand hygiene practices among the goat and sheep handlers proved to be effective in changing the behavioural practice towards handwashing and other hand hygiene parameters among the workers. Further, this study suggests the need for interventions and public health policies on hand hygiene practices among the animal handlers in order to curb zoonotic disease transmission into the community. Interventions on hand hygiene practices among animal handlers could be included as an effective tool in the One Health approach framework which may serve as a critical barrier to intercept cross-species transmission.

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Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical approval

The study protocol was approved by the University Ethics Committee (35/AHS/2023).

Artificial Intelligence Statement

Throughout the preparation of this manuscript, no form of artificial intelligence was used.

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