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GAP ANALYSIS OF FARMERS' KNOWLEDGE AND MISCONCEPTIONS REGARDING DEWORMING AND VACCINATION

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Abstract

In Pakistan, livestock production is an integral part of rural livelihoods and food security. The implementation of effective deworming and vaccination program is considered a major preventive animal health management approach; however, farmers' knowledge, attitudes, and practices (KAP) play a crucial role in implementing these programs. The present study was undertaken to investigate the KAP of livestock farmers in District Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan, to measure the current knowledge gaps and misconceptions. A cross-sectional survey was conducted from July 2024 to June 2025 with 200 livestock farmers who were selected using stratified random sampling technique. A pre-tested structured questionnaire was used for data collection, which included questions on demographic characteristic, knowledge, attitude and practice on deworming and vaccination. The findings revealed 85.5% and 78.5% of the respondents had knowledge on deworming and vaccination, respectively. The awareness of anthelmintic resistance was however low (30.5%) and only 33.5% of farmers were aware of zoonotic diseases that could be prevented by vaccination. Positive attitudes for preventive animal health practices were found, with 84.0% and 86.0% of the respondents saying deworming and vaccination was important for animal health. As far as practices are concerned, 44.5% of farmers dewormed the cattle every six months and 48.5% vaccinated the cattle yearly. There was a significant difference between the knowledge, attitude and practice scores with respect to education level ($p < 0.05$). The education level of the respondent (AOR = 2.45; 95% CI: 1.72 – 3.56) and frequency of veterinary care (AOR = 1.81; 95% CI: 1.21 – 2.71) were significantly associated with adequate KAP. To conclude the study, it was found that while there is an overall understanding of the value of deworming and vaccinations there are still significant knowledge gaps and misconceptions, notably with anthelmintic resistance and vaccine management. Capacity building for farmer education and veterinary extension services is crucial for enhancing preventive health care, livestock productivity and decreasing the impacts of infectious and parasitic diseases in rural farmer communities.

INTRODUCTION

The health of livestock is essential for maintaining agricultural productivity and the livelihoods of millions of producers all over the world. One of the most crucial aspects of livestock production to guarantee the health and productivity of animals, and therefore the socio-economic sustainability and food security of rural communities is the deployment of an effective deworming and vaccination programs (Kappes et al., 2023). Although they have been proven to have positive effects, challenges in implementing these practices remain because of significant knowledge gaps and misconceptions among farmers (Athambawa et al., 2021; Robi et al., 2023). This means that preventable livestock diseases continue to be a reality, impacting on animal welfare and economic losses (Hill et al., 2022).

The most critical preventive medication includes vaccines and deworming of animals to protect against infectious and parasitic diseases (Monath, 2013). Deworming can be helpful to remove internal worms that can lead to malnutrition, stunted growth and death (Taylor et al., 2019). Likewise, vaccinating creates protection and lowers the prevalence of disease in a population, which also breaks the transmission cycle of pathogens within animals. But farmers' knowledge and prevailing attitudes have been a major challenge in the implementation and adoption of these interventions (Lee et al., 2012).

There are several reasons why farmers lack adequate knowledge and have misconceptions: These include cultural beliefs, misinformation, lack of formal training opportunities, and limited access to veterinary services. In many rural environments vets are limited, or unavailable, and farmers rely on traditional or anecdotal methods for animal health management (Balzani and Hanlon, 2020). This issue is compounded by the fact that there are no structured education programmes leaving producers without scientifically sound and up to date information on modern deworming and vaccination. These difficulties are further exacerbated by cultural norms, practices, and informal sources of misinformation, which often promote ineffective or even harmful interventions (Robi et al., 2023; Lee et al., 2012).

Therefore, a systematic gap analysis to find out the gaps in farmers' knowledge and misconceptions is a must. This analysis can inform stakeholders to create educational and extension initiatives that are tailored and evidence-based to better understand and implement deworming and vaccination. Overall, these gaps could be filled to improve animal health and productivity and boost rural livelihoods.

MATERIALS AND METHODS

Study Area

The study was conducted in the Tehsils and District of Dera Ismail Khan located in Khyber Pakhtunkhwa province of Pakistan. The district is a predominant rural district, where agriculture and livestock farming are the main livelihood sources of majority of people. It was chosen for the fact that it represents farmers with typical farming practices and is heavily involved in livestock production, offering a relevant and practical scenario through which to explore deworming and vaccination practices among local farmers.

Study Period

This study's data collection took place from July 2024 to June 2025. This period was selected to cover different climatic seasons and farming cycles of livestock to capture more in-depth knowledge of the practices, problems and constraints that farmers face during the year.

Study Design

A cross sectional study design was used to assess the knowledge, attitudes and practices (KAP) of livestock farmers on deworming and vaccination. This design allowed to collect data at a particular point of time displaying the prevalence of farmers with diverse characteristics, hence capturing a snapshot of the situation at the study area with respect to awareness and uptake of animal health interventions.

Sample Size

200 livestock farmers were selected for inclusion in the study from various locations of the Tehsils and District Dera Ismail Khan. Sample size was calculated on the estimated size of the local farming community that was required to provide enough statistical power to show important relationships in the KAP variables to be investigated.

Sampling Technique

Stratified random sampling was used to secure a representative sample. Administrative tehsils were taken as strata in the district. The villages were randomly selected in each stratum. Later, the farmer's lists of each selected village were prepared and farmers were selected from the lists by random sampling. This way, the selection bias was reduced and represented different levels of geographic and socio-economic backgrounds.

Data Collection

Structured face-to-face interview method was used to collect data from the selected farmers. The interviews, which were approximately 10 minutes each, were carried out by a pretested structured questionnaire. The questionnaire was divided into five large sections:

1. Demographic Information: age, sex, education level, farming experience and livestock owned.

2. Knowledge Assessment: Farmers' awareness of deworming and vaccination, recognition of common farmers' parasites, understanding of zoonotic diseases and familiarity with the concept of anthelmintic resistance (AR).

3. Attitudes Assessment – to identify farmers' perceptions of the importance of deworming and vaccination and their trust in veterinary services and their views of the effectiveness of various brands and formulations of anthelmintic drugs.

4. Practices Assessment: recording how often, how and when deworming and vaccinating were done, where information used for this comes from and whether it was following veterinary advice.

5. Additional Comments: allowing farmers to offer suggestions and/or presenting any other comments that may stem from deworming and vaccination in their community.

Data Analysis

Completed questionnaires were inputted into Microsoft Excel spreadsheets and then analyzed with SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to present the demographic profile and KAP scores of the respondents. Chi-square tests were used to assess relationships between demographic factors and KAP outcome, and logistic regression analyses were used to determine the predictors of adequate knowledge, positive attitudes, and appropriate practices of deworming and vaccinations.

Ethical Approval

Ethical clearance was taken from Directorate of Livestock and Dairy Development Department, Khyber Pakhtunkhwa, Peshawar before starting the study. All participants signed a written informed consent prior to data collection. Participants were assured of the voluntary nature of their participation, and their right to withdraw from the study at any time without any negative consequences. Every effort was made to preserve the confidentiality and anonymity of all of the data collected.

RESULTS

200 livestock farmers were included in the study. The majority of respondents belonged to the 41–50 years age group (33.0%), followed by those aged 30–40 years (23.5%) and 51–60 years (19.5%). The average age of the subjects was 47.8 ± 12.4 years. The greater proportion of the respondents was male (91.5%) and female was (8.5%) of the study population. In terms of education, 26.0% had primary education, 24.5% had high school education, 21.5% had no education, 18.5% had Mid-level education and 9.5% had Higher education. The average farming experience was 12.8 ± 7.2 years. Cattle (45.5%), sheep (21.0%), mixed livestock systems (19.0%) and goats (14.5%) were the main livestock types. The age group ($p = 0.041$)

and the education level ($p < 0.001$) were significantly associated with the KAP outcomes, while sex, farming experience and type of livestock were not (Table 1).

There was a high awareness among most of the farmers that deworming (85.5%) and vaccination (78.5%) is important. There was, however, a lesser degree of knowledge about specific aspects of parasite control and disease prevention. The correct responses to clinical signs of helminth infections were 59.5% and 43.5% for zoonotic parasites. Anthelmintic resistance (AR) was especially under recognised with only 30.5% indicating familiarity with the concept. Similarly, 33.5% were aware about zoonotic diseases preventable by vaccination and 26.5% knew about factors which might cause vaccine failures. 46.5% reported knowledge of recommended vaccination schedules. The mean knowledge score was 6.3 ± 1.9/10 and the education level was significantly related to all the knowledge variables (Table 2).

Overall, farmers had positive attitudes towards preventive livestock health practices. The majority felt deworming (84.0%) and vaccination (86.0%) were important or very important management practices to keep livestock healthy. 77.5% said they trusted the advice of their veterinarian. But 37.5% thought foreign/more expensive anthelmintic products were more effective than locally available options. Fortunately, 81.5% would be interested to learn more about anthelmintic resistance and better deworming techniques with a veterinarian. High correlation was found between educational status and attitude related variables (Table 3).

In terms of livestock health management practices, 44.5% of farmers dewormed their livestock every 6 months, and 23.5% dewormed every 3 months. In comparison, 18.5% of the respondents dewormed only once a year and 13.5% did not deworm at all. The vaccination practice revealed that 48.5% vaccinated their livestock annually, 25.5% vaccinated them every six months, 15.5% vaccinated livestock only during disease outbreaks and 10.5% did not vaccinate any livestock. Veterinarians were used on 67.5% of farms and almost half of the respondents (48.5%) indicated that they always follow recommended deworming and vaccination programs. 31.5% of the farmers reported frequent veterinary consultations. Fourteen and a half percent of the respondents observed nonprescribed use of anthelmintics. In addition, just 43.5% indicated that they deworm their sheepdogs, and 24.5% said that they give offal to their sheepdogs. The overall practice score was 6.7 ± 1.8 out of 10 (Table 4).

There was a significant effect of educational level on knowledge, attitude, and practice scores. The mean knowledge, attitude, and practice scores were highest among farmers with higher education (7.7 ± 1.2, 7.8 ± 0.8, and 7.6 ± 0.9, respectively) and lowest among those with no formal education (4.2 ± 1.6, 5.1 ± 1.5, and 5.3 ± 1.6, respectively). KAP scores increased progressively with educational level. Significant differences were observed among educational

categories for knowledge ($F = 21.6$, $p < 0.001$), attitude ($F = 5.82$, $p = 0.003$), and practice scores ($F = 4.96$, $p = 0.007$) (Table 5).

Adjusted multivariable logistic regression analysis revealed that education level and frequency of veterinary consultation were significant factors associated with adequate KAP outcomes. The educational level of farmers was significantly associated with adequate KAP with the higher educated farmers being more likely to exhibit adequate KAP than lower educated farmers (AOR = 2.45, 95% CI: 1.72–3.56, $p < 0.001$). Similarly, having frequent veterinary check-up was also positively associated with adequate KAP (AOR = 1.81, 95% CI: 1.21-2.71, $p = 0.003$). Knowledge score (AOR = 1.68, 95% CI: 1.31–2.15, $p < 0.001$) and attitude score (AOR = 1.44, 95% CI: 1.09–1.90, $p = 0.011$) were also significant predictors. The other variables age, farming experience, type of livestock and sex however, were not significantly associated with adequate KAP in the final regression model (Table 6).

Table 1: Socio-Demographic Characteristics of Respondents (n=200)

Variable	Category	n	%	Mean ± SD	p-value
Age group (years)	<30	23	11.5	47.8 ± 12.4	0.041*
	30–40	47	23.5		
	41–50	66	33.0		
	51–60	39	19.5		
	>60	25	12.5		
Sex	Male	183	91.5	–	0.194
	Female	17	8.5		
Education	No formal education	43	21.5	–	<0.001*
	Primary	52	26.0		
	Middle	37	18.5		
	High school	49	24.5		
	Higher education	19	9.5		
Farming experience	<5 years	31	15.5	12.8 ± 7.2	0.128
	5–10 years	63	31.5		
	11–20 years	57	28.5		
	>20 years	49	24.5		
Livestock type	Cattle	91	45.5	–	0.393
	Sheep	42	21.0		
	Goats	29	14.5		

	Mixed	38	19.0		

*Significant at p<0.05

Table 2: Knowledge Assessment of Farmers on Deworming and Vaccination

Knowledge Item	Correct n (%)	Incorrect n (%)	OR (95% CI)	p-value
Importance of deworming	171 (85.5)	29 (14.5)	2.21 (1.13–4.31)	0.014*
Importance of vaccination	157 (78.5)	43 (21.5)	2.95 (1.56–5.60)	<0.001*
Clinical signs of helminths	119 (59.5)	81 (40.5)	1.83 (1.18–2.84)	0.007*
Awareness of zoonotic parasites	87 (43.5)	113 (56.5)	1.69 (1.09–2.62)	0.019*
Awareness of AR	61 (30.5)	139 (69.5)	3.12 (1.72–5.65)	<0.001*
Zoonotic diseases prevented by vaccines	67 (33.5)	133 (66.5)	1.88 (1.10–3.20)	0.021*
Causes of vaccine failure	53 (26.5)	147 (73.5)	2.91 (1.61–5.27)	<0.001*
Vaccination schedules	93 (46.5)	107 (53.5)	1.77 (1.10–2.86)	0.018*

Table 3: Attitudes toward Deworming and Vaccination

Attitude Statement	Positive Response (%)	Neutral (%)	Negative (%)	p-value
Deworming is important	84.0	12.5	3.5	0.009*
Vaccination is important	86.0	10.0	4.0	0.013*
Trust veterinarian advice	77.5	–	22.5	0.038*
Foreign drugs are superior	37.5	–	62.5	0.034*
Willing to learn more	81.5	–	18.5	<0.001*

Table 4: Practices Related to Deworming and Vaccination

Practice Variable	Category	n (%)
Deworming frequency	Every 3 months	47 (23.5)
	Every 6 months	89 (44.5)
	Yearly	37 (18.5)
	Never	27 (13.5)
Vaccination frequency	Every 6 months	51 (25.5)
	Yearly	97 (48.5)
	During outbreaks	31 (15.5)
	Never	21 (10.5)
Vaccine administered by veterinarian	Yes	135 (67.5)
Adherence to guidelines	Always	97 (48.5)
Veterinary consultation	Frequent	63 (31.5)
Non-prescribed anthelmintic use	Yes	29 (14.5)
Sheepdog deworming	Yes	87 (43.5)
Feeding offal to sheepdogs	Yes	49 (24.5)

Table 5: Education Level and KAP Scores

Education Level	Knowledge Mean ± SD	Attitude Mean ± SD	Practice Mean ± SD
No formal education	4.2 ± 1.6	5.1 ± 1.5	5.3 ± 1.6
Primary	5.5 ± 1.7	6.0 ± 1.3	6.1 ± 1.4
Middle	6.4 ± 1.5	6.7 ± 1.1	6.9 ± 1.1
High school	7.2 ± 1.3	7.4 ± 0.9	7.3 ± 1.0
Higher education	7.7 ± 1.2	7.8 ± 0.8	7.6 ± 0.9
Test	**F-statistic**	**p-value**	
Knowledge	21.6	<0.001*	
Attitude	5.82	0.003*	
Practice	4.96	0.007*	

Table 6: Multivariable Logistic Regression Predicting Adequate KAP

Predictor	AOR	95% CI	p-value
Age	1.07	0.97–1.18	0.114
Education level	2.45	1.72–3.56	<0.001*
Farming experience	1.11	0.87–1.39	0.327
Livestock type	1.05	0.76–1.46	0.632
Veterinary consultation	1.81	1.21–2.71	0.003*
Male sex	1.24	0.62–2.48	0.539
Knowledge score	1.68	1.31–2.15	<0.001*
Attitude score	1.44	1.09–1.90	0.011*

DISCUSSION

The present study assessed the Knowledge, Attitude and Practices (KAP) towards deworming and vaccination among Livestock farmers in District Dera Ismail Khan, Pakistan. Results indicated moderate overall knowledge and practice scores, generally positive attitudes towards preventive animal health measures and a number of important misconceptions regarding parasite control, vaccination, and anthelmintic resistance. These results reveal key areas with potential impacts on livelihoods, animal welfare and disease management in rural farmers' communities.

There was generally positive awareness of livestock health management practices, with 85.5% of respondents recognising the importance of deworming and 78.5% recognising the importance of vaccination. About 80% of livestock producers in Ethiopia and Sri Lanka reported the benefits of livestock vaccination programs on animal health and to minimize losses from diseases in their farms (Athambawa et al., 2021; Robi et al., 2023). This relatively high awareness in the present study could be attributed to the ubiquitousness of veterinary services and the disease control campaigns sponsored by the government in the area. However, even if people are aware of the need for preventive measures, this does not always mean they have the technical knowledge and the right implementation practice.

Farmers had a basic awareness about deworming and vaccination, but significant gaps were found in more specialized knowledge areas of animal health management. Only 59.5% of the respondents were able to identify the clinical manifestations of helminth infections, and fewer than half were aware of zoonotic parasites. The results are alarming since; insufficient awareness of the presence of the parasitic infection could lead to failure to treat, to disease

spreading and to losses in production. A comparable lack of knowledge was observed in livestock producers in Iran, who showed very little knowledge about the epidemiology of parasites and how parasites are transmitted (Sazmand et al., 2020). It is especially crucial from a One Health perspective that awareness of zoonotic parasites is low as many parasites associated with livestock are zoonotic and can be transmitted to humans either directly, or via contaminated food products or environmental exposure.

An important result of this study was the low awareness of anthelmintic resistance (30.5%). With the current high level of deworming drug use and misuse, anthelmintic resistance is becoming a big problem globally that threatens sustainable livestock production. Resistance mechanisms are often unknown to farmers, which may lead to incorrect dosage, the wrong product or the sequential use of the same classes of drugs, and speed the rate of resistance. Likewise, there have been reports in Iran among livestock farmers, where a lack of awareness about anthelmintic resistance remains one of the main challenges to implementing effective control programs against parasites (Sazmand et al., 2020). The current study indicated that there was lack of awareness, and there is a great need for educational interventions to promote responsible drug use and resistance management strategies.

Vaccination-related concepts knowledge was also found to be poor. Fewer knew about the recommended schedule of vaccination and only 26.5% knew about the reasons that make the vaccine fail. In addition to the quality of the biological product, vaccine efficacy will also rely on appropriate storage and transport, vaccine administration and animal health at the time of vaccination. It has been reported in previous studies that vaccine handling and farmers' awareness can significantly compromise the success of vaccination campaigns (Lee et al., 2012). The low level of understanding that was revealed in this study could explain in part why vaccine preventable diseases are still prevalent in the rural livestock population despite the availability of effective vaccines.

The attitude assessment showed that deworming and vaccination were important farmer practices in livestock management in the majority of the farmers. The majority of respondents (>75%) trusted veterinary advice and a very high proportion were willing to learn more about parasite control and anthelmintic resistance. The findings are good as positive attitudes are often the first steps towards uptake of good animal health practices. According to Balzani and Hanlon (2020), farmers' perception and beliefs has a great effect on farmer adoption of scientifically recommended livestock management practices. Thus the overall good attitudes shown by the respondents in this study indicate that if extension programmes are designed accordingly, significant improvements in knowledge and practices can be obtained.

A number of misconceptions were identified even though the general attitudes were positive. Over one-third thought foreign or expensive anthelmintic products were inherently better than the locally available products. These perceptions can result in a decision by the farmer to treat with a particular product or a product that is less expensive, instead of the product that is scientifically proven and recommended by his veterinarian. Robi et al. (2023) reported such misconceptions in the context of developing livestock systems, where marketing impacts and informal information sources affect farmers' perception of veterinary products. Education with the facts is crucial in dispelling these misunderstandings to foster the use of drugs in a rational manner and to achieve cost-effective disease control.

The practice assessment showed that compliance with livestock health management practices (Soltan-Alinejad et al., 2025) was not uniform across different practices. While the majority of farmers indicated that they deworm and vaccinate their animals on a regular basis, a significant number stated they deworm and vaccinate annually or only during disease outbreaks. These reactive measures can diminish the impact of disease prevention programs since they are most effective when targeted proactively based on scientifically proven prevention programs, such as vaccination and parasite control. Past studies have shown that poor vaccination compliance can have a significant impact on herd immunity, and lead to outbreaks of infectious diseases (Hill et al., 2022).

Vaccines were used on most farms and veterinary services were important, as far as disease control was concerned. But, almost 15% of the respondents mentioned that they use non-prescribed anti-helmintics. Uncontrolled drug use can be a problem in relation to correct dosage, misuse of drugs, failure of treatment and the development of anthelmintic resistance. It is acknowledged that the use of veterinary pharmaceuticals without professional guidance is a common problem in many developing countries, and is a major cause of antimicrobial and antiparasitic resistance (Sazmand et al., 2020; Kapo et al., 2025).

The results of the dog management practices are also of interest. Only half of the respondents said they dewormed their sheepdogs and only about one-quarter said they feed offal from their livestock to their dogs. Such practices can contribute to the spread of zoonotic parasites of significance such as Echinococcus spp. and other helminth parasites that use the dog as definitive host. It is known that poor management of farm dogs has been a risk factor for the persistence of zoonotic parasitic infections in rural livestock production systems before (Lu et al., 2015; Katsarou et al., 2024). Increasing awareness of farmers on deworming dogs and handling animal by-products safely could thus help prevent both livestock and public health issues.

One of the most important factors in this study that affected KAP outcomes was education. There was a gradual positive rise in the knowledge, attitude and practice scores with education, and in the multivariable regression analysis, a higher level of education had independent positive association with better KAP score. This aligns with many earlier studies that have shown that farmer education is associated with their capacity to access, understand and apply scientific information on animal health management (Athambawa et al., 2021; Robi et al., 2023). Farmers with education may be more likely to request veterinary advice, implement farm protection measures, and appreciate the long-term economic value of farm protection methods.

Another important factor for adequate KAP was frequent veterinary consultation. Farmers with frequent contact with veterinarians had significantly higher knowledge and practices compared to those with less contact with vets (Caudell et al., 2020; Osmani et al., 2021). Veterinary professionals are an important source of information about disease prevention, vaccination schedules, parasite control and responsible drug use. The same effect has been observed under several livestock production systems with veterinary extension services being a key component for the increase of farmers' awareness and the practice of evidence-based decision-making (Balzani and Hanlon, 2020; Robi et al., 2023). Thus, enhancement of veterinary extension services can be one of the best ways to improve the livestock health management in rural Pakistan.

The results of this study are significant for development of livestock and disease control programmes. Farmers understood the importance of deworming and vaccinating, but a lot of gaps were identified on topics related to anthelmintic resistance, zoonotic diseases, vaccine failure, and recommended vaccination timing. These information gaps can jeopardize the success of disease prevention efforts and help to sustain losses in production. Therefore, educational campaigns that are targeted, farmer training workshops, community-based extension programs and a greater role for vets should be focused. Special attention should be given to raising awareness about anthelmintic resistance, prudent use of drugs, vaccine handling and prevention of zoonotic disease in a One Health context.

Our findings suggest that the livestock farmers of Dera Ismail Khan have moderate knowledge and positive attitudes regarding deworming and vaccination but there are some important misconceptions and sub-optimal practices. Improving farmer education and strengthening veterinary extension services are likely to play critical role in enhancing the preventive animal healthcare, enhancing livestock productivity and reducing the burden of infectious and parasitic diseases in the region.

CONCLUSION

The findings of this study showed that the attitude and knowledge of livestock farmers towards deworming and vaccination are also moderate in district Dera Ismail Khan with significant gaps in knowledge on anthelmintic resistance, zoonotic diseases, vaccine failure, recommended vaccination schedule. While the majority of farmers understood the value of proactive animal health care, there were also some gaps in knowledge and practices that could jeopardize livestock output and animal health and control strategies. The importance of farmer education and veterinary extension services was undeniable as the education level and regular veterinary consultation were found as the important predictors of better knowledge, attitude, and practices. Thus, well-designed awareness creation, training and veterinary outreach programs are required to strengthen EBDW and vaccination uptake, to promote responsible drug use and to enhance the health, productivity and rural livelihoods in the region.

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