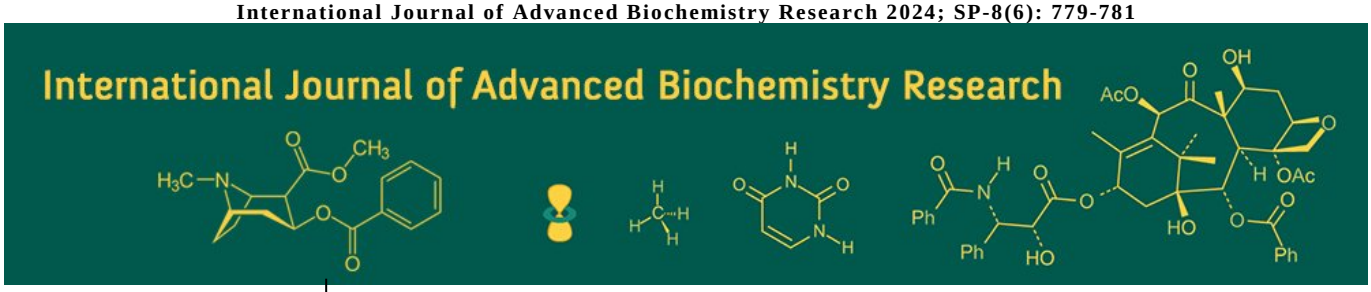

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Prevalence of gastrointestinal parasites in Equines of Haryana in relation to their feeding history

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Abstract
This study examines the prevalence of gastrointestinal parasites (GIP) in equines across different feeding practices in Haryana. A total of 1500 faecal samples were collected from horses (967), donkeys (178), and mules (355) across three agro-climatic zones. The prevalence of GIP was highest among horses, with roughage-fed horses showing a prevalence of 69.57%, followed by mixed ration-fed horses at 62.87%, and concentrate-fed horses at 53.21%. Donkeys exhibited the highest prevalence under roughage feeding (66.67%), followed by mixed ration (53.61%), and concentrate feeding (62.32%). Similarly, mules had the highest prevalence under roughage feeding (71.43%), followed by mixed ration (65.12%), and concentrate feeding (55.60%). These findings emphasize the significant correlation between feeding practices and GIP prevalence in equines in Haryana, underscoring the importance of tailored dietary management in controlling parasite infections.

Keywords: Equines, gastrointestinal parasites, feeding history, roughage, concentrate

Introduction
Gastrointestinal parasitism poses a significant health challenge for horses worldwide (Alaba *et al*., 2022) [1]. Parasites inflict varying degrees of damage depending on their type, abundance, location within the host, and the host's immune response, resulting in substantial economic losses (Papazaharidou *et al*., 2009). Among grazing horses, infections by helminths such as nematodes, trematodes, and cestodes—including troublesome species like large and small strongyles and ascarids—are particularly prevalent (Brady and Nichols, 2009) [4]. These parasites manifest in clinical signs such as weight loss, decreased appetite, poor coat quality, sporadic diarrhea, lethargy, physical deterioration, peripheral edema, and disrupted intestinal function. Notably, colic, a primary cause of equine mortality worldwide, is often attributed to intestinal parasitic infestations (Proudman, 2006) [10], contributing significantly to morbidity and economic losses in the equine industry.
Diagnosing gastrointestinal helminth infections typically relies on clinical observation and traditional parasitological methods, notably the examination of fecal samples. However, accurately identifying specific strongyle species, especially in cases of mixed infections common in field settings, proves challenging with conventional microscopic analysis of egg morphology alone (Lichtenfels *et al*., 2008) [6]. Therefore, larval cultivation through coproculture becomes essential for distinguishing between large and small strongyles based on third-stage larval morphology (L3) (Andersen *et al*., 2013; Anutescu *et al*., 2016) [2, 3].
To better combat the menace of equine parasitism and develop effective control measures, understanding its epidemiology and prevalence is crucial. Utilizing both parasitological and molecular techniques allows for precise determination of infection prevalence and intensity. This knowledge facilitates the strategic planning of treatment protocols, thereby minimizing the risk of anthelmintic overuse and mitigating the development of drug-resistant parasites.

Materials and methods
Fresh faecal samples from equines were promptly transported to the Department of Veterinary Parasitology, LUVAS, Hisar, and refrigerated at 4°C for preservation until processing. Sampling was conducted across randomly selected villages in three agro-climatic zones where equines were prevalent. Over a year-long period from November 2021 to

October 2022, a minimum of 125 faecal samples per zone were collected during each season (winter, summer, monsoon, and spring).

In the laboratory, faecal samples underwent qualitative examination for parasitic eggs using both flotation and sedimentation techniques based on Soulsby's methods (1982). Microscopic examination confirmed the presence of parasitic eggs. Statistical analysis was conducted to evaluate associations between various variables and positive parasitic reactions. The Chi-square test was employed for statistical testing, with significance set at 5% ($P < 0.05$). All statistical analyses were performed using SAS software Version 9.3 (SAS Institute, Cary, USA).

Results

The prevalence of gastrointestinal parasites of equines in Haryana with relation to their feeding history is depicted in table 1.

Table 1: Prevalence of gastrointestinal parasites in equines of Haryana with relation to their feeding history

Type of Equids	Feeding History Levels	Examined	Positive	Positive (%)	Odd ratio	95% CI	P value
Horses	Roughage	69	48	69.57	1.57	0.75-3.28	0.23
	Mix	167	105	62.87	1.59	0.98-2.55	0.06
	Concentrate	731	389	53.21			
Donkeys	Roughage	12	8	66.67	1.50	0.26-8.67	0.65
	Mix	97	52	53.61	1.38	0.56-3.42	0.49
	Concentrate	69	43	62.32			
Mules	Roughage	28	20	71.43	1.77	0.54-5.75	0.35
	Mix	86	56	65.12	1.19	0.63-2.25	0.59
	Concentrate	241	134	55.60			

Prevalence of Gastrointestinal Parasites in Equines of Haryana According to Feeding History

Horses: From a total of 967 horse faecal samples, 69 were from horses fed primarily roughage, 167 from those on a mixed diet of roughage and concentrate, and 731 from horses fed concentrate alone. Gastrointestinal parasite prevalence was highest among horses with a history of roughage feeding (69.57%), followed by those on mixed diets (62.87%), and lowest among horses fed concentrate (53.21%). Odds ratios indicated a slight increase in the likelihood of positive parasite findings in roughage-fed horses (OR = 1.57; 95% CI = 0.75-3.28) and those on mixed diets (OR = 1.59; 95% CI = 0.98-2.55) compared to concentrate-fed horses (OR = 1.00), though these differences were not statistically significant.

Donkeys: Among 178 donkey faecal samples, 12 came from animals fed roughage, 97 from those on mixed diets, and 69 from donkeys fed concentrate. The prevalence of gastrointestinal parasites was highest in donkeys with a history of roughage feeding (66.67%), followed by those on mixed diets (53.61%), and lowest in concentrate-fed donkeys (62.32%). Odds ratios indicated a slightly higher likelihood of positive parasite findings in roughage-fed donkeys (OR = 1.50; 95% CI = 0.26-8.67) and those on mixed diets (OR = 1.38; 95% CI = 0.56-3.42) compared to concentrate-fed donkeys (OR = 1.00), without reaching statistical significance.

Mules: Out of 355 mule faecal samples, 28 were from mules fed roughage, 86 from those on mixed diets, and 241 from mules fed concentrate. Gastrointestinal parasite prevalence was highest among mules with a history of roughage feeding (71.43%), followed by those on mixed diets (65.12%), and lowest among mules fed concentrate (55.60%). Odds ratios suggested a tendency towards higher parasite prevalence in roughage-fed mules (OR = 1.77; 95% CI = 0.54-5.75) and those on mixed diets (OR = 1.19; 95% CI = 0.63-2.25) compared to concentrate-fed mules (OR = 1.00), although these differences were not statistically significant.

Discussion

The findings of the current study align with previous research on equine gastrointestinal parasite prevalence across different feeding regimes. Fleurance *et al*. (2016) [5] noted a higher prevalence of gastrointestinal infections among horses grazing on pasture compared to those on other feeding types, which resonates with our observations. Similarly, Mangassa and Mhatebu (2016) [7] reported varying infection rates, with pasture grazing showing the highest prevalence (53.44%), followed by grain grazing (32.88%), and mixed grazing (32.81%). They also highlighted feed as a significant risk factor associated with strongyle parasite occurrence ($p < 0.05$) in horses, reinforcing the importance of dietary management in parasite control strategies.

Mezgebu *et al*. (2013) [8] further support these findings, documenting a higher infection prevalence in horses on pasture feeding (97.14%) compared to those on mixed feeding (80.43%) and grain feeding (83.33%). These studies collectively underscore the critical role of feeding practices in influencing equine gastrointestinal health and parasite susceptibility. The higher prevalence observed in pasture-based feeding systems could be attributed to increased exposure to infective larvae present in grazing environments, highlighting the need for targeted parasite management strategies in such settings.

In our study, horses, donkeys, and mules fed primarily on roughage exhibited higher gastrointestinal parasite prevalence compared to those on mixed diets or concentrate feeding. While the odds ratios indicated trends towards increased parasite risk in roughage-fed equines, the differences were not statistically significant. This emphasizes the complexity of factors influencing parasite transmission and the need for further research to elucidate specific mechanisms underlying feeding-related parasite dynamics in equines. Overall, integrating these findings with our study contributes to a broader understanding of how feeding practices impact equine health and underscores the importance of tailored management strategies to mitigate gastrointestinal parasitism in diverse husbandry systems.

Conclusion

This study investigated the prevalence of gastrointestinal parasites among horses, donkeys, and mules in Haryana, with a focus on their feeding histories. Our findings indicate that equines fed primarily on roughage showed a higher

prevalence of gastrointestinal parasites compared to those on mixed diets or concentrate feeding. These results are consistent with previous research highlighting pasture grazing as a significant risk factor for parasite infections in equines. Pasture-based feeding systems appear to increase exposure to infective larvae, contributing to higher parasite prevalence rates observed in this study. Moving forward, effective parasite control strategies should consider the specific feeding practices of equines to mitigate infection risks. This includes targeted deworming protocols and improved pasture management techniques to minimize environmental contamination. Further research is recommended to explore additional factors influencing parasite transmission dynamics and to develop tailored management approaches for enhancing equine health and welfare in diverse husbandry settings.

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