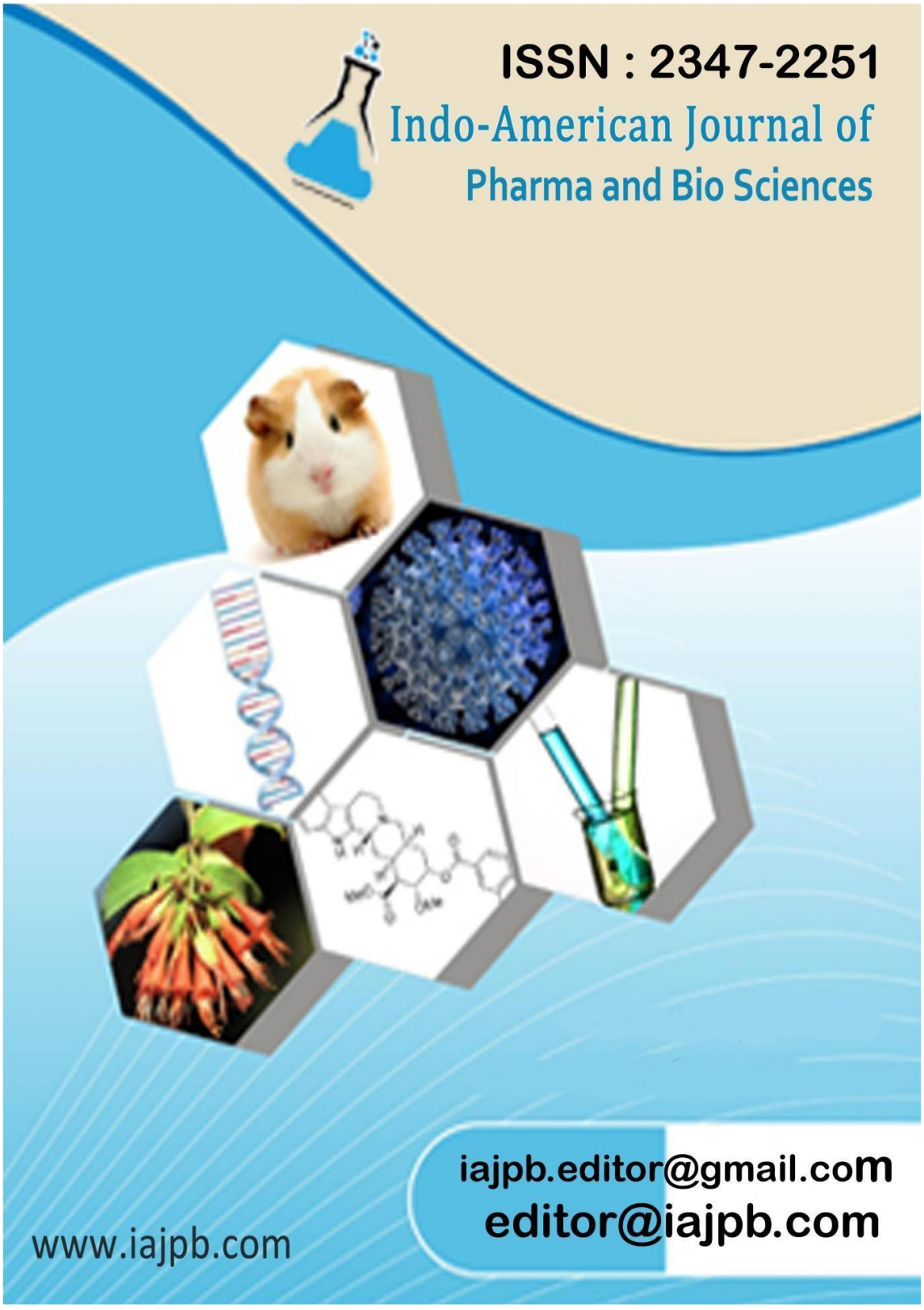
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Comparative Study on Haemtobio chemical Alterations in Sheep with Respiratory Afflictions Reared under Organized and Unorganized Farming Systems

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ABSTRACT:

Respiratory diseases are among the major health problems affecting sheep production worldwide leading to significant economic loss due poor growth and reduced productivity. The present study was undertaken to evaluate and compare hematobiochemical alterations in sheep suffering from respiratory afflictions reared under organized and unorganized farming system. The present study was conducted in five organized and ten unorganized farms comprising healthy and respiratory affected sheep. Clinical examination was carried out based on respiratory signs such as coughing, nasal discharge, dyspnoea, pyrexia and abnormal lung sounds. Blood samples were collected for hematobiochemical analyses for different hematology and biochemical parameters. Respiratory disease affected sheep exhibited significant alterations in hemtobiochermical parameters characterized by decreased Hb, TEC and PCV values along with increased TLC and neutrophil counts compared to healthy controls. Biochemical analysis revealed hypoproteinaemia, hypoalbuminemia, elevated globulin levels and increased AST and ALT activities in affected animals. The alterations were more pronounced in sheep reared under unorganized farming systems, indicating the influence of poor housing, inadequate nutrition, improper ventilation and higher environmental stress on disease severity. The study concluded that respiratory afflictions markedly affect haematological and biochemical profiles in sheep, with greater severity observed in unorganized farming systems. Hematobiochemical parameters may serve as valuable indicators for diagnosis, assessment of disease severity and formulation of effective management strategies for respiratory diseases in sheep.

KEYWORDS

Sheep, Respiratory afflictions, Hematobiochemical alterations, Organized farming system, Unorganized farming system

Introduction

Respiratory diseases in sheep are among the major causes of economic loss due to reduced growth, poor feed efficiency, decreased wool/meat production, treatment expenses and mortality. Organized sheep farming system includes housing, facilities for feeding, grazing, watering and transport. The sheep are managed to ensure they have access to healthy food, protection from extreme weather, hygienic animal husbandry practices, good health management protocols and record keeping which contribute to economy by high yields in production. Unorganized farming is not a well-established farming system and does not have consistent employment condition and comprise small/marginal farmers, landless laborers and

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Vol. 24, Issue 2, 2026
Indo-American Journal of Pharma and Bio Sciences

croppers. This type of farming lacks structure and efficient management and is ridden with challenges of inconsistent and inadequate protection/shelters, lack of housing and irregular grazing management system leads to living conditions with health risks. Combined with lack of record keeping, there is chance of decreased production with high mortality and morbidity. The present study was carried out to compare the hematobiochemical alterations in the sheep affected with respiratory afflictions reared under organized and un-organized farming systems.

Materials & Methods:

Sheep showing clinical signs related to respiratory afflictions such as nasal and ocular discharge, dullness, depression, coughing and sneezing, labored breathing, increase in body temperature and arching of back, reported from identified organized and unorganized farms were considered for the study. Epidemiological data were collected by questionnaire method from identified farmers rearing sheep from five organized and ten unorganized farms.

The sheep reared under organized farms and unorganized farming were observed for signs of respiratory illness viz., coughing, sneezing, fever, inappetance, lethargy, dullness, depression, bleating, nasal discharge, ocular discharge etc.

Method:

Collection of blood from suspected sheep was done aseptically by using 5 ml syringe. About 5 ml of blood was directly drawn from the jugular vein of the sheep and 2 ml was put into the vial containing the EDTA and remaining 3 ml to the serum collection vials. Collected blood samples were transported in cold to laboratory and subjected for different parameter estimation.

Hematological parameters

The hematological parameters were estimated from whole blood collected in EDTA by using automatic hematology analyzer to evaluate Total Erythrocyte count (10^6/µL), Total Leukocyte count (10^3/µL), Differential counts (both per centage and absolute), Hemoglobin levels (g/dL), Platelet count (10^3/µL), Packed cell volume (%) and Erythrocyte Sedimentation Rate (mm/hr).

Biochemical parameters

The biochemical parameters were estimated from whole blood collected in EDTA. Biochemical test kits for Serum Aspartate Transaminase (Units/L), Creatinine (mg/dl), Blood Urea Nitrogen (mg/dl), Total protein (mg/dl) and Serum cholesterol (g/dl) using automated biochemical analyzer machine by kit method.

Statistical Analysis

The parameters of epidemiological data derived by questionnaire method were compared as % Mean±SE between organized and un-organized farms. Hematological and biochemical parameters were analyzed by t-Test: Two-Sample Assuming Unequal Variances $p \leq 0.05$, t Critical two-tail = 2.004045

Result:

In the present study a total of five organized farms were identified from Anupinakatte, Govindapura, Narayanapura, Harnahalli and Agasvalli which had sheep flock size of 450, 190, 110, 80 and 270 respectively.

In the unorganized farming sector total of ten farmers were identified in Narayanpura, two in Aihole, three in Govindapura, two in Hosudi, one in Yalavatti and one in Mallenahalli, The flock size at Narayanpura was 70, 110 and 80 in two farms of Aihole, 160, 170 and 180 in Govindapura, 108 in Hosudi, 90 in Yalavati and Mallenahalli. The prior consent was taken from the farmers for participation in present studies.

During the study period, the sheep were observed for exhibition of signs and symptoms indicative of respiratory illness among sheep from organized (N=5) and unorganized (N=10) farms in and around Shivamogga. Accordingly, from organized farms, there were 29 cases and 32 from unorganized farms, that showed respiratory illness. The common signs observed were fever, nasal discharge, coughing, sneezing, bleating, anorexia, lethargy, dyspnoea, dullness and congested conjunctival mucosa.

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Vol. 24, Issue 2, 2026
Indo-American Journal of Pharma and Bio Sciences

The blood from animal showing respiratory symptoms was collected for whole blood analysis of cellular counts and morphology. In a total there were 29 sheep in organized farms and 32 from unorganized farms which formed a part of hematology in the present study. The parameter estimated were total erythrocyte count (10^6/µL), total leukocyte count (10^3/µL), differential counts, hemoglobin levels (g/dL), platelet count (10^3/µL), packed red cell volume (%) and Erythrocyte sedimentation rate (mm/hr).

Haematology

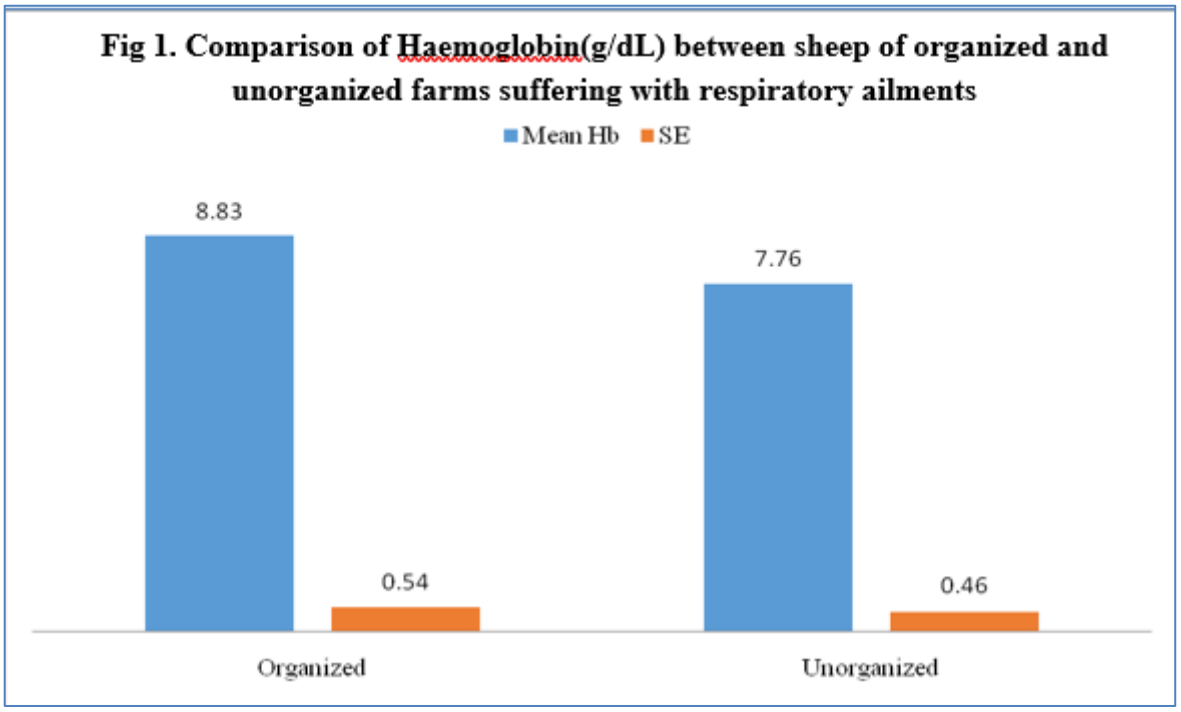
Hemoglobin (g/dl)

The comparison of hemoglobin level between sheep of organized and unorganized farm has been presented in Table1 and Fig. 1. Accordingly the Mean ±SE of hemoglobin was 8.83±0.54 in organized farm and 7.76±0.46 in unorganized farms. By statistical analysis, values between the farms were comparably not significant.

Table 1. Comparison of Hemoglobin (Hb) (g/dL) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized (N=5)	Unorganized (N=10)
Total sheep	29	32
Mean Hb	8.83[a]	7.76[a]
SE	0.54	0.46

Note: t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail = 2.0114



Total Erythrocyte Counts (millions/cmm)

The comparison of Total Erythrocyte Counts (millions/cmm) between sheep of organized farm and unorganized farm has been presented in Table 2 and Fig. 2. Accordingly, the Mean ± SE of TEC was 4.56±0.61 in organized farm and 3.20±0.39 in unorganized farms. By statistical analysis, both farms were comparably not significant.

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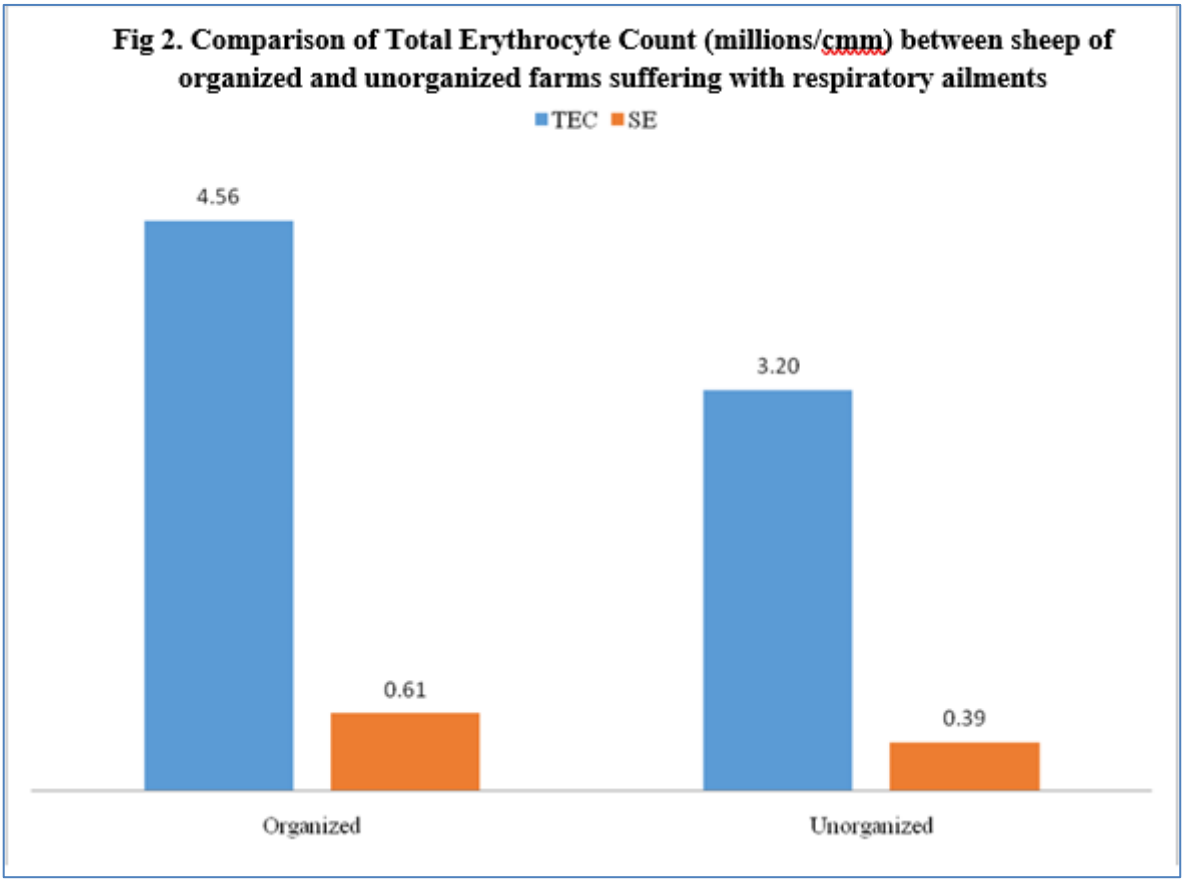
Vol. 24, Issue 2, 2026
Indo-American Journal of Pharma and Bio Sciences

Table 2. Comparison of Total Erythrocyte Count (millions/cmm) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized(N=5)	Unorganized(N=10)
Farms	5	10
Total sheep	29	31
Mean TEC	4.56[a]	3.20[a]
SE	0.61	0.39

Note: t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =2.01174



Total Leukocyte counts (thousands/cmm)

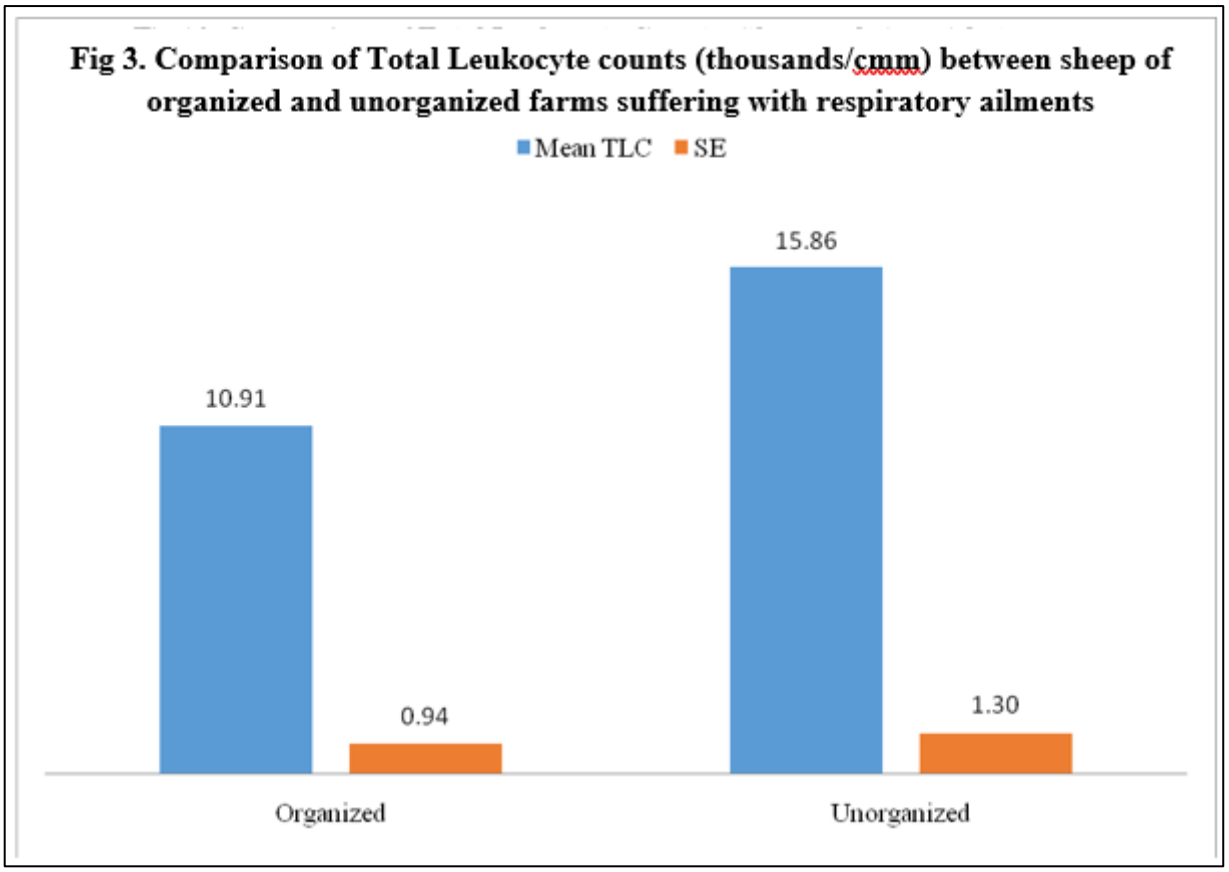
The comparison of Total Leukocyte counts (thousands/cmm) between sheep of organized and unorganized farm have been presented in Table 3 and Fig. 3. Accordingly, the Mean ±SE of TLC was 10.91±0.94 in organized farm and 15.86±1.3 in unorganized farms. By statistical analysis the values were both farms were comparably more significant.

Indo-American Journal of Pharma and Bio Sciences
ISSN 2347-2251 www.iajpb.com
Vol. 24, Issue 2, 2026

Table 3. Comparison of Total Leukocyte counts (thousands/cmm) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized (N=5)	Unorganized(N=10)
Total sheep	29	31
Mean TLC*	10.91[a]	15.86 [b]
SE	0.94	1.30

Note: t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =2.006647



Total Monocyte counts (%)

The comparison of Total Monocyte counts (%) between sheep of organized and unorganized farm have been presented in Table 4 and Fig. 4. Accordingly the Mean ±SE of TLC was 22.62±0.65 in organized farm and 8.05±0.66 in unorganized farms. By statistical analysis, both farms were comparably more significant

Table 4. Comparison of Total Monocyte (%) between sheep of organized and unorganized farms suffering with respiratory ailments

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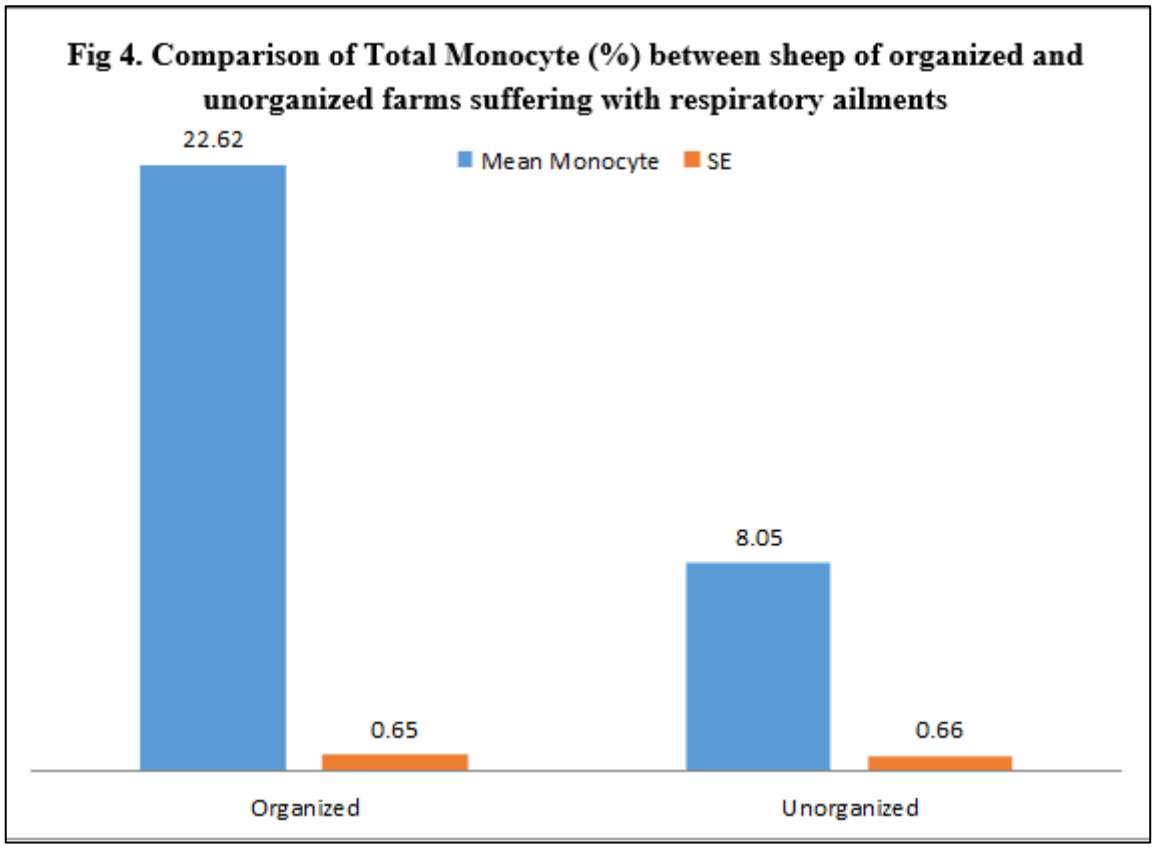
	Organized(N=5)	Unorganized(N=10)
Total sheep	29	31
Mean Monocyte*	22.62 [a]	8.05 [b]
SE	0.65	0.66

Note: t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =1.672522



Total Lymphocyte counts (%)

The comparison of Total Lymphocyte counts (%) between sheep of organized and unorganized farm have been presented in Table 5 and Fig. 5. Accordingly, the Mean±SE were 40.84±0.6 in organized farm and 40.59±0.96 in unorganized farms. By statistical analysis, both farms were comparably not significant.

Table 5. Comparison of Lymphocytes (%) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized(N=5)	Unorganized(N=10)
Total sheep	29	31
Mean Lymphocyte*	40.84 [a]	40.59 [b]
SE	0.60	0.96

Note: t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =1.675905

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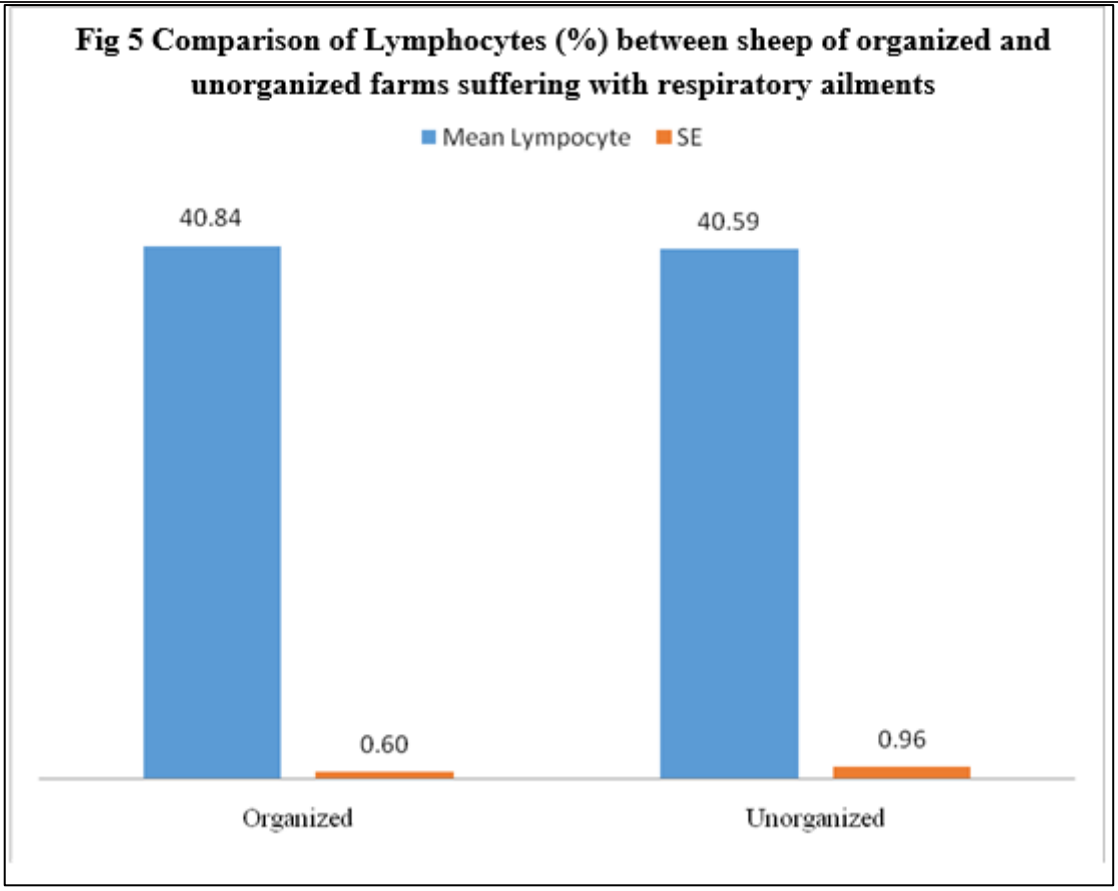
Vol. 24, Issue 2, 2026
Indo-American Journal of Pharma and Bio Sciences



Total Granulocyte counts (%)

The comparison of Total Granulocyte counts (%) between sheep of organized and unorganized farm have been presented in Table 6 and Fig. 6. Accordingly, the Mean±SE were 25.18±0.31 in organized farm and 44.05±1.63 in unorganized farms. By statistical analysis, the values were found highly significant.

Table 6. Comparison of Granulocyte (%) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized (N=5)	Unorganized(N=10)
Total sheep	29	31
Mean Granulocyte*	25.18 [a]	44.05 [b]
SE	0.31	1.63

Note: t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =2.036933

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Vol. 24, Issue 2, 2026
Indo-American Journal of Pharma and Bio Sciences

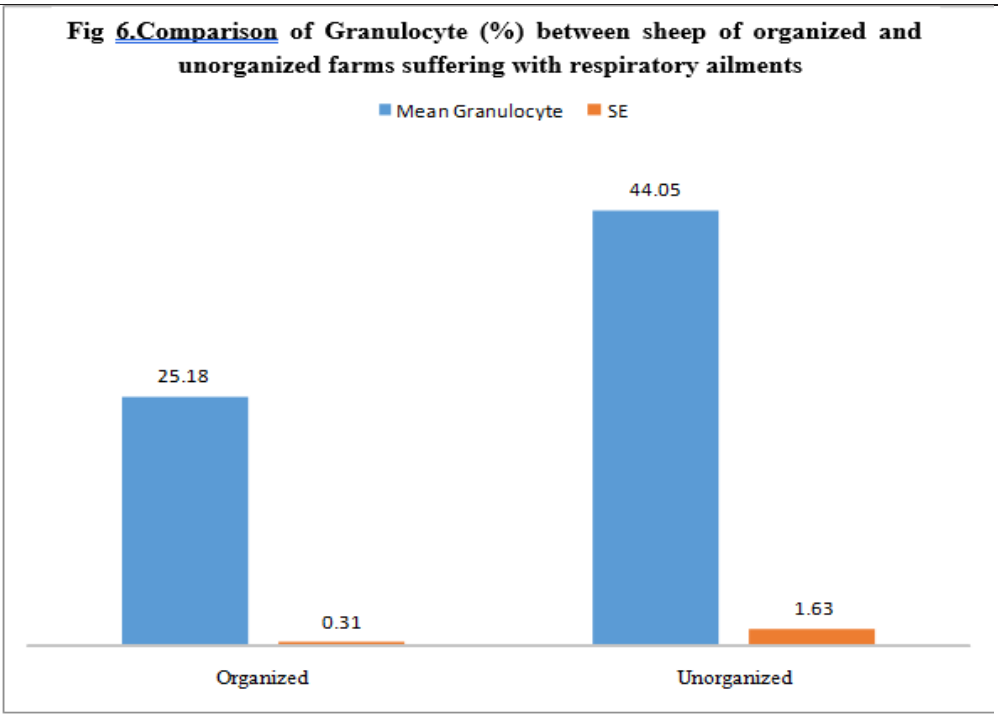

Fig 6.Comparison of Granulocyte (%) between sheep of organized and unorganized farms suffering with respiratory ailments

Total Platelet counts (thousands/cmm)

The comparison of Total Platelet counts (thousands/cmm) between sheep of organized and unorganized farm have been presented in Table 7 and Fig. 7, Accordingly the Mean±SE of TLC were 719.92±11.85 in organized farm and 716.77±25.23 in unorganized farm. By statistical analysis, there was no significant difference.

Table 7. Comparison of Platelets (thousands/cmm) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized(N=5)	Unorganized(N=10)
Total sheep	29	31
Mean Platlets*	719.92 [a]	716.77 [a]
SE	11.85	25.23

Note: t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =2.016692

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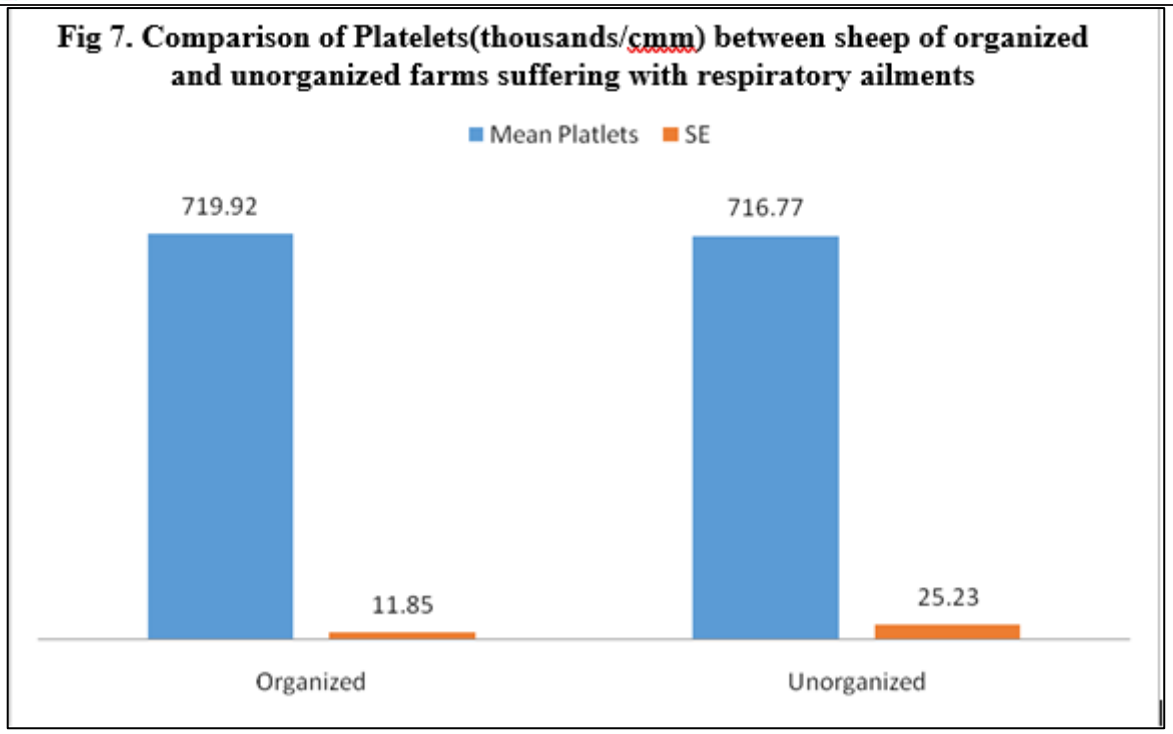
Vol. 24, Issue 2, 2026
Indo-American Journal of Pharma and Bio Sciences



Packed cell volume (%)

The comparison of Packed cell volume (%) PCV between sheep of organized and unorganized farm have been presented in Table 8 and Fig. 8, Accordingly the Mean±SE of PCV were 31.95±0.28 in org farm and 33.40±0.35 in unorganized farms. By statistical analysis, both farms were comparably more significant.

Table 8. Comparison of Packed cell volume (%) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized(N=5)	Unorganized(N=10)
Farms	5	10
Total sheep	29	31
Mean PCV*	31.95 [a]	33.40 [b]
SE	0.28	0.35

Note:t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =2.003241

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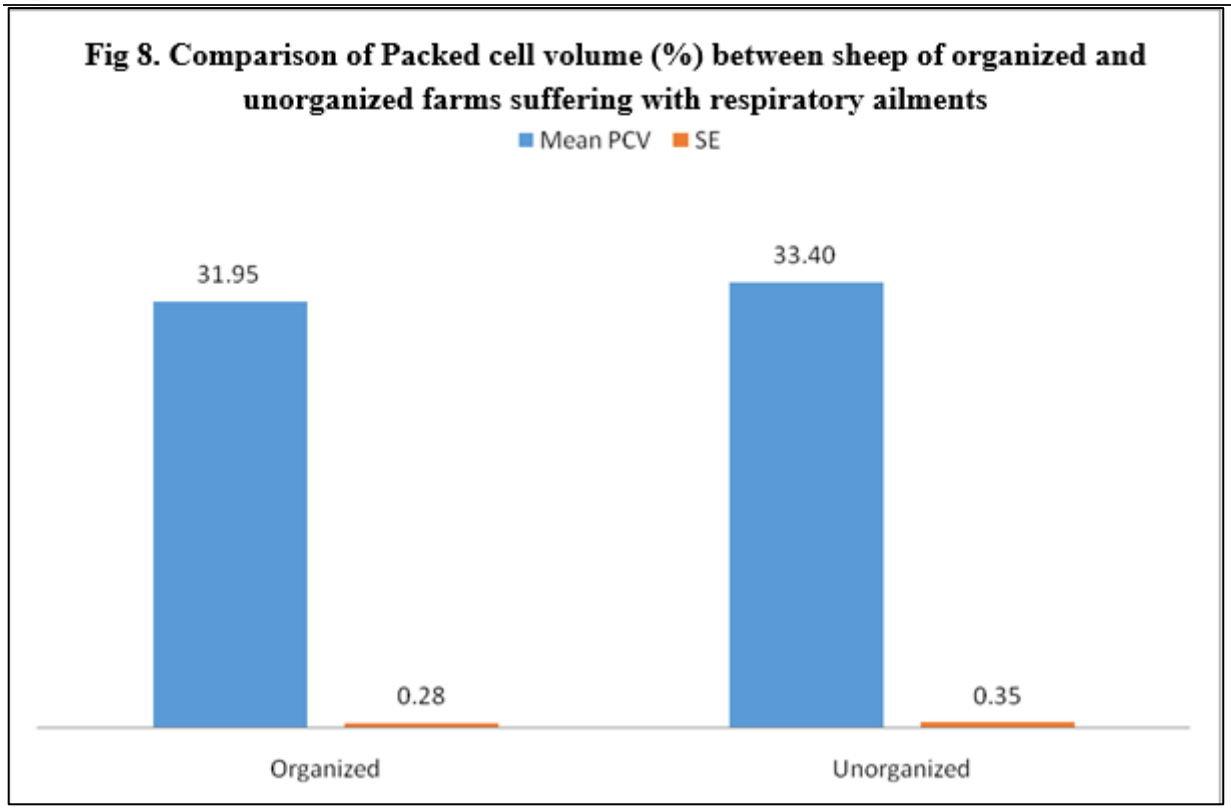
Vol. 24, Issue 2, 2026
Indo-American Journal of Pharma and Bio Sciences



Erythrocyte sedimentation rate (mm/hr)

The comparison of Erythrocyte sedimentation rate (mm/hr) between sheep of org and unorganized farm have been presented in Table 9 and Fig. 9, Accordingly the Mean±SE of ESR were 2.48±0.9 in organized farm and 3.14±0.1 in unorganized farms. By statistical analysis, both farms were comparably more significant.

Table 9. Comparison of ESR (mm/hr) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized	Unorganized
Farms	5	10
Total sheep	29	31
Mean ESR*	2.48 [a]	3.14 [b]
SE	0.09	0.10

Note: t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =1.671553

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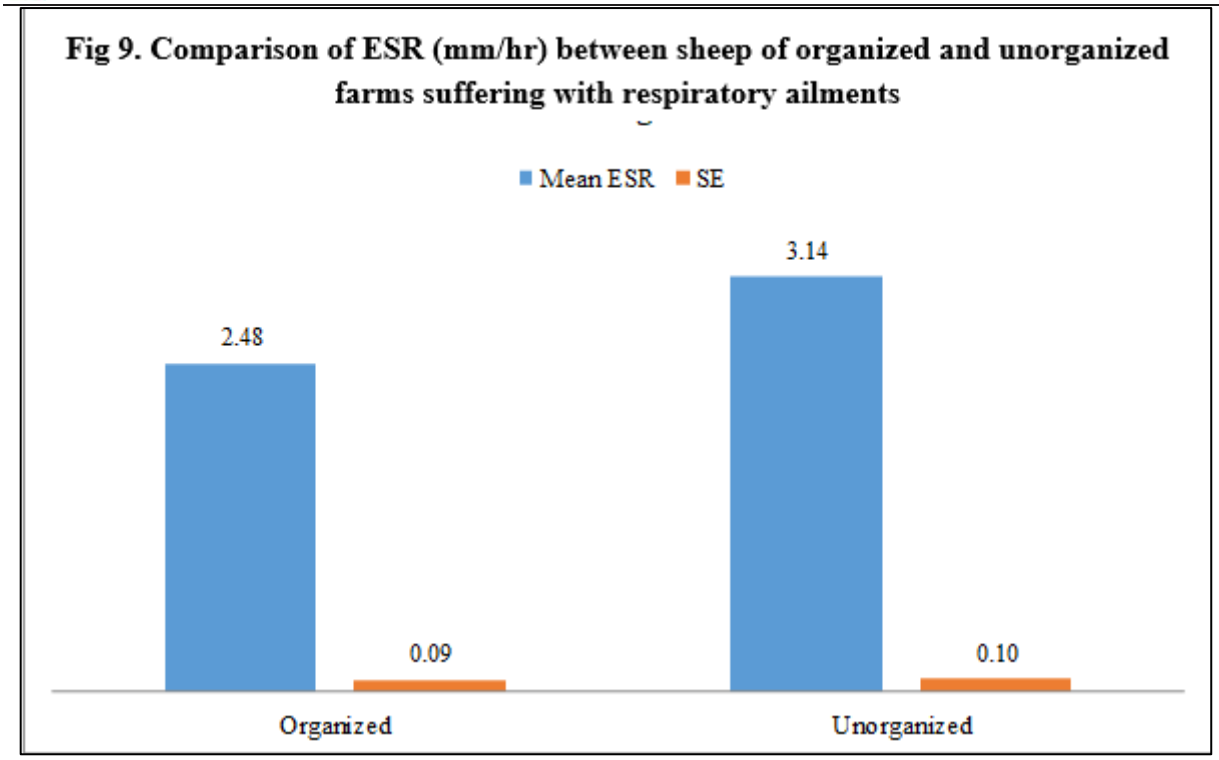

Fig 9. Comparison of ESR (mm/hr) between sheep of organized and unorganized farms suffering with respiratory ailments

Biochemical Analysis

The blood from animal showing respiratory symptoms was collected in clot accelerator vial and serum was subjected for biochemical analysis. In a total there were 29 sheep in organized farm and 32 from unorganized farm which formed a part of biochemical analysis in the present study. The parameter estimated were Aspartate transaminase, Total Protein, Blood Urea Nitrogen, Creatinine and cholesterol.

Aspartate Transaminase (IU/L)

The comparison of Serum Aspartate Transaminase (IU/L) between sheep of organized and unorganized farm have been presented in Table 10 and Fig. 10, Accordingly the Mean±SE of AST (IU/L) were124.37±2.89 in organized farm and 153.25±5.64 in unorganized farms. By statistical analysis both farms were comparably more significant.

Table 10. Comparison of AST (IU/L) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized(N=5)	Unorganized(N=10)
Total sheep	29	31
Mean AST*	124.37 [a]	153.25 [b]
SE	2.89	5.64

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Vol. 24, Issue 2, 2026
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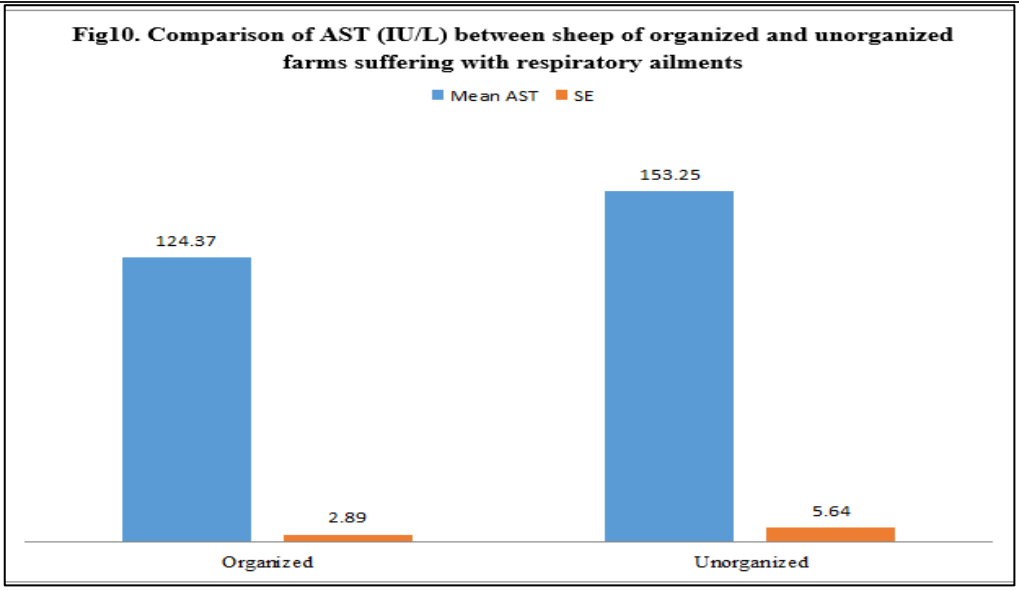

Total proteins (g/dl)

The comparison of Total proteins (g/dl) between sheep of organized and unorganized farm have been presented in Table 11 and Fig 11, Accordingly the Mean±SE of Total proteins (g/dL) were 6.33±0.7 in organized farm and 5.51±0.9 in unorganized farms. By statistical analysis both farms were comparably not significant.

Table 11. Comparison of Total protein (g/dL) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized(N=5)	Unorganized(N=10)
Total sheep	29	31
Mean TP*	6.33[a]	5.51[b]
SE	0.07	0.09

Note: t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =1.86

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Vol. 24, Issue 2, 2026
Indo-American Journal of Pharma and Bio Sciences

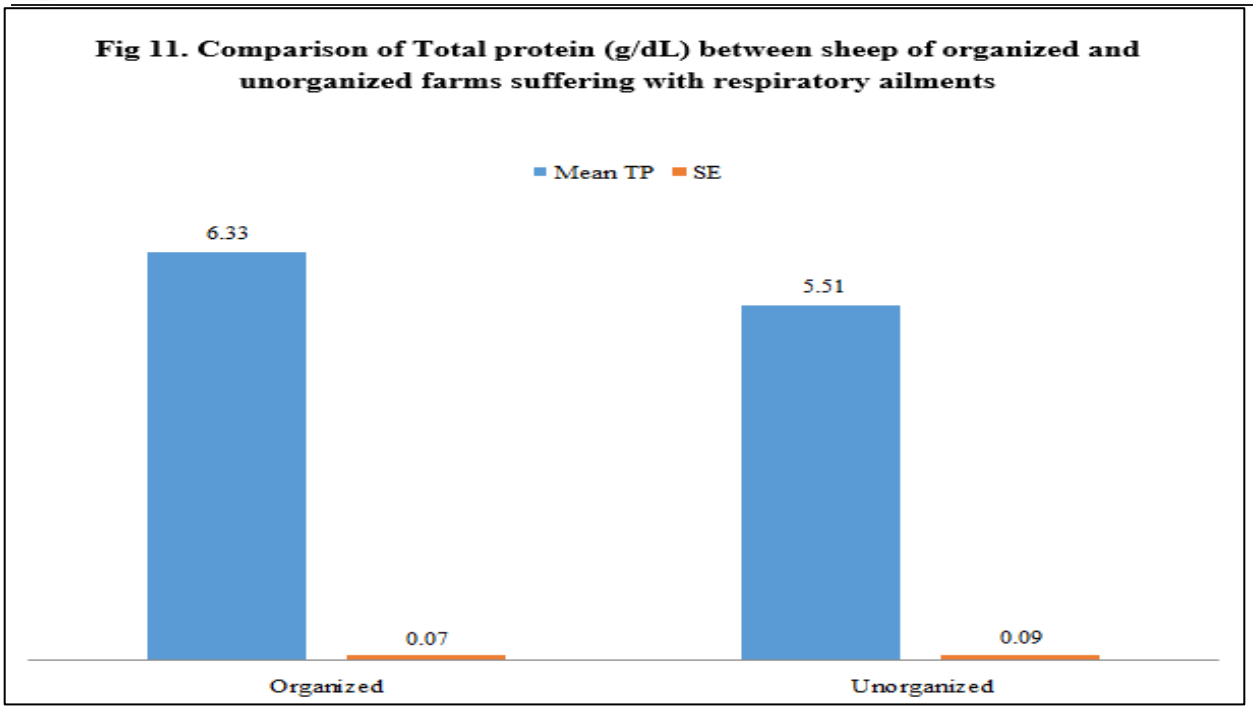

Fig 11. Comparison of Total protein (g/dL) between sheep of organized and unorganized farms suffering with respiratory ailments

Creatinine (mg/dl)

The comparison of Creatinine (mg/dL) between sheep of organized and unorganized farm have been presented in Table 12 and Fig. 12, Accordingly the Mean±SE of Creatinine (mg/dL) were 1.15±0.03 in organized farm and 1.21±0.03 in unorganized farms. By statistical analysis both farms were comparably not significant.

Table 12. Comparison of Creatinine (mg/dL) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized(N=5)	Unorganized(N=10)
Total sheep	29	31
Mean Creatinine*	1.15[a]	1.21[a]
SE	0.03	0.03

Note: t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =2.002465

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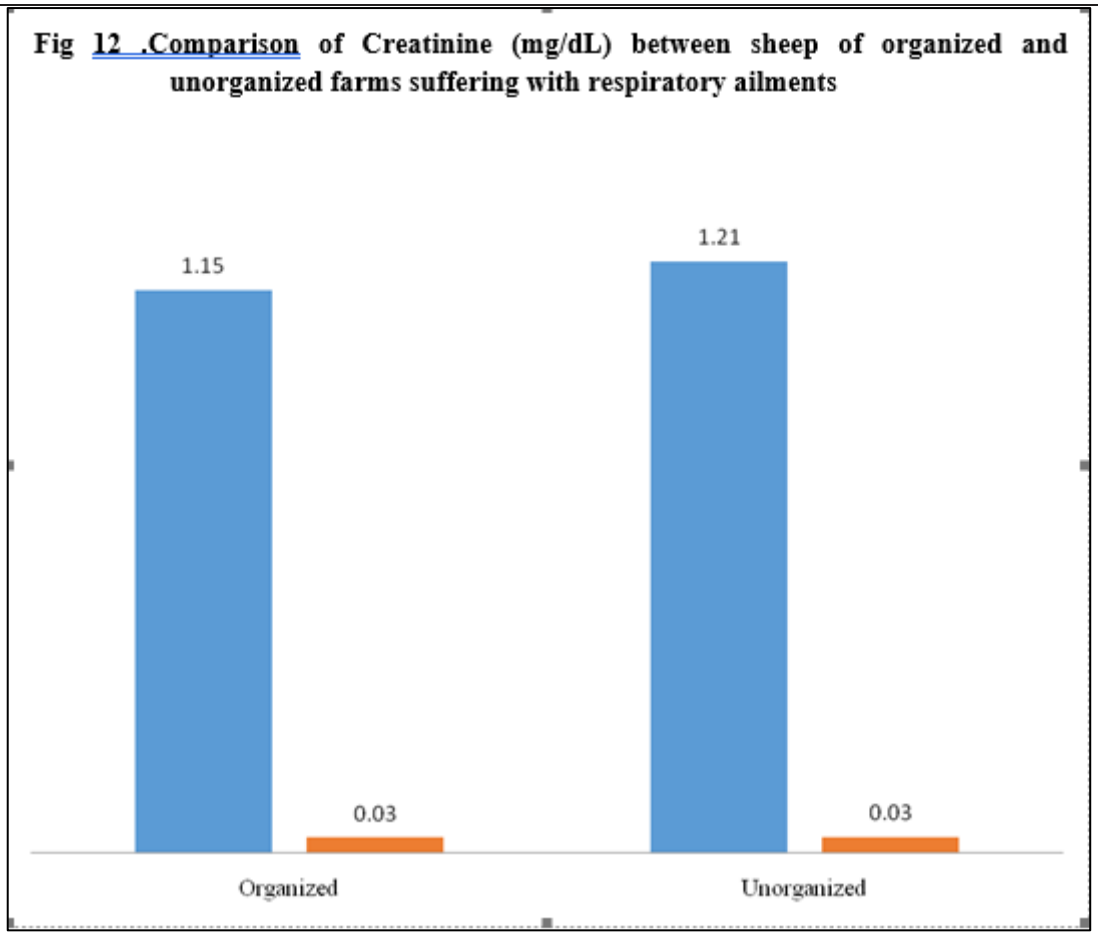
Vol. 24, Issue 2, 2026
Indo-American Journal of Pharma and Bio Sciences



Blood urea nitrogen (mg/dl)

The comparison of Blood urea nitrogen (mg/dl) between sheep of organized and unorganized farm have been presented in Table 13 and Fig. 13, Accordingly the Mean±SE of Blood urea nitrogen (mg/dl) were 17.19±0.22 in organized farm and 18.82±0.34 in unorganized farms. By statistical analysis both farms were comparably more significant.

Table 13. Comparison of BUN (mg/dL) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized(N=5)	Unorganized(N=10)
Total sheep	29	31
Mean BUN*	17.19 [a]	18.82 [b]
SE	0.22	0.34

Note :t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =2.008559

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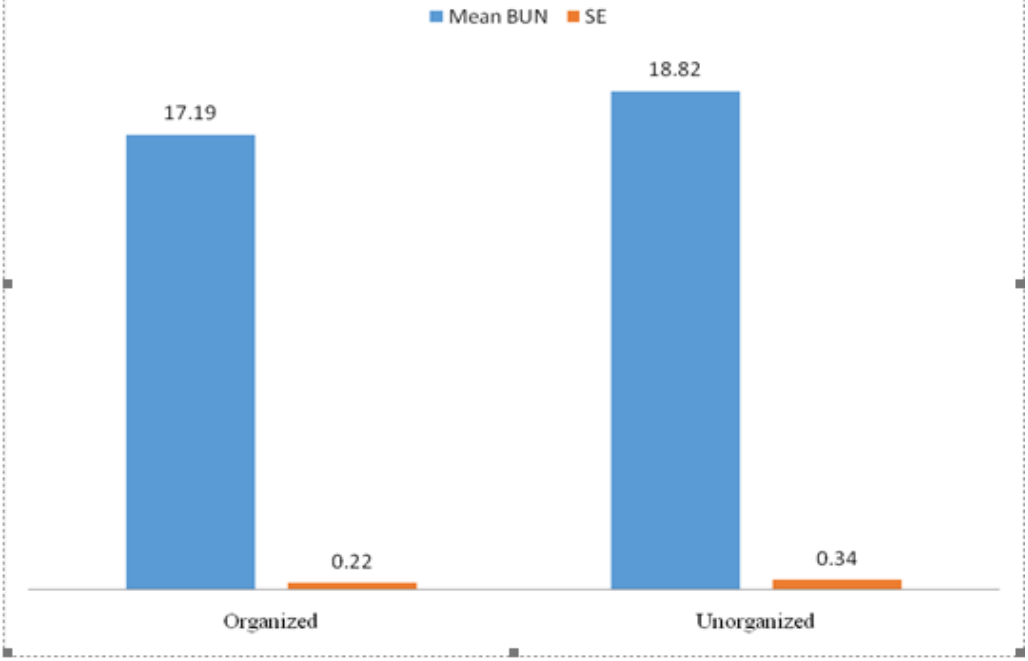
Vol. 24, Issue 2, 2026
Indo-American Journal of Pharma and Bio Sciences

Fig 13. Comparison of BUN (mg/dL) between sheep of organized and unorganized farms suffering with respiratory ailments



Serum Cholesterol (IU/dl)

The comparison of Serum Cholesterol (IU/dL) between sheep of organized and unorganized farms have been presented in Table 14 and Fig. 14. Accordingly the Mean±SE of Serum Cholesterol (IU/dL) were 130.44±4.84 in organized farm and 146.60±1.08 in unorganized farm. By statistical analysis both farms were comparably more significant.

Table 14. Comparison of Serum Cholesterol (IU/dL) between sheep of organized and unorganized farms suffering with respiratory ailments

	Organized(N=5)	Unorganized(N=10)
Total sheep	29	31
Mean Cholestrol*	130.44 [a]	146.60 [b]
SE	4.84	1.08

Note: t-Test: Two-Sample Assuming Unequal Variances P≤0.05, t Critical two-tail =2.039513

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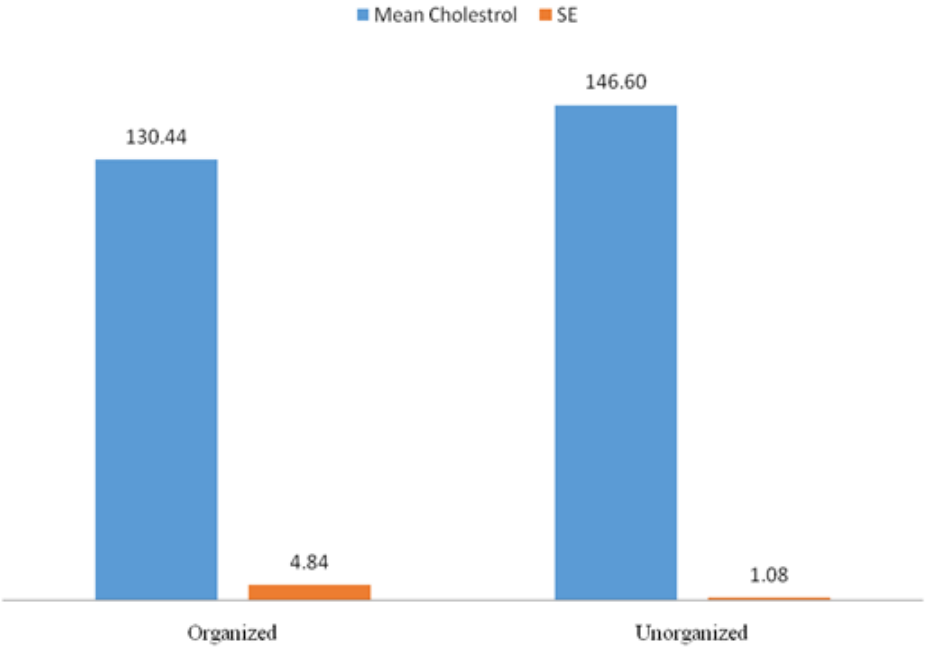
Table 14. Comparison of Serum Cholesterol (IU/dL) between sheep of organized and unorganized farms suffering with respiratory ailments



Discussion

The most common clinical signs exhibited in sheep suffering with respiratory afflictions were nasal discharge, as was commonly seen in animals suffering from upper respiratory tract infections. Cough and sneeze were also commonly observed. These symptoms are observed in respiratory tract afflictions (McGavin, 2003). The clinical signs documented were similar to the reports of Parker *et al.* (2018), Yatoo *et al.* (2019), Dudek *et al.* (2020), Mousel *et al.* (2021), Khan and Rana (2021) and Kant *et al.* (2024)

Comparison of Hematology parameters in organized and unorganized farms

The comparison of Mean±SE of hemoglobin between sheep of organized and unorganized farms was 8.83±0.54 and 7.76±0.46 respectively. Although there was slight dip in the values of hemoglobin in sheep from unorganized farms, it was statistically non-significant indicating the prevalence of variations probably owing to nutritional differences among flocks.

The comparison of Mean±SE of Total Erythrocyte Counts (millions/cmm) between sheep of organized and unorganized farms was 4.56±0.61 and 3.20±0.39 respectively. Although there was reduction in total red cell counts in unorganized sector, the difference were not significant. The observations were similar to Hampel *et al.* (2014) and Wahed and Amery (2018).

The comparison of Mean±SE of Total Leukocyte counts (thousands/cmm) was significantly different between sheep of organized and unorganized farm at 10.91±0.94 and 15.86±1.3 respectively.

The comparison Mean±SE of Total Granulocyte counts (%) were significantly different between sheep of organized and unorganized farm at 25.18±0.31 and 44.05±1.63 respectively. The high counts in unorganized farm might indicate the presence of inflammatory reaction increasing the immune response of acute nature.

The comparison of Mean±SE of Total Monocyte counts (%) between sheep of organized and unorganized farms were 22.62±0.65 and 8.05±0.66 respectively and was found significantly altered bordering on severe elevation. The elevated levels of monocytes may be due to existence of chronic inflammations in ailing sheep from organized farm, when compared to the other sector.

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The comparison of Mean±SE of Total Lymphocyte counts (%) between sheep of organized and unorganized farms were 40.84±0.6 and 40.59±0.96 respectively, indicating non-significant change.

The comparison of Mean±SE of Total Platelet counts (thousands/cmm) between sheep of organized and unorganized farms were 719.92±11.85 and 716.77±25.23 respectively, which were non-significant, although they were slightly lesser than normal values in sheep (MSD Veterinary manual, 2025). Hampel *et al.* (2014) documented alterations in complete blood counts associated with acute infections.

The comparison of Packed Cell Volume (%) between sheep of organized and unorganized farms was 31.95±0.28 and 33.40±0.35 respectively and was found to be significant, but well within normal range of PCV for sheep.

The comparison of Mean±SE of Erythrocyte sedimentation rate (mm/hr) between sheep of organized and unorganized farms was 2.48±0.9 and 3.14±0.1 respectively and was significantly different among the two sectors. The higher ESR in unorganized sheep population might probably be attributed to higher incidence of inflammations, as indicated by leucocytosis, monocytosis and lymphocytosis in the present study. The observations on PCV & ESR in acute infection have been documented by Wahed and Amery (2018).

Comparison of Biochemical parameters in organized and unorganized farms:

The comparison of Mean±SE of aspartate amino transferase (AST) (IU/L) between sheep of organized and unorganized farms was 124.37±2.89 and 153.25±5.64 respectively and was significantly different. The elevated levels of AST in sheep from unorganized farms probably indicate the existence of hepatic insufficiency or respiratory tract affliction along with respiratory ailment. Banga et al. (1989) reported elevated AST activity in sheep.

The comparison of Mean±SE of Total proteins (g/dl) between sheep of organized and unorganized farms were 6.33±0.7 and 5.51±0.9 respectively and were found non-significant. The slightly lower levels of total proteins in sheep of unorganized farms might probably indicate the hypoproteinaemia which might be due to loss of proteins due inflammation, or hepatic insufficiency. Decrease in TP values have been reported by and Wahed and Amery (2018).

The comparison of Creatinine (mg/dL) between sheep of organized and unorganized farms was 1.15±0.03 and 1.21±0.03 respectively, whereas the Blood urea nitrogen (mg/dl) were 17.19±0.22 and 18.82±0.34 respectively. Although there were slight elevation in the serum creatinine and BUN in unorganized farms when compared to organized farms, the difference were non-significant, indicating negligible effects on kidneys in sheep suffering from respiratory ailments. Wahed and Amery (2018) also reported elevated BUN.

The Serum Cholesterol (IU/dL) between sheep of organized and unorganized farms was 130.44±4.84 and 146.60±1.08 respectively. Although the values were significantly different they were well within the normal levels for sheep (MSD Veterinary Manual, 2025)

Conclusion

Respiratory diseases are among the major health problems affecting sheep production worldwide leading to significant economic loss due poor growth and reduced productivity. The most common clinical signs exhibited were nasal discharge, as was commonly seen in animals suffering from upper respiratory tract infections along with respiratory distress. The study may conclude that, respiratory afflictions significantly alter hematological and biochemical parameters in sheep with more pronounced changes observed in sheep reared under unorganized farming systems due to poor management, nutritional deficiencies and environmental stress. Hematobiochemical parameters may serve as valuable indicators for diagnosis, assessment of disease severity and formulation of effective management strategies for respiratory diseases in sheep.

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