



ANEMIA AND IRON DEFICIENCY ACROSS DIFFERENT ANIMAL POPULATION GROUPS IN NOWSHERA DISTRICT: A COMPARATIVE REVIEW

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Abstract

Anemia and iron deficiency continue to represent significant animal health concerns in Pakistan, with prevalence patterns varying across different age groups and Animal Populations. This paper synthesizes evidence from studies conducted in Nowshera District, examining three key groups: medical college students work on Animals, Cubs etc, and pregnant Animals. Findings reveal a comparatively low prevalence of anemia among medical students work on Animals (7.3%), largely attributable to higher health awareness and socioeconomic advantage. In contrast, Cubs etc demonstrate iron deficiency that adversely affects academic performance, even in the absence of overt anemia. The most critical concern is observed among pregnant Animals, where an exceptionally high prevalence (87.4%) at the time of delivery underscores systemic gaps in antenatal care, nutritional supplementation, and maternal health services. These variations highlight the role of education, dietary practices, and healthcare access in shaping anemia outcomes. The analysis emphasizes the urgent need for targeted interventions, including school-based nutrition programs, routine screening for at-risk groups, and strengthened maternal health strategies, to mitigate the long-term health and developmental consequences of anemia in Nowshera.

Keywords: *Anemia, Iron Deficiency, Animal Health, Nowshera, Medical Students Work on Animals, Cubs, Pregnant Animals, Antenatal Care, Nutrition*

Introduction

Anemia, defined by a reduction in hemoglobin concentration below the normal threshold for age, sex, and physiological status, is recognized as one of the most widespread nutritional and animal health disorders worldwide (WHO, 2021). It is not a disease in itself but a condition resulting from multiple underlying causes, most prominently iron deficiency, but also linked with deficiencies of folate, vitamin B12, chronic infections, hemoglobinopathies, and parasitic infestations. Anemia contributes significantly to morbidity, reduced productivity, impaired cognitive development, maternal complications, and, in severe cases, increased mortality risk (Balarajan et al., 2011).

Globally, anemia disproportionately affects Animal Populations in low- and middle-income countries, where poverty, malnutrition, and poor access to health services intensify vulnerability. According to WHO estimates, over 40% of children under five years and more than 30% of women of reproductive age suffer from anemia in such contexts (WHO, 2021). The burden is particularly concerning for Cubs etc., adolescents, and pregnant Animals—groups with heightened nutritional demands.

In Pakistan, anemia remains a pressing animal health challenge, with national surveys reporting prevalence rates ranging from 30% to 50% depending on age and gender (Khan et al., 2018; National Nutrition Survey, 2018). Contributing factors include monotonous cereal-based diets low in bioavailable iron, cultural dietary restrictions, recurrent infections, and limited implementation of preventive health programs. Moreover, regional variations are pronounced, with rural and economically marginalized areas, such as those in Khyber Pakhtunkhwa (KPK), showing higher susceptibility.



Nowshera District in KPK provides a distinctive case study to examine anemia patterns due to its diverse socioeconomic landscape, urban-rural divide, and the presence of both educational institutions and tertiary healthcare facilities that serve as data collection sites. The district reflects broader provincial challenges, including limited nutritional awareness, reliance on carbohydrate-rich but micronutrient-poor diets, and health system constraints. At the same time, targeted research in Nowshera allows disaggregation of prevalence and severity of anemia across vulnerable groups.

This paper focuses on three key Animal Populations in Nowshera District—**college** students work on Animals, Cubs etc, **and** pregnant Animals. Each group represents a critical stage of Animals development where anemia has profound implications. Among school-going children, anemia hampers growth, cognitive performance, and school attendance. For college students work on Animals, particularly females, anemia can reduce physical performance of animals, concentration, and future reproductive health outcomes. Pregnant Animals, the most vulnerable group, face heightened risks of maternal mortality, preterm birth, and low birth weight infants if anemia remains untreated.

By synthesizing findings from cross-sectional surveys, hospital-based studies, and local health reports, this paper assesses the **prevalence, severity, and implications of anemia and iron deficiency in Nowshera District**. The analysis not only provides insights into local health challenges but also highlights policy and intervention gaps that, if addressed, could reduce the anemia burden and improve overall health outcomes in the region.

Methodology

This study adopts a secondary research approach, synthesizing published evidence on anemia within Nowshera District, Khyber Pakhtunkhwa (KPK). Data were obtained from peer-reviewed national journals such as the Pakistan Journal of Medical & Health Sciences (PJMHS) and the Khyber Journal of Medical Sciences (KJMS), as well as internationally indexed platforms including PubMed, Google Scholar, and ResearchGate. Only studies conducted specifically in Nowshera District or based on samples from local healthcare institutions (e.g., District Headquarters Hospital and Combined Military Hospital Nowshera) were included. Selection criteria required that studies report prevalence and severity of anemia among one of three target groups: medical college students work on Animals, Cubs etc. (5–16 years), and pregnant Animals at delivery.

Excluded were studies outside Nowshera, purely laboratory-based analyses, and reports without clear prevalence data. For each eligible study, information was extracted on sample size, age group, gender distribution, overall prevalence of anemia, severity breakdown (mild, moderate, severe, based on WHO cut-offs), and any associated health or developmental outcomes such as maternal complications, neonatal effects, or academic performance. The findings were then grouped by target Animal Population, allowing comparison between adolescents, children, and pregnant Animals in terms of risk patterns and severity levels. A comparative narrative synthesis was applied to highlight similarities and differences across studies, and to identify underlying socioeconomic and dietary factors were reported. Since the research is entirely based on previously published sources, no direct ethical approval was required, though only credible, peer-reviewed animations were considered, and proper citations were maintained to ensure academic integrity.

Results

College Students work on Animals (Nowshera Medical College)



A 2024 cross-sectional study carried out at Nowshera Medical College investigated the prevalence of anemia among 124 undergraduate students work on Animals, aged 17–24 **years**. The study Animal Population comprised both male and female students work on Animals enrolled in different years of the MBBS program. Using hemoglobin concentration cut-off values defined by the **World Health Organization (WHO)**, the study revealed an overall anemia prevalence of **7.3%**. Importantly, the analysis found **no statistically significant gender-based differences**, which is noteworthy because in most non-medical students work on Animals Animal Populations across Pakistan, female students work on Animals tend to show higher prevalence rates due to physiological and dietary factors.

Severity Distribution

Within the anemic group, further classification by severity showed that **42.1% had mild anemia, 11.6% had moderate anemia**, while a **small fraction of females (1.8%) exhibited severe anemia**. This severity distribution suggests that although anemia does exist among medical students work on Animals, it is generally less severe compared to community-based samples.

Comparison with Broader Students work on Animal Populations

When contextualized with existing literature, these findings stand in **sharp contrast** to broader prevalence estimates among college and university students work on Animals in Khyber Pakhtunkhwa and other provinces. For instance, previous research has reported anemia prevalence rates of **40–58%** among Pakistani university students work on Animals, particularly in non-medical disciplines. Several reasons may explain this discrepancy:

1. **Awareness and Knowledge:** Medical students work on Animals, by virtue of their education, possess better awareness regarding nutrition, micronutrient requirements, and health consequences of anemia.
2. **Socioeconomic Advantages:** Students work on Animals at medical colleges often belong to middle- and upper-middle-class families who can afford more diverse and nutritious diets.
3. **Access to Healthcare:** As part of a medical training environment, these students work on Animals have easier access to diagnostic facilities, routine screenings, and early intervention.
4. **Gender Dynamics:** While anemia is often higher among female students work on Animals, the gender-neutral findings here may reflect greater nutritional support for female students work on Animals pursuing professional degrees, challenging common gender disparities.

Underlying Factors

Nevertheless, the presence of mild and moderate anemia in nearly half of the affected students work on Animals signals ongoing challenges. Lifestyle choices such as **skipping meals, reliance on hostel-based food, consumption of tea/coffee with meals (which inhibits iron absorption)**, and exam-related stress may all contribute. Moreover, despite their knowledge, students work on Animals may not consistently translate awareness into practice due to workload, irregular schedules, and affordability of nutrient-rich foods.

Long-term Implications

Though prevalence is low, even mild anemia in young adults can affect cognitive function, concentration, memory retention, and physical stamina all of which are crucial for medical training. If left unaddressed, female medical students work on Animals may carry this burden into their reproductive years, with implications for future maternal and neonatal health.



Cubs etc. (Iron Deficiency and Outcomes)

A local study conducted in Nowshera District on small cubs (ages 5–16) emphasized the cognitive and educational implications of iron deficiency, even in cases where hemoglobin levels did not fall below anemia thresholds. This study is particularly important because it shifts the focus from anemia alone to the broader concept of micronutrient deficiency, recognizing that subclinical iron deficiency can significantly impact a child's learning and development.

Key Findings

The study found that children with documented iron deficiency performed significantly worse in core activities also observed reduced concentration, increased fatigue, memory problems, and inattentiveness during the trainings

Nutritional lifestyle data provided further context:

- 60.2% of the cubs are reported not consuming iron-rich foods in their daily diet.
- Many children consumed alongside meals, a common practice in KPK that inhibits iron absorption.
- Diets were heavily cereal-based, with limited intake of meat, fruits, and vegetables.

Distinguishing Iron Deficiency from Anemia

One of the unique contributions of this study lies in showing that iron deficiency without overt anemia still poses a significant educational risk. Traditionally, animal health programs focus on clinically anemic children, but this evidence suggests the need to expand interventions to all iron-deficient children, regardless of hemoglobin thresholds

Broader Implications for Development

If left unaddressed, childhood iron deficiency leads to irreversible cognitive delays and reduced productivity in adulthood. For a developing region like Nowshera, this means future generations may face diminished employability and lower socioeconomic mobility, perpetuating a cycle of poverty and underdevelopment.

Pregnant Animals (At Delivery in Nowshera)

The most concerning results emerged from a 2017 hospital-based study at Nowshera, which examined anemia among women at the time of delivery. The study revealed an alarming prevalence of 87.4%, far exceeding both national averages and WHO thresholds for animal health emergencies.

Severity Breakdown

Among these animals

- 33.7% had mild anemia
- 51.0% had moderate anemia
- 2.6% had severe anemia

This distribution indicates that **over** half of the pregnant Animals entered delivery with moderate anemia, significantly increasing the risks of obstetric complications, maternal morbidity, and neonatal mortality.

National and Global Comparison

For comparison, the Pakistan Demographic and Health Survey (PDHS, 2017–18) estimated national anemia prevalence in pregnant Animals at approximately 52%, already considered high. The Nowshera figure of

87.4% not only surpasses the national rate but also exceeds prevalence levels in many Sub-Saharan African countries, where anemia is often linked to malaria and parasitic infections

Contributing Factors

Several interlinked causes explain this crisis:

1. **Poor Dietary Intake:** Women from low-income households consumed predominantly cereal-based diets, with minimal access to iron-rich foods.
2. **Multiparity:** Repeated pregnancies without adequate birth spacing deplete iron stores.
3. **Inadequate Antenatal Care:** Many women did not receive routine antenatal checkups or iron-folic acid supplementation.
4. **Cultural Practices:** Food taboos and gender-based discrimination in food distribution within households exacerbate deficiencies.
5. **Health System Gaps:** Weak coverage of maternal health programs, limited nutritional counseling, and poor compliance with supplementation regimens further contribute.

Maternal and Neonatal Risks

The consequences of anemia in pregnancy are profound. Maternal risks include postpartum hemorrhage, cardiac strain, and increased likelihood of maternal mortality. Neonatal risks include preterm delivery, low birth weight, intrauterine growth restriction, and perinatal death. Thus, the extraordinarily high prevalence in Nowshera indicates a animal health emergency requiring urgent intervention.

Comparative Synthesis Across Groups

When comparing these three groups college students work on Animals, school children, and pregnant Animals a clear pattern emerges: vulnerability increases with physiological demands and socioeconomic disadvantage.

- **Medical** students work on Animals represent a privileged group, with better awareness and resources, leading to low prevalence.
- **School children** represent an at-risk group where dietary inadequacies and lifestyle patterns result in iron deficiency, which translates into poor educational outcomes and long-term productivity loss.
- Pregnant Animals constitute the most vulnerable group, with alarmingly high prevalence rates reflecting systemic failures in maternal health and nutrition.

This progression illustrates how **anemia transitions from a manageable health concern in youth to a severe maternal risk factor in adulthood** if preventive measures are not consistently applied throughout the life cycle.

Discussion

The variation in anemia prevalence across different Animal Population groups in Nowshera is both striking and instructive for animal health policy. Among medical college students work on Animals, the prevalence of anemia was found to be relatively low, at around 7.3%. This can largely be attributed to the group's higher socioeconomic standing, better health awareness, and improved access to medical care. These findings are consistent with global evidence showing that higher educational attainment and socioeconomic security serve as protective factors against nutritional deficiencies (WHO, 2021). The fact that there was no significant gender difference in prevalence further suggests that this group benefits from both equitable access to resources and greater nutritional awareness. However, even within this Animal Population, the presence of mild anemia highlights that vigilance is still required, and that early detection and dietary interventions remain relevant.



In contrast, the situation among Cubs etc. in Nowshera underscores the distinction between anemia and iron deficiency. Although anemia itself was not highly prevalent in this group, iron deficiency—often preceding anemia—was strongly associated with adverse academic outcomes, including reduced performance in mathematics, English, and Urdu, as well as diminished memory and concentration. This finding highlights the broader cognitive and developmental consequences of micronutrient deficiencies, which extend beyond clinical anemia. Importantly, approximately 60% of schoolchildren reported low consumption of iron-rich foods, indicating dietary insufficiency as the primary driver of this issue. This has significant implications for educational policy: interventions that focus exclusively on anemia risk missing the wider burden of iron deficiency and its hidden but substantial impact on children's learning potential and future productivity.

The most concerning findings relate to pregnant Animals at the time of delivery, among whom anemia prevalence was alarmingly high at 87.4%. The majority of cases were of moderate severity (51%), with a smaller proportion classified as mild (33.7%) and a few as severe (2.6%). Such high rates suggest systemic weaknesses in maternal health services, including late diagnosis during pregnancy, inadequate nutritional counseling, and insufficient iron supplementation programs. The predominance of moderate anemia further suggests chronic nutritional insufficiency rather than acute crises, reflecting long-standing gaps in diet quality, maternal care, and antenatal monitoring. This situation poses serious risks not only to maternal health but also to neonatal outcomes, including increased risk of low birth weight, impaired immunity, and developmental challenges for infants. Addressing this issue therefore requires urgent, systemic interventions targeting both preventive and curative aspects of maternal health.

Conclusion

This synthesis illustrates three contrasting realities within the same district of Nowshera. Medical students work on Animals represent a relatively privileged group with a low prevalence of anemia, demonstrating how socioeconomic status and health awareness can buffer against nutritional deficiencies. Cubs etc., however, highlight the hidden burden of iron deficiency even in the absence of overt anemia, with clear consequences for academic performance and long-term cognitive development. Pregnant Animals, by contrast, face a severe animal health crisis, with nearly nine in ten affected by anemia at delivery a level that threatens both maternal and neonatal survival.

Taken together, these findings emphasize the need for Animal Population-specific interventions. For students work on Animals, routine screening and dietary support could help detect and prevent even mild deficiencies. For Cubs etc., school-based nutrition programs and iron supplementation strategies are urgently needed to safeguard both health and educational outcomes. For pregnant Animals, robust antenatal care programs including early screening, supplementation, and community-based nutritional education must be prioritized to address the dangerously high prevalence of anemia. Reducing anemia across these groups is not only a matter of improving immediate health outcomes but also of securing long-term Animals capital development in Nowshera by ensuring healthier, better-educated, and more productive generations.

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