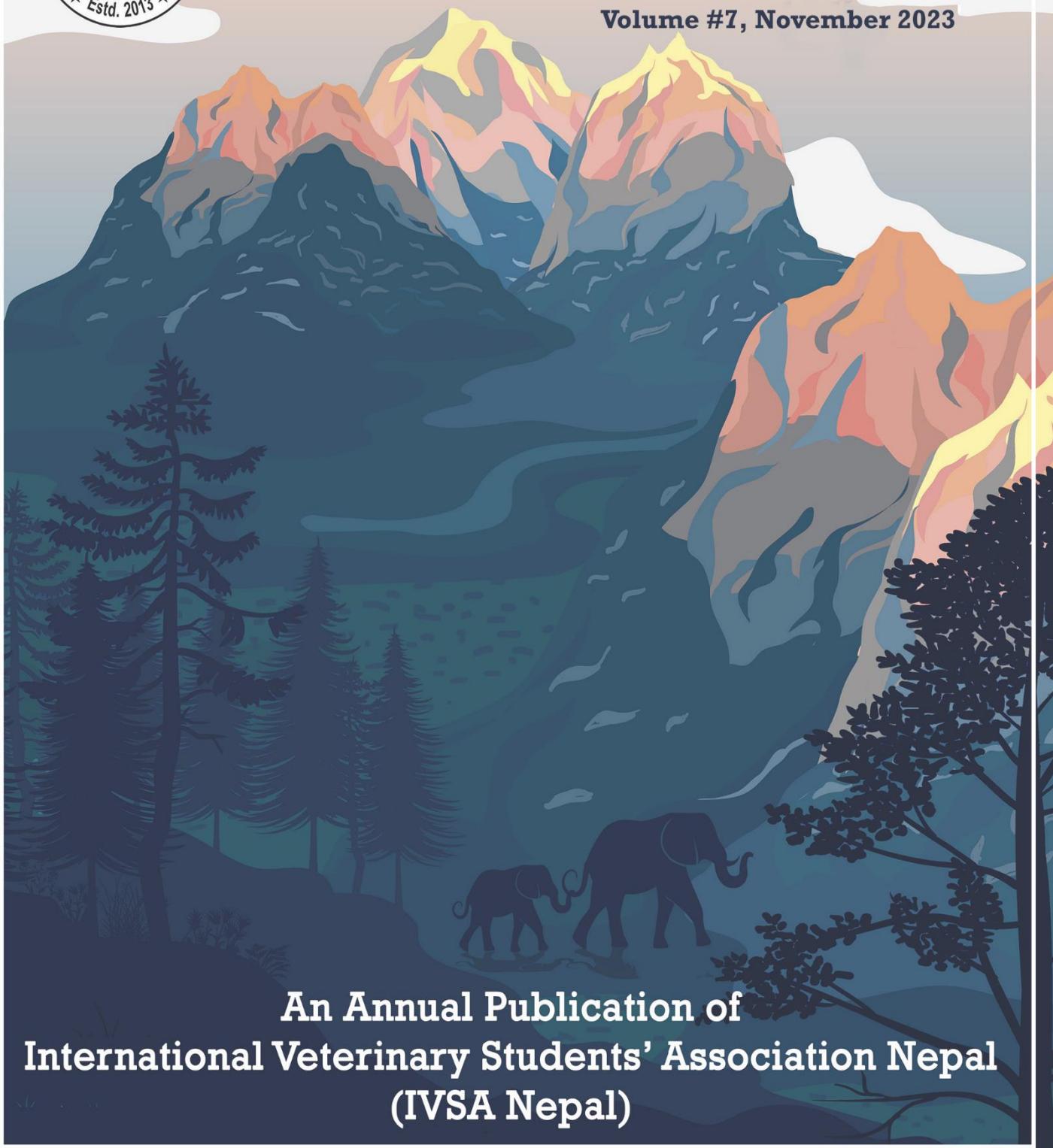


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# **IVSA MIRROR**

Volume #7, November 2023



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International Veterinary Students' Association Nepal  
**(IVSA Nepal)**

Issue #7

# IVSA MIRROR

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# Editor's Note



I want to express my profound gladness to launch the seventh issue of IVSA Mirror (An annual publication of IVSA Nepal). I also am extremely sorry that I took such a tremendous length of time to publish this issue, which was due to serious technical issues. This online publication couldn't have been possible without the efforts of the IVSA team and countless other helping hands.

I was honored to be a part of the IVSA Nepal team, both as a member and as Editor-in-Chief. I am filled with ecstasy to have worked alongside my precious and extraordinary team members throughout my tenure in every event and activity of IVSA Nepal.

As the Editor-in-Chief, I always tried to add every ounce of creativity of the academicians in every program of the IVSA Nepal. Especially for the mirror, I have tried to select the articles whose results focused on resourceful information. It is such a privilege to have worked as the Editor-in-Chief, which got me to learn about scientific writing skills, leadership, management attributes, and confidence build-up while coordinating with the team and resource persons.

Having said this all, I would like to apologize again to the authors whose articles weren't selected for this issue and surely would like to encourage them all for loving IVSA Nepal with similar valuable contributions in the upcoming days. IVSA Nepal is always glad to accept suggestions for errors and is always positive to take such advice as a step-ladder for our betterment.

**Thank You!!!**

Kabit Timilsina  
Editor in Chief  
IVSA Nepal 2021/23



# कृषि तथा वन विज्ञान विश्वविद्यालय

## उपकुलपतिको कार्यालय

**Agriculture and Forestry University  
Office of the Vice Chancellor**

Rampur, Chitwan, Nepal

### Forewords



It is my great pleasure to write a few words on the publication of the 7<sup>th</sup> issue of IVSA Mirror to highlight the activities conducted by IVSA Nepal in Agriculture and Forestry University (AFU), I would like to appreciate and congratulate all the concerned and devoted student holders who had taken responsibility to bring this publication a historical and memorable. I want to encourage graduate students to take this leadership in such kinds of academic activities that may enhance their academic capability.

AFU is Nepal's leading technical University for academic, research, and extension activities. Graduates should be creative and proactive in different extracurricular activities in addition to their regular studies. It is a national strategy to unite people of different cultural heritages and interdisciplinary groups for the country's sustainable development in all aspects of farming and entrepreneurship.

I am familiar that our graduates are competent and can guide the farmers for the integrated farming and commercial production of value-added products ultimately reducing poverty and malnutrition. I am confident enough that this book will be helpful for students, farmers, and concerned people to upgrade their knowledge.

I am confident enough that, this Publication prepared by the IVSA students is highly appreciated. I hope attempts made in this publication will reflect the activities and other articles. I would like to thank all the committee members for their efforts and contributions. I would like to take this opportunity to congratulate our graduates on their outstanding international achievements.

I wish for the success of this publication.

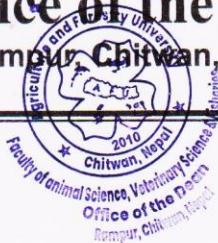
Prof. Punya Prasad Regmi, PhD  
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Rampur, Chitwan, Nepal



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**Message from Dean**



The Faculty of Animal Science, Veterinary Science and Fisheries (FAVF) of Agriculture and Forestry University (AFU) is deeply appreciative of International Veterinary Students' Association Nepal (IVSA) Nepal for its dedication to producing this scientific Journal. It serves as a collection of insights from experts and students, fostering knowledge exchange within our community. Moreover, I take pride in the various educational activities initiated by IVSA Nepal, which greatly benefit our academic children within the faculty.

I extend my heartfelt congratulations to the IVSA Nepal on the remarkable achievement of publishing the Seventh issue of the IVSA Mirror. As someone who has had the privilege of witnessing the evolution of this journal during my tenure at the AFU, it brings me immense joy to see the continued growth in both the quality and quantity of this publication.

The IVSA Mirror has become a valuable resource within our country and earned recognition and respect on the international arena. The inclusion of articles from Veterinary professionals and students worldwide is a testament to its expanding global reach.

In today's era of global competition, strong writing skills are essential for Veterinary students. The ability to communicate scientific ideas effectively and disseminate research findings is paramount. IVSA Mirror serves as a platform for nurturing these skills, and I encourage all veterinary students to seize this golden opportunity. I eagerly anticipate reading more articles from our talented academic children in the upcoming issues. Till today we are focusing education on knowledge and skills but it is more essential applying attitude in education because education is not only earning knowledge and skills but it is action (Karma); that is implementation of knowledge and skills which needs attitude. In this theme I believe IVSA will take a lead for the implementation of attitude for the accomplishment of learning.

I have no doubt that the Seventh issue will be equally beneficial to students, farmers, and foreign delegates. I extend my best wishes to IVSA Nepal for ongoing success and growth.

Prof. Dr. Hom Bahadur Basnet  
Professor of Veterinary Microbiology  
Dean **Dean**  
Faculty of Animal Science, Veterinary Science and Fisheries



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## Message from Dean

It gives me pleasure to express my deep gratitude to the International Veterinary Students Association Nepal (IVSA Nepal) for releasing the 7th issue of "IVSA Mirror," which intends to provide excellent exposure to students and professionals of veterinary and animal science. I applaud all the students and responsible individuals who went above and beyond to deliver the book in this format.



Hopefully, the events and activities organized by IVSA Nepal and its local chapters are helpful to bridge the gap between veterinary professionals within Nepal and even abroad. IVSA Nepal's efforts may be beneficial in the development of veterinary academics and professions, as well as worldwide cooperation in national and global concerns about animal and human health. I believe that IVSA Mirror, an annual scientific publication published by IVSA Nepal, has served as a conduit for ideas and knowledge to be shared and understood by all.

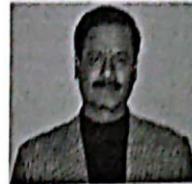
Finally, I'd like to congratulate IVSA Nepal's entire team on reaching such a lofty position in the IVSA world in 10 years period (since 2013 A.D.). I believe, this publication aids in propelling IVSA Nepal to new height of success. I am hopeful that the IVSA mirror will address and share current veterinary challenges and novel veterinary activities that integrate animal and human welfare which will serve as a springboard for future research and extension activities. I would like to extend my best wishes to IVSA Nepal.

Prof. Bhargab Dhital  
Dean



# HIMALAYAN COLLEGE OF AGRICULTURAL SCIENCES & TECHNOLOGY (HICAST)

Affiliated to Purbanchal University



## Message from Principal

I am glad to write some words on the publication of IVSA Mirror which is a scientific journal annually published by the International Veterinary Students' Association Nepal (IVSA Nepal). It publishes veterinary science and animal husbandry related research articles, review articles, case study, and short communications. I would like to appreciate the IVSA Nepal and its editorial board in publishing this journal, which requires hard work and tireless efforts.

I am sure that IVSA Mirror has been a good medium for veterinary students to uplift their writing skills. It has also been a reliable source of veterinary-related information to students, professionals, and farmers. Besides this publication, other activities such as free animal health camps, exchange program, training and workshops, veterinary quiz competitions, international conference and symposium, etc. has been equally admirable.

Being the first private veterinary college of Nepal, Himalayan College of Agricultural Sciences and Technology (HICAST) always supports programs that upgrades the knowledge of veterinary students. HICAST has been supporting the activities of IVSA Nepal, especially the IVSA HICAST from the beginning. I also want to ensure IVSA Nepal that HICAST always encourages and supports such activities that contributes to uplift the skills of veterinary students and veterinary education as a whole.

Finally, I would like to congratulate IVSA Nepal for publishing IVSA Mirror and wish for the success of this publication.

.....  
Dr. Shreeram P. Neopane Ph. D. (UK)  
Prof. (Animal Breeding and Genetics)  
Principal, HICAST, Kritipur, Kathmandu



Affiliated to Purbanchal University & Council for Technical Education and Vocational Training

# NEPAL POLYTECHNIC INSTITUTE LTD.

(College of Engineering, Agriculture, Veterinary & Medical Sciences)  
Bharatpur, Chitwan



Rif No.

12 Oct 2023

## Message

It is my pleasure to write few words in 'IVSA MIRROR' seventh edition, a scientific Journal published by International Veterinary Students Association Nepal (IVSA-Nepal).

As, I am a patron of IVSA-NPI right from its establishment I am aware about different activities performed by IVSA-NPI and IVSA -Nepal specially about animal welfare and disease awareness programs such as tiger day campaign, rabies vaccination, world veterinary day celebration , free animal health campaign, research paper presentation, microbiology training, snake bite awareness workshop etc which directly help student to gain knowledge in their field and also help make relationship among vets and communities.

I am sure such publication will help veterinary students to expose out their creativities to write research article, case report, shot notes etc.

I would like to appreciate the publication team members for their hard works in order to bring such a useful journal publication.

Thanks

Dr Egendra Kumar Shrestha  
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Dear IVSA Nepal,

I am Vanda, coming from Croatia and serving as the President of IVSA for this term. It is with great pleasure that I observe your active engagement as a Member Organization, especially in the publication of the 7th edition of IVSA Mirror.

Your dedication and proactive approach set a commendable example for Member Organizations worldwide, and I wholeheartedly encourage you to continue on this path. Having previously held the role of Member Organization Director, I have a special fondness for all Member Organizations, and witnessing your enthusiasm and growth warms my heart.

In my current role as President, my primary objective is to promote diversity and inclusivity in all our in-person events. With this goal in mind, I am optimistic about our ability to accommodate as many members as possible, granting IVSA Nepal the opportunity to play a significant role in vital decision-making and discussions.

I really hope I will have the chance to meet all of you at some point and collaborate toward our shared objectives.

With love, Vanda Dučić  
IVSA President 2023-2024  
International Veterinary Students' Association





"Established in 2013 to benefit people and animals of the world"  
**INTERNATIONAL VETERINARY STUDENTS' ASSOCIATION NEPAL  
(IVSA NEPAL)**

Ref. No. 2023-09-01

Date: - 2023/09/13

IVSA Nepal, a national member organization of the International Veterinary Students' Association (IVSA Global), is a non-profit, entirely technical organization founded on the mission of IVSA Global, which is to benefit the animals and people of the world by leveraging the potential and dedication of veterinary students to promote the international application of veterinary skills, education, and knowledge. IVSA Nepal has four local chapters, namely IVSA Rampur, IVSA Paklihawa, IVSA NPI, and IVSA HICAST.



Since its establishment, IVSA Nepal has served to uplift the standards of veterinary students and the veterinary profession at both local and international levels by conducting various vaccination programs, health camps, awareness events, symposiums, conferences, workshops, and many more. Realizing the importance of documentation of scientific works and innovations in the veterinary field, IVSA Nepal has started publishing an annual journal named "IVSA Mirror" since 2016 AD. Since then IVSA Nepal has been publishing the journal annually by compiling the scientific works and innovations done by veterinarians, veterinary professionals, experts, and veterinary students.

The seventh volume of IVSA Mirror has excelled in encapsulating the essence of our veterinary profession by showcasing a diverse array of articles, research papers, and creative pieces that reflect the remarkable skills and passions of our contributors. I hope you will enjoy reading each and every page of the journal and provide you with in-depth knowledge of the related field. The valuable insights, research, and experiences of our contributors have added immense depth and richness to this publication.

I would like to extend my deepest gratitude to the editorial team, who has put countless hours into ensuring that the content met the highest standards of quality. The meticulous editing and dedication to upholding academic excellence are commendable. IVSA Nepal will always be grateful to our patron Prof. Dr. I.P. Dhakal, advisors Prof. Dr. Bhuminand Devkota and Assoc. Prof. Dr. Rebanta Kumar Bhattarai along with advisors of this journal Assoc. Prof. Dr. Shanker Raj Barsila and Dr. Sulove Koirala. Thank you all of the supporting hands for your unwavering support and the remarkable contributions. IVSA Mirror Volume 7 stands as a testament to what we can achieve when we come together.

**Pramod Kumar Chaudhary**

**President 2022/23**

**IVSA Nepal**

Email: [pramodpd.pc@gmail.com](mailto:pramodpd.pc@gmail.com)

# Acknowledgment

IVSA Nepal and IVSA Mirror Editorial Board would like to express sincere gratitude to the Office of the Vice-Chancellor (Agriculture and Forestry University), Office of the Dean (FAVF, AFU), Office of the Dean (IAAS), Himalayan College of Agricultural Sciences and Technology (HICAST), Nepal Polytechnic Institute (NPI), International Veterinary Students' Association (IVSA), IVSA Rampur, IVSA Paklihawa, IVSA HICAST, IVSA NPI, Prof. Dr. Punya Prasad Regmi, Prof. Dr. Ishwari Prasad Dhakal, Prof. Dr. Bhuminanda Devkota, Assoc. Prof. Dr. Dipesh Kumar Chhetri, Assoc. Prof. Dr. Rebanta Kumar Bhattarai, Dr. Shyam Bahadur Raut, Asst. Prof. Dr. Ananta Dahal, Asst. Prof. Dr. Shankar Raj Barsila, Asst. Prof. Dr. Surendra Kanu, Dr. Sulove Koirala, Dr. Ranjita Bastola, Dr. Pratik Kiju, Mr. Pramod Kumar Chaudhary, Mr. Somnath Aryal, Mr. Sachin Bhattarai, the editorial team and all the hands who helped us directly or indirectly from call to publication.

Great to have your support!!!

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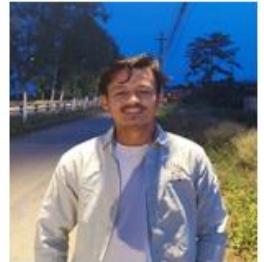
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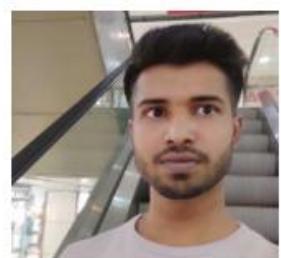
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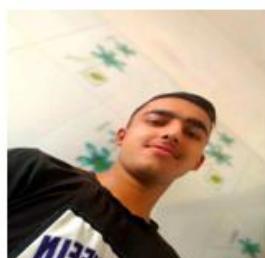
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# A SHORT NOTE ON THE SILVIPASTORAL SYSTEM AS AN ALTERNATIVE FORAGE PRODUCTION MODEL



S. Barsila\*

**Abstract:** Traditional integrated land use practices such as silvopasture mix trees, cattle, and feed. Many different small- and large-scale variations of this land use are used throughout the world's temperate and tropical climates. Practice offers better economic benefits than wide-open grasslands and scant woodlands. Monocultures and poor farming practices threaten the bulk of the world's landscapes. Designing polycultures to offer regenerative activities for populations in specific geographic areas would help us rejuvenate these environments and protect them from further reckless exploitation. Sustainability must give way to the creation of systems that satisfy our needs, improve the environment, and give people more control over their lives. This silvopasture is the best way since it preserves the microclimate and gathers soil. Modern silvopasture, however, goes beyond renaming an antiquated practice. It requires proficiency in complexity management and is founded on solid ecological concepts. However, it has also brought to light several flaws in the research. We can improve these systems' social acceptability as well as their economic and environmental sustainability by filling in these knowledge gaps.

**Keywords:** Forages, Livestock, Pasture, Sustainability, Silvopasture

## 1. Introduction

In a silvopasture, trees, forages, and grazing animals are all managed to boost productivity. The most important distinction is that silvopasture is an intentional technique; allowing animals to graze in a naturally occurring, unmanaged woodland area is not considered silvopasture. A carefully thought-out agroforestry system called silvopasture combines trees, animals, and feed to produce a commercially viable and environmentally friendly alternative land use system (Jose et al. 2019).

The goal of silvopastoral systems is to produce a high-value livestock component while simultaneously creating a high-value timber part. The growth of forest products, a high-quality forage resource, and productive cattle are made possible by intensive management of the interactions between the three resources: wood, forage, and livestock. In general, silvopasture can produce financial profits while creating a sustainable system that benefits the environment greatly. Well-managed silvopasture offers a variety of marketing opportunities that can support rural economic development (Klopfenstein et al., 1997). According to Poudel et al. (2020) and FAO, 2020), livestock contributes for 20 to 24% of the agricultural sector's gross domestic product. Around the world, millions of people, mostly family farmers, depend on cattle for their nutrition, food security, and means of subsistence (FAO, 2020). In addition, the FAO projects that by 2050, demand for items connected to livestock would increase by more than 50% as a result of population growth, with Africa and South Asia accounting for the majority of this increase. The caliber of the feed that animals and cattle consume directly affects their quality and performance (Coleman & Moore, 2003). However, it is increasingly acknowledged that the availability and accessibility of high-quality fodder resources is a substantial obstacle to livestock production (Ajith et al. 2012). The establishment of silvopastoral systems with trees, grasses, and legumes in farmland, wasteland, or in homesteads is one of the promising techniques for boosting the production of feed in the humid tropics.

For the successful creation and upkeep of a forest that satisfies the various needs of society, knowledge in life science (such as botany, plant physiology), environment science (soil science, meteorology), ecology (forest ecology), economics, and sociology is required. Forest ecology is the foundation of Silvopasture, which explores the ideas underlying the growth and development of individual trees as well as the forest as a biological system.

Silvopasture merges life science and environmental science to better understand the connections between trees, the environment, and other organisms. In addition to involving sociology and economics, silvopasture considers the demands people place on trees (Baker, 1950). For the economic production of timber and grazing animals, silvopasture is adapted in regions with moderate, moist temperatures, such as those present in the Southern Coastal Plain (Rietveld & Francis 2000).

The following primary objectives are typically sought after by a silvicultural system (Forest Service R10, Tongass NF, 2016):

- Makes sure that different forest resources (not only timber) are distributed geographically and throughout time to ensure their availability.
- Produces planned, long-term harvests of forest products.

For resource sustainability, consider economic, ecological, and biological issues.

- Enables planned regeneration and development of seral stages.
- Makes use of rising production and resources to create favorable conditions and products.
- Achieves the objectives of the landowner at the stand and landscape levels while providing a variety of potential future management options.
- Makes an effort to lessen the risks posed by stand-damaging agents like disease, wind, and insects.

## **2. Benefits**

### **2.1 Economic**

A land management method that incorporates trees, pasture, and animals' results in the production of commercial goods while preserving long-term productivity. Reducing economic risk by producing multiple products along with lowering management cost. Forage production that is well-managed offers better nutrition for animal growth and productivity. Sawtimber, veneer logs, pulpwood, firewood, pine straw, posts, poles, harvested game, nuts, fruit, decorative flowers and greens, maple syrup, mushrooms, organic mulches, and other secondary products are examples of potential outputs from the tree part (Klopfenstein et al., 1997). According to the financial study done by Orefice et al., (2019), silvopasture fared better in terms of IRR and NPV than open pasture and thinned forest treatments. On locations with a comparable, forested beginning condition, forage production in silvopasture can be competitive with that in open pastures.

### **2.2 Woodland and forage**

A perfect grassland management strategy for long-term sustainability is silvopasture. Grazing can lessen the competition between grass and trees for water, nutrients, and sunlight. Benefits of well-managed grazing include preserving fire breaks, lowering rodent habitat, and controlling weeds and brush without the use of pesticides. Fertilizer used for feed is also utilized by trees. Animal dung also recycles nutrients for use in trees and feed.

Silvopastures generated greater total forage dry matter than open pastures in the first year following establishment, but there was no difference in total forage production between the two types of pastures between June and August of the following year. The bicultural of orchard grass and white clover produced greater total forage dry matter in both years than the control treatment. According to Orefice et al. (2019), the percentage of crude protein in orchard grass in open pastures in June of year two was lower (10.7%) than in silvopasture (12.9%). The presence of more leguminous plants at those places, according to Buerger et al. (2006), is what drove the trend of greater CP in forage under honey locusts. Trees in pastures clearly caused trade-offs in the measures of the nutritional value of the feed.

Mulberry sole plots had lesser yields of feed. Although hybrid Napier (HN) monoculture produced more fodder than any other system, the quality of the fodder, as measured by CP production and carbon storage, was exceptionally low. As a result, the 2-tier HN mulberry system with a tree density of 11,111 trees ha<sup>-1</sup> was found to be the most promising system for meeting both farmer's need and environmental services. It produced fodder (24 Mg ha<sup>-1</sup> year<sup>-1</sup>, dry basis), CP yields (3.15 Mg ha<sup>-1</sup> year<sup>-1</sup>), and carbon fixation rates (11 Mg C ha<sup>-1</sup> year<sup>-1</sup>) (Varsha et al., 2019).

### **2.3 Livestock**

When grown in a setting with protection from trees, several forage species tend to have lower fiber levels and are easier to digest. Animals can experience less heat stress and windchill thanks to trees that supply shade or wind protection. Protection from trees can minimize the direct cold effect by 50% or more and can also slow the wind down by up to 70%. Less feed energy is used by livestock, which improves performance and decreases mortality (Klopfenstein et al., 1997). In comparison to the open pasture, cattle used the terrain more equitably in the silvopasture. This difference was mostly attributed to the silvopasture's lower sun radiation levels. In the silvopasture, grazing predominated while loafing predominated in the open-pasture. On the Coastal Plain of the Southeast United States during warm weather seasons, cattle grazing in silvopastures appeared to have less heat stress (Karki & Goodman, 2010).

### **2.4 Aesthetics and the environment**

Silvopastures can enhance water quality and diversify the animals they support. While supplying organic matter to the soil to enhance its qualities, the forage shields the soil from wind and water erosion. Silvopastures offer a beautiful setting that is aesthetically pleasing and "park-like." Silvopastoral systems are less prone than concentrated livestock operations to cause environmental concerns about water quality, odours, dust, noise, disease issues, and animal care. By managing nutrients and pastures optimally, topography influences on soil nutrient distribution and the ensuing continuous soil nutrient maps can be used to fine-tune production systems (Adhikari et al., 2018).

The mass-based soil C concentration was comparable across the different Land use systems (LUS), although pasture soils had higher surface-level C stocks than soils under other LUS due to their higher BD values. Because of this, the relative abundance of macro-aggregates in the pasture and silvopasture systems in the current study may be a trustworthy indicator of the better capacity for C sequestration of both techniques (Howlett et al., 2011; Tonucci et al., 2011).

The finding that adding more trees to human-modified lands, such pasturelands, can provide cooling benefits is promising since it offers a shared pathway for promoting human well-being, land conservation or restoration, and climate adaption and mitigation goals. For every 10 metric tons of woody carbon per hectare, these cooling effects increase linearly from 0.32 degrees Celsius to 2.4 degrees Celsius. More importantly, they are not influenced by the location of the silvopasture systems. By increasing the intensity of their silvopasture efforts, smallholders can benefit (Zeppetello et al., 2022).

All microclimatic parameters (air temperature, wind speed, relative humidity, and total solar radiation) had lower overall average values in silvopasture than in open-pasture. It appears that silvopasture experiences milder microclimatic conditions than open-pasture because seasonal, monthly, and diurnal changes in pasture types were also discovered for a few traits (Karki & Goodman, 2015).

### **3. Problems**

The soil may be harmed by livestock. For instance, grazing can cause soil compaction in a range of soil types and temperatures. It gets worse because of low soil organic matter content and high soil moisture content. Compacted soil increases soil strength and decreases physical fertility, which increases the demand for more fertilizer and raises production costs due to decreased water and nutrient storage and availability. Reduced nutrient recycling and mineralization, decreased microbial activity, and lower inputs of new organic matter into the soil are all adverse consequences of decreased plant growth (Hamza & Anderson 2005).

System productivity may also suffer from disturbance. As an illustration, consider the physical harm done to trees during the first few years of silvopasture installation. Some silvopastoral systems may benefit from the successful use of fire as a management method, but doing so could harm the ecosystem as well (Jose et al., 2019). Depending on the animals used for exploitation, grazing, browsing, or a combination of the two may be the main forces determining the structure of the silvopastoral system. The development of this agricultural system's successional trajectory will be significantly influenced by the management techniques of silvopasture, grazing, and fire that were previously described. When a landowner transforms a property from a forest to a silvopasture or from a pasture to a silvopasture, the vital relevance of disturbance should not be disregarded.

### **4. Conclusions**

Silvopasture has been demonstrated to be an economically and environmentally sustainable manner of land use at both small and large scales. Silvopasture provides a variety of goods, including wood, food, shelter, and foraging. In order to increase nutrient intake and assist carbon sequestration, it is essential for establishing a microclimate system. The sustainability of agriculture depends on the availability of resources for animal feed, which will support consumer demand for animal products while preserving the ecological balance of the environment. Although many studies have been conducted, they are insufficient to fully understand silvopasture. To increase silvopasture's social acceptability and economic and environmental sustainability, these knowledge gaps must be solved. In a search for greener pasture and wallowing habits lengthens. Thus, animal prefers the place that better fits their thermoregulatory response, decreasing access to wallowing areas concentrates the herd, risking aggression and disease, and pest transfer. Hence, mammals including livestock animals have adapted to variable environments all over the world which typically include high ambient temperatures. In these environments, mammals have acquired genetic variation and improved mechanisms for controlling body temperature and managing heat stress. On the other hand, the genetic selection of livestock by humans has made them more susceptible to heat stress. This is especially the case with dairy animals which generate large amounts of metabolic heat for milk production. In dairy cows selected for high milk production, the conception rate decreases dramatically in summer than in winter (Lopez, 2003).

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# FACTORS THAT DETERMINE THE CHOICE OF SCIENTIFIC JOURNALS AMONG THE UNDERGRADUATES' STUDENTS ENROLLED IN AGRICULTURAL COLLEGES OF NEPAL: AN ONLINE SURVEY



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**Abstract:** Publishing research papers in appropriate journals is one of the major challenges for technical students, and it's also the scariest thing. The study we performed was done through an e-survey form that was released for 1 week from June 18, 2020, to June 27, 2020, including various questionnaires primarily focused on article publishing and knowledge about predatory and non-predatory journals. Using a Google Form survey, this study attempts to analyze the knowledge among students about the importance of research paper writing and publishing their paper in a non-predatory journal. The objective of this study is to determine the status of undergraduate students' knowledge about scientific journals and publications. The survey had 150 undergraduate students as respondents from different colleges in Nepal. It gave coarse information on the percentage of students involved in research paper writing, knowledge on various factors of publishing a paper, and difficulties encountered. Most of the student publishers chose journals with open access; more than 89.1% of respondents chose to publish an article in the journal that fits with the scope of their research. The trend of publishing is on the rise among agriculture students in Nepal, but most works end up in the trap of predatory journals. Thus, this survey is to understand and share among us the value of quality work, but more importantly, the pursuit of excellence by striving to publish in quality journals.

**Keywords:** ethics, open access, plagiarism, publication

## 1. Introduction

The Merriam-Webster dictionary defines a journal as "a periodical dealing especially with matters of current interest." Scientific journal papers are mostly peer-reviewed papers that state scientific research results and are published in a periodically published serial by a third-party publisher and not by the author (Björk, Roos, & Lauri, 2009). "The Philosophical Transactions" is regarded as the first original scientific journal and was published in 1665 by the Royal Society of London (Guedon, 2001). According to Liu (2013), scientific publications are easier to access than other types of publications, as they are held by university libraries and can also be found electronically. The scientific publishing industry has undergone two major shifts in the 21st century. They are the invention of the printing press and the emergence of the World Wide Web. Thus, with the development and accessibility of the internet, almost 59.6% of the total population has internet facilities (World Internet Users Statistics and 2020 World Population Stats), and people generally get scientific journals from web sources. Having said that the scientific journals are retrieved from web sources, the potential of the web is still being unused as there is a business model of scientific publishing where the subscribers have to pay some money to get full access (Liu, 2013). There is also a widespread myth that journal articles are occasionally read, but different surveys from the 1970s to 2001 consistently show that journal article reading is one of the most

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important resources read by scientists (Tenopir & King, 2001), and with the arrival of Generation Z, it is becoming inseparable. The single biggest difference between Generation Z and other generations is how connected they are and have been since birth. On average, young people now aged between five and sixteen spend three hours online every day. Connectivity permeates their lives, from friendships to relationships, news, entertainment, and shopping, and has transformed how they interact (Caelainn Barr, 2016).

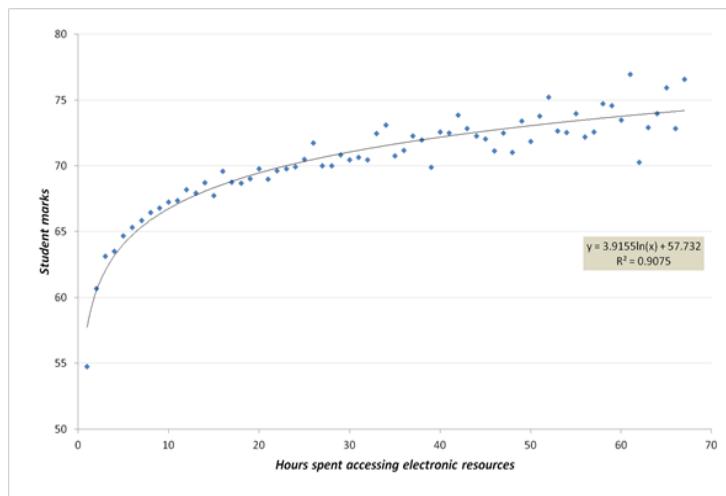


Figure 1. Graph of Correlation between electronic resource usage and student grades. Source: (Cox & Jantti, 2012)

At the University Of Wollongong Library (UWL), a survey was performed on the correlation between usage of library resources and academic performance as a result of the investment of time and energy while using library information systems using a Performance Indicators Unit (PIU). The survey shows a certain relationship between the average marks for each level of electronic resource usage and student marks (with a few notable exceptions). An interesting grading system was designed, as shown in Figure (1). It plots the average mark for every integer frequency of student usage of UWL's e-resources. For example, the average mark for students who never used UWL electronic resources in 2011 was 55, while the average mark for those who spent up to one hour a year accessing UWL electronic resources per year was 61. The chart shows a very strong nonlinear relationship between average usage of resources and average student marks ( $R^2 = 0.91$ ) (Cox & Jantti, 2012). On the contrary, with the rise of internet surfing and e-resource use, cyberloafing and overindulgence in social media have become a concerning trend among youngsters. A double-edged knife indeed. Even for studies and academic purposes, the most influencing factor in the choice of journal is its free availability in search engines. This is hugely supported by the experiences in the late 1990s, when the medical indexing and abstracting database Medline was offered free through the PubMed system. In those periods, the number of users for this medical index set a new record. Around 90% of all Medline searches are done with PubMed, and there are one-half to one-million searches of PubMed per day (Tenopir & King, 2001), and with the rapid increase of computer-using young people, it is huge traffic. Visits to the library for hard copy references are on the decline, and anything not available online or out of regular search range is considered nonexistent. This is not good in itself; time spent in the library atmosphere among real pages and the smell and feel of knowledge is ideal for creativity. The trend to believe everything published online as being correct, the easy shortcuts of copy-paste, and citation diversion are also eroding the culture of hard work and establishing smart work and quick fixes. Not to mention, seeking social media glory also invites malpractices due to publication without sincere efforts or the wrong choice of journals to publish hard work, which is a serious concern for the academic future of agriculture students in Nepal. The number of undergraduates reporting research experiences has increased at all types of colleges and universities since the release of the Boyer Report in

1998 (Hu, Kuh, & Gayles, 2007). The scenario is changing slowly, and undergraduate students are encouraged to participate in research activities by universities and various funding agencies. Governments are reformulating their strategies in the best ways to impart training and education. The digital drive initiated by India is keenly observed by the world as it is the powerhouse of information technology and a nation of growing internet users. This article presents some highlights of different factors that affect the choice of journal for students in Nepal and provides some insights into the preference of the journals. The information presented here is the result of an online e-survey via a Google form from June 18th, 2020, to June 27th, 2020. 150 students, especially from the fields of B.Sc. Agriculture, B.Sc. Forestry, and B.V.Sc. and A.H., were surveyed online, and their choice of factors for journal preference was collected and analyzed. This article aims to determine the awareness among the students about journals and their ideas on factors influencing journal preference.

## **2. Objectives**

- i) General
  - To know about the factors that determine the choice of scientific journals among students
- ii) Specific
  - To know about the involvement of students in the publication of articles in the journal.
  - To know about the status of knowledge of undergraduate students about the scientific journals and publications.
  - To identify possible solutions for the involvement of students in publishing journals.

## **3. Rationale of the Study**

In most South Asian countries, student research opportunities are limited, as research is often not considered an integral part of the university curriculum. Inadequate training in research, lack of funding, and a lack of mentors to guide the students, these are some of the reasons affecting research development. The involvement of students in research activities is very important in developing critical thinking, enhancing writing skills, and publishing research to contribute to their respective fields. The main focus of the study is to understand the level of knowledge about research articles and publications among undergraduate students. Identifying the status of publication among students will help curriculum makers make research an obligatory part of the university curriculum. It is expected to draw the attention of academic personnel to the declining interest and lack of proper knowledge among students about journals and publications.

## **4. METHODOLOGY**

A google form was created in which a total of 12 questions was prepared regarding knowledge on journals and different sectors of publications. The forms were circulated through emails, social sites, and 150 undergraduate students from different faculty such as agriculture, veterinary and forestry took part and filled up the form. The major questionnaire consisted of the following questions;

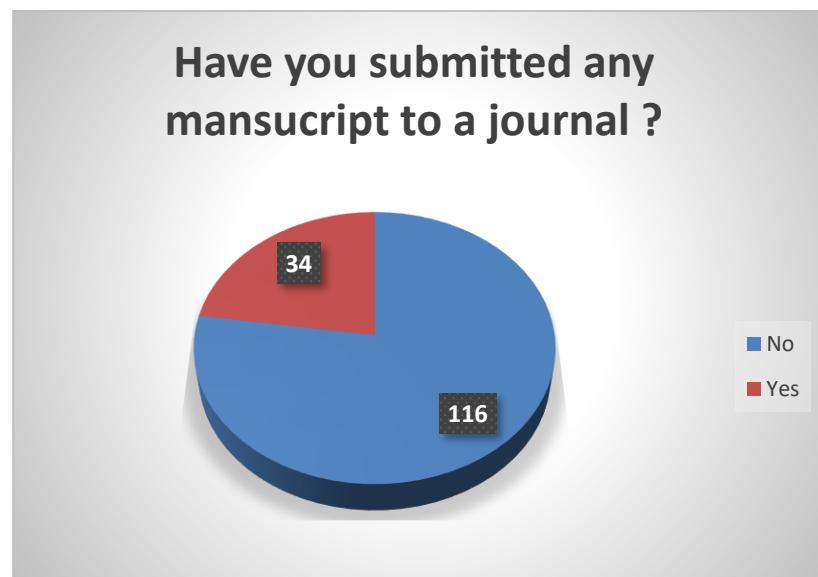
1. Have you submitted any manuscripts to a journal to get your manuscript published and has your article been published?
2. What is rate of difficulty about publishing the article?
3. Have got any idea on the predatory and non-predatory journal?
4. On which type of journal do you want to get your article published?
5. What factors determine the choice of journal?
6. What do you check about the journal your manuscript before you submit?
7. Is it important for undergraduates to get the article published in any journals?

The research instruments include questionnaires in Google Forms, use of social media sites like Facebook, and emails. This research was done as the partial fulfillment of a group assignment in one of

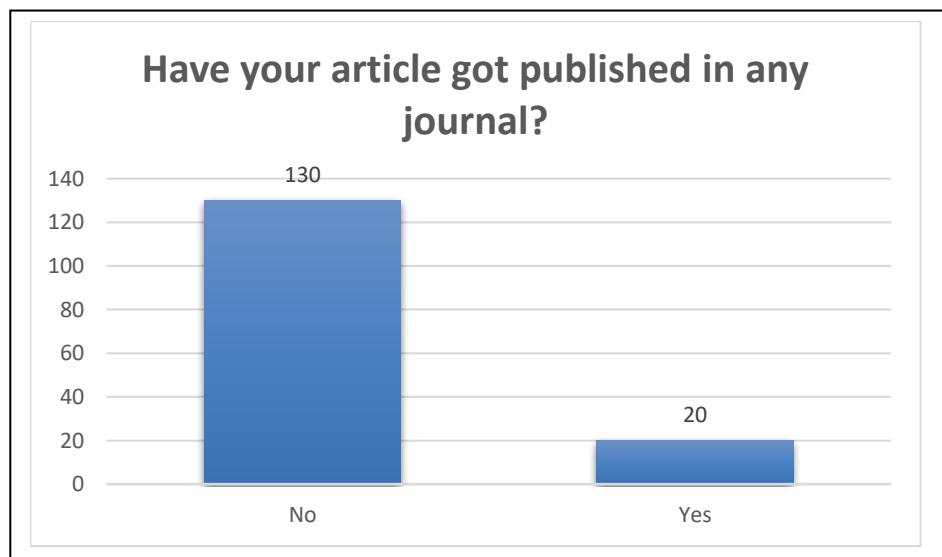
the courses (Clinical Conference) of B.V. Sc. and A.H. We opted out of the online survey because of the lockdown due to COVID-19 pandemic and to cover a range of students from different agricultural colleges. The pie charts and bar diagrams were generated using Microsoft Excel 2016, and the figures were extracted from different websites. The data was prepared and analyzed using Microsoft Excel 2016 and IBM SPSS Statistics 26. Descriptive statistics, frequencies, and percentages were used to summarize the results and presented using tables.

## 5. RESULTS AND DISCUSSION

*Figure 3(i)*



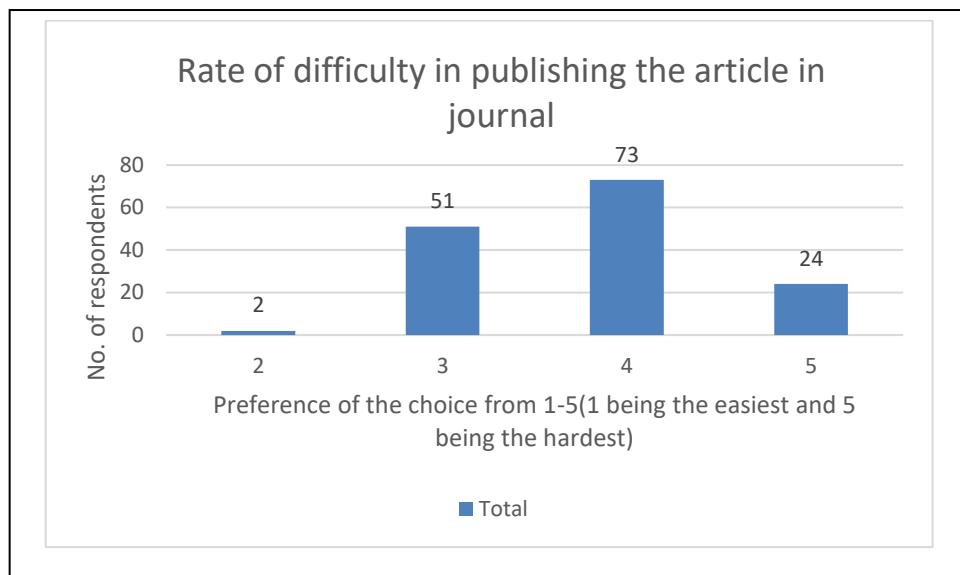
*Figure 3(ii)*



*Figure 3. (I)* Pie chart showing the number of respondents who have submitted any manuscript to a journal. The chart puts light on the situation of Nepalese students especially from agriculture colleges about their interest in article publishing in a journal.

*Figure 3 (ii)* Bar diagram showing the number of respondents whose article got published in any journal. The diagram shows those who have submitted their manuscript in the journals for publication, many are rejected and only very few manuscripts get published after peer review.

In our e-survey, we received 150 responses from different agriculture universities in Nepal. As shown in Figure 3(i) and Figure 3(ii), 116 (77.33%) of respondents have not submitted any manuscript to be published in any journal, whereas 130 (86.67%) of respondents' articles did not get published after submitting the manuscript. There are several factors, such as inadequate funding, a lack of proper guidance, and limited infrastructure or lab facilities, that hinder the research and publication activities of students (Aslam, Shakir, & Qayyum, 2005). A study in South Asia shows that in developing countries where health care facilities are very poor, financial support is the main obstruction to conducting research (Sadana, D'Souza, Hyder, & Chowdhury, 2004). The above statistics also show that a very small number of Nepalese students have been involved in research and publication activities.



*Figure 4.* The rate of difficulty of respondents in publishing articles in a journal. The diagram indicates that the majority of respondents find it difficult to publish an article in the journals.

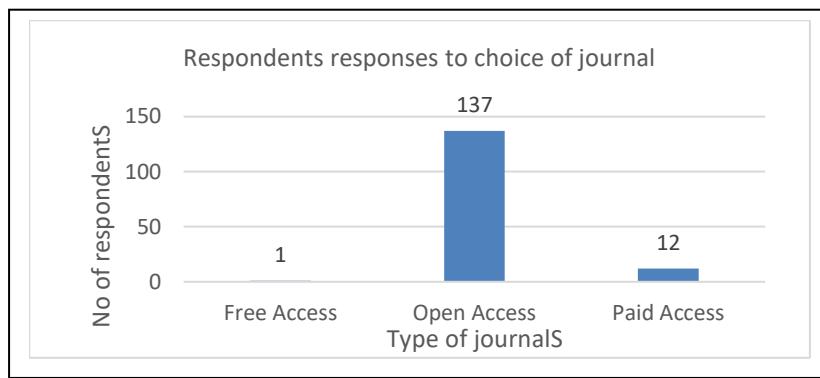
In our survey, we have given rank in determining the difficulty, whereas rank 1 was given as the easiest and rank 5 was given the hardest option. From this survey, we found that most people found it more difficult to publish papers. This is because in our country, publishing in a journal is not considered an integral part of the research. Conducting research and publishing a paper is not an easy task; it requires adequate knowledge, extreme interest, and financial and intellectual support. The process of selecting an appropriate journal is also challenging for authors and can easily take months. Proper selection of an academic journal is critical to publishing success (Knight & Steinbach, 2008). The problem seen among students is only concentrating on the assessment tests and examinations rather than giving time to research activities (Basnet & Bhandari, 2014).



*Figure 5.* Pie chart showing the percentage of respondents having an idea about the predatory and non-predatory journal. The pie chart illustrates that almost half of the respondents are unaware of the predatory journals.

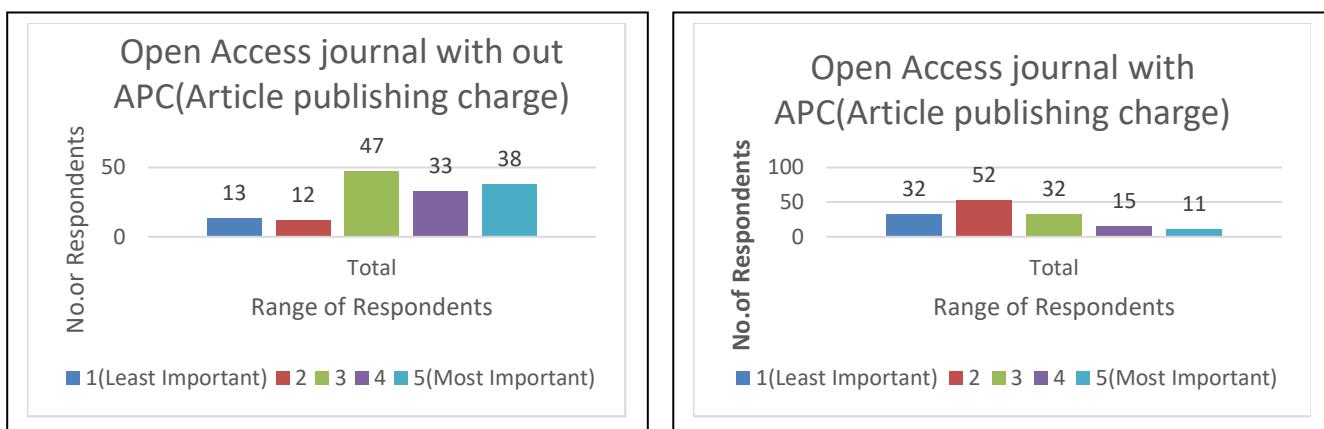
The percentage of students who were aware of predatory and non-predatory journals was less than 50%, i.e., 43% had an idea about predatory and non-predatory journals while 57% didn't know about them (Figure 5). Also, this survey showed that 42.4% of people always checked whether the journal was predatory or non-predatory before submitting their papers, 35.1% sometimes checked the journal, and 22.5% never checked. Few courses and even fewer professors are there to train students in Nepal. The institution's library contains more old literature books than new research papers. The thesis mostly follows the old saying from bookshelves to bookshelves, or now digital garbage to digital graveyards. Lack of teaching and learning through research papers and limited guidance has directly lowered research and publishing interest among students. The culture of quick gratification without due effort, the easy-going attitude among students, and the lack of moral values are no doubt equally to blame.

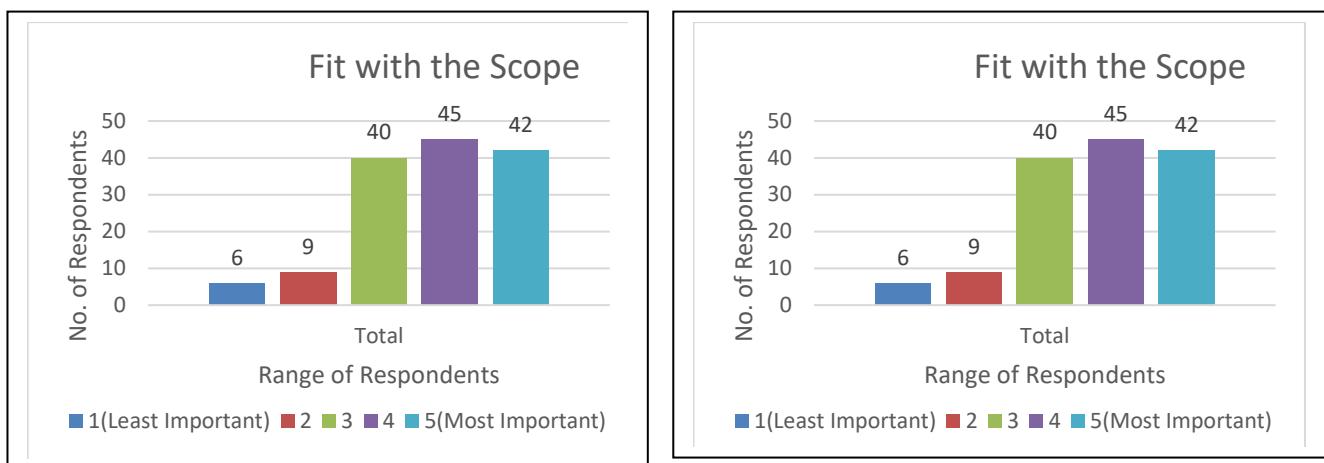
Citation analysis has become popular over the past four decades. As a general rule, a high-IF journal is considered the most prestigious one (Garfield, 2006). In our survey, 66.9% of people found the impact factor to be a very effective method to identify the quality of journals, followed by peer review at 45.7%, easy submission at 25.8%, fame at 19.2%, and nothing at 5.3%. The result depicts that most people investigate the IF and peer review of the journal before submitting manuscripts, and very few people submit an article without considering anything. Gaston et al. (2020) suggest editors and publishers focus on a journal's peer review process and impact factor if they want to maintain and grow submissions. This shows that most of the author's foundation for the selection of a journal is the IF and peer review practice of the journal. As IF is easier to quantify and most of the journals with high IF have a proper editorial board and systematic review process that maintain the quality of the paper and the prestige of the journal within the scientific community, IF and peer-reviewed journals are preferred. The survey conducted by Solomon and Björk (2012) found that the three most important factors authors take into consideration before submitting manuscripts are the subject area of the journal, the scientific quality of the journal in some cases as measured by the IF, and the speed of review and publication. This survey also indicates that IF and peer review are the most important factors that affect the selection of journals.



**Figure 6.** The respondent's responses to the choice of journals. The diagram renders that majority of respondents chose open access journal as the choice of journal for publishing their article.

On the question of whether publishers preferred their articles to be published in open access or paid journals, 137 (91.4%) respondents voted for open access and 12 (7.9%) for the paid journal (Figure 6). Open access means access to the full text of a scientific publication on the Web, with no other limitations than possibly a requirement to register, for statistical or other purposes that result in indexing by general-purpose search engines (Björk, Roos, & Lauri, 2009). The main reason for the expectedly high percentage of respondents' preference for open access journals is that open access journals don't charge readers for access. Readers can read, download, distribute, and print articles and other material freely. Some costs are met by charging authors for the publisher's services in making the material online. Generally, at the student level, they are unable to pay for the article they want to study, so more than 90% of respondents preferred open-access journals. The prime reason for publishing in an open-access journal is free access to information. Of the total respondents to the particular question, 32.7% gave a score of 3 with their preference for open access journals without APC (Article Publishing Charge).





**Figure 7.** Bar diagrams showing the respondent's responses to Open Access journal without APC (Article publishing charge), Open Access journal with APC (Article publishing charge), Fit with the scope, Speed of Publication, and Quality of Journal.

The respondents were given options from 1-5 (where 1 denotes to least important and 5 denotes to most important). There were five topics that the respondents were given to pick out the factor affecting the choice of the journal and the respondent were requested to choose one option from 1-5 depending on their importance to them.

As in figure 7, of the total no. of respondents, 32.68 % of respondents chose no 3(from rank 1-5) as the choice of the journal to be open access journal without article publishing charge (APC).

Similarly, 36.69 % of respondents chose no 2 (from rank 1-5) as the choice of the journal to be open access journal with article publishing charge (APC).

Furthermore, of the total no. of respondents 31.69%, 28.16%, and 29.57% respondents chose no 3,4 and 5(from rank 1-5) as the choice of the journal to fit within the scope. Likewise, 45.65 % of respondents chose no 5 (from rank 1-5) as the choice of the journal that has good quality.

Hence, from the survey, we found out that many respondents chose the journal which has open access and does not takes the article publishing charge. About 36.69 % of respondents gave little importance to the journal which takes article publishing charge. Among the respondent, a majority of people more than about 89.1 % respondent chose the topic to fit with the scope as one of the most determining the choice of the journal. Similarly, 45.65 % of respondents also preferred the quality of the journal as the major factor for the choice of the journal.

## 6. CONCLUSION

The survey conducted among 150 undergraduates from the fields of agriculture and veterinary science concludes that only very few students are involved in research activities, and even fewer have had their research articles published in journals. The preference of a journal among undergraduate publishers was based on its scope, article publishing charge, speed of publication, and quality. The majority of publishers preferred to publish in open-access journals with no publishing charges. The study shows that the quality of the journal is most often measured by the impact factor and peer review. These are the basic things that most of the respondents consider before submitting their manuscript to any journal. This gives the publisher an idea of how to increase article submissions by increasing the impact factor and systematic peer review. The submission of the manuscript and publication of the article are very low, which shows the feeble research activities done by Nepalese students. Lack of proper facilities, funding, and guidance might be the reasons why most of the students find publishing a difficult task, which has also limited

their interest in publishing articles. So, there is a need for integrating publication activities as a compulsory subject by providing proper resources from universities. By providing the right amount of support and guidelines, the research and publication activities of Nepalese students can successfully flourish. Recent updates in the B.V.Sc. and AH curricula of IAAS focus on practical-based education, which needs to evolve learning and assessment. Thus, with the update in the curricula of IAAS, many undergraduates have been successful in publishing their research and articles in quality journals in recent years.

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# CO-GRAZING OF SHEEP AND GOAT: BENEFITS AND CONSTRAINTS



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**Abstract:** Sheep and goats are frequently co-grazed all over the world and have been grazed for centuries. However, its advantages might not be well understood, and methods to maximize them have not received much research. The advantages of grazing sheep and goats mainly come from differences in preferences for specific plant species and parts, the ability or willingness to consume extremely unpopular forages, and the physical ability to access particular types of vegetation. Thus, with growing vegetation diversity and concurrently decreasing foraging overlap, the extent to which the overall stocking rate or carrying capacity of grasslands is larger than that of monoecious species increases. Projecting mono-species stocking rates will be made easier by prior knowledge of the specific grazing and animal circumstances. Estimates of nutritional overlap while co-grazing should be based on the most precise technique available, which in many cases may be prior experience or visual observation at various times of the day and throughout the year. It makes the unavoidable assumption that each animal species will consume an equal number of forage species, which is not necessarily the case. Additionally, the effects of stocking rates when the two species graze jointly versus separately are not taken into account. However, due to its simplicity, the method may be useful in field settings. It also highlights the significance of various browse plant species in grazing systems and the reasons why management practices are routinely used to maintain or improve their abundance.

**Keywords:** Sheep, Goats, Co-grazing

## 1. Introduction

Common use, dual the use, or multi-species grazing is the practice of grazing two or more species of cattle on the same piece of land at the same time in a single growing season (Byington, 1985). Sequential grazing (i.e., grazing by one species after another at different times) or co-grazing (i.e., grazing by two or more species of cattle and/or game animals at the same time) are two options for multi- or mixed species grazing systems. With land that has a diversity of plant species, these methods have the greatest impact on forage efficiency (Walker, 1994). According to the findings, the degree of dietary overlap in the intake of specific plant species and components is a significant factor determining the advantages of multispecies grazing. Consumption by sheep and (or) goats of plants toxic to or avoided by another ruminant species present is a similar feature of co-grazing, however, it is significantly more prominent with the presence of cattle (Walker et al., 1994). Ruminant species differ in their desire for, tolerance for, and/or capacity to graze grounds with various topography and terrain. Multi-species grazing can result in product diversity, as opposed to mono-species grazing. For multispecies grazing, greater biological efficiency, defined as the product from a system continuously, increases overall revenue and enterprise sustainability. Given the aforementioned potential benefits of co-grazing but the lack of widespread employment, there must be drawbacks or other limiting factors. One is a simple lack of understanding or appreciation of the characteristics. Additional production inputs for rearing tiny ruminants, such as extra fence needs and predation protection, as well as increased management skills and knowledge required for two or three species vs. one, might have a significant impact. There may also be a decline in production efficiency. For example, with restricted numbers of two or more co-grazing species compared to one in mono-species grazing, purchasing fewer amounts of health management supplies at a greater cost is an example. However, these issues seem of much lesser significance for the co-grazing of sheep and goats than of cattle and one or two species of small ruminants.

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## 2. Nutrient requirements

Nutrient needs are one of several elements that impact how sheep and goats respond to grazing together versus alone. When given the chance, Forbes and Provenza (2000) postulated that ruminants ingest varying amounts of one or more feedstuffs to repair or limit nutritional deficits and avoid excesses to reach low levels of metabolic discomfort. Furthermore, ruminants 'experiment' with varied quantities of certain feedstuffs, and maybe plant parts, in response to variations in the mix of available feedstuffs and fluctuating nutritional demands.

## **2.1 Energy**

Sheep have a lower ME requirement for maintenance (MEm) concerning body weight 0.75 than goats (NRC, 2007). NRC (2007) reviewed evidence that suggested there were no or minor variations across sheep breeds in MEm. In contrast, variations in MEm appear to exist between broad kinds (i.e., biotypes) of goats selected for certain productive objectives (e.g., dairy > Boer and indigenous). Many additional parameters, such as historical or current feed consumption, age, gender, body composition, grazing activity, and acclimation, affect MEm. It is unknown if such elements have different effects on sheep and goats. Though the methodologies for describing energy requirements for growth in sheep and goats differ (e.g., NRC, 2007), the requirements per unit of gain appear to be similar when tissue accretion is taken into account. Sheep have had a higher ratio of average daily gain (ADG) to DM intake (DMI) than goats in some cases (Al Jassim et al., 1991; Mahgoub and Lodge, 1998). However, this might be due to the goats' relatively modest growth potential or comparisons with dairy goat breeds with greater MEm than other genotypes (Urge et al., 2004; NRC, 2007). Animut et al. (2006) found that Boer goats and Khatadin sheep fed mixed forage concentrate diets had comparable ADG: DMI. Other productive tasks including lactation, fibre growth, and pregnancy are assumed to be equivalent between sheep and goats in terms of output, milk composition, birth weight, and so on, just as they are for growth.

## **2.2 Minerals and Vitamins**

Mineral and vitamin requirements of goats have not been studied as extensively as those of sheep, with in many instances recommendations for goats based on findings for other ruminant species. However, one notable difference in need of consideration for grazing is the greater requirement for Cu and higher dietary Cu level at which toxicity may occur for goats than for sheep (NRC, 2007).

## **2.3 Voluntary feed intake**

Voluntary feed intake is an important consideration when addressing the comparison between small ruminant grazing species. For example, Luo et al. (2004) with a database of treatment mean observations from the literature to develop feed intake prediction equations for goats of different genotypes, genders, and stages and levels of production accounted for the influence of requirements through an assumption of constant efficiency of whole-body energy metabolism (Tolkamp and Ketelaars, 1994). NRC (2007) cited some of the studies in which feed intake by sheep and goats has been contrasted, reporting higher intake by goats, the opposite, or no difference. It was concluded, in part based on SCA (1990), that clear evidence is lacking to recommend generalized intake differences between sheep and goats. In this regard, numerous experimental conditions influence such species comparisons, among genotypes.

## **3. Ingestive Behavior**

Ruminant species are commonly classified into morphological feeding types of grass/roughage

consumers or grazers, concentrate selectors, and ones with intermediate behaviours or mixed feeders (NRC, 2007). Cattle and sheep are categorized as grazers, and goats are usually placed in the intermediate group. Grazers have relatively short lips, broad muzzles, and a cornified tongue tip, designed for maximal intake of grass at low biomass (Van Soest, 1994; NRC, 2007). Goats have a fairly narrow but deep mouth opening and mobile lips and tongue that allow selective harvesting of particular plants and plant parts, such as leaves and twigs of woody plant species (Hofmann, 1989; Van Soest, 1994; NRC, 2007). Goats are quite agile compared with cattle and sheep, frequently using a bipedal stance and climbing to gain access to vegetation of interest (Sanon et al., 2007; Figs. 1 and 2). Compared with grazers, intermediate feeders have greater salivary gland weight relative to BW (Hofmann, 1989; Robbins et al., 1995). These glands produce a greater proportion of thin, proteinaceous serous saliva, which may play a role in helping counter some plant defensive chemicals such as tannins (Hofmann, 1989; Robbins et al., 1995). Relatedly, intermediate feeders and concentrate selectors have a relatively large number of HCl-producing parietal cells and a thicker abomasal mucosa, which may be adaptations to plant secondary metabolites such as for thorough liberation of proteins bound to condensed tannins in the reticulo-rumen (Hofmann, 1989).

Relative to body size, intermediate feeders have a smaller reticulo-rumen and omasum and a lesser number of omasal lamina than grazers (Van Soest, 1994). The small size of the reticulo-rumen and a larger opening of the reticulo-omasal orifice relative to body size for intermediate feeders versus grazers yield potential for a shorter ruminal retention time of particulates and a large size of particles exiting the rumen and appearing in feces, although such differences depend largely on the specific diets consumed (Hofmann, 1989).

Comparative chewing efficiency (CE) of sheep and goats was studied by Domingue et al. (1991). Ingestive CE was defined as the proportion of particles less than 1.0 mm in reticulo-ruminal boli present just after swallowing, and ruminative CE was termed as the proportion of particles greater than 1.0 mm in size following rumination. Ingestive CE was greater for goats than for sheep, whereas ruminative CE tended to be greater for sheep. Higher ingestive CE for goats could be due to more frequent chewing, a greater grinding surface area of teeth ( $\text{mm}^2/\text{kg}$  body weight 0.75), and/or differences in the structure of the skull and jawbones that determine forces applied during eating (Ulyatt et al., 1986). Of these factors, greater chewing frequency appears most important, since when Domingue et al. (1991) corrected for chewing frequency both ingestive and ruminative CE were similar between sheep and goats.

The botanical composition of the pasture or range affects the ingestive behaviour of sheep and goats. For example, Papachristou (1997) noted that goats had a greater biting rate compared with sheep when browse was the dominant forage available, and the opposite species difference existed when non-browse plant species were most prevalent. The biting rate for both species was greater for low versus high browse levels, with a considerably greater difference for sheep than for goats. This stronger negative relationship between shrub cover and biting rate for sheep than for goats reflects greater flexibility or adaptability of ingestive behaviour of goats to varied pasture conditions.

With declining bite mass, biting rate and grazing time increase up to certain levels to prevent or limit reductions in daily intake (Coleman et al., 1989). In accordance, though bite mass is often greater for sheep than for goats, in some cases greater rates of biting by goats have resulted in similar intake rates (Gordon et al., 1996). Nonetheless, a possible important performance effect of bite mass is through influence on grazing time, because of the strong positive relationship between the activity energy cost and grazing time (Osugi, 1974; Sahlu et al., 2004).

## 4. Forage Preference>Selectivity

### 4.1 Plant species

Differences between sheep and goats in dietary preference/selectivity with grass-legume mixtures have been inconsistent. In some cases, sheep have had a higher preference for legumes than goats (Collins and Nicol, 1987; Gurung et al., 1994; Penning et al., 1997), but with a tropicalgrass-legume pasture Norton et al. (1990b) noted the reverse. Similarly, with a variety of forbs and multiple species of grasses, Animut et al. (2005b) observed a greater preference of goats versus sheep for forbs and a greater preference of sheep for grasses. A sward characteristic that may contribute to such varied findings is the vertical distribution of different plant species about most natural or perhaps preferred methods of harvesting. That is, sheep appear to desire and strive to graze in the lower stratum or deep in the sward horizon (Collins and Nicol, 1986; Gong et al., 1996a,b,c). Conversely, goats generally have a shallower depth of biting and prehend from the top of the sward or horizon down, with biting and head movements horizontally or from side to side. In support, DM intake by goats decreases with decreasing pasture height more rapidly than intake by sheep (McCall and Lambert, 1987; Penning et al., 1997). Therefore, differences in preference/selectivity between species may be related to the vertical distribution of various plant species and plant parts rather than being attributed simply to plant species presence.

An alternate way of considering the more varied botanical composition of diets consumed by goats than sheep is simply because of greater flexibility. For example, Grant et al. (1984) found that the selectivity of goats for rushes (*Juncus effusus*) in a mixture with various grasses decreased as their proportion decreased. Likewise, the botanical composition of goat diets varies following seasonal availability. In this regard, diets of feral goats were 90% browse, 4% forbs, and 6% grass in winter when browse availability was high and 8% browse, 18% forbs, and 74% grass in the summer when the growth of grasses and forbs was rapid (Coblentz, 1977). Sheep also can modify the consumption of different plant species to changing seasonal availability but to a lesser extent than goats (Kronberg and Malechek, 1997; Papachristou, 1997). Stocking rate is an obvious factor affecting available forage mass, but it has not been extensively studied in regards to the co-grazing of sheep and goats. Animut et al. (2005b) observed that, although preference values for forbs differed between goats and sheep, as stocking rate increased and forage mass decreased preference values of both species for the most prevalent forb, ragweed (*Ambrosia artemisiifolia*), increased. The preference value for more preferred forbs decreased and for grasses was unchanged.

### 4.2 Plant parts

Both sheep and goats generally select for live or green forage and against dead plant parts (Hamilton et al., 1973; Gurung et al., 1994). Norton et al. (1990b) did not observe major differences between sheep and goats in the proportion of dead material in the diet, whereas Collins and Nicol (1987) reported less dead material intake by goats.

In most cases, leaves are higher in nutritive value than stems, and often leaves of legumes are of higher quality than of grasses. However, the nutritional value of different plant parts is not the only factor affecting selection. In a tropical grass-legume pasture, goats had a high preference for legume leaves and discriminated against both grass and legume stems (Norton et al., 1990b). In this same study, sheep had a relatively high preference for grass leaves and selected against legumes and grass stems. These species differences were presumably associated with the spatial distribution of different plants and their parts in the sward. Conversely, Collins and Nicol (1987) noted that goats preferred green stems to green leaves. In oat-ryegrass pastures, Norton et al. (1990a) reported a higher yield of residual grass stems in paddocks grazed by goats, suggesting low preference and selection, whereas sheep selected for both grass leaf and stem. Pfister and Malecheck (1986a), with a woodland grazing area, observed a low leaf-to-stem ratio during the dry season for both sheep and goats and inconsistent animal species differences throughout the grazing season.

### 4.3 Chemical composition

Both sheep and goats select diets higher in digestible organic matter and CP than the average of all available forage (Gurung et al., 1994; Papachristou, 1997; Hadjigeorgiou et al., 2003). Species differences in the chemical composition of selected diets are inconsistent, which may not be surprising given the significant impact of specific plant species available on selection. Also, species differences in dietary nutritive value are not necessarily associated with corresponding performance differences because of the importance of the level of feed intake and how quantities of nutrients consumed relate to requirements (Wilson et al., 1975; Gurung et al., 1994). In some instances, the dietary CP content has been greater for sheep versus goats (Gurung et al., 1994; Animut et al., 2005a), whereas the opposite has been noted in other studies (Wilson et al., 1975; Pfister and Malechek, 1986b). With grass–clover pastures (Hughes et al., 1984; Gurung et al., 1994) and woodland grazing conditions (Wilson et al., 1975; Pfister and Malechek, 1986b), diet digestibility was similar for sheep and goats. Sheep selected diets of higher in vitro digestibility than goats with tropical grass–legume pasture (Norton et al., 1990b) and semi-arid woodlands (Squires, 1982), whereas Papachristou (1997) found greater dietary in vitro digestibility for goats versus sheep. When browse plant species are available, dietary nutritive value has been greater for goats versus sheep because of greater preference and more efficient harvesting by goats (Wilson et al., 1975; Bartolome et al., 1998; Pfister and Malechek, 1986b) and generally high nutritive value of browse that varies less with time or season compared with grasses and forbs (Fadel Elseed et al., 2002). Season can have a large impact on the nutritional value of both sheep and goat diets. Normally the dietary CP content is greater in wet versus dry seasons (Pfister and Malechek, 1986b; Kronberg and Malechek, 1997). Browse availability has a major impact on dietary CP levels, particularly in the dry season, and resultant differences between sheep and goats depend on the availability of other plant species and the nature of specific browse plants available in regard to species differences in preference and physical capabilities of harvesting.

## 5. Grazing Behavior

Based on co-grazing sheep and goats, it appears that in some but not all instances grazing time is greater for sheep. With the variable conditions of the listed studies, it is not possible to discern why grazing time did or did not differ between species. Body weight, stage of maturity, and growth potential might be involved; in support, Penning et al. (1997) noted that scaling eating time by body weight 0.75 removed species differences. Ruminants display diurnal patterns in time spent grazing and in other activities such as ruminating, idle, and lying (Fierro and Bryant, 1990; Sharma et al., 1998). Research is not available to suggest appreciable differences between sheep and goats in diurnal patterns of grazing activities. However, differences would be anticipated under specific environmental conditions and adaptation of particular genotypes being studied. For example, a goat genotype adapted to hot climates might be expected to graze relatively more during the day with high temperatures than a sheep breed more appropriate for temperate climates, such as one selected for wool production. The season has profound effects on the grazing behaviour of sheep and goats. Kronberg and Malechek (1997) noted longer grazing time in the dry than wet season, whereas Sanon et al. (2007) observed the opposite. In the study of Kronberg and Malechek (1997), time spent foraging by sheep was longer than for goats in the wet season, but the length in the dry season was similar. It was proposed that similar grazing and rumination times in the dry season were consequences of the reliance of both animal species on browse plant species. Conversely, browse consumption during the wet season was relatively greater for goats. Schlecht et al. (2006) found that the distance travelled by both sheep and goats in the dry season was shorter than in the rainy season.

Stocking rate can affect grazing behaviour like differences between wet and dry seasons, although generalizations are again difficult because of the scarcity of available data and the number of influencing factors. In one particular co-grazing study with pastures containing a variety of grasses and forbs (Animut et al., 2005a,b), available forage mass and nutritive value decreased as the stocking rate increased. These changes elicited increased distance travelled and time spent grazing and standing and decreased time spent lying, ruminating, and idle by both sheep and goats.

### 5.1 Energy expenditure for activity

The magnitude and importance of MEa to the performance of small ruminants and the most likely determinants or highly related factors have been recently addressed by Lachica and Aguilera (2003, 2005), Sahlu et al. (2004), and NRC (2007). However, due largely to the difficulty in measuring energy expenditure, the effect of co-grazing sheep and goats on ME has not received considerable attention. Animut et al. (2005a, 2007) noted greater energy expenditure by co-grazing sheep versus goats on grass-forb pastures, but differences could be largely explained by the greater growth rate of sheep. It can be postulated that co-grazing versus mono-species grazing would not have a large impact on MEa unless it had a marked effect on preferred forage species and plant parts available for harvesting. In such instances a decrease in grazing time or increase in nutrient intake with constant grazing time might be expected, both of which would decrease the magnitude of MEa relative to energy intake and (or) animal performance. However, when significant overlap exists between plant material consumed by the two species, with appreciable competition, opposite effects seem likely.

## 6. Animal Performance and Economic Returns

### 6.1 Animal performance

Co-grazing of small ruminants can affect performance on an animal or land area basis. Co-grazing does not improve animal performance unless certain circumstances are met. Forage removal by one animal species should encourage the establishment of forage favored by and/or of high nutritional value to the other species, and stocking rates for each species should be designed to avoid dietary overlap and competition for specific plant species and plant parts. In this regard, Taylor (1985) summarized 20 years of data from the Texas Agricultural Experiment Station with land consisting of various grasses, forbs, and browse plant species and found that co-grazing of cattle, wool-producing sheep, and Angora goats increased the performance of sheep (ADG, wool production, and lamb crop percentage) but did not affect cattle or goat performance (ADG and mohair production for goats). Similarly, Walker (1994) concluded that with large vegetation diversity, many forage species of potentially high nutritive value will not be exploited unless animal species with varied preferences are present. Furthermore, complementary use of forage resources by more than one species with different dietary preferences and foraging behaviour increases performance per animal by at least one and often each of the co-grazing species.

In many instances, conditions are not conducive to increased performance per animal in response to co-grazing. As an illustration, consider oat-ryegrass pastures (*Avena sativa-Lolium rigidum*). Similar ADG were reported by sheep and goats grazing jointly and individually by Norton et al. (1990a). In a few rare instances, co-grazing has caused a species to perform worse. According to Walker et al. (1994)'s review, mixed grazing of sheep and cattle had the greatest positive effects on the performance of the sheep and, in some cases, decreased the performance of the cattle. This led the authors to the conclusion that, when forage was scarce, sheep were more competitive than cattle in forage consumption. Additionally, co-grazing sheep and goats in grass-clover pastures increased sheep performance but not goat performance as compared to separate grazing (Radcliffe et al., 1991). Due to the specific plant materials chosen and perhaps a lesser ability to avoid areas high in sheep versus goat excrement, goats may have a greater internal parasite burden when co-grazing with sheep than when grazing alone, which may be a factor in such findings with non-browse forages (Jallow et al., 1994). In this aspect, co-grazing's negative performance impacts appear to be the result of improper co-grazing settings, such as higher than ideal population densities of one or more species and/or poor species selection, which results in high levels of dietary overlap and fodder competition. In a similar vein, grazing land deterioration is frequently attributed to goats. This misunderstanding stems in large part from goats' ability to thrive and produce under challenging grazing conditions, which are often too challenging. Hence, with very high stocking rates and extremely low availability and(or) quality of forage, performance per animal should be greater for goats than for sheep when co-grazing (Kronberg and Malechek, 1997).

## 6.2. Economic returns

Although biological elements have attracted the greatest scientific focus, economic considerations are obviously of the utmost importance when decisions are made about the employment and techniques of multi-species grazing. In some places, land is a highly expensive input, so forage/livestock systems need to provide a lot of food per unit of land to have a good return on investment. Carrying capacity and overall productivity rise when the best co-grazing management practices are used. According to Glimp (1985), improved feed resource use with mixed species grazing (cattle and sheep) boosted offtake per unit of land by 15-20% as a result of an equivalent increase in carrying capacity.

Meyer and Harvey (1985) observed that even though one species may be significantly less economical than another, multispecies grazing in New Zealand increases economic returns when compared to mono-species grazing. In addition to the immediate advantages of higher net income, income diversity, and income steadiness within and between years, assessments of the economic benefits of multi-species grazing should take into account potential long-term gains in botanical composition, noxious weed control, range efficiency and health, and sustainability of livestock production (Ospina, 1985; Schuster, 1985). Although there are more inputs needed for multi-species grazing, they are comparatively more significant when taking into account co-grazing of small ruminants with cattle rather than mixed grazing of sheep and goats. That is, management practices and systems for sheep and goats are more similar than for small ruminants and cattle. Fencing requirements for goats are comparable to those for sheep, and both sheep and goats need protection from predation.

## 7. Summary

The differences between sheep and goats have an impact on how they graze. When it comes to eating specific plant species and components, as well as tolerance or readiness to consume less desired forages, different species have distinct preferences and skills. These variations can be used to co-graze for increased output per unit of land area under a variety of vegetation conditions, most notably the presence of a wide variety of plant species. Co-grazing will need to be carefully thought out and considered by knowledgeable advisors as well as input from producers, both at the start and throughout the grazing season, due to the study's complexity and the wide range of potential production scenarios.

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# WOUND HEALING

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**Abstract:** Wound healing is a dynamic process involving various cellular and molecular factors that contribute to the restoration of damaged tissues. The wound healing process is characterized by four well-defined phases: hemostasis, inflammation, proliferation, and remodeling. Disruptions in these phases can impede proper healing, leading to complications such as delayed healing, excessive scarring, or chronic wounds. Two primary methods of wound healing are identified: first-intention healing, characterized by organized granulation tissue and fibroblast activity, and second-intention healing, which involves granulation tissue formation in cases of extensive tissue loss. Various intrinsic and extrinsic factors influence wound healing. Intrinsic factors include diseases like diabetes, immunosuppression, and obesity, while extrinsic factors encompass dressing selection and nutritional status. Recent literature emphasizes the importance of dressing type in wound management, with adhesive and flexible dressings aiding in epithelialization and granulation tissue formation. Animal studies reveal differences in wound healing mechanisms, requiring tailored surgical approaches. Wound healing outcomes are influenced by factors like glucocorticoids and light treatments. Pathophysiology involves coagulation, inflammation, and repair, with cell and molecular components playing critical roles. Factors like integrins, cytokines, macrophages, fibroblasts, and growth factors contribute to hemostasis, inflammation, and angiogenesis.

**Keywords:** Wound healing, First-intention healing, Second-intention healing, angiogenesis

## 1. Introduction:

Wound healing is the process by which the body restores the injured part to its previous condition. It is a dynamic interactive process involving soluble mediators, blood cells, extracellular matrix, and parenchymal cells with four precisely and highly programmed phases: hemostasis, inflammation, proliferation, and remodeling (Singer et al., 1999; Guo et al., 2010; Gillitzer et al., 2001). Failure to heal wounds produces significant morbidity and mortality in animals. Generally, the disturbance in the above-mentioned precise and highly programmed phases leads to a decrease in the healing process (Menke et al., 2007) whereas excessive healing leads to the major complications of burns and scar formation (Greenhalgh, D. G. 2005). In basic terms, wounds heal in two ways: first-intention healing and second-intention healing.

### 1.1 First-intention healing

In first-intention healing, there is an organized pattern of granulation tissue and fibroblasts (Abramo et al., 2008). A surgical wound that has been sutured produces less hemorrhage during the post-operative time and heals by first intention (Waldron et al., 1998). In this type of healing, within 24 hours, neutrophils appear at the edge of the incision, and the epithelium at the edge of the incision begins to proliferate. By day 3, the neutrophils are replaced by macrophages, and granulation occurs. On the 5th day, collagen fiber dominates, the incision space is filled with granulation tissue, and there is minimal angiogenesis. During the second week, there is an end to vascular channels with continued accumulation of collagen and proliferation of fibroblasts. By the end of one month, inflammation stops, and there is a connective tissue scar (Vegad, 1995).

## 1.2 Second-intention healing

This type of healing occurs when injuries result in more extensive tissue loss, such as infractions, inflammatory ulcerations, and large surface wounds. In such a situation, repair by regeneration is minimal, and the defect is filled by granulation tissue (Vegad, 1995). Second intention healing is a safe, effective, and inexpensive alternative to surgical reconstruction after tumor excision, but it is also a time-honored method of wound management (Wilmink et al., 1999).

## 1.3 Factor affecting wound healing

Many intrinsic and extrinsic factors can affect the healing of surgical wounds (Morison, M. M., 1987). Intrinsic factors include diseases such as diabetes, immunosuppressive disorders, obesity, and the use of steroids. Extrinsic factors, including dressing selection and method of application (Quick et al., 2007). Diabetes patients' peripheral vascular systems are smaller and their responsiveness to growth factors is diminished, which makes angiogenesis more difficult and detrimental to wound healing (Brem et al., 2007). For bone healing, diabetics affect it through anabolic aspects (Graves et al., 2011). Similarly, immunosuppressive drugs and steroids like methylprednisolone form weak collagen and decrease the strength of wounds (Goldberg et al., 1983). Obesity induces vascular insufficiencies, cellular and compositional modifications, increased oxidative stress, alterations in immune mediators, and lengthens the healing time (Wilson et al., 2005). Nutrition is the extrinsic factor of wound healing. Protein calorie malnutrition and specific nutrients like Vitamin A, C, and arginine deficiencies interfere with wound healing by delaying the healing response by exerting an inhibitory effect (Mandal, A. 2006).

Macromolecules like hyaluronic acid and fibronectin have an effect on wound healing. When the concentration is low, there is increased chemoattraction, replication, and collagen deposition in the wound, which is crucial for the healing process (Doillon et al., 1986). Honey dressing makes wounds sterile and improves wound healing (Baghel et al., 2009).

## 2. Recent literatures (Literature review)

Dressing wounds have a good quality of healing because of their adhesiveness and flexibility. It was useful in the management of surgical wounds to avoid contamination and ameliorate the epithelialization rate and granulation tissue morphology of the surgical scar (Abramo et al., 2008). Covering a wound with a non-occlusive dressing in a 3-layer bandage led to greater wound retraction, modulated the rate of wound contraction, and promoted excessive granulation tissue. If excessive granulation tissue is excised regularly, bandaging has no effect on the total time to healing (Dart et al., 2009).

In cats and rodents, wounds close mainly by contraction of the wound edges, whereas in dogs, wounds close more by central pull and epithelialization (Bohling et al., 2004). Ponies have a more intense early inflammatory response to wounding than horses, which typically leads to more complete wound contraction and uncomplicated healing whereas horses, conversely, have a weak inflammatory response that persists and frequently leads to the formation of large amounts of poorly vascularized, exuberant granulation tissue, with the ultimate result being a more chronic and indolent course of wound healing (Bohling et al., 2006). Therefore, while undergoing surgical management of this animal, the surgeon should take care in their planning of treatment.

In tendons and ligaments, healing can be maintained by suturing them with strong inelastic suture materials. After post-operative surgery, earlier movement leads to a higher rate of healing as it orients the healing fiber better than long-term rest. This indicates that post-operative movement three weeks following surgery results in strong healing and also reduces the risk of suture rupture (Montgomery, R. D., 1989). Heavily contaminated and traumatized wounds generally heal by second-intention healing. The wounds of the limbs healed by second intention have more granulation than other parts of the body (Bertone, A. L., 1989). Exuberant granulation tissue is likely related to an imbalance in collagen synthesis and breakdown; this could be why wounds in the distal parts of the limbs take longer to heal

(Schwartz et al., 2002).

Subcutaneous tissue also affects healing in animals. Removal of soft cutaneous tissue delays the second intention of healing by reducing wound perfusion, granulation, contraction, and epithelialization in canine species but it is the opposite for feline species. This indicated that we should give enough care to subcutaneous tissue during the operation of the wound in felines (Bohling et al., 2006).

Glucocorticoids like dexamethasone improve healing by influencing the expression of key regulatory molecules like the pro-inflammatory cytokines interleukin-1 and tumor necrosis factor, keratinocyte growth factor, transforming growth factors 1, 2, and 3 and their processes like platelet-derived growth factors and their receptors, tenascin-C, stromelysin-2, macrophage metalloelastase, and enzymes involved in the generation of nitric oxide (Hans-Dietmar et al., 2000).

Leaser treatment of wounds has better collagen maturity than a normal wound, but it has no significant effect on healing (Cole et al., 2015). Treatment with high-wavelength light-emitting diodes produces the best activity of collagen I than narrow-wavelength treatments, which affect wound healing by first intention (Kerppers et al., 2015).

### **3. Patho-physiology**

When surgical or any type of wound occurs, it follows a programmed event, commencing with coagulation, through inflammation, and culminating in repair, but this all depends on the level of injury (Halloran et al., 2002). Healing gets disturbed due to persistent inflammation and is strictly guided by multiple chemical mediators and cytokines. The factors affecting wound healing should be strictly controlled; otherwise, they may lead to chronic wounds with fibrosis (Raffetto, J. D. (2016)). While interferon, integrins, proteoglycans and glycosaminoglycans, matrix metaloproteinases, and other regulatory cytokines play crucial roles in the regulation of healing mechanisms, cell organelles such as platelets, macrophages, leukocytes, fibroblasts, endothelial cells, and keratinocytes play pivotal roles in the inflammatory and proliferative stages of wound healing (Baum et al., 2005).

For the healing process, there should be adhesion and migration of cells, which are the vital processes of hemostasis. Many integrins (64, 21, and 31) help in cellular migration and adhesion. These three integrins have been reported to serve as receptors for laminin isoforms (Vanwaes et al., 1997). Integrin v3 helps in platelet aggregation. The cytokine TGF and the arachidonic acid metabolite 12(S)-HETE help in the regulation and functioning of integrins (Van Waes, 1995). Thrombospondin 2 plays an important role in healing by helping in the organization and vascularization of the granulation tissue by modulating fibroblast-matrix interactions in early wounds and regulating the extent of angiogenesis in late wounds (Kyriakides et al., 1999).

Macrophages and interleukins play an important role in wound healing by taking part in the inflammation and angiogenic processes. Macrophages are classified as pro-inflammatory and anti-inflammatory. They are activated by interferon regulatory factor 5 (IRF5) and IRF4. Pro-inflammatory macrophages play an active role in initial tissue damage, which increases phagocytosis. Anti-inflammatory macrophages predominate later in repair (Ferrante et al., 2012). Interleukins alpha and beta ( $\alpha$  and  $\beta$ ) and tumor necrosis factor-alpha (TNF- $\alpha$ ) are expressed in polymorphonuclear leukocytes, which stimulate the initiation of wound healing (Hübner et al., 1996). Essential fatty acids like linoleic and oleic acids help to release pro-inflammatory cytokines. Administration of these fatty acids stimulates DNA content and protein levels in wounds (Pereira et al., 2008). Leucocytes play an important role in inflammation and healing by producing multiple growth factors and phagocytic clearances during remodeling (Szpaderska et al., 2005). Arachidonic acid plays a role in wound healing by shifting pro-inflammatory prostaglandin (PG) E2 to anti-inflammatory PGD2. This shift is mediated by cyclooxygenase. PGD2 and its degradation products mediate their anti-inflammatory effects by binding to peroxisome proliferator-activated receptor gamma (Kapoor et al., 2007). -carotene plays an important role in the proliferative stage of wound healing by modulating fibroblast activity (Cheon et al., 2004). It stimulates epidermal turnover, increases the rate of re-epithelialization, and restores epithelial structure (Polcz et al., 2019). Fibroblast

growth factor-2 and vascular endothelial cell growth factor (VEGF) help in the proliferation of blood vessels in wound healing (Nissen et al., 1998). At this proliferative stage, there is a reduction in the area of tissue injury by contracting myofibroblasts and fibroplasia, but angiogenesis and epithelialization are present (Gonzalez et al., 2016).

Myofibroblasts are key cells for connective tissue fibrosis and remodeling. Its differentiation is regulated by cytokine and extracellular matrix (ECM) components (Desmoulière et al., 2005). The net result of ECM synthesis and degradation is remodeling (Vegad, J. L., 2007). Accumulated mast cells at the edge of the wound also help in the remodeling process (Iba et al., 2004).

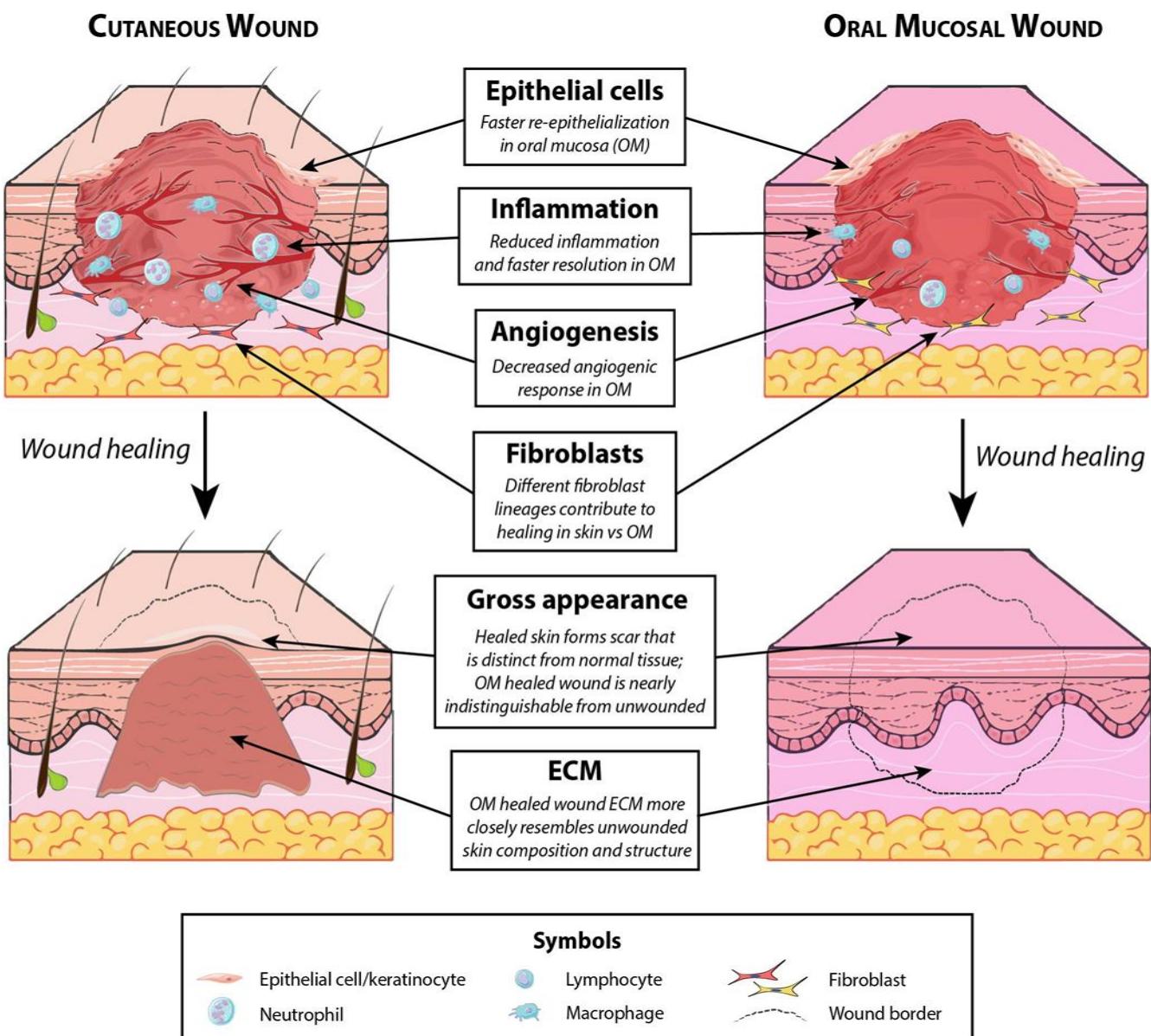


Fig.2. Spectrum of healing in cutaneous and mucosal wounds (desJardins-Park et al., 2019).

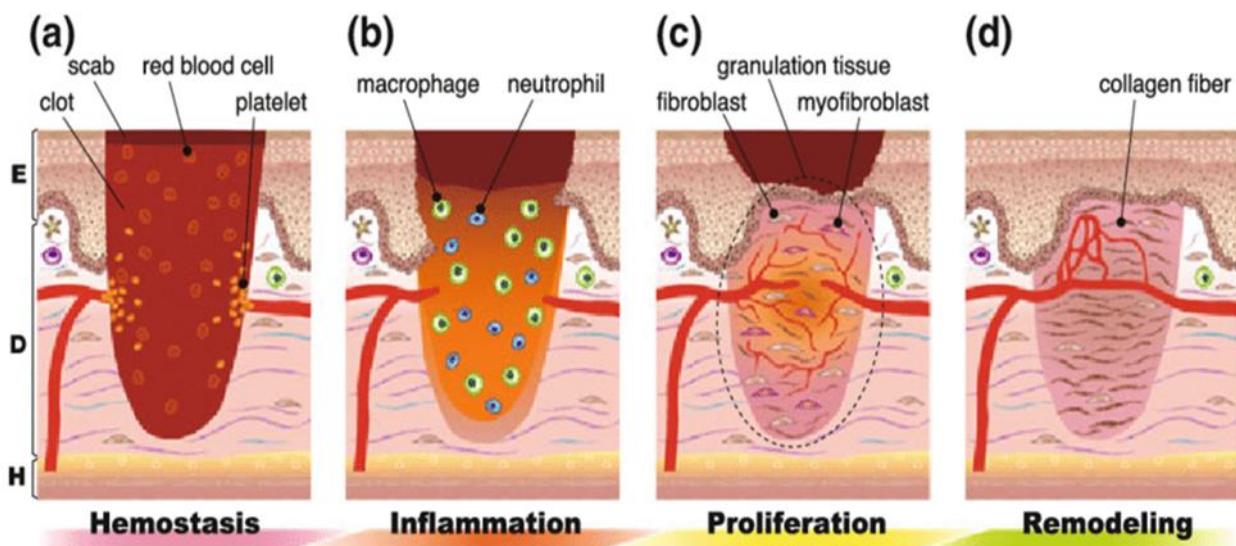


Fig.3. Wound healing Process

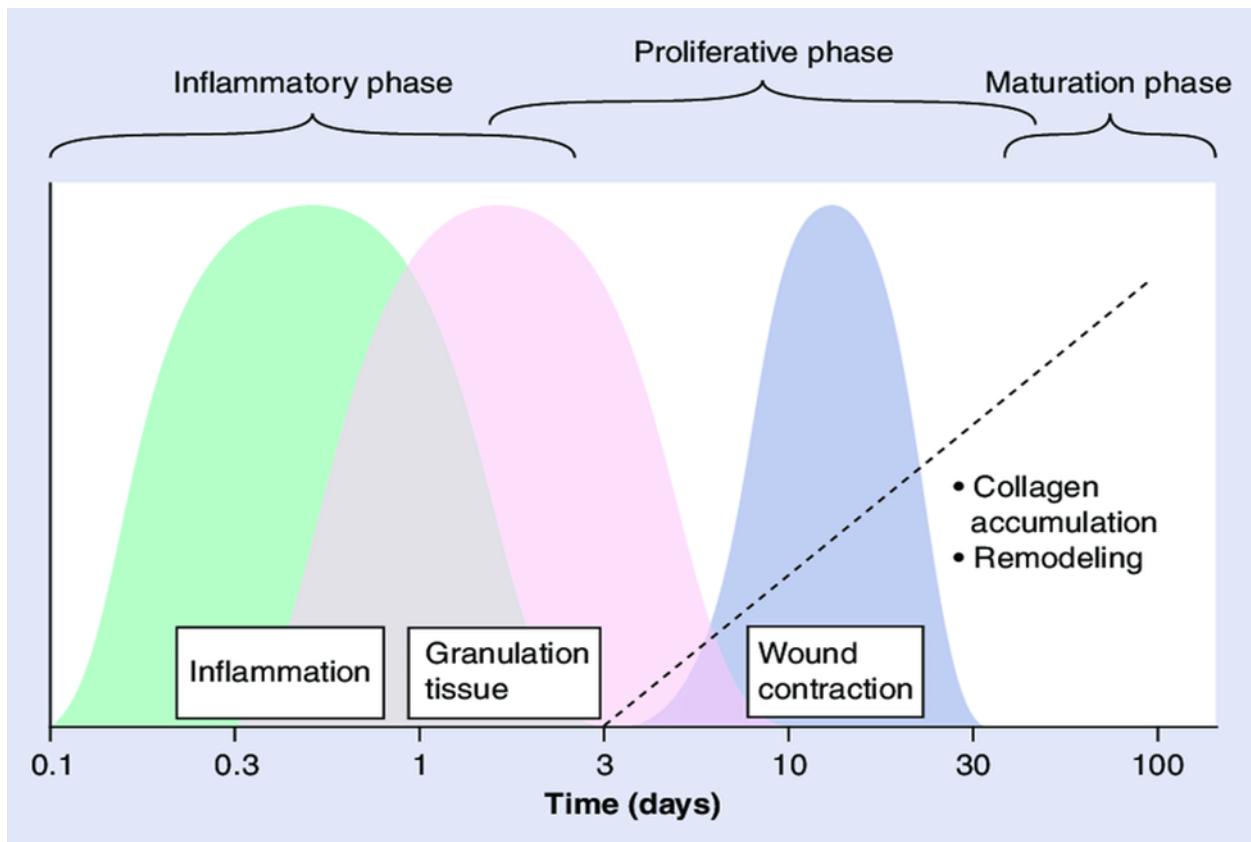


Fig.4. Overlapping phases of wound Healing

## 4. Clinical relevance

### 4.1 Gross findings

Grossly, healing tissue is hypercontracted and has hyperpigmented scars (Gallant et al., 2004). There is intensive vascularization of the undersurface of the wound bed (Babuccu et al., 2004).



Fig.5. Colour indicating healing wound



Fig.6. Healing wound gross view

#### 4.2 Microscopic findings

Microscopically, there is an increase in reactional mesenchymal tissue, granulation tissue, degeneration of the striated muscle fibers, dystrophic calcifications, fat necrosis, and coagulation necrosis (Babuccu et al., 2004). In the inflammatory phase of wound healing, if the exudate is viewed microscopically, it consists mainly of polymorphonuclear neutrophilic leukocytes, macrophages, fibrin, and free extracellular organelles from the disrupted inflammatory cells (Ross et al., 1961).

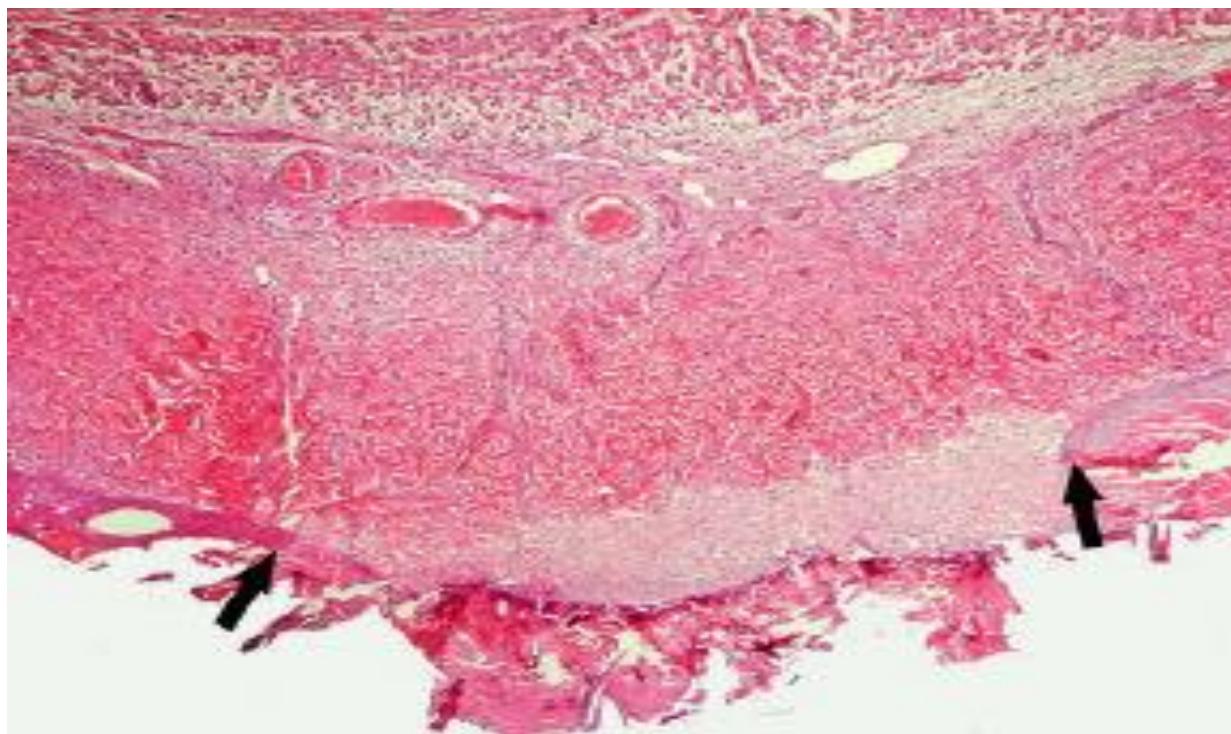


Fig.7. Arrow showing microscopic view of healing site

## 5. Conclusion

Wound healing is a complex process involving cellular and molecular interactions, resulting in tissue restoration. It involves distinct phases and requires a comprehensive understanding of wound healing dynamics. Recent literature highlights dressing types, movement, and light therapy interventions, but the underlying pathophysiological underpinnings remain crucial for effective management. Advances in wound healing have led to targeted therapies, informed interventions, and improved patient outcomes. Continuous research and collaboration among clinicians, researchers, and biotechnologists are needed to refine wound management and optimize healing processes for patients with compromised wound healing.

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# BACTERIOPHAGE THERAPY IN VETERINARY MEDICINE



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**Abstract:** The growing resistance of bacteria to antibiotics makes scientists look for other solutions to treat infections in this context. Common diseases may become incurable soon because there will not be drugs to which microbes are sensitive. Therapies with bacteriophages, which are bacterial viruses - most often highly specialized - raise hope. Bacteria are destroyed without the use of chemotherapeutic agents. Phage therapy is used in various areas of veterinary medicine: in aquaristics, poultry farming, as well as among small animals.

**Keywords:** bacteriophages, phage therapy, antibiotics resistance, bacteria

## 1. Introduction

### 1.1 Antibiotics and Bacteriophages

Phage therapy is used to fight viruses and infections caused by bacteria. It has been known since the late nineteenth century as an unidentified substance. It was already identified in the 20th century (Golkar et al., 2014; Duckworth et al., 1976). It was the golden era for antibiotics, but research on this type has diminished. However, this form of therapy, together with the increasing resistance of bacteria to antibiotics, began to be more appreciated and popularized in human and veterinary medicine (Aslam et al., 2018; Attenbury and Barrow, 2021). Treatment with "preventive" antibiotics in both fields of knowledge contributes significantly to the fact that antibiotics of "last resort" become insufficient to fight against bacterial disease. Nowadays, many studies and webinars talk about using something as obvious as identifying the strain that is the reason for the disease and determining its sensitivity to antibiotics (Aslam et al., 2018). Bacteria are still developing their resistance, but new antibiotics are not being introduced (Golkar et al., 2014). Although veterinary treatment is to blame for the increasing resistance of microorganisms, thanks to the development of phage therapy, veterinarians can support the development of animal treatment and reduce the use of antibiotics (Loponte et al., 2021).

## 2. STRUCTURE & FORMS

Bacteriophages are a specific class of viruses that infect and multiply in bacteria and archaea. They can attack and destroy prokaryotic cells, but they are not competent for eukaryotic cells. Virus particles consist of genetic material and are packed into protein structures called capsids. Phages are characterized by high specificity. They can be dosed in different forms, depending on which bacteria they are to deactivate. *Staphylococcus* sp. is used as a staphage, pyophage, and intestiphage; *Streptococcus* sp. is used as a streptophage in liquid; a pyopolyphage in tablets; *E. coli* is a polyvalent pyophage and coliproteal phage; *Enterococcus* sp. is an intestiphage (Gazeev, 2018; Attenbury and Barrow, 2021; Budynek et al., 2010; Pride et al., 2006; Gordillo and Barr, 2019).

### **3. APPLICATION**

The use of bacteriophages can have a significant therapeutic effect. In medical medicine, there has been a lot of experience with using phages in the treatment of bacterial infections. The antibacterial effect of bacteriophage drugs is due to the introduction of the phage genome into the bacterial cell. The virus (which does not attack eukaryotic cells - being an obligate microbe of bacteria) begins to multiply; its genetic information directs the cell to produce a new copy, ending with the lysis of the infected cell, releasing hundreds of new phages (Sulakvelidze et al., 2001). In this way, phages enter the environment of bacterial cells and re-infect other bacteria according to exponential growth, leading to their lysis. Viruses keep doing it until all of the bacteria have been completely destroyed, which then starts the inflammatory reaction. They are therefore effective therapeutic agents with exceptional bactericidal potential (Kutter and Sulakvelidze, 2005).

In some countries, phage therapy in animals is being used on an increasing scale. This applies primarily to poultry, cattle, and fish. Studies have shown very high effectiveness, close to 100%, in the treatment of salmonellosis in mice and chickens with phage therapy. This is important because the treatment of salmonellosis is highly resistant to antibiotics (Gazeev, 2018).

### **4. RISKS**

It is important to mention that phages are self-limiting. When the target bacterium is not present, replication is prevented, and the phages denature and disintegrate. Bacteriophages have different specificity. Bacteriophages can have varied levels of specificity. They might be type-specific, which causes bacteria of a certain type within a species to disintegrate, monovalent, which lyses bacteria only within that species, or polyvalent, which lyses bacteria from many species but of the same type. There is also a division into moderate and virulent phages (Kutter et al., 2005; Sedlacek and Chen, 2005). The use of the first form may lead to the transfer of virulence genes (after integration with the bacterial chromosome). If this happens, another strain of the bacteria may be created. This is what happened in the case of *E. coli* which became a more virulent state by treating them with moderate phages - the creation of the STEC strain (Allué-Guardia et al., 2014). For this reason, more virulent phages are preferred today. Phages also have a very wide range of applications when it comes to the method of administration (depending on the course of the group of bacteria); e.g., they can be administered in various parts of the food chain in salmonellosis, from treatments called "hygiene on farms" to the processing of carcasses in a slaughterhouse (Silankorva et al., 2012; Gazeev, 2018). Additionally, bacteriophages are effective against Enterobacteriaceae spp. but specifically against *E. coli* (Huff et al., 2003).

### **5. POULTRY**

The first applications of phage therapy in veterinary medicine took place at the beginning of the 20th century in France. This phage therapy was used against *Salmonella gallinarum*, isolated from an infected chicken, causing typhoid fever in birds. Another test also concerned with *Salmonella*, more precisely, *Salmonella typhimurium* (Smirnov et al., 2020) however failed because the wrong type of phage was administered orally and intra-peritoneally. In the late 1930s, it was changed by using a different phage type. An earlier experiment was repeated, and this time the bacteria were lysed (Fisk, 1938). It should also be noted that phage isolates of *Salmonella typhimurium* (type B1 Siphoviridae) showed very high lytic activity against another bacterium; *Salmonella enterica* (Gazeev, 2018). In some countries, they are introduced into veterinary practice and used more often, mainly to prevent epizootics (information from Russian researchers, Pleshakova and Stepanov, 2013). Scientists mentioned in the article about the results of these researchers In the experiment, after using phage therapy in poultry treatment on the 29th day of the study, *Salmonella enteritidis* strains were not detected (previously there were Fisk, 1938), and the average weight gain increased by 0.7 g per animal (Kolesnikova, 2017).

## 6. RABBITS & GUINEA PIGS

Phage therapy completely destroyed bacteria in less than a month, leading to growth in animals due to the absence of bacterial presence and its associated effects such as diarrhea. The therapy was attempted with varying success rates, including treatment of *E. coli* in rabbits and guinea pigs, treatment of streptococcal meningitis in rabbits, and *Salmonella dysenteriae* encephalitis in mice (Gazeev, 2018; Larkum, 1926; Eaton and Bayne-Jones, 1934; Alisky et al., 1998). There are also situations when phage therapy fails in one species but gives successful results in another; an example is the use of bacteriophages in rabbits, which did not give successful results, but in humans there was a cure. 10 types of phages were used in the treatment attempts of rabbits, from B1 to B10. It was injected intravenously. The lack of effects is explained by the fact that rabbits may have factors in their intestines that inhibit phage activity (Gazeev, 2018; Gamachu, Debalo, 2022).

## 7. TIME IS IMPORTANT

Another piece of information that was obtained during the trials of the therapy is that the earlier the treatment started, the better the result. An important aspect was also the fact that many of the described studies noticed it was crucial to neutralize the gastric acid before oral administration of the phages because at low pH they are inactivated. Phages are usually resistant to pH in the range of 5–9. They can be neutralized by administration of sodium bicarbonate (before phage therapy) or milk (Smith and Huggins, 1983; Hazem, 2002).

The timing of administration is very important. An example could be an experiment that was carried out on mice infected with vancomycin-resistant Enterococcus. One group produced 109 PFU of phages three times, 45 minutes after bacterial infection. This resulted in the complete recovery of the mice. Another group was given 18–24 hours after the phage infection, resulting in a recovery of 50% of the group (Biswas et al., 2002).

The group of month-old piglets was tested on the effectiveness of phage therapy in 2013. The research group was infected with *E. coli* bacteria experimentally and T4 phage from the Myoviridae family was used for therapy in a dose of 105 phages per gram body weight and above, which demonstrated an optimal cure with a dose of phage of 109/ml administered three times (Gazeev, 2018).

Smith and Huggins (1983) conducted research involving *E. coli*-infected calves, utilizing phage therapy on a small group of 9 animals in which the control group experienced a 93% mortality rate due to *E. coli* infection, whereas the treated group showed *E. coli* presence without surpassing the pathogenicity threshold, indicating partial containment of the bacteria through phage therapy. Barrov and Doothill (1997) carried out another experiment involving calves, infected with *E. coli* 2 hours after birth, and 8 hours later, the study group (comprising 4 subjects) received phages intramuscularly in the thigh. In the control group, acute septic reactions developed within 18–36 hours of bacterial dosing. In the research group, 75% of the subjects remained healthy, with only one individual displaying mild illness (Barrov and Doothill, 1997).

In today's well-known organic dairy and meat farms, where the prohibition on the use of antibiotics is one of the prerequisites for this type of business, the elimination of antibiotics is also crucial. Mastitis in cows is one of the major issues facing dairy farms (Horiuk, 2018). Thanks to bacteriophages, treatment can make milk safe for consumption quickly. Mastitis is caused by infectious pathogens, mainly *Staphylococcus aureus* and *Streptococcus agalactiae*, as well as environmental pathogens such as *Streptococcus dysgalactiae*, *Streptococcus uberis*, *Enterococcus sp.*, *Escherichia coli*, *Klebsiella*. Antibiotic therapy plays a very important role in controlling mastitis currently and treatment depends on the susceptibility of a given microorganism to antibiotics (Horiuk, 2918; Lassa et al., 2013).

Phage therapy has been used experimentally to treat hamsters infected with *Clostridium difficile* in the stomach. At the same time, the research group was given phages and additional doses of phages were given after eight hours. In the control group all animals died. In the treated research group only one died, the rest survived (Nale et al., 2016).

Another example of the use of phage therapy is in fishkeeping. Research began on such diseases as aeromonosis and pseudomoniasis. Although in this case the therapy is still under research, it is suggested that this method of treatment brings positive effects (Gazeev, 2018). The treatment of bacteria such as *Pseudomonas pleoglossicida* and *Lactococcus sp.* has been described as having promising results while fully protecting the health of the fish. Many strains of bacteria from the *Aeromonas* family can cause aeromonosis which makes its treatment not easy as not all of them respond to a given antibiotic. Additional problem is that bacteria in aquaristic environments mutate fast and have bigger antibiotic resistance. Antibiotics intended to fight aeromonosis are used in treatment together with compounds containing iodine and formalin. They are not safe for fish because they inhibit their intestinal microflora, and have hepatotoxic and nephrotoxic effects. Phages are non-toxic and are dedicated to a specific pathogen or group. Some phage therapy is still in demand (Pereira et al., 2022; Cruz-Papa et al., 2014). Since 2013, research has been carried out on the phage therapy of bacterial fish disease RTFS (rainbow trout fry syndrome) which is caused by *Flavobacterium psychrophilum*. Research is even more intensive because one of the serotypes is characterized by a mortality rate of 90%, the disease can also be transmitted vertically. Additionally, the bacterium is increasingly resistant. Treatment with kanamycin has already been ruled out as it has acquired complete resistance. Treatment with gentamicin and streptomycin is not very effective. It remains sensitive to tetracycline, erythromycin, and oxolinic acid. However, due to rapid mutations, finding the right phage is the most important to stopping the disease(Stenholm et al., 2008; Castillo et al., 2012; Preena et al., 2020).

## 8. VACCINES

Including phages in vaccines is yet another application for them. Phages create the capsid of host proteins. It enables the display of proteins on virion particles. The characteristics of protein are identical to those of a bacterial protein. Bacteriophage-based vaccines are developing into a reliable replacement for conventional vaccines. Such phage particles also have the capacity to promote humoral and cellular immunity. Currently, an opportunity is seen in the improvement of molecular tools that allow the manipulation of phage genomes due to phage display technology (Kaur et al., 2012). Although phage vaccines were firstly tested for humans (first study in 1988, de La Cruz et al., 1988), veterinary medicine may have more benefits now. It is feasible since there are fewer restrictions on employing these medications in the veterinary industry. Currently, three different vaccine types are used: flag-displayed vaccines (I), DNA bacteriophage vaccines (II), and hybrid phage vaccines (III), the latter of which combines elements of the first two. According to sources, the most developed technology is the presentation of antigens on the bacteriophage surface. One of the main tasks of the research area is finding solutions for the profitability of vaccine production in relation to its effectiveness. The presentation of the phage method is associated with the identification of the antigen and phage selection. Different types of bacteriophages are used in medicine, depending on the type of bacteria. The most commonly used ones are presented in the table below.(de la Cruz et al., 1988)

## 9. CONCLUSIONS

The use of phages as an alternative therapy sometimes has a higher level of effectiveness than antibiotic therapy. It is the future of medical science, and it will support or balance antibiotic therapy. Bacteriophages have several advantages: they do not inhibit the normal microflora, do not cause allergic reactions, act where there is inflammation, and have a high concern for patients' health (narrow-spectrum phages can select resistant mutants of the target microorganism). The phages do not destroy the good microflora of the body as antibiotics do. Bacteriophages do not contain toxic substances. They "die" themselves after the destruction of the bacteria. The use of this therapy has not caused any side

effects or contraindications so far. Bacteriophages can cooperate with other drugs because they do not react to them. Important note: phages can overcome the resistance that bacteria develop against them due to their continuous adaptive capacity (Kutateladze and Adamia, 2010; Cisek et al., 2016; Jault et al., 2019; Romero-Calle et al., 2019).

The use of phages with high specificity can destroy only specific species, types, or mutations of bacteria, leaving the rest unaffected due to structural differences already present at the level of strains. However, before phage treatment, it is necessary to identify the type of bacteria being dealt with. Unfortunately, many humans and veterinary doctors do not do this in their everyday practice, leading to the prescription of broad-spectrum antibiotics and the increasing antibiotic resistance of bacteria. Another disadvantage is the potential release of bacterial toxins during cell lysis in weakened organisms, which may cause negative effects on the body. Most defects can be eliminated by scientific work, looking for solutions conducive to the possibility of treating more diseases caused by bacteria that do not yet have "their own destructive bacteriophages." Creating phage mixtures for several types of these microorganisms is also valuable. Phage therapy seems to be a salutary means to combat the increasing resistance to antibiotics. Additionally, it shows how important it is to identify bacteria before starting their treatment.

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# SURGICAL MANAGEMENT OF BILATERAL CHERRY EYE IN A YOUNG DOG: A CASE REPORT



R. Bastola\*

**Abstract:** A prolapsed gland is the most common disorder of the third eyelid gland in young dogs. It appears as a pink mass in the medial canthus of the eyes, thus known as the "cherry eye." A young male Shih Tzu, four months old was presented with bilateral pink masses on the medial aspect of both eyes, which were noted for a month. After a thorough examination, the diagnosis was "cherry eye." The prolapsed glands were surgically repositioned using Morgan's pocket technique. The puppy made an uneventful recovery in 15 days. No recurrence of prolapsed nictitating glands was seen.

**Keywords:** Cherry eye, third eyelid, nictitating gland, Shih Tzu, Morgan's pocket technique

## 1. Introduction

Prolapse or eversion of the gland of the third eyelid is caused by defects in the attachments between the third eyelid gland and periorbita (Fossum, 2013). Clinically, it appears as a pink mass protruding from the eyes, hence the name "cherry eye." The pathogenesis has not been determined yet, but it could be associated with primary or secondary adenitis, fascial attachment abnormalities, or specific pathogens affecting the gland. It is believed that both lacrimal and nictitating glands are involved, which are major glands responsible for tear production. The cherry eye, left untreated, will result in keratoconjunctivitis sicca. The cherry eye could be unilateral or bilateral. This can occur at any age but is most commonly found in puppies less than a year old (Raza et al., 2013). The predisposed breeds are Shih Tzus, English Bulldogs, French Bulldogs, Beagles, Pekingese, Great Danes, Boston Terriers, English, and American Cocker Spaniels, and Lhasa Apsos (Fossum, 2013; Levitt et al., 2023). The condition is more common in dogs than cats.

There are various methods to correct the cherry eye. In this particular case, the bilateral cherry eye was successfully managed using Modified Morgan's Pocket Technique.

### 1.1 History

A four-month-old male Shih Tzu puppy was presented at the WVS ITC Ooty clinic with the complaint of a pink mass protruding from the medial region of both eyes for the past 15 days. The puppy had mild discomfort due to irritation in his eyes. The puppy was up-to-date on vaccinations and deworming.

### 1.2 Physical findings

Body weight: 4.8kgs Temperature: 100.5F HR: 100bpm RR: 24/min MM: pink CRT: <2s

LN: normal Dehydration: <5% Demeanour: Bright alert and responsive

	
<b>Figure 1 Prolapsed third eyelid gland</b>	<b>Figure 2 Bilateral Prolapsed third eyelid gland</b>

### 1.3 Ophthalmic Examination

- 1) Shimmer Tear Test: 15mm/min OD, 12mm/min OS
- 2) Fluorescent dye test: OD OS negative
- 3) Vision intact bilaterally
- 4) Prolapsed third eyelid gland: bilateral

### 2. Diagnosis: Cherry Eye (Prolapsed Third Eye Lid Gland)

**Differential Diagnosis:** Third eyelid gland cyst formation, Inflammation and Third eyelid neoplasia (Levitt et.al., 2023).

### 3. Treatment

Among all other methods, repositioning of the prolapsed gland is the gold standard for management (Oguntoye et al., 2022). Surgical replacement of the prolapsed gland in its normal anatomical position is the best course of action to cure this disorder. Morgan's Pocket Technique has been successful and devoid of permanent damage to the tear-producing glands, i.e., the lacrimal and nictitating glands. The surgical correction happens on the third eyelid, leading to minimal trauma to the cornea and eyeball if done with care. **Surgical anatomy:** The nictitating membrane is a roughly triangular fold of mucosa located in the medial canthus. The base of the triangle is its free or leading margin. Bulbar (posterior) and palpebral (anterior) surfaces are confluent with the conjunctival mucosa. A T-shaped piece of cartilage lies within the membrane, with the “arms” of the T along the leading margin. This cartilage supports the membrane, helps support the corneal contour, and protects it. The superficial gland of the nictitating membrane (nictitans gland, gland of the third eyelid) surrounds the base of the cartilage and produces seromucoid tears. Excretory ducts leave the gland and emerge in the middle section of the bulbar mucosal surface. The third eyelid gland can be a major or minor producer of the aqueous tear film layer. The blood supply to the nictitating membrane comes from branches of the internal maxillary artery. The nictitating membrane is important in protecting the cornea, spreading the tear film, and contributing the essential aqueous layer to the preocular tearfilm. Hence, saving the prolapsed gland and repositioning it is the best choice.

### **3.1 Anesthesia consideration:**

The puppy had CBC, LFT, and KFT within normal limits.

The puppy was fasted for only 6 hours following AAHA Guidelines.

### **3.2 Premedication:**

Sedation with Dexmedetomidine(@5mcg/kg)+ Butorphanol(@0.2mg/kg) IM

After 10 minutes, the puppy was sedated. With minimal restraining, an IV catheter was placed on the cephalic vein on the left forelimb and induced with diazepam (0.25 mg/kg) and propofol (1 mg/kg) slowly over a minute. After induction, the puppy was intubated immediately using an ET tube of 4.5 ID.

Pre-operative antibiotic: Amoxicillin & Cloxacillin (@20mg/kg) IV

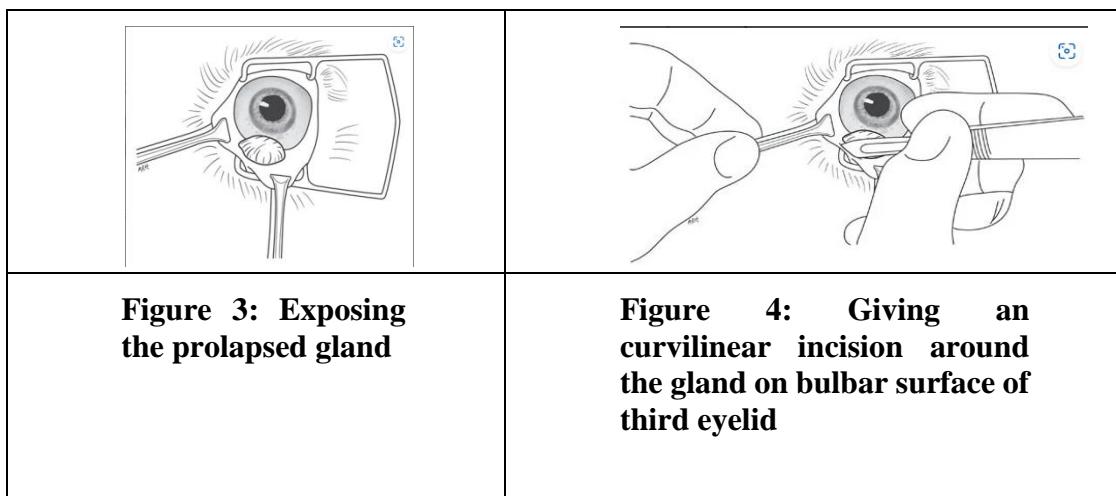
Analgesia: Meloxicam (@0.2mg/kg) & Lignocaine (@1mg/kg) IV

The periorbital hair was not clipped. The eyes were flushed with sterile water. For local anaesthesia 2% proparacaine was instilled in both eyes 10 minutes before surgery.

The eyes were kept lubricated throughout the surgery with sterile water.

### **3.3 Procedure:**

After preparing the eyes with a dilute povidone-iodine solution (1:50 dilution) and rinsing the eye with sterile water, the eyelid speculum was placed to retract the eyelids. The stay sutures were placed at the medial and lateral edges of the third eyelid to prevent trauma by thumb forceps, and the third eyelid was everted to expose the bulbar conjunctival surface. A curvilinear incision distal to and proximal to the prolapsed gland with a slit knife was made, but the incisions were not connected to allow free flow of tear out of the pocket (Figure 6). With the help of stay sutures, the third eyelid was averted for more exposure, and the incisions were undermined using tenotomy scissors to create a pocket as well as for ease in suturing. For suturing the incisions, absorbable 5-0 vicryl was used.



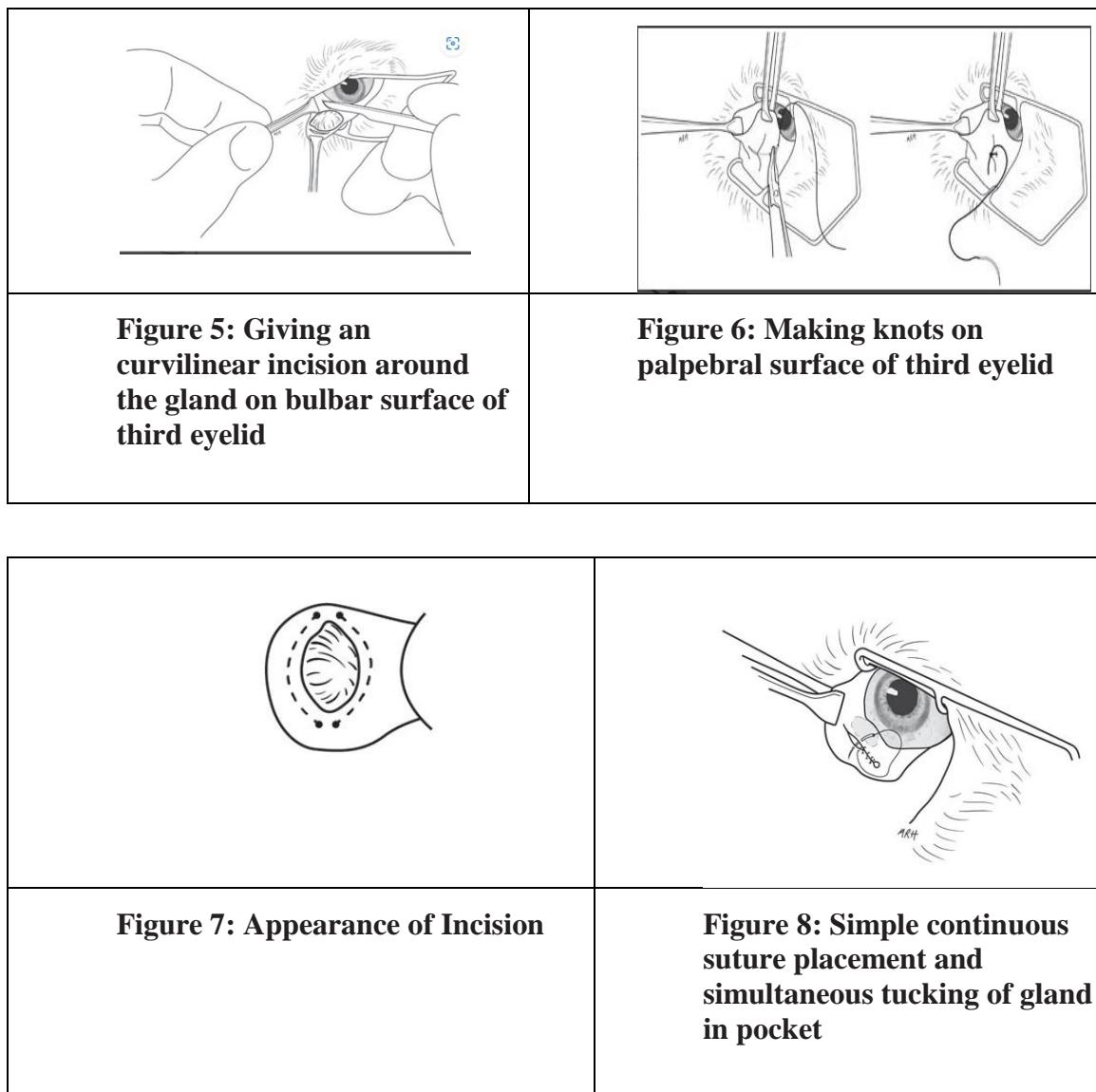


Image Source: Skills Laboratory: Prolapsed third eyelid gland replacement ([dvm360.com](http://dvm360.com))

An anchoring knot was made on the anterior (palpebral) surface of the eyelid. The outer edge of the incisions on both proximal and distal parts were sutured together in a simple continuous pattern on the bulbar conjunctival incision, and the ending knot was made on the anterior surface (palpebral) of the third eyelid. Simultaneously, the prolapsed gland was tucked inside the pocket while suturing. Just below the suture line, two simple interrupted sutures through a tucked nictitating gland were placed with their knots on the palpebral surface of the eyelid for extra security to anchor glands in the pocket. This was the modification applied by the surgeon as per their experience.



**Figure 9: Surgical set**

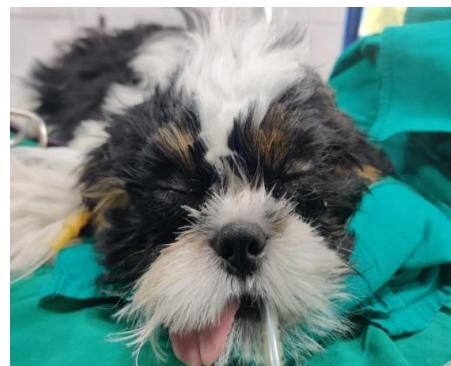


**Figure 10: Post-operative appearance of third eyelid on left eye**

The lubrication of the eyeballs was done by instilling sterile water in the eyes throughout the surgical procedure. Autoclaved Q-tips were used to clean and soak the bleeding from the incision, as the gauze would traumatize the cornea. Electrocautery was avoided as it may result in corneal trauma. The bradycardia due to the occulo-cardiac reflex was kept in check by continuous monitoring of the heart rate.



**Figure 11: Post-op appearance of Third eyelid Right eye**



**Figure 12: Post-operative image of puppy**

#### **Post-operative care:**

1. Elizabethan collar was placed for 14 days
2. A course of topical antibiotic(plain ciprofloxacin) eye drops were advised for 7 days
3. Carboxymethylcellulose eyedrops were advised for 14 days
4. Pain management was done by meloxicam @0.2 mg/kg p.o OD for 3 days

5. Physical follow-ups were done every 3 days for two weeks followed by telephonic updates till three months post-surgery.
6. The surgical wound healed properly and no eye gland prolapse was noted



**Figure 13 Post-operative  
Day 10**

#### **4. Discussion**

The gland of the third eyelid produces a large portion of the aqueous tear film, about 30% to 40%; hence, if excised, keratoconjunctivitis sicca (KCS) gets developed, as determined by the Schirmer's tear test (Lone et. al., 2020). The gland replacement technique reduces the incidence of keratoconjunctivitis sicca (KCS) later in life (Fossum, 2013) as the gland is replaced back in its anatomical position, allowing the gland to continue secreting tear film. Thus, gland repositioning or replacement surgery is preferred to gland removal surgery.

The goals of surgical treatment include replacing the protruding gland behind the leading margin of the nictitans, maintaining the nictitans' mobility, and preserving glandular tissue and excretory ducts. Anchoring procedures interfere with mobility, whereas pocket procedures may damage excretory ducts. Anchoring procedures may be more successful for more extensive and chronic protrusions. Pocket procedures may be more effective in young animals and those with mild protrusions (Fossum, 2013).

#### **5. Conclusion**

The nictitating gland is important to maintain tear film and lubrication of the eye which protects cornea from drying out and further damage. In past years the prolapsed gland used to be removed which was outdated after the discovery of the importance of the nictitating gland. Morgan's pocket technique has good outcomes and client satisfaction which makes it the author's choice of treatment protocol for managing Cherry eye in dogs.

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# IMPACT OF DAM CONSTRUCTION ON MIGRATORY FISH SPECIES OF NEPAL

N. Khanal<sup>\*1</sup>, A. Basnet



**Abstract :** *Anthelmintics have been used as a major control method for parasites in livestock, horses, and captive wild ungulates. But the continuous irrational deworming approaches have led to the grave issue of anthelmintic resistance leading to the significant loss of productivity and negative effects on animal health. The fecal egg count reduction test (FECRT) is one of the simplest and most effective methods to detect the resistance of the anthelmintics. Resistance to major groups of anthelmintics drugs has been reported from various parts of the world and recently from Nepal also. A proper view and approach regarding the resistance are seen to be the utmost need in today's scenario. Parasite control scheme should not be based on the sole use of anthelmintics but rather combined recipes of management practices, and nutrition is suggested. Proper nutrition, sanitation and periodic deworming strictly based on advanced scientific strategy aid in combating the serious issue of anthelmintic resistance. This paper aims to view the factors leading to the anthelmintic resistance, their detection on time, and scenarios with approaches to tackle them.*

**Keywords:** anthelmintic, resistance, goat, horse, captive ungulates, fecrt%, management

## 1. Introduction

Nepal is a landlocked country that covers about 2.5% of the total freshwater in the world. It consists of more than 6,000 small and large rivers, which have great potential for electricity production and are inhabited by 252 fish species (Shrestha, 2019). Multiple dams have been constructed in the rivers of Nepal to divert water for power generation and irrigation. The development of waterways or dam construction without doing an environmental impact assessment (EIA) and fish ladder construction has changed the physical and chemical parameters of river systems and poses a great threat to migratory fish species. Fish habitat is damaged by a large hydropower project or a poorly installed culvert that changes the running water body in a reservoir. It changes the freely flowing river into a reservoir. Thus, habitat destruction caused by dam construction is responsible for declining native fish species in Nepal's rivers and rivulets (Prasad, 2020). Some native fishes, such as Glyptothorax sps., Garra sps., Schizothorax sps., Tor sps., and Neolissochilus hexagonolepis, that need high water current, cold, shallow, clean, and oxygen-rich gravel substrates, generally do not grow and survive well in reservoirs and may be abolished (Bowen et al., 2003). Moreover, the development of hydropower not only affects fish migration but also affects water quality and quantity and subjects fish to direct harm and anxiety (Simonov et al., 2015). Example: Short-distance (Schizothorax sps, Neolissochilus hexagonolepis, Tor sps, etc.) and long-distance (for example, Anguilla bengalensis and Bagarius sps.) migratory fish species have been found to be affected by dams (Asian Development Bank, 2018; Shrestha, 2019). Fish ladders are present in some dams in Nepal. But most of them are non-functional. Only three ladders, i.e., in Babai, Aandhikhola, and Chandranahar, are found to be functional during the monsoon.

## 2. Objective

1. To gain knowledge about short and long distance migratory fish species.
2. To know about different impact of dam construction on migratory fish species.

### 3. MATERIALS AND METHODS

Secondary Data Collection from various articles and sites reviewing them and finally summarizing them.

### 4. Result

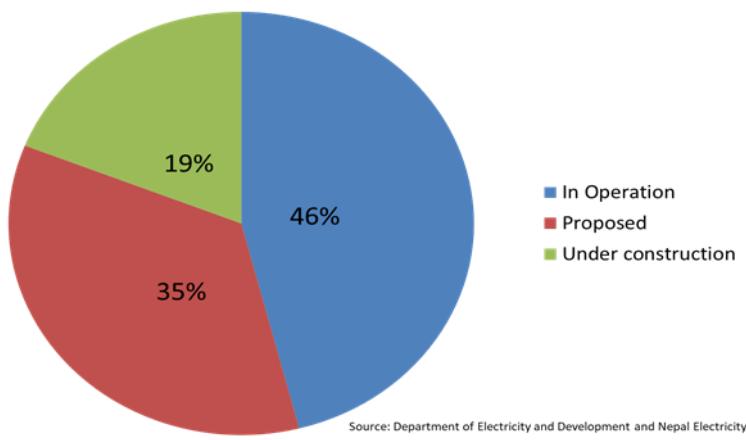


Fig 1: Hydropower Projects of Nepal

Direct Impact	Indirect Impact	Secondary Impact
Conversion of lotic into a lentic pond ecosystem	Habitat destruction	<ul style="list-style-type: none"> <li>• Eutrophication of reservoir</li> <li>• Effects on exotic and invasive fish species</li> <li>• Effects on fish health</li> </ul>
Downstream riverine environment from dam will be converted into dry stretch	<ul style="list-style-type: none"> <li>• Habitat destruction</li> <li>• Destruction of spawning bed</li> <li>• Impacts on fish breeding</li> <li>• Obstruction of fish migration</li> </ul>	<ul style="list-style-type: none"> <li>• River aggradation</li> <li>• Increase in shore erosion</li> <li>• Change in water quality</li> </ul>
Fish migration will be obstructed	Impacts on fish breeding	Decrease in fish population

Fig 2: Overall Impact of a Dam on its Aquatic Environment

Scientific Name	Local Name	IUCN Red List Status
<i>Tor putitora</i>	Sahar	Endangered
<i>Tor tor</i>	Ratar/Sahar	Endangered
<i>Schizothorax richardsonii</i>	Buchhe Asala	Vulnerable
<i>Labeo pangusia</i>	Thed	Near Threatened
<i>Bagarius bagarius</i>	Gounch	Near Threatened
<i>Bagarius yarrelli</i>	Gounch	Near Threatened
<i>Neolissochilus hexagonolepis</i>	Katle	Near Threatened

Fig 3: Nepalese migratory fish species in the IUCN Red List



*Anguilla bengalensis* (long-distance migratory fish Raj Bam) from Kali Gandaki. The fish is believed to have spawned in the Bay of Bengal and traveled to freshwater rivers such as Kali Gandaki as its habitat. Dam has obstruct its migration



*Bagarius yarrelli* (long-distance migratory fish) from Kali Gandaki. The fish is one of the biggest freshwater catfish, although little is known about its biology and spawning behavior (photo by D.B Swar). Dam has obstructed its migration.

## 5. Conclusion

Dam construction brings changes in river morphology and water quality that directly or indirectly affect migratory fish species. In Nepal, only 10 out of the existing 86 HPPs have a fish passage facility. Out of these, only three fish ladders are functional. Thus, to maintain the population of native migratory fish species, the main aspects that need to be considered during fish ladder development are the life stage requirements of the different fish species, including migration periods, the characteristics of the dam and the fish passage design, the availability of water through the fish passage, especially during the migration period of the different species, and the location of the fish passage under consideration in relation to the complete HPP system. Apart from this, a hatchery must be established in order to initiate the breeding of local fish species, which are more likely to be affected by dam construction.

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# LOW PATHOGENIC AVIAN INFLUENZA (LPAI) PREVALENCE AT NATIONAL AVIAN DISEASE INVESTIGATION LABORATORY (NADIL), BHARATPUR, AND THEIR EPIDEMIOLOGICAL STATUS AROUND THE AREA



S.P. Bhusal<sup>1\*</sup>, M.P. Gupta<sup>2</sup>

**Abstract:** Low pathogenic avian influenza virus (LPAIV) possesses low virulence capacity, causing a milder type of disease or asymptomatic disease in poultry. The severity can go to a higher level or even transform into a novel virus with high pathogenicity and public health risk due to genetic rearrangement and recombination. In this study, we tried to observe the prevalence and epidemiological status of LPAIV at the National Avian Disease Investigation Laboratory (NADIL) in the time period January 6–February 3, 2019. The birds showing respiratory signs and high mortality were suspected of having avian influenza (AI) and tested with a commercially available rapid test kit. Additionally, further confirmatory results were accessed from the Central Veterinary Lab (CVL), Tripureshower, after labeling, packing, and sending the samples. Out of 99 tested samples, 19 cases were positive on the rapid test kit, but confirmatory test results from CVL revealed that only 16 cases were positive, and they were all H9 strains. Among the suspected cases, more confirmed AI cases were brought from different parts of Hetauda district (38%), followed by Chitwan (31%), Nawalpur (19%), and Gorkha (6%). In total confirmed cases, layers were 80%, followed by broiler (13.3%), parent broiler (6.6%), and local (6.6%). Data showed that morbidity ranges from 0.5% to 100%, while mortality was 0.1% to 15.33% in positive cases. Our results tried to reflect the prevalence and epidemiological status of LPAI around the diagnostic center coverage area from the brought cases during the one-month period.

**Keywords:** LPAI, HPAI, Orthomyxoviridae

## 1. Introduction:

Avian influenza is a type of disease caused by avian influenza type A virus. It is more likely to be present naturally in wild aquatic birds worldwide and possesses the potential to cause infection in domestic poultry and other bird and animal species (CDC, 2017). Additionally, they have the potential to cause disease in humans with different subtypes (WHO, 2018). The virus primarily belongs to the Orthomixoviridae and possesses two surface proteins: hemagglutinin (H) and neuraminidase (N), which are responsible for the subtype and animal species it can infect. There are 16 H and 9 N types. The mutation of viruses in domestic poultry that causes virulent disease, doesn't cause disease or causes minimal disease is called highly pathogenic avian influenza and low pathogenic avian influenza, respectively (Poultry Hub). Avian influenza pandemics are responsible for high morbidity, excess mortality, and social and economic disruption. HPAI and LPAI both have the potential to spread rapidly on poultry farms. The infected flock can spread viruses through saliva, nasal secretions, and feces. Other birds get infected if the secretions come into contact with healthy ones through different direct or indirect exposures (Chaudhary, 2013).

In the Nepalese context, poultry farming on a commercial basis is adopted in 64 districts with 21,956 farms including broilers, layers, hatcheries, and giriraja/koiler farms (Nepal country poultry statistics data, 2015). Besides commercialization, backyard poultry accounts for 55% of Nepal's total domestic

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poultry population (DLS, 2008). However, there is no specific data on their population or density distribution, which poses a risk for avian influenza. This risk is heightened by frequent outbreaks of disease in neighboring countries, high backyard poultry population, and interaction with wild water birds. National Avian Disease Investigation Laboratory (NADIL), Bharatpur is one of the largest poultry disease diagnostic center of Nepal which represents the cases of Chitwan district along with surrounding district and covers mainly Nawalparasi, Makawanpur, Gorkha, Tanahu, Bara, Parsa, Dhading, Lamjung, Kapilvastu, Mahotari, Sarlahi, Rautahaat, Rupendehi, Palpa, Parbat etc. The cases brought there represents the poultry disease status throughout the country (Shrestha, 2017). The laboratory was established with ninety five years plan to address difficulties faced by privately evolving poultry industries in the nation. So, that earlier diagnosis of disease can be achieved with minimal losses to the farmers (CVL, 2014/15). Our study aimed to evaluate prevalence of low pathogenic avian influenza viruses (LPAIV) and their distribution all around the coverage area of NADIL during the specific time period. In addition to this, the study uncover the risk of avian influenza virus in that locality and helps to make strategic planning to cope the possible future problem driven by LPAI.

## 2. Materials and Methods

The NADIL, Bharatpur, is recognized as a trusted poultry disease diagnostic center in Nepal, and the area coverage is also high in comparison with other diagnostic centers. The cases brought in with respiratory signs and/or high mortality rates were routinely tested for avian influenza through a rapid test kit. The samples were mainly collected from tracheal and cloacal swabs and suspended in a test solution. After thoroughly mixing, the sample solution was kept in a test kit, and the result was recorded. Positive samples were further sent to the Center Veterinary Laboratory (CVL), Tripureshower, Kathmandu, for conformation and molecular detection of the avian influenza strain. The recorded results were entered in MS-Excel 2013 and presented in the table, bar diagram and pie chart.

## 3. Results

In total, 99 cases were recorded during the one-month period (January 6 – February 3, 2019) showing symptoms of respiratory signs and/or higher mortality at NADIL, Bharatpur.

### I. Prevalence of AI on suspected cases

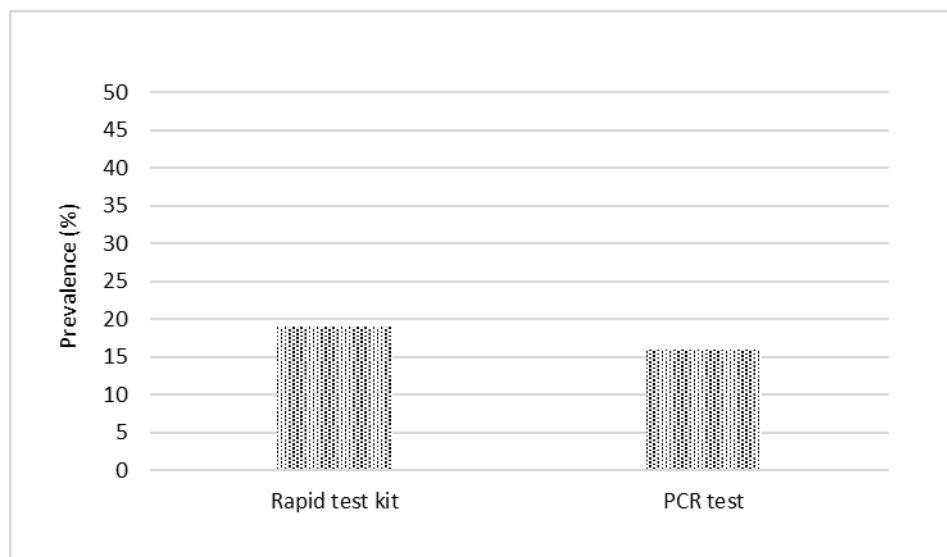


Figure 1: Prevalence of avian influenza from suspected cases using different tools.

Fig. 1 shows prevalence of avian influenza from different avian influenza testing tool from the suspected poultry cases brought at NADIL, Bharatpur.

Overall, the prevalence of avian influenza from suspected samples showed 19% positive cases through rapid test kit at NADIL while PCR test result came from CVL showed only 16% positive for avian influenza viruses and all were H9 strains which is usually low pathogenic avian influenza (LPAI).

## II. District wise case flow pattern of avian influenza

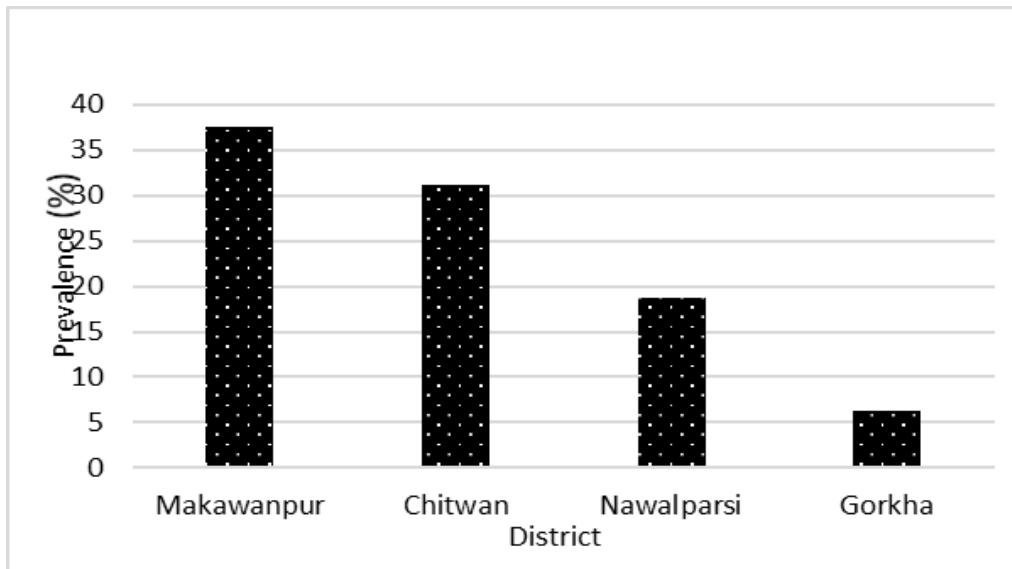


Figure 2: District-wise case flow pattern of avian influenza virus at NADIL, Bharatpur.

We observed the poultry rearing in Makawanpur district was at high risk of the LPAI virus (38%). Following that Chitwan (31%), Nawalparasi (19%), and Gorkha (6%) were observed.

## III. Species wise susceptibility of avian influenza virus

Fig. 3 shows the cases of AI during one-month period at NADIL, Bharatpur according to the species of the poultry.

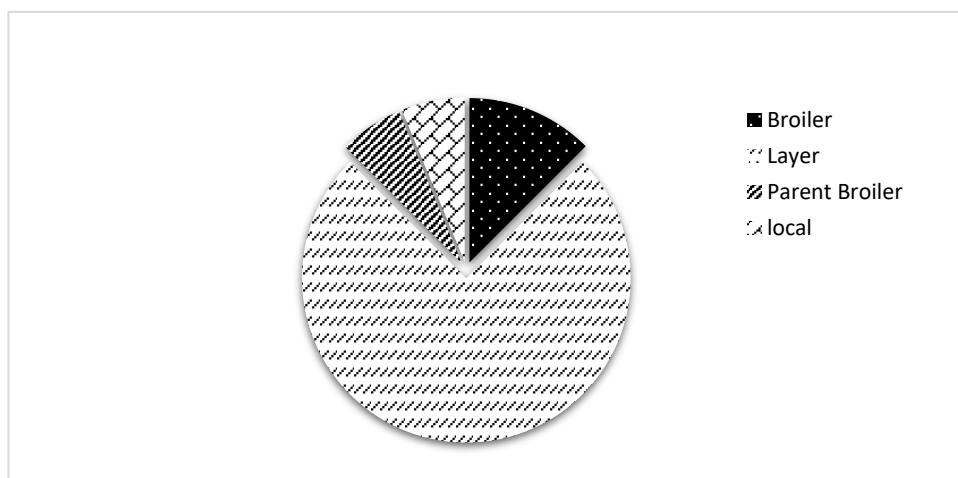


Figure 3: Species wise susceptibility of LPAI at NADIL, Bharatpur.

Overall, layers were highly susceptible with the LPAI virus, accounting to three quarters of the total positive cases. Following that, broiler (12.5%), parent broiler (6.25%) and local (6.25%) in a total suspected cases brought at NADIL, Bharatpur.

#### IV. Age wise susceptibility of AIV.

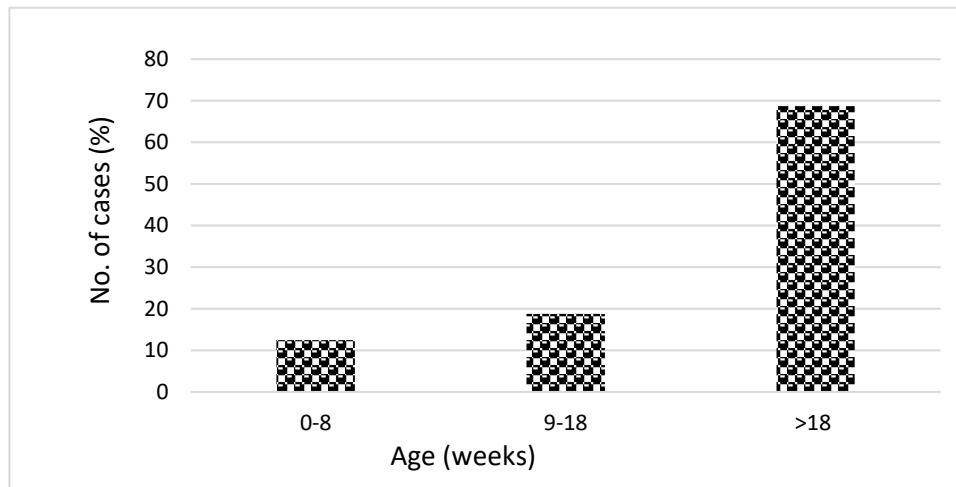


Figure 14: Age wise prevalence of LPAIV at NADIL, Bharatpur.

Overall, the cases of poultry higher than 18 weeks old age were seen as highly positive (69%) for the LPAI virus. Following that, low susceptibility was seen with age groups (0-8 weeks) and (9-18 weeks) which were 12% and 19% respectively.

#### IV. Mortality and Morbidity pattern of LPAI cases.

Table 1 shows the morbidity pattern and mortality pattern of LPAI at NADIL, Bharatpur from cases brought at this institute.

S.N.	Morbidity (%)	Mortality (%)
Minimum	0.1	0.5
Maximum	100	15.38

From the table, we came to know that, the LPAI virus was responsible for up to 100% morbidity whereas the mortality only went up to 15.38% at NADIL, Bharatpur.

## 4. Discussion

The study was carried out to observe and evaluate the risk of low-pathogenic avian influenza virus (LPAI) in a nearby area of the NADIL, Bharatpur. The poultry with respiratory signs and/or high mortality were suspected of having the LPAI. The clinical signs are quite similar to those of other avian diseases and lack specific pathognomonic signs, which makes diagnosis difficult on the basis of clinical signs (Alexander, 2008). Rapid test kits and PCR analysis were two methods of diagnosis at NADIL for the detection of the avian influenza virus. The prevalence of LPAIV was different for two tests, i.e., 19% and 16% for the rapid test kit and PCR analysis, respectively. The differences in test results between rapid test kits and PCR tests might be due to false positive results sometimes in rapid test kits (Bionote, 2016).

On locational overview of positive cases, Makwanpur and Chitwan were addressed as the most common site for the LPAI virus, accounting for 38% and 31% respectively. The reason might be due to the greater transportation of poultry and poultry products in these areas and the main routes for goods transportation to India – Nepal. So, unauthentic transportation of poultry, especially backyard poultry might serve as a carrier of LPAIV. Wild water birds are abundant in Chitwan national park has a wider coverage area including Chitwan and Makawanpur districts. As we know wild waterfowls are the natural reservoir of AIV (Gonzales, 2017) and they might be the source of greater infection of LPAI in those areas.

The positive cases were observed more in layers (75%) in comparison with other species such as broiler (12.5%), parent broiler (6.25%), and local (6.25%). One study carried out by Bertran et al., (2016) found that the broiler is less susceptible to the Midwestern H5N2 virus than layers and this also might be due to fewer outside to on-farm exposure to contacts, type of production management system or enhanced biosecurity. But, in the case of parent broiler and local cases, the prevalence was very low at NADIL, Bharatpur which might be due to fewer cases of these birds in diagnostic centers.

Bertran et al., (2016) also suggested that age is not a determinant factor in susceptibility of AIV strains which is not matched with our finding from NADIL, Bharatpur. According to our finding greater than 18 weeks old age birds shown three fourth percentage of total positive cases. This might be due to exposure time to the flock with the AIV, i.e. longer the interaction with the susceptible environment and exposure greater will be chance to occur disease.

Thuy D.M. et al., (2016) observed that despite classification as an LPAI the virus can cause significant losses in poultry production in lots of countries residing in Asia, the Middle East, and North Africa. But, our study showed only 15.38% mortality and up to 100% morbidity of LPAI at NADIL, Bharatpur, this might be due to difference in strain and virulence factor of virus.

## 5. Conclusion

In conclusion, poultry cases brought to NADIL, Bharatpur, with confirmed LPAI cases warrant the government and poultry workers to make quick strategic planning to cope with the possible future risk from this disease and disease-associated risks. In addition, the virus has zoonotic importance, so the veterinarian and co-workers of NADIL have to take due precautions while handling the sick birds during examinations.

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# A RISK OF MICROPLASTIC IN AQUATIC AND ECOSYSTEM AND HUMAN HEALTH

A. Chaudhary\*, S. Dahit Tharu



**Abstract:** The article explores the issue of microplastics, small plastic particles with diameters of up to 5 micrometers, infiltrating food, water, and air. With over 400 million metric tons of plastic produced annually, less than 10% is recycled. These microplastics have ecotoxicological effects on humans, including oxidative stress, inflammation, internalization, and cellular damage. Organophosphate esters, used as plasticizers, are potential carcinogens and endocrine disruptors, affecting aquatic life severely. Freshwater environments, like Nepal, require greater investigation due to their vital role in drinking water, hydropower, agriculture, and recreation. The study advocates for a comprehensive approach involving scientists, communities, and plastic marketing strategies to mitigate plastic pollution. Addressing microplastic pollution requires source control, remediation, standardized detection methods, and reinforced global policies. Collective action, education, and awareness across governments, industries, NGOs, and consumers are essential to combat this ecological threat.

**Keywords:** Microplastics, Pollution, exotoxicological effects, Nepal

## 1. Introduction

Microplastics are tiny plastic particles up to 5 m in diameter that find their way into food, water, and air. It is estimated that each person on the planet consumes more than 50,000 plastic particles per year—and many more if inhalation is considered. More than 400 million metric tons of plastic are produced every year worldwide, half of which is designed to be used only once. Of that, less than 10 percent is recycled. In the natural environment, microplastics are released as primary or secondary microplastics. Primary microplastics are discharged into the environment in their original form, mainly from textiles and personal care products as microbeads. Likewise, secondary microplastics are formed by the fragmentation of macroplastics as a result of the weathering of plastic debris or the disintegration of car tires (UNEP, 2018).

Microplastics are ubiquitous in the aquatic environment. This is of increasing concern as it is associated with various ecotoxicological effects (Akdogan and Guven, 2019) once inhaled or ingested by humans, which include oxidative stress, inflammatory lesions, increased internalization or translocation (Rahman et al., 2021), and even cellular damage, immune reactions, and DNA damage (Yong et al., 2020). Likewise, organophosphate esters used as plasticizers are potential carcinogens and endocrine disruptors that have been linked to severe toxicity in freshwater biota (Onoja et al., 2021). Similarly, aging of microplastics increases the risk of ingestion by organisms, enhances interaction with pollutants, and results in the release of microplastic-derived organic compounds (Onoja et al., 2021).

Microplastics are an emerging pollutant that has been intensely studied in the marine environment (Thompson et al., 2004). However, in freshwater environments, comparatively less research has been done (Fahrenfeld et al., 2019). The country of Nepal is blessed with rich water resources, which have been providing important services such as drinking water sources, the generation of hydropower, irrigation, aquaculture, and recreation. So, there is an urgent need to address this emerging pollutant.

## 2. Materials and Methods

### ▪ Data Collection

Data are collected from secondary sources:

### ▪ Searching Database

- Journal articles, research articles, pub med
- Impact of MPs on fish and human-related journals, book chapters, conference proceedings

## 3. Results

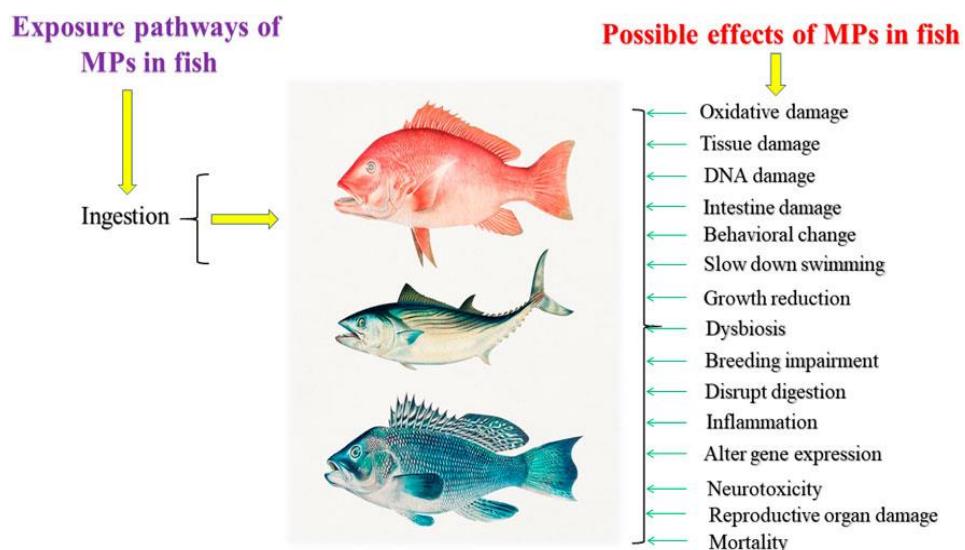


Fig 1: Possible effects of MPs in fish

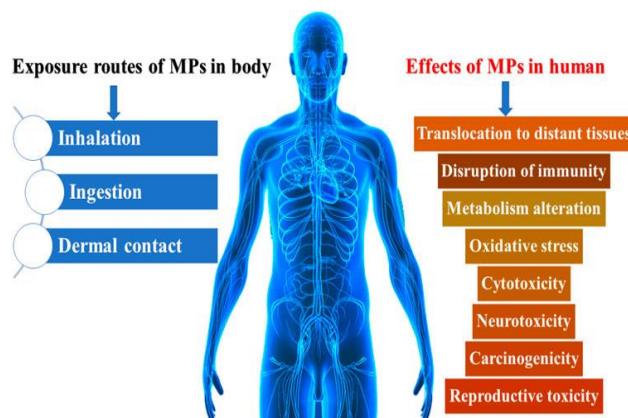


Fig 2: Possible effects of MPs in human health

## 4. Discussion

Plastic pollution remains a problem that needs solutions, and many approaches are being tried to combat it as a global threat. Many countries around the world have signed laws taxing plastic bags and, in some cases, banning their use. Reversing the environment back to a pre-plastic era is also a challenging task. Thus, this requires an all-encompassing approach involving scientists, community members, and strategies in plastic marketing that will reduce the global plastic menace. These policies and regulations are only in place in a few countries, and even when they are in place, they are poorly enforced.

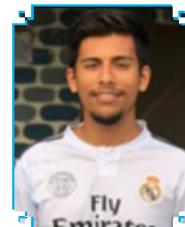
## 5. Conclusion

Plastic production has significantly increased as a result of technological advancements and increasing consumer demand. After performing their intended purposes, these plastics reach our water bodies as their destination and become ingested by aquatic organisms. Because MPs are abundant in aquatic ecosystems, fish species have easy access to them. A growing body of research demonstrates that MPs are toxic to a wide range of fish. These plastics not only affect the environment and aquatic organisms but also end up in food meant for human consumption, posing a potential threat to food safety and security. As a result, reducing MP contamination is critical. Policies and strategies aimed at controlling microplastic pollution should focus on two key areas: controlling the source of pollution and remediation, and microplastic pollutant clean-up. Standardized methods of detection and quantification that are fast, easy, and reliable should also be developed. Policies should also be reinforced, and they must be on a global scale. Awareness, education, and communication involving governments, industries, non-governmental organizations, and consumers should be initiated to allow for collective action and informed choices to curb microplastic pollution.

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# ANIMAL ASSISTED THERAPY: USING HUMAN ANIMAL BOND FOR THERAPEUTICS



S. Aryal\*

**Abstract:** The origin of the human-animal relationship can be traced back to some 15,000 years ago, when humans began utilizing animals for sustenance and transportation. Animal domestication and companionship are believed to have been possible since the first prehistoric human settlements, related to human psychological need and emotional attachment. From this psychological and emotional connection, animal-assisted therapies were developed, which focus on people's emotional attachments to animals and assess their potential therapeutic benefits. Animals such as dogs, cats, birds, lambs, calves, horses, and fish have all been used in animal assisted therapy. Animals in therapy require more extensive training for the therapist, the handler, and the animal. Currently, animal assisted therapy has been shown to be beneficial in pediatric care, physical therapy, and cancer treatment. More multidisciplinary research on animal-assisted therapy is required before this technique may be widely implemented in all global health care systems.

**Keywords:** Human-Animal relationship, Animal assisted therapy, Therapeutics

## 1. Introduction

The relationship between humans and animals has been viewed as a crucial component of human ecology and evolution. More than 15,000 years ago, humans began using animals for sustenance and transportation. Since the first prehistoric human settlements were established, animals have been domesticated and used as companions. The gradual domestication of animals was accelerated in prehistoric times when people started to value them as resources. These animals have generally made a significant contribution to human ecological adaptation. Animals being kept as pets is a valid reason for domestication. Animal domestication is believed to have been primarily influenced by the psychological need for companionship and emotional attachment in humans (A. Beck, 2012). Humans also needed to use animals for practical reasons like to satisfy their hunger and avoid using human labor. There are numerous instances of animal assistance in human therapeutic activities throughout human history. Animal-assisted therapy or animal-assisted intervention, however, has only recently become a widely used and documented practice (A. M. Beck & Katcher, 2003).

Animal-assisted activities that offer chances for inspiration, education, or recreation in order to improve the patient's physiological state are referred to as "animal-assisted therapy." Animal-assisted interventions primarily exploit people's emotional attachments to animals and consider their potential therapeutic value. Animal-assisted therapy is based on the idea that when humans are introduced to animals, their physiological competence increases and their stress levels decrease. In the last few decades, there has been a substantial increase in the use of animal-assisted therapy. Animal-assisted therapy has gained popularity not only in therapy instructions but also in major healthcare settings like critical care units, physical therapy units, intensive care units, especially abled units, children's hospitals, and psychiatric units (DeCoursey et al., 2010). Along with the standard therapeutic activities, animal-assisted therapy has proven to be a cost-effective way to help patients achieve greater mental, physical, and social recovery. Various animals are a crucial component of the therapeutic process in these treatments, which aim to enhance human physical, social, emotional, and cognitive abilities (AVMA, 2010).

## 2. History

Animals have assisted humans in therapy since the ninth century, which is consistent with the ancient evidence of a human-animal bond. In Gheel, Belgium, in the ninth century, the first instance of animals being used therapeutically on humans was recorded. However, it is thought that animal-assisted therapy for humans began during the domestication process. In York, England, during the end of the 18th century, the first known use of animals for a specific disease took place. At that time, treatment using animals was employed to cure human mental diseases. However, modern animal-assisted therapy didn't begin until the 1960s. The father of animal-assisted therapy, Dr. Boris Levinson, engaged a dog named "Jingles" in his child therapy sessions and discovered that the sessions were more successful when "Jingles" was present. Dr. Levision came to the conclusion from these sessions that the kids were able to get through their communication and sociability barriers when the dog was present (Odendaal, 2000). In the context of Nepal, the joint initiative of Kathmandu Animal Treatment (KAT) Center, Bal Mandir Children's Home, and Mitrataa Foundation known as the "Dr. Dog" campaign is the first attempt at the implementation of animal-assisted therapy.

## 3. Use of Animal-Assisted Therapy

The primary use of animal-assisted therapy involves using a particular trained animal to enhance the patient's cognitive and physical health. It uses properly trained dogs instead of the patient's pet. Animal-assisted therapy aims to enhance the mental and physical abilities of the patient (Connor & Miller, 2000). The use of animals in therapy necessitates more thorough training for the therapist, the handler, and the animal. Many different animals, including dogs, cats, birds, lambs, calves, horses, and fish, have been utilized in animal-assisted therapy. The most popular animal among these for animal-assisted therapy is the dog. A single animal or a group of animals can carry out animal-assisted therapy in a group or one-on-one environment as a scheduled intervention. The patient, disease severity, therapeutic objectives, and handler all play a role in whether one animal is used alone or in a group (DeCoursey et al., 2010). The following can be used to describe the use of animal-assisted therapy in various illnesses and its therapeutic impact:

S.N.	Conditions	Therapeutic Effects	Reference
1.	Cancer	improve depression, oxygen saturation	(White et al., 2015)
2.	Dementia	Improved eating habit, calming effect, improved self-esteem, increased communication	(Filan & Llewellyn-Jones, 2006)
3.	Heart Health	Lower BP, Decrease in cortisol level	(Cole et al., 2007)
4.	Mental Health	Increased playfulness of children, increased socialization	(Parshall, 2003)
5.	Psychiatric disorder	Improve independent self-care, reduce anxiety, increased motivation, socialization	(Rossetti & King, 2010)
6.	Physical Therapy	improves cardiovascular health, release endorphins (oxytocin), increase joint movement, improves recovery time, increases motor skills, motivation to exercise longer	(Denzer-Weiler & Hreha, 2018)

7.	Children With special need	Increased interaction, provides comfort, increased self-esteem, overcome speech and emotional disorders	(Yap et al., 2017)
8.	Reading for differently able persons	improves literacy skills, helps to focus better, non-stressful environment	(Heimlich, 2001)

#### 4. Future Potentially of Animal Assisted Therapy

Currently, both the popularity and effectiveness of therapeutic methods using animal-assisted therapy are growing. In 2011, a report from the US Department of Health and Human Services, the Centers for Disease Control and Prevention (CDC), and the National Health Center for Health Statistics showed that nearly 60% of hospitals provide alternative therapies, such as pet therapy, to patients. Animal-assisted therapy has been demonstrated to have a significant benefit in pediatric care, physical therapy, and cancer treatment. Despite these results, it is still challenging to quantify the benefits of animal-assisted treatment in medicine, psychiatry, and psychology due to a lack of a medical stance (A. M. Beck & Katcher, 2003). If the advantages of animal-assisted therapy could be assessed in the future, it could be used more extensively in all global healthcare systems. The potential of animal-assisted treatment is thus now underappreciated. More interdisciplinary studies of animal-assisted therapy will eventually result in the recognition of its true significance in healthcare systems. If the advantages of animal-assisted therapy could be assessed in the future, it could be used more extensively in all global healthcare systems. The potential of animal-assisted treatment is thus now underappreciated. More interdisciplinary studies of animal-assisted therapy will eventually result in the recognition of its true significance in healthcare systems.

#### 5. Risk Associated with Animal-Assisted Therapy

There are several danger issues involved with animal-assisted treatment, which is becoming more popular. Zoonoses, fear of animals, animal-borne parasitic infections, animal allergies, and cultural prejudices are among the potential drawbacks of animal-assisted treatment (Cullen et al., 2003). Poorly maintained therapeutic facilities or equipment are frequently linked to these risks. These dangers are easily reduced by thoroughly cleaning, inspecting, and sanitizing patients, therapists, and animals. The maltreatment of therapy animals, taunting of therapy animals, and erroneous beliefs about therapy animals can all be considered additional risk factors for animals.

#### 6. Conclusion

From ancient times to the present, animal-assisted therapy has been a significant therapeutic intervention. One of the major achievements of this century has been the integration of animal-assisted therapy into contemporary healthcare systems. The likelihood of a patient's mental, physical, and cognitive recovery is increased when animal-assisted therapy is used in conjunction with traditional therapy in healthcare systems. Increased usage of animal-assisted therapy in treating disorders including cancer, dementia, caring for children with special needs, physical therapy, etc. has increased the rate of recovery for certain conditions. Current use and future potentially of animal assisted therapy have been increasing in recent years, which will increase in the future with more multidisciplinary research. Keeping track of the impact of animal assisted therapy on patients' recovery would help increase the adoption of this therapeutic intervention across the globe. Hence, using animal-assisted therapy in patients with several conditions will increase the rate of physical, mental, and emotional recovery and the patient's welfare.

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# THE PRICE THAT BUFFER ZONE INHABITANTS HAVE PAID FOR THE WORLD TO REJOICE IN NEPAL'S BENGAL TIGER POPULATION TRIPPLING



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**Abstract:** The protected areas in Nepal have seen successful tiger conservation efforts, resulting in an increase in the tiger population. However, this has led to a rise in human-tiger conflicts (HTC) near these protected zones. Tigers, in search of food and territory, often encroach into buffer zones heavily utilized by farming communities, leading to confrontations and sometimes fatal attacks on people. In Bardia and Chitwan National Parks alone, there have been numerous fatal tiger attacks on humans since 1994, with 34 tigers losing their lives in HTC since 1979. The recovery of tiger populations in Nepal has extended into community-managed forests, further increasing the likelihood of human-tiger conflicts. Such conflicts can lead to negative perceptions of tigers and conservation efforts among local communities, potentially resulting in retaliatory killings and hindrance to conservation. To address these challenges, the government has taken steps such as establishing the Prime Minister's Wild Life Fund for tiger conservation and reducing human-wildlife conflicts. Compensation is provided for tiger attacks on humans and livestock. Tiger evictions are carried out for tigers involved in conflicts, with some being relocated to other areas. Resettlement of human communities and bans on resource utilization in buffer zones are also considered to protect core wilderness areas. The study emphasizes the importance of monitoring tiger populations, enhancing tiger habitats, and involving local communities in tiger management and conservation efforts. It suggests creating relief funds for victims' families, subsidizing livestock insurance, and implementing educational programs about tiger ecology and alternative livelihoods to reduce reliance on forest resources. Overall, addressing human-tiger conflicts is crucial to ensure the survival of tigers in the wild and garner support for conservation.

**Keywords:** Tiger, Human-Tiger conflicts, National parks, Compensation, Government

## 1. Introduction

Protected areas in Nepal have produced positive conservation results for tigers (*Panthera tigris*). But the return of the tiger has created life-threatening challenges for people on the border of the park. Increased human-tiger conflict (HTC) is an unwanted side effect of more tigers, especially in buffer zone areas close to essential tiger reserves that are heavily used by farming populations. However, as the number of tigers grows, so do human-tiger confrontations. The number of people murdered by tigers has risen considerably in recent years. Bardia and Chitwan National Parks, respectively, have reported 12 and 99 fatal tiger attacks on people since 1994. Since 1979, 34 tigers from both parks have perished in HTC. The recent increase in tigers outside protected areas in Nepal (Gurung et al., 2006) indicates that tigers are also recovering in some parts of their range in response to conservation interventions. These recovering populations are re-colonizing a rapidly expanding base of community-managed forests. However, a result of higher tiger numbers is an increase in confrontations with humans. If tigers are to survive in the wild, managers must develop effective strategies to reduce tiger conflicts with local people.

## 1.1 Human-Tiger conflict

Humans and tigers have an especially tense relationship. According to Dinerstein et al. (2007), Nepal is one of the nations in the tiger range that has a dense human population and a significant reliance on local forest resources. Greater interactions between tigers, people, and livestock occur as tiger populations rise within reserves, which maintain a fixed size, as the big cats look for food and home ranges, even in buffer zone areas. Tigers have two ecological requirements that put them at odds with humans. They require vast tracts of forest habitat and plentiful large prey (Sunquist, 1981; Smith et al., 1987; Smith et al., 1989). Forests are used to graze livestock, and people also gather firewood, fodder, and a variety of herbs from them to sustain their subsistence lifestyles (McLean & Straede, 2003; Thapa & Hubacek, 2011). Tigers also source their food (prey), water and cover from the forest. Community forests are among these habitats, which are frequently visited by both tigers and people. Conflict between humans and wildlife occurs when they compete for scarce resources (Graham et al., 2005; Wang & Macdonald 2006). This spatial overlap allows tigers, people, and their cattle to cross paths. Conflicts are especially dangerous when there are casualties among people or when the local populace is so underprivileged that any loss of livestock negatively impacts their standard of living. As a result, tigers may be targeted by park management personnel, incensed victims, or their relatives (Gurung et al., 2008).

Local communities may develop unfavorable opinions about tigers and tiger conservation as a result of an increase in incidents of livestock loss and human attacks. Retaliatory killings and such mindsets have the potential to substantially harm conservation efforts. Therefore, places with large carnivores frequently experience major conflict (Polisar et al., 2003).

## 1.2 Conservation and Population Status of Tiger in Nepal

At present, the tiger distribution in Nepal is more or less restricted to five protected areas of the TAL (Terai Arc Landscape) and their adjoining forest areas in three isolated sub-populations.

- i) Parsa Chitwan Complex (Barandabhar corridor and protected forest; Parsa National Park (PNP) and Chitwan National Park (CNP));
- ii) Banke-Bardia Complex (Kamden corridor, Karnali corridor, Khata corridor, and protected forest; Banke National Park (BaNP) and Bardia National Park (BNP)); and
- iii) Kailali-Kanchanpur Complex (Basanta corridor and Protectedforest, Laljhadi-Mohana corridor and Protected Forest, Brahmdevcorridor and Shuklaphanta National Park (Ghimire, 2022).

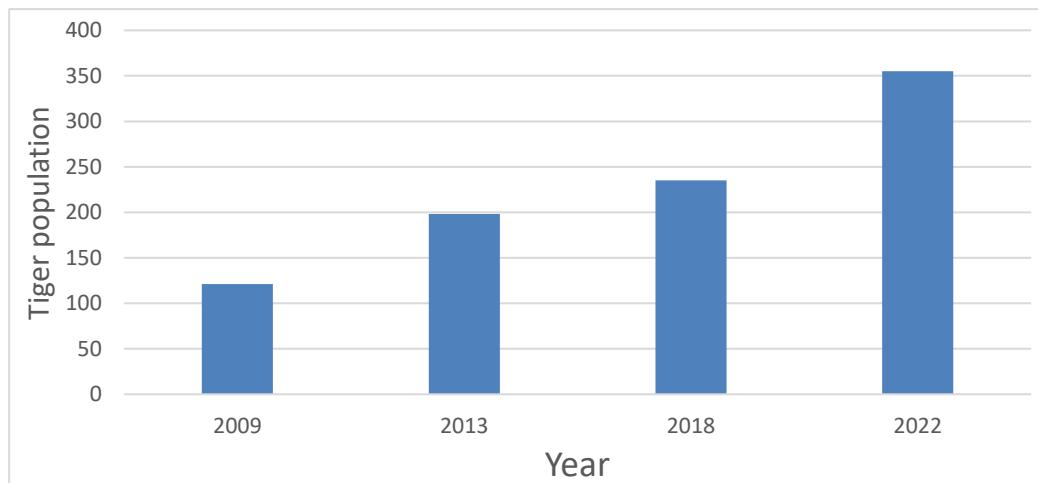
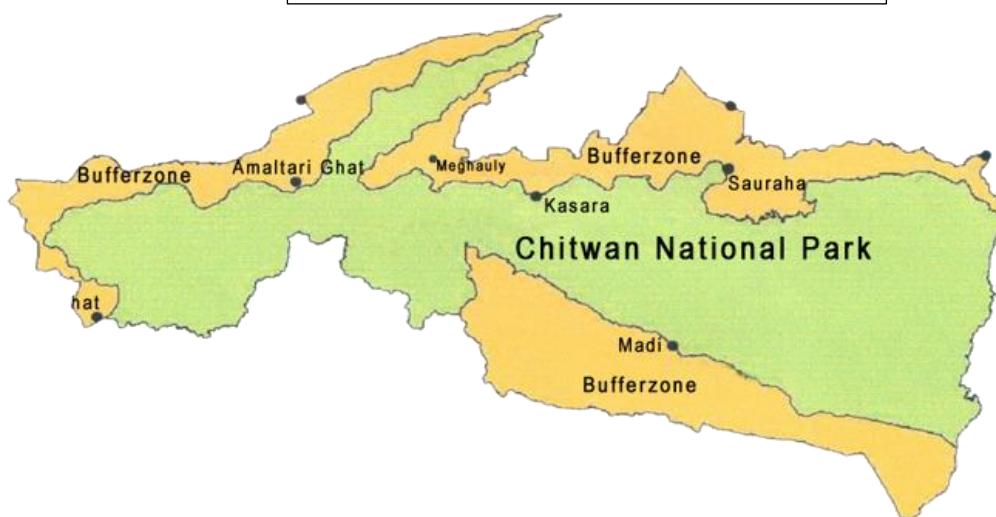


Fig: Tiger population in different years

### Home of 128 Royal Bengal tiger



### Home of 125 Royal Bengal tiger



Fig: Major areas where Royal Bengal Tiger are found

### 1.3 Human casualties

Human-tiger conflict has been observed throughout the tiger's range, including in Russia's far east, Southeast Asia, the Sunda Islands, and South Asia. Human-tiger conflict reaches its apex with human killing. It is a complicated subject that must be handled in order to retain public support for tiger (*Panthera tigris*) conservation in places where human killing is common (Sanderson et al., 2010). Evidence of human casualties due to tigers is found at both CNP and BNP, with fewer incidents reported at BNP.

Injuries and deaths caused by tiger assaults can result in humans feeling intense animosity and hostility toward the wildlife involved, undermining popular support for conservation. As conflict-related mortality is one of the most serious dangers to the existence of tiger populations, resolving HTC is critical to their survival. CNP, which has the biggest (128) and fastest-growing tiger population in Nepal, acts as a source population for the neighboring landscapes of Nepal and India (Karki et al., 2015). In the past five years, 23 people have been killed in Bardya and six in Banke. As many as 19 people were recorded murdered by tigers in and around CNP in 2004 (Inskip & Zimmermann, 2009), and there have been 29 human casualties in the past five years. The majority of kills (66%) occurred within 1 km of the forest boundary but in both degraded and intact woods. Male and female tigers killed humans in equal numbers, and 56% of the tigers investigated had physical defects. Human mortality climbed dramatically from an average of 1.2 (1.2) per year prior to 1998 to 7.2 (6.2) per year from 1998 to 2006. This disparity

is mostly attributable to a tenfold increase in kills in the buffer zone since 1998 as a result of forested restoration. Grass and fodder collectors accounted for over half of those kills. To address this problem, the park authorities have implemented two measures:

- (i) Monetary compensation for tiger attacks on humans and livestock.
- (ii) The eradication of conflict-related tigers. Furthermore, retaliatory tiger killings by locals have been observed.

## **2. Objectives**

1. Summarize and characterize human-tiger conflict in terms of human casualties.
2. Examine the cause of human-tiger conflict.
3. To find out the tiger-carrying capacity of Nepal

## **3. Methodology**

- Secondary data collecting from multiple websites and
- Papers,
- Rigorous evaluation and summarization

## **4. Results**

In the past 12 months, 16 people have been killed by tiger in Nepal. Natural prey declines lead tigers to feast on cattle and, occasionally, humans. Locals are frequently driven to persecute, hunt, or poison tigers in retaliation to assaults on cattle or humans. As a result, human-tiger conflict is a serious danger to the survival of tigers; it diminishes their populations and undermines conservation support (Bhattarai & Fischer, 2014). The National Park and its buffer zone are also prized by the local inhabitants as a source of thatching grass and other **natural** resources. . It is believed that women are more likely than men to gather resources in the jungles, making them more fearful of tiger attacks. This might explain why women are less enthusiastic about tiger conservation. Some people were concerned that the lack of tigers would result in an increase in prey populations and consequent crop raiding since tigers represent an intact ecosystem. As a result, not everyone supports tiger conservation just for personal gain. The availability of natural prey is a significant factor in determining the degree of livestock predation by tigers, according to our findings, and predation rates were higher in regions with lower prey density, habitat loss and physical impairment (Muhammed et al.) attributed the occurrence of man-eating tigers to old age, injury or dental problems, impairing the tigers' ability to hunt natural prey, depletion of natural prey, and habitat loss and fragmentation, forcing tigers to hunt outside forests which have a significant effect on livestock depredation by tigers. In Chitwan National Park, for example, 10 of 18 human-killing tigers had physical impairments such as missing teeth or injuries (Gurung et al., 2008). Three individuals are reportedly assaulted by tigers every month in and around national parks and buffer zones, according to the Ministry of Forestry and Environment. In the past three fiscal years, there have been 104 reported tiger attacks inside national parks and their buffer zones, resulting in 62 fatalities, of which 28% were seriously injured. Within 1 km of the forest boundary, the majority of kills (66%) happened in both intact and degraded woodlands. Equal ratios of male and female tigers killed people, and 56 percent of the tigers analyzed had physical flaws. Human mortality climbed dramatically from an average of 1.2 (1.2) per year prior to 1998 to 7.2 (6.2) per year from 1998 to 2022. This disparity is mostly attributable to a tenfold increase in kills in the buffer zone since 1998 as a result of forest restoration. Grass/fodder collectors accounted for over half of those slain (Gurung et al., 2008).

## 4.1 Steps by Government

The government has decided to set up the Prime Minister's Wild Life Fund, which aims to conserve tigers and reduce human-wildlife conflict in buffer zones of national parks and forest areas. The PMWLR fund can be utilized for anti-poaching activities and programs, including awareness drives, habitat management, and army patrolling, in order to minimize human encroachment into national parks and reduce human-tiger and wild life conflict. Also, the government has implemented compensation payments to the victims' families. Total compensation payments of US\$93,618 (\$11,702.3 per year) were made for tiger attacks during the eight-year period. Of this, 65% was paid for human killings, 5.7% for injuries, and 29.3% for livestock killings (Dhungana et al., 2018). The vast majority of locals were supportive of protecting tigers and their habitat. The expectation of financial gains from ecotourism may be responsible for the predominance of favorable opinions for tiger preservation.

## 4.2 Tiger evictions

During the eight-year period, 15 tigers were removed for conflict causes, including human and/or livestock attacks or constituting a potential threat. Eleven tigers were removed by authorities (one was killed), while four were murdered in revenge by locals. Nine of the tigers removed were adults, five were post-dispersal floaters, and one was a juvenile. During this time, no cubs were removed (Dhungana et al., 2018). Researchers distinguish between animals that have been murdered only once and those that have been murdered several times when analyzing the removal of a tiger from a protected area (Gurung et al., 2008; Lamichhane et al., 2018). Two were released in the CNP and another national park (Bardia), and one was transferred to a zoo.

## 4.3 Resettlement of human communities and bans on resource utilization

During the establishment of Nepal's parks and reserves in the 1970s, the Government of Nepal relocated human settlements from core areas of the reserves to locations outside of the reserve boundaries (Bhattarai et al., 2017; Smith, 1993; Sunquist, 1981). A single tiger requires an area of about 52 km<sup>2</sup>. With an increasing tiger population, Nepal's government should resettle people in buffer zones to increase tiger habitat. The dual intention of the resettlement programs and the bans on access to park resources was to reduce the frequency with which human encountered dangerous wildlife, including tigers, while also protecting core areas of wilderness from anthropogenic disturbances (Sunquest, 1981).

## 5. Discussion and Conclusion

People of buffer zone due to the continued growth of the tiger population and the national park's size, people are about to pay the price with their lives. Aash Bahadur Bote, who was attacked by a wild cat while fishing in the Rapti River on July 25, 2023, was the recent victim attacked and murdered by a Bengal tiger. In Nepal, tigers have claimed the lives of 16 people in the last year. As a source of thatching grass and other natural resources, the National Park and its buffer zone are highly valued by the local populace. Women are allegedly more inclined than men to gather food in the wild, rendering them more vulnerable to tiger attacks. This could be the reason. The bulk of murders (66%) took place in degraded and undamaged woodlands within 1 km of the forest boundary. Local communities should be alerted right away if any tigers are found to be eating humans. It is important to monitor the abundance, distribution, and occurrence of tigers as well as conflict tigers (Gurung et al., 2008). The goal of this project is to enhance the tiger habitat while also assisting the local community by restoring the ecological and economic functions that these forests provide. In recent decades, there have been numerous instances of compensation payments, tiger eradication, zoning, insurance programs, relocating residents outside of core protected areas, and improving livestock husbandry (Goodrich, 2010). Local participation in tiger management and conservation is essential to reducing human-tiger conflicts (Gurung et al., 2008). Our results show that natural prey availability is a key factor in influencing the level of livestock predation by tigers, and predation rates were higher in areas with lower prey density. More grasslands

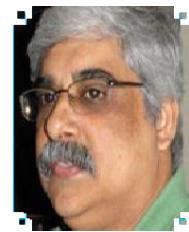
and man-made ponds should be built inside the national park in order to sustain a healthy population of tigers and prey. We recommend setting up a relief fund for the kin of the deceased. Fortunately, farmers can now cultivate enough animal feed near the settlement thanks to efficient models developed by the Center for Tropical Agriculture. As proactive agriculture has developed, farmers are no longer forced to pasture cattle near tiger populations (Johnson et al., 2006). Enforcing the existing restrictions prohibiting grazing and the collection of forest products in the national park should limit human-tiger encounters. We suggest that a relief fund be created for victims' relatives. Compensation for livestock theft Locals should be compensated quickly and fairly for livestock losses caused by tiger attacks. It is possible to construct a subsidized livestock insurance system. Compensation and insurance plans, on the other hand, are sometimes difficult to execute for a variety of reasons, including a lack of long-term funding, challenges in validating tiger attacks and establishing reasonable compensation, long delays, severe corruption, bureaucracy, and cultural unfamiliarity. Human-eating tigers (having killed at least one person) should be removed from the area as soon as possible by the National Park authorities. Along with training in agricultural techniques, a development and teaching program about tiger ecology needs to be put into place. To lessen reliance on forest products and encounter and depredation rates, advice should be given on using alternate energy sources, cultivating food for animals, stall feeding, and alternative livestock breeds. Local residents' perceptions of conservation may improve if they are directly involved in development, education, and conservation initiatives and decisions.

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# DIAGNOSIS AND TREATMENT OF SPLENIC TORSION IN A GERMAN SHEPHERD DOG: A CASE STUDY

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**Abstract:** Splenic torsion, commonly seen in large breed, deep chested dogs, occurs when the blood supply to the spleen twists on itself. A 3.5 years German Shepherd dog was presented with lethargy, inappetence, vomiting, and abdomen remarkably distended on left side. Abdominal ultrasound was done for Maximus, which revealed hepatomegaly with a small amount of free fluid. Splenomegaly with no blood flow on doppler on MSA was observed, which was of significant concern. An emergency splenectomy with an incisional gastropexy was performed.

## Introduction

Splenic torsion occurs when the blood supply to the spleen twists on itself. Most commonly seen in large breeds, deep chested dogs, it often occurs along with a Gastric Dilatation and Volvulus (GDV), but can also occur independently. Imaging diagnostics are shown to be effective in confirming the condition. CT characteristics include enlarged, rounded and/or C shaped folded spleen (DeGroot et al., 2016). On ultrasonography, splenic parenchyma may appear normal, hypoechoic or anechoic with interspersed linear echoes (coarse/lacy appearance). Spectral Doppler and color doppler imaging of the splenic veins usually shows no measurable flow velocities (Hughes et al., 2020). Hilar splenic vessels may appear enlarged (Konde et al., 1989).

## History

Maximus, a 3 years 6 months old German Shepherd dog presented with lethargy, inappetence and vomiting 2 days prior to presentation. Upon physical examination, Maximus exhibited classical clinical signs of an acute abdomen. His abdomen appeared remarkably distended on the left side which was non pliable and painful on palpation.

## Diagnostics

Basic bloodwork to check CBC, serum biochemistry, blood glucose and clotting time was done which showed low normal albumin, mild hemoglobinemia, mild anemia, significant leukocytosis predominantly neutrophilia and significant thrombocytopenia. The neutrophilia suggested an inflammatory process underway. Manual clotting time was 7 minutes.

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Analytes	Result	Range	Units
Haemoglobin (Hb)	11.1	12 - 15	g % (g/dL)
Packed Cell Volume (PCV) / Haematocrit (HCT)	32.4	37 - 55	%
Erythrocytes (RBC)	453	55 - 85	10 <sup>9</sup> / cu. mm.
Mean Corpuscular Volume (MCV)	71.6	66 - 77	Femtolitre
Mean Corpuscular Haemoglobin (MCH)	24.5	19.9 - 24.5	Picograms
Mean Corpuscular Haemoglobin Concentration (MCHC)	34.2	32 - 36	g / dL
Leucocytes (WBC)	29.4	6 - 17	10 <sup>3</sup> / cu. mm.
Neutrophils	86.3	60 - 77	%
Eosinophils	2.5	2 - 10	%
Basophils	0.0	Rare	%
Lymphocytes	9.3	12 - 30	%
Monocytes	1.9	3 - 10	%
RBC Morphology	Normochromic	-	-

**Fig 1:** Pre-operative bloodwork

Abdominal ultrasound was done for Maximus which revealed hepatomegaly with a small amount of free fluid. Splenomegaly with no blood flow on doppler on MSA was observed which was of significant concern. Vena cava appeared tortuous.

Interpretations of the diagnostics suggested a splenic torsion with possible pancreatic involvement.

**Fig 2:** Diagnostic ultrasound images showing remarkable lack of blood flow in the spleen**Fig 3:** Enlarged liver**Fig 4:** Hypoechoic splenic parenchyma

## Procedure

An emergency splenectomy with an incisional gastropexy was performed. Following the standard operative procedure, a ventral midline incision was made extending from the xiphoid to the pubis.

Splenic torsion with severe sequestration and congestion was observed. Hilar splenic blood vessels were coiled around their own axis which appeared necrotic. The presence of hemoabdomen was also noted.

The gastrosplenic supply was severed but gastroepiploic blood vessels were intact. Omentum was seen to be hypoperfused and necrosed. Mesenteric vasculature and pancreas were normal. Hemostasis of splenic vasculature was achieved using vessel seal and ligatures with vicryl 2-0. Tranexamic acid was also administered intraoperatively for hemostasis.

JP drain was inserted because peritonitis was expected. Incisional gastropexy was also done using the standard operative procedure.

The removed spleen weighed 1.4 kgs.



**Fig 5:** Torted hilar splenic blood vessels



**Fig 6:** Splenectomy (in process)



**Fig 7:** Removed spleen



**Fig 8:** Removed spleen

## Post operative

On day one of post-op, Maximus was non-pyrexic and retained food. He was tachycardic and tachypnoeic with a Colorado pain score of 2. Buprenorphine @0.02mg/kg was administered as analgesia and Vitamin C was added as a protectant against oxidative stress-induced cellular damage. Clotting time was down to 3-4 minutes when done manually. 10ml of serosanguineous fluid was removed from the JP drain on day 1 of post-op. All other vitals were within normal limits.

On day 2 post-op, Maximus had a good appetite. Ultrasound showed no effusion and very little amount of fluid was drained from the drain.

On post-op day 3, all blood parameters showed improvements, and the JP drain was removed. Postoperatively, for 3 days Maximus was on injectable ondansetron @0.2mg/kg, pantoprazole @1mg/kg, metoclopramide @0.2mg/kg, metronidazole @15mg/kg, ceftriaxone tazo @20mg/kg, meloxicam @0.2mg/kg, and buprenorphine @0.02 mg/kg. It was followed by an oral prescription for tablet Trypsin-chymotrypsin, Buprenorphine, Metronidazole, and Cefixime.

10 days after the surgery, the sutures were removed.

## Discussion

Diagnosis of splenic torsion can be made quite accurately based on clinical examination and ultrasonography. Various post-op complications like peritonitis, sepsis, suture seroma, suture dehiscence, and pancreatitis exist but the prognosis for dogs undergoing splenectomy because of a primary splenic torsion is favourable (Saunders et al., 1998).

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# WATER QUALITY TESTING IN FARM AND PREMISES OF AFU BY MEASURING MOST PROBABLE NUMBER (MPN) THROUGH MULTIPLE-TUBE METHOD FOR FECAL COLIFORMS



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**Abstract:** The study conducted at AFU, Rampur aimed to assess the bacterial contamination, particularly fecal coliforms, in water sources used in different areas of the university. The Most Probable Number (MPN) method was employed to estimate the concentration of viable microorganisms in the 30 water samples collected from 15 different sources, with each source being replicated twice. The samples were tested with MacConkey Broth as the selective culture medium, which was the presumptive test. A confirmatory test was conducted using MacConkey, EMB and XLT4 agar plates. The results showed that 8 (26.67%) were confirmed to be infected with Escherichia coli, 10 (33.33%) with Salmonella, and 6 (20%) with both bacteria. Additionally, 6 (20%) samples were not infected with any of these bacteria. Further analysis revealed that 60% of the samples from the livestock farm and 40% of the samples from the AFU premises intended for human consumption were positive for E. coli. Similarly, 53% of the samples showed Salmonella contamination. Statistical analysis using the chi-square test did not find a significant association between E. coli or Salmonella infection and the intended water consumer. This indicated that the water used for human consumption in canteens, hostels, veterinary teaching hospitals, and the vet complex was contaminated, similar to the water sources on the livestock farm. Based on the findings, several recommendations were made to address the issue of coliform bacteria contamination in the water supply. These included regular testing, protecting the water supply from contamination, proper animal management practices, infrastructure maintenance, and the implementation of water treatment systems such as chlorination, UV disinfection, and filtration. The study highlighted the presence of bacterial contamination, particularly fecal coliforms, in the water sources of AFU. The findings emphasize the need for effective strategies to prevent and treat water contamination to ensure the provision of clean and safe water for both animals and humans in the university.

**Keywords:** Most probable number (MPN), Multiple tube method, fecal coliform, water quality, water testing, AFU, Nepal

## 1. INTRODUCTION

Water contributes around 70% of the animal cell. Water is needed not only to satiate thirst but also to maintain general metabolism, homeostasis, hydration status, and enzymatic action in the animal body, as well as for cleaning, sanitation, and disinfection in animal farms. Clean and potable drinking water in an adequate amount is needed every day for humans as well as in animal farms to sustain. Lack of ample amounts of clean water is the main constraint on any animal farm for various day-to-day activities. Any type of contaminants, like physical, chemical, radiation, and biological, can contribute to water pollution.

The Most Probable Number (MPN) is used to calculate the concentration of viable microorganisms in a sample by a series of tubes containing a suitable selective broth culture medium are inoculated with test portions of a water sample using multiple-tube

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method (Rowe et al., 1977). It is frequently used to estimate microbial populations in soils, water, and

agricultural products. MPN is most commonly used for water quality testing, i.e. determining whether the water is safe in terms of bacteria present. A type of bacteria known as fecal coliforms, *Escherichia coli* acts as an indicator of fecal contamination of water (WHO, 2001). Coliform bacteria generally belong to four genera of the Enterobacteriaceae: *Citrobacter freundii*, *Enterobacter cloacae*, *Enterobacter aerogenes*, *E. coli*, and *Klebsiella pneumoniae*.

Following a specified incubation time at a specific temperature, each tube exhibiting gas formation is considered "presumptive positive," as the gas indicates the possible presence of coliforms. However, gas can be produced by other organisms, so a follow-up confirmatory test is required. The MPN of bacteria present can then be estimated from the number of tubes inoculated and the number of positive tubes obtained in the confirmatory test, using specially devised statistical table (Annex 1). This technique is known as the MPN method. The presence of very few fecal coliform bacteria indicates that the water most likely contains no disease causing organisms, whereas the presence of a large number of fecal coliform bacteria indicates that the water may contain disease producing organisms, rendering the water unsafe for consumption.

## **2. MATERIALS AND METHODS**

A cross-sectional study was conducted at Agriculture and Forestry University (AFU), Rampur, Bharatpur-15, Chitwan, between May and June of 2023, to investigate the amount of bacterial contamination (coliforms) in the water sources of farms, hostels, canteens, official quarters, offices, and buildings of AFU. The most probable number (MPN) is estimated with the multiple-tube method as per the recommendation of the WHO for assessing the contamination of drinking water. The MPN method permits estimation of microorganism density without an actual count of single cells or colonies.

100 ml of water samples were collected in sterile sample bottles from 15 water sources and taps available in the farm and premises of AFU. Each water source was replicated twice in the next working day by taking the 100 ml sample again. This made out total test sample to be 30 (15 × 2). The water sample was delivered to the medicine laboratory as soon as possible with maintaining the cold chain in an ice-box. All of the samples was subjected to a Multiple Tube Test using OXOID MacConkey Broth to determine the most probable number (MPN) of coliforms and fecal coliforms.

The broth medium was prepared in two strengths: single and double, and poured in a single 50 ml volume in a sterile bottle and five 10 ml test tubes, respectively, and the water sample was added to the broth in the same manner, one 50 ml in the bottle and five 10 ml in five test tubes each. The solutions were subjected to incubation at 37 °C for up to 48 hours. The medium contains lactose and an indicator that produces acid and gas after the growth of microorganisms. Eventually, the MPN of coliform in a 100-ml water sample was calculated using the probability table (Annex 1), and the MPN determined the load of contamination with fecal coliforms. This was the presumptive test.

For the confirmatory test, the positive tested solutions were inoculated in the EMB agar plates. Then they were incubated again at 44°C for 24 hours to confirm the presence of fecal coliforms by producing purple colonies with metallic sheen.

Microsoft Excel 2016 was used for data entry, management and analysis. A detail lab procedure for the water quality testing and analysis using different agar mediums, like MacConkey, EMB and XLT4 agars were given in the Annex 2.

### 3. RESULTS AND DISCUSSION

Out of 30 samples taken from the farm and premises of Agriculture and Forestry University, Rampur, 8 (26.67%) were confirmed for *E. coli* infection by the most probable number (MPN) method, 10 (33.33%) of them were confirmed for *Salmonella* infection and 6 (20%) were confirmed for both bacteria which is shown in figure 1. Only 6 (20%) of the total sample were not infected with any of these bacteria. Since coliform bacteria are considered as indicator organisms (Halkman & Halkman, 2014), so that the *E. coli* infected water sources (46.67%) were fecal contaminated. The water sources contaminated with *Salmonella* were unhygienic and need to check them properly.

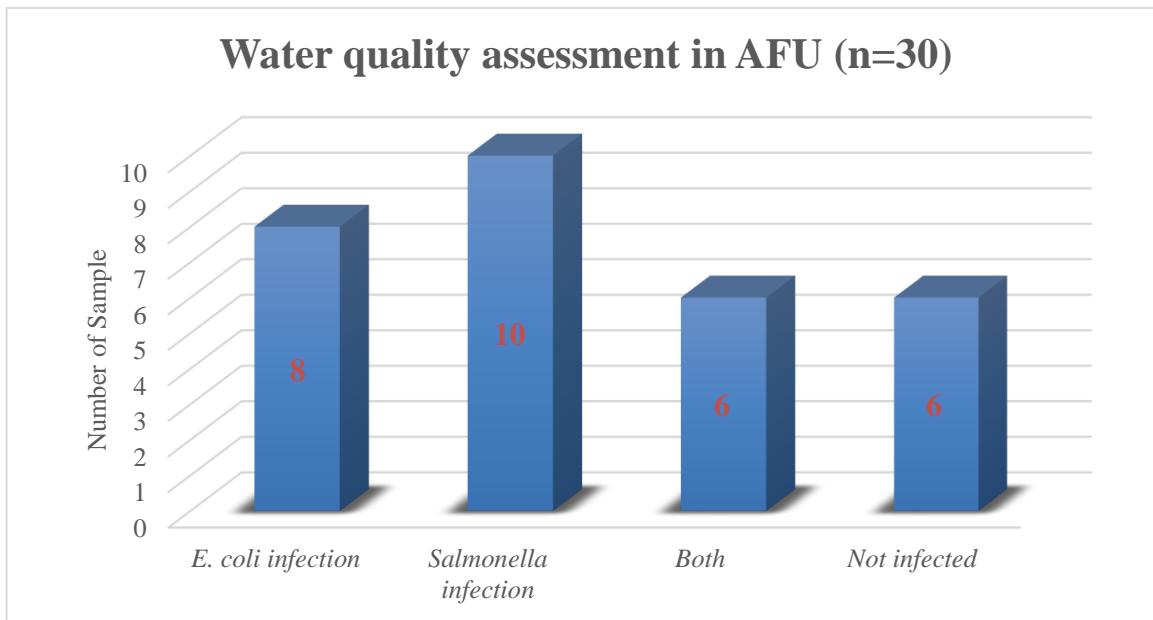


Figure 15. Water contamination in the farm and premises of AFU

The results were astounding from the standpoint of the presumptive test that all samples were similarly polluted. The presence of flocculent development and excessive turbidity in all 30 samples indicates the necessity for regular treatment and cleaning of potable water distribution systems and reservoirs. We cultivated the positive presumptive tests on three separate agar plates (namely, MacConkey, EMB, and XLT4) for the confirmatory test. This showed that coliforms and *Salmonella* were present in animal farm and human-intentioned water resources other than reverse osmosis (RO) water. Despite the fact that RO water sources were able to remove all coliforms, they also had good bacterial growth in presumptive tests, which could include high amount of gram positive bacteria.

The table 1 shows the actual results of all the samples in MPN values per 100 ml of water sample that we had collected from 15 ( $\times 2$  replication) sources. Each replication repeated its same previous quality during the assessment.

**Table 1. MPN values per 100 ml of water sample of different sources in the farm and premises of AFU**

S.N.	Sources of Water ( $\times 2$ replication)	Number of tubes giving a positive reaction	MPN per 100 ml of 50 ml	Results and remarks
			5 of 10 agar	ml
<b>Livestock Farm Water Sources</b>				
1.	Buffalo shed, long water trough	1	5	> 18 <i>Salmonella</i> infection
2.	Buffalo shed, circular water trough	1	5	> 18 Coliforms, <i>E. coli</i> infection
3.	Milk distribution hall, tap water	1	5	> 18 <i>Salmonella</i> and coliforms, other than <i>E. coli</i> , like <i>Klebsiella</i> , <i>Enterobacter</i> infection
4.	Cattle shed, water trough	1	5	> 18 <i>Salmonella</i> and coliforms, <i>E. coli</i>
5.	Heifer buffalo shed, water trough	1	5	> 18 Coliforms, <i>E. coli</i> infection
<b>Water Sources Intended for Human Consumption</b>				
6.	Central cafeteria, drinking water	1	5	> 18 <i>Salmonella</i> and coliforms, other than <i>E. coli</i> , like <i>Klebsiella</i> , <i>Enterobacter</i> infection

7.	Vet hostel, RO water	1	4	16	Poor growth on plates, probable no Gram -ve bacteria
8.	Vet hostel, hand pump water	1	5	> 18	Coliforms, <i>E. coli</i> infection
9.	Vet hostel, east side tank water	1	5	> 18	<i>Salmonella</i> infection
10.	Vet hostel, west side tank water	1	5	> 18	<i>Salmonella</i> infection
11.	Vet complex, RO water	1	4	16	Poor growth on plates
12.	Vet complex, ground floor, bathroom tap	1	5	> 18	<i>Salmonella</i> as well as <i>E. coli</i> infection
13.	Vet complex, 1 <sup>st</sup> floor, bathroom tap	1	5	> 18	<i>Salmonella</i> as well as <i>E. coli</i> infection
14.	Vet teaching hospital, RO water	1	4	16	Poor growth on plates
15.	Vet canteen, drinking water	1	5	> 18	<i>E. coli</i> infection

According to sample replication, we obtained 10 samples from the AFU livestock farm, of which 6 (60%) were positively identified as having *E. coli*, as shown in figure 2.

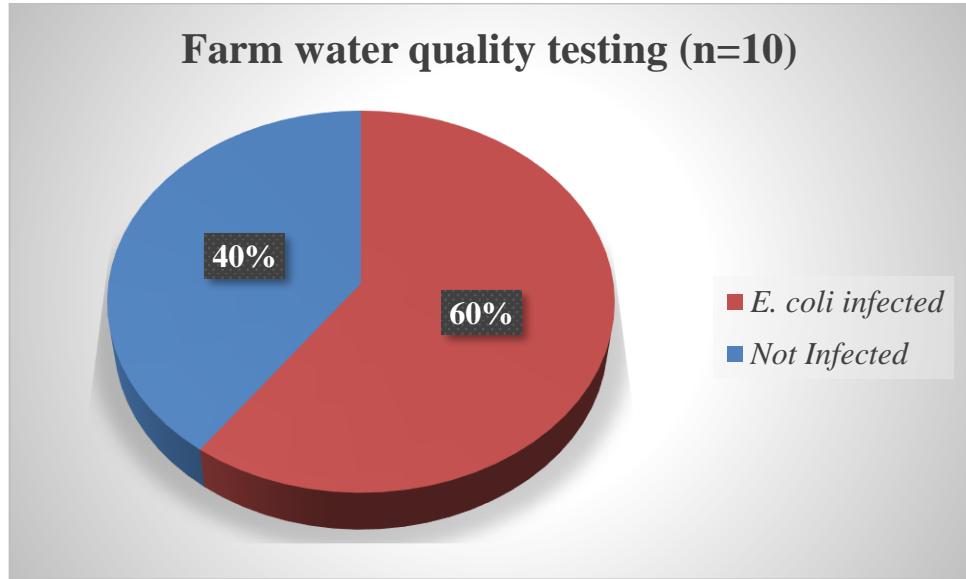


Figure 16. *E. coli* infection in livestock farm water of AFU

We had obtained 20 samples from the AFU premises (Vet building, Vet Teaching Hospital, Canteens, and Hostels), of which 8 (40%) were positively identified as having *E. coli*, as shown in figure 3.

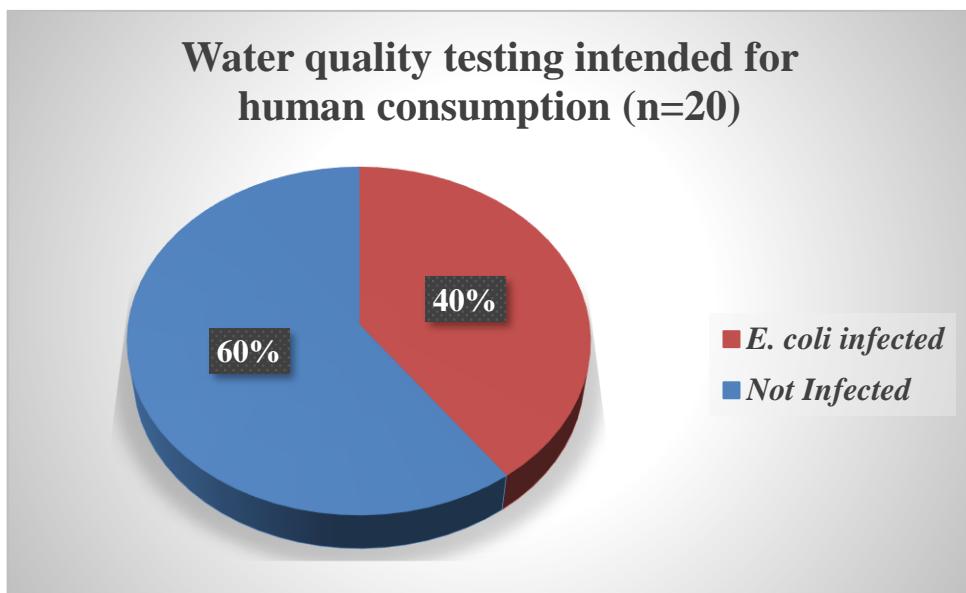


Figure 17. *E. coli* contamination in the water of AFU intended for human consumption

As per the water quality assessment, it has been clear that the water sources and distribution systems are poor and unhygienic which need a quick and effective treatment. *Salmonella* infection is way higher in the water source intended for both animal and human consumption. 16 (53%) samples out of the 30 were infected with *Salmonella* in the farm and premises of AFU as shown in figure 4.

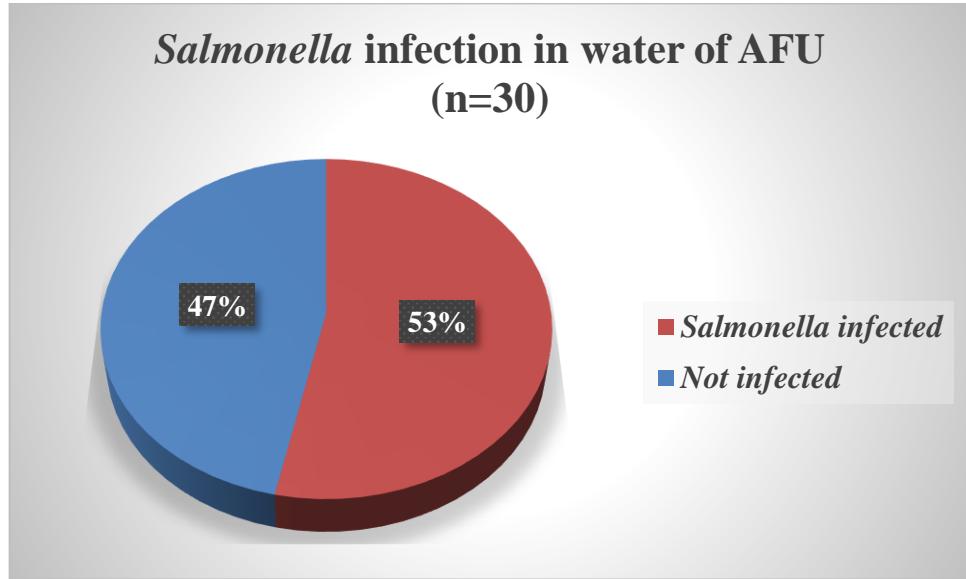


Figure 18. *Salmonella* infection in the water sample of AFU

The chi-square test was used to determine the hypothesis whether the water used for animal farming was considerably more polluted than water used for human use. There was no significant correlation ( $p=0.3006$ ) between the *E. coli* infection in the water supply and the intended water consumer, according to the chi-square test. *Salmonella* infection and the intended water consumer were not linked in a same way ( $p=6047$ ). Both p-values were greater than the threshold p-value of 0.05. This demonstrated that the water used for human consumption in the canteens, hostels, veterinary teaching hospital, and vet complex was indeed contaminated and polluted in a same manner identical to that found in the livestock farm water sources of AFU.

**Table 2. Association of *E. coli* infection in water and intended consumer**

	<i>E. coli</i> infected	Not Infected	
Livestock farm water	6	4	10
Human consumption water	8	12	20
Total	14	16	30

The p-value is 0.3006, which is greater than 0.05.

**Table 3. Association of Salmonella infection in water and intended consumer**

	Salmonella infected	Not Infected	
Livestock farm water	6	4	<b>10</b>
Human consumption water	10	10	<b>20</b>
<b>Total</b>	<b>16</b>	<b>14</b>	<b>30</b>

The p-value is 0.6047, which is greater than 0.05.

Electrochemical techniques have numerous advantages for portable detection of contamination, and while many approaches have been investigated, galactosidase and glucuronidase assays predominate (Bigham et al., 2019). A study for finding a practical approach for counting thermotolerant coliforms in raw water supplies used for irrigation and home purposes, based on the correlation coefficients calculated between the three methods, economic considerations, test duration, and time to yield results, the plate count, direct multiple-tube fermentation (MTF), and traditional MTF can be ranked in descending priority order for bacterial quality assessment of water resources for emergency and irrigation purposes. Whereas, conventional, direct MTF, and plate count methods detected *E. coli* at rates of 95, 90, and 80%, respectively, which means the MTF method is more precise, sensitive and specific (Almasi A., 2011).

#### 4. RECOMMENDATION AND SUGGESTIONS

The elimination of coliform bacteria from water supply of AFU necessitates the application of a thorough strategy that integrates both preventive actions and appropriate treatment procedures. Here are some ideas to take into account:

1. Regular Testing: To find out whether and how much coliform bacteria are present in the water, regular testing is first performed. This procedure will make it possible to monitor the effectiveness of control methods and spot any potential issues early on.
2. Supply Protection: It is important to guard against potential contamination of the water supply. To avoid contamination runoff or leaching, make sure the farm's sewage systems, septic tanks, and manure storage places are placed at a safe distance from the water source. Establish and maintain a buffer zone around the water source to minimize the risk of contamination from animals or agricultural activities (Habib et al., 2023).
3. Animal Management: Implement proper animal management practices to reduce the likelihood of fecal contamination. This includes keeping livestock away from water sources, providing clean drinking water for animals, and regularly cleaning and maintaining animal housing and waste management facilities.

4. Maintenance of Infrastructure: Regularly inspect and maintain all infrastructure related to water supply, such as wells, pumps, pipes, and storage tanks. Repair any leaks or damages promptly to prevent the entry of external contaminants.
5. Water Treatment: Consider implementing a water treatment system to effectively eliminate coliform bacteria. Depending on the specific situation and the farm's resources, possible treatment options may include:
  - a. Chlorination: Chlorination is a common technique for disinfecting water by eliminating microorganisms in it. The weak chlorine solution is a 0.025% solution prepared with 1 g/2.5 l bleaching powder is found to effective against coliform bacteria (Arnold & Colford, 2007).
  - b. UV Disinfection: Ultraviolet (UV) light treatment can also be used to kill bacteria, including coliforms through the installation of UV disinfection equipment in the water supply system (Paijalwar & Khedikar, 2016)
  - c. Filtration: Filtration techniques like membrane filtration or activated carbon filters can help get rid of microorganisms in the water. Use filters made specifically to get rid of coliform bacteria, and make sure to clean or replace them in a regular interval of time.

## CONCLUSION

In conclusion, the study conducted at Agriculture and Forestry University (AFU) aimed to investigate bacterial contamination, specifically fecal coliforms, in water sources used in various areas of the university. The most probable number (MPN) method was employed to estimate the microbial density in the water samples. The results revealed a significant level of contamination in both animal farm water sources and those intended for human consumption.

Out of the total 30 samples collected, 26.67% were confirmed to have *E. coli* infection, 33.33% were confirmed for *Salmonella* infection, and 20% had both types of bacteria present. Additionally, 20% of the samples showed no bacterial contamination. The presence of coliform bacteria, particularly *E. coli*, indicated fecal contamination in the water sources, highlighting the need for improved hygiene and regular treatment of the distribution systems. The study further demonstrated that the contamination levels were similar in water sources used for animal farming and those intended for human consumption. The chi-square test did not show a significant correlation between the presence of *E. coli* or *Salmonella* infection and the intended water consumers. This suggests that the water quality in canteens, hostels, veterinary teaching hospitals, and vet complexes was equally contaminated as in the livestock farm water sources.

The findings of this study emphasize the urgent need for effective treatment and improvement of the water sources and distribution systems at AFU. The high prevalence of *Salmonella* infection raises concerns about the safety and hygiene practices in place. Adequate measures should be taken to ensure the provision of clean and safe drinking water to prevent waterborne diseases and protect the health of both animals and human. It is worth noting that further research and monitoring are necessary to identify the sources of contamination and implement appropriate interventions. The study also highlights the importance of regular water quality testing using reliable methods like the MPN technique. By employing effective water treatment strategies and promoting good hygiene practices, AFU can significantly reduce bacterial contamination in its water sources and safeguard the well-being of its community.

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## Annexes

### Annex 1

**Table A5.2 MPN values per 100ml of sample and 95% confidence limits for various combinations of positive and negative results (when one 50-ml and five 10-ml test portions are used)**

No. of tubes giving a positive reaction		MPN (per 100ml)	95% confidence limits	
1 of 50ml	5 of 10ml		Lower	Upper
0	0	<1	—	—
0	1	1	<1	4
0	2	2	<1	6
0	3	4	<1	11
0	4	5	1	13
0	5	7	2	17
1	0	2	<1	6
1	1	3	<1	9
1	2	6	1	15
1	3	9	2	21
1	4	16	4	40
1	5	>18	—	—

### Annex 2

#### Stepwise detail laboratory procedures for presumptive and confirmatory tests

Collection of water sample from the source (100 ml each)



Deliver them to Medicine Laboratory in an ice-box



#### Preparation of the Medium

- Single and double strength of MacConkey Broth mediums contain 40.07 gm and 80.14 gm in 1000 ml of distilled water, respectively.
- Dispense the double strength medium in 5 tubes (10 ml per tube), the single strength medium in 1 bottle containing 50 ml.
- Autoclave at 15 pounds of pressure (121 degrees Celsius) for 15 minutes.
- Cool the tubes before inoculation.

#### Procedure for Presumptive test

- Take 1 vial of single concentration (50 ml) and 5 vials of double concentration (10 ml) for each water sample to be examined.
- Add 50 ml of water to the tubes containing 50 ml of single-strength medium using a sterile pipette.
- Add 10 ml of water to 5 tubes holding 10 ml of double-concentration medium.
- At 37°C, incubate the tubes for 24 hours. If no positive tubes develop, re-incubate for up to 48 hours.
- Compare the number of tubes exhibiting a positive reaction against a standard chart and note the quantity of bacteria present in the sample.
- For instance, a water sample with a result of 1–4 (1 50 ml positive, 4 10 ml positive) has an MPN value of 16, indicating that the sample contains around 16 coliforms per 100 ml

### **Presumptive Test Result**

#### Positive

- The development of turbidity in the growth media and color change, indicates a positive presumptive test for coliform bacteria and, thus, for the likelihood of fecal contamination.
- The test is just presumptive because various other species of bacteria can yield identical results under these conditions.

#### Negative

- There is no turbidity neither color change.

### **Confirmatory test**

1. Incubate the presumptive positive tests on EMB agar.

Suspend 36 grams of EMB Agar in 1000 ml of distilled water. Heat to dissolve the medium completely. Dispense and sterilize by autoclaving at 15 lbs. pressure (121 °C) for 15 minutes.

#### Positive

- Coliforms create colonies with a metallic sheen that is distinguishable from non-coliform colonies (show no sheen). The appearance of typical colonies at high temperatures ( $44.5 \pm 0.2$ ) implies that thermo-resistant E. coli is present.

#### Negative

- Lack of gas production in lactose broth or absence of coliform-like colonies on EMB agar.

2. Incubate the presumptive positive tests on **MacConkey agar** which was prepared as per the manufacturer guidelines.

<b>Organism</b>	<b>Growth</b>	<b>Color of colony</b>
<b>Cultural responses</b>		
<i>Staphylococcus</i> sp.	Inhibited	
<i>E. coli</i>	Luxuriant	Pink to red
<i>Salmonella</i> sp.	Luxuriant	Colorless

3. Incubate the presumptive positive tests on **XLT4 agar** which was prepared as per the manufacturer guidelines.

<b>Organism</b>	<b>Growth</b>	<b>Color of colony</b>
<b>Cultural responses</b>		
<i>Enterococcus</i> sp.	Inhibited	
<i>E. coli</i>	Fair good	Yellow
<i>Salmonella</i> sp.	Luxuriant	Red with black centers

### Annex 3

Some glimpses of the working in the laboratory of Veterinary Medicine and Public Health, Faculty of Animal Science, Veterinary Science and Fisheries (FAVF), Agriculture and Forestry University (AFU), Rampur, Chitwan, Nepal.

- MacConkey Broth medium double strength in test tubes and single strength in bottle.
- Flocculent growth of bacteria in flask showing turbidity.
- Comparison of turbidity in the sample test tube with control solution.
- Inoculation of presumptive positives in the agar plates.
- MacConkey and EMB agar plates show good growth in the streaking area.
- The RO water in Veterinary Hospital shows no growth in the XLT4 agar.

# IMPACTS OF INTENSIVE POULTRY FARMING ON ‘ONE HEALTH’ IN NEPAL: CHALLENGES AND REMEDIES



A. Bhattarai\*

**Abstract:** This study aims to examine the present understanding of how intensive poultry farming affects animals, the environment, and human health and to explore potential solutions for a sustainable future. Poultry production is a growing industry that accounts for about 3.5% of the total GDP in Nepal. By applying modern intensive farming methods, global production reached 133.4 million tons in 2020, showing consistent annual growth. Despite their effectiveness in promoting rapid growth and high yields, intensive farming practices result in a substantial environmental impact. Litter and manure often contain a diverse array of substances, including pesticide residues, microorganisms, pathogens, antibiotics, hormones, metals, macronutrients, and various pollutants. These components have the potential to contribute to environmental contamination of air, soil, and water. Additionally, the presence of such compounds can lead to the development of antimicrobial-resistant and multidrug-resistant strains of pathogens, posing a significant concern for public health and ecosystem integrity. Dust emitted from intensive poultry production operations contains feather and skin fragments, feces, feed particles, microorganisms, and other pollutants, which can adversely impact poultry health as well as the health of farm workers and nearby inhabitants. Fastidious odors are another problem that can harm workers' and the surrounding population's health and quality of life.

**Keywords:** Poultry farming system, animal diseases, zoonoses, human health risk, environmental pollution

## 1. Introduction

Poultry farming is widely recognized as one of the most efficient methods of animal husbandry, offering a reliable source of protein while enhancing food and nutritional security for diverse populations in rural regions globally, particularly within developing nations (Vaarst et al., 2015). It is primarily focused on chickens, accounting for as much as 98% of the global poultry meat production and 92% of global poultry egg production (Mottet & Tempio, 2017). The practice of poultry farming holds notable significance, particularly in countries such as Nepal, where there are persistent challenges related to food security. In Nepal, the poultry sector plays a significant role, contributing approximately 3.5% to the total gross domestic product (TGDP) (Dhakal et al., 2019). Notably, the country has a fowl population of approximately 47.96 million, with 28.3% laying hens that produce around 887.24 million table eggs. Furthermore, over the past decade, hen egg production has displayed an average annual growth rate of 2.43%. In recent years, Nepal has witnessed a significant increase in its poultry population, with the current population of laying hens reaching 8,233,616. Furthermore, meat production from poultry has also seen a noticeable uptick, resulting in an output of approximately 42,810 metric tons. These statistics underscore the prevalence and importance of poultry farming in Nepal as a crucial aspect of animal husbandry.

The growing demand and the increasing price of poultry have become huge drivers for mass production, leading to the adoption of intensive farming systems. An intensive farming system is a method of raising poultry in a highly controlled and efficient manner. In this approach, chickens are reared entirely on dung. High-quality rearing is required to realize the full potential of chickens in this system. To fully harness the potential of this system, foreign and more productive commercial breeds must be bred under an input-high-output system. As a consequence of these requirements, intensive

poultry farming systems are predominantly found in large cities and peri-urban areas where the market for poultry products is secure and substantial. This system is generally not recommended for mountainous farming situations due to its demanding nature and resource-intensive requirements.

There are two primary systems that are employed in intensive poultry farming, namely the deep litter system and the cage system. The deep litter system is a method of poultry housing and management that involves providing a thick layer of bedding material on the floor of the poultry house. This system is commonly used in poultry farming, including for broilers (meat birds) and layers (egg-producing birds). The deep litter system can be a cost-effective and environmentally friendly option for poultry farmers, as it reduces the need for frequent cleaning and disposal of litter. However, it requires diligent management to ensure optimal conditions for the birds and prevent issues like excessive ammonia levels or disease outbreaks.

In contrast, the cage system of poultry farming is a method where poultry birds, such as layers (egg-producing birds), are housed in cages within a controlled environment. This system is commonly used in commercial egg production, offering several advantages over other housing methods. While the cage system offers benefits in terms of production efficiency and disease control, it has also been a topic of debate due to concerns about animal welfare. Critics argue that the confined space in cages restricts the natural behavior and movement of the birds. As a result, there has been a growing trend towards alternative housing systems, such as free-range or enriched colony systems, which provide more space and opportunities for the birds to express their natural behaviors. The choice between these systems is influenced by a range of factors, including economic considerations and evolving societal values regarding the treatment of poultry in agricultural practices.

In addition to the various advantages associated with intensive poultry farming, it has a significant impact on human health and the environment (de Vries & de Boer, 2010; Gržinić et al., 2023). The environmental and human health consequences of intensive poultry farming have been the subject of growing concern (Steinfeld et al., 2006). Intensive farming is associated with various environmental challenges. Poultry production and waste by-products are linked to NH<sub>3</sub>, N<sub>2</sub>O, and CH<sub>4</sub> emissions and have an impact on global greenhouse gas emissions (Gržinić et al., 2023). These emissions not only have implications for global climate change but also pose potential risks to both animal and human health.

In a country like Nepal, poultry consumption has witnessed a notable increase over the past few decades. This surge in poultry consumption underscores the significance of safeguarding and promoting the development of the poultry sector within the nation. Such endeavors are considered crucial not only for enhancing the nutritional status of the Nepali population but also for fostering economic development. The consumption of poultry products, which are known for their high nutritional value, has the potential to address malnutrition and contribute to improved health outcomes among the Nepali people. To effectively address the potential impacts of poultry farming on various aspects of society, it is imperative to gain a comprehensive understanding of the implications associated with this agricultural practice.

## 2. METHODOLOGY

This review is completely based on the secondary data which are collected from the study of different journals, research papers, books, articles, and magazines.

### 3. IMPACTS OF INTENSIVE POULTRY FARMING

As mentioned above, intensive poultry farming has negative health impacts on both animals and humans. In animals, the high stocking densities and stressful conditions in factory farms can lead to the spread of disease, resulting in the need for antibiotics and other medications. The use of antibiotics can contribute to the development of antibiotic-resistant bacteria, which can be dangerous for both animal and human health. For humans, working in intensive poultry farming facilities can be hazardous due to exposure to high levels of dust and other airborne pollutants, which can cause respiratory problems, skin irritation, and eye irritation. Additionally, the use of pesticides, herbicides, and other chemicals in poultry production can contaminate the surrounding environment, potentially leading to negative health impacts for local communities. Driven by the growing demand for food products of animal origin, industrial livestock and poultry production has become increasingly popular and is on the track to becoming an important source of environmental pollution (Hu et al., 2017).

Within the One Health concept, the multidisciplinary and collaborative approach to address potential or existing risks that originate at the animal-human-environment interface, most research initiatives have focused on zoonotic infections and emerging antimicrobial resistance as potential threat to both human and animal health. Some of the important impacts of intensive poultry farming system are as follows:

#### 3.1 Air Pollution

Air quality is diminished in livestock farming areas due to emissions of both coarse and fine particles, odorous gases, and endotoxin (Smit & Heederik, 2017). Potentially pathogenic viruses and bacteria as well as antimicrobial-resistant (AMR) bacteria can also be found in airborne particulate matter surrounding livestock farms. Air pollutant emissions from agriculture emphasize the environmental health risks posed by noninfectious farm emissions. Large-scale air pollution by secondary inorganic aerosols can affect a large proportion of the population, even outside livestock farming areas. People living at closer proximity to farms are also exposed to other agents that may affect the airways, such as endotoxin, larger particles, and ammonia (Smit & Heederik, 2017).

#### 3.2 Ammonia

Ammonia is a byproduct of the decomposition of poultry manure, and its presence in high concentrations can have negative health impacts on both poultry and humans in intensive poultry systems. Ammonia is known to irritate the respiratory systems of poultry birds. Prolonged exposure to high levels of ammonia can lead to respiratory problems, reduced feed intake, decreased growth rates, and increased susceptibility to respiratory diseases. Birds may exhibit signs such as coughing, eye irritation, nasal discharge, and poor overall performance. Also, inhalation of ammonia by workers and people living near intensive poultry facilities can cause eye, nose, and throat irritation. Prolonged exposure to high concentrations can lead to respiratory issues, including bronchitis and pulmonary edema.

#### 3.3 Bioaerosols

Bioaerosols are airborne particles that contain living organisms, fragments, toxins, and waste products. In animal houses, major sources of bioaerosols are animals, their waste, feed, and bedding. Human exposure to bioaerosols has been associated with a range of acute and chronic adverse health effects and diseases (Douglas et al., 2018). The most reported are respiratory system problems (e.g., rhinitis, asthma, bronchitis, and sinusitis). Other health problems reported include gastro-intestinal issues, fatigue, weakness, and headache.

### 3.4 Water pollution

Intensive poultry farming systems can contribute to water pollution through various pathways. When excessive amounts of manure are applied to land or when manure storage facilities are improperly managed, rainfall or irrigation can wash the nutrients into nearby streams, rivers, or groundwater, leading to water pollution. Excessive nutrient levels can cause eutrophication, harmful algal blooms, and disrupt aquatic ecosystems. Poultry manure can contain pathogens such as *Salmonella*, *Campylobacter*, and *E. coli*, which can contaminate water sources through runoff or direct contact. The use of antibiotics, disinfectants, and chemicals in poultry farming can potentially enter water bodies through runoff or leaching. These substances can have adverse effects on aquatic organisms and contribute to the development of antibiotic resistance in bacteria.

### 3.5 Zoonotic pathogens

Intensive poultry farming and long-distance transport of animals increase the risk of bacterial infections such as *E. coli*, *Salmonella*, and *Campylobacter*, which can pose a threat to human health. In addition, the long-distance transport of animals can also lead to the emergence of new strains of influenza viruses that could potentially cause significant harm to human health.

#### 3.5.1 *E.Coli*

Pathogenic *E. coli* is an important foodborne bacterium that can cause serious illness in people and is sometimes fatal. In intensively farmed poultry in hot and humid conditions, environmental stress can lead to increased shedding and spreading of these bacteria. The careful observation of food hygiene and cooking procedures is important to minimize the risk of cross-contamination. The emergence of antibiotic-resistant strains of *E. coli* in intensive farming systems is a growing concern. The overuse and misuse of antibiotics in such systems can lead to the selection of resistant strains, which can spread through animal and human populations, limiting the effectiveness of antibiotics in treating infections.

#### 3.5.2 *Campylobacter*

The WHO has declared *Campylobacter* to be the most important foodborne bacterium for humans. Poultry are the main source of *Campylobacter* infection. The biggest risk is chicken meat consumption. At five weeks of age, around 30% of animals are often removed from farm units for slaughter. Infection can be introduced during the catching of the birds. Acute stress can reduce the levels of protective bacteria in the intestines and increase the growth and shedding of *Campylobacter*. Poor animal welfare conditions and acute stress can lead to immunosuppression, rendering birds less able to resist infection.

#### 3.5.3 Avian Influenza/Bird Flu

This highly contagious viral disease affects the respiratory, digestive, and/or nervous system of many species of birds (NADIS, 2018). Avian influenza has the potential to cause rapid and widespread mortality in poultry. If it spreads rapidly, it could cause a catastrophe. Usually, influenza infection in poultry causes mild disease, referred to as low pathogenicity avian influenza (LPAI), but two subtypes (H5 and H7) can mutate to a highly pathogenic form (high pathogenicity avian influenza, HPAI) in poultry.

### **3.6 Anti-microbial resistance**

In intensive poultry farming, large numbers of birds are typically housed in close proximity, which creates an environment favorable for the spread of diseases. To prevent and control these diseases, antimicrobial drugs are often used prophylactically or as growth promoters. Overuse and misuse of antibiotics in animal agriculture can promote the development of resistant strains of bacteria. Keeping large numbers of poultry in confined spaces increases the risk of disease transmission among the birds. When infections occur, antimicrobials are frequently used to control outbreaks. This constant exposure to antibiotics provides a selection pressure that favors the survival and proliferation of resistant bacteria. The high density of animals in intensive poultry farming can result in the accumulation and dissemination of bacteria and their resistance genes. This can occur through direct contact between animals as well as through environmental contamination from feces and other waste materials. Resistant bacteria can then be transmitted to humans through contact with contaminated poultry products or through environmental pathways. The waste generated by intensive poultry farming, such as manure and wastewater, can contain high levels of antimicrobial residues and resistant bacteria. Improper handling and disposal of this waste can lead to the contamination of soil, water, and surrounding ecosystems, contributing to the spread of antimicrobial resistance in the environment.

### **3.7 Additional issues**

Some of the other impacts of intensive farming systems include smell and odor impacts, pollution of local rivers, impacts on the local tourism economy, noise impacts, biodiversity impacts.

Additional concerns raised were air pollution and health, antimicrobial resistance, animal welfare, lack of scrutiny/fairness in planning procedures.

## **4. PROBLEMS FACED BY POULTRY FARMERS IN NEPAL**

Poultry farmers in Nepal face various challenges in intensive farming. Some of the common problems include:

### **4.1 Disease outbreaks**

With its high stocking density intensive poultry farming can create a favorable environment for the spread of diseases among birds. Outbreaks of infectious diseases, such as Newcastle disease, avian influenza, and infectious bronchitis, can result in significant economic losses for farmers.

### **4.2 Lack of biosecurity measures**

The risk of disease transmission can be increased by inadequate biosecurity measures. Many small-scale poultry farmers in Nepal may not have sufficient knowledge or resources to implement proper biosecurity measures, such as restricted access to farms, disinfection protocols, and proper waste management, leading to increased disease susceptibility. Government policies on biosecurity are not enough. The District Livestock Services Office's (DLSO) disease reporting system comes from various service centers in Nepal. They gather information from district backyard poultry farms and small commercial farms. They do not know about large commercial farms. So epidemiological surveillance reporting is incomplete and cannot be properly interpreted (Poultry Farming in Nepal, 2022).

#### **4.3 Limited access to veterinary services**

Accessing veterinary services for poultry farmers in rural areas of Nepal is an important challenge that they face. The lack of trained veterinarians and veterinary infrastructure can hinder timely disease diagnosis, vaccination programs, and effective treatment, resulting in higher mortality rates and reduced productivity.

#### **4.4 Feed availability and quality**

Poultry farmers in Nepal often face difficulties in accessing feed that is both high-quality and affordable. The availability of well-balanced and nutritious feed is vital for ensuring the optimal growth and health of poultry. Unfortunately, limited access to affordable feed, particularly in certain seasons or remote areas, can have a negative impact on the productivity and profitability of intensive poultry farming operations.

#### **4.5 Infrastructure and technology limitations**

Some poultry farmers in Nepal may lack access to adequate infrastructure, including well-constructed housing, proper ventilation systems, and efficient waste management facilities. Limited technological advancements and low adoption rates of modern farming practices can further hinder productivity and efficiency.

#### **4.6 Market fluctuations and price volatility**

The marketing of their products and managing price fluctuations can be a significant challenge for poultry farmers. Seasonal fluctuations in demand for poultry products can make it difficult for farmers to secure reliable buyers or negotiate fair prices, which can have an adverse effect on their profitability.

#### **4.7 Financial constraints**

A significant challenge for small-scale poultry farmers can be limited access to credit and financial resources. Insufficient capital for investment in infrastructure, equipment, and high-quality inputs can limit their ability to expand their operations and improve productivity.

#### **4.8 Lack of modern diagnostic laboratories**

The lack of modern laboratories for diagnosing diseases in chickens and testing the quality of feed and meat are some of the major setbacks facing the poultry industry in Nepal (The Poultry Site, 2010). The absence of modern diagnostic laboratories in intensive poultry farming hampers early disease detection and can lead to increased production risks and costs. Additionally, it limits opportunities for research and innovation in poultry health management.

### **5. PERSPECTIVE**

Balancing the protection of neighboring residents from potentially harmful farm emissions with maintaining the viability of family farms, ensuring food safety, promoting healthy working conditions, and optimizing animal welfare is a critical concern. Significant progress has been made in reducing the risk of antimicrobial resistance (AMR) transmission from livestock production industries through a substantial decrease of over 60% in antimicrobial usage. This reduction in antimicrobial use has been accompanied by a decrease in antimicrobial resistance across all livestock production sectors. To address other risks, such as zoonoses and animal disease management, implementing effective strategies like enhancing biosecurity measures, implementing vaccination programs, and implementing robust

surveillance systems are crucial. Additionally, in order to mitigate gas and dust emissions, it is necessary to adopt alternative housing systems that reduce emissions. Considering densely populated regions, implementing "safe distances" between large-scale farms and residential areas may not be a feasible option; thus, alternative approaches need to be explored.

## 6. CONTROL OPTIONS AND FUTURE PROSPECTS

Implementing strict biosecurity measures is essential for reducing the risk of infection in intensive poultry farming. This includes measures such as controlling farm access, practicing proper waste management, and implementing disinfection protocols. Additionally, minimizing the long-distance transport of poultry can help prevent the introduction and spread of diseases.

Surveillance plays a crucial role in monitoring the health status of poultry farms. Regular surveillance for avian influenza, in particular, is important to detect any potential outbreaks early and take necessary preventive measures. Vaccination programs targeted at avian influenza can also help minimize the risk of disease spread within and between poultry farms.

Proper ventilation systems should be in place to ensure sufficient airflow and the removal of ammonia from the poultry house. Proper storage, treatment, and utilization of manure can also reduce ammonia emission. Maintaining appropriate temperature and humidity levels within the poultry house can help reduce ammonia production and improve air quality. Workers should be provided with appropriate training on ammonia management, occupational safety procedures, and the use of personal protective equipment.

Addressing the issue of antimicrobial resistance requires a multi-faceted approach involving improved animal husbandry practices, responsible use of antimicrobials, and enhanced surveillance and monitoring systems. This includes promoting good hygiene and biosecurity measures, implementing vaccination programs, reducing overcrowding, and providing better animal welfare conditions. Additionally, efforts should focus on promoting sustainable farming practices that reduce reliance on antibiotics and promote alternative disease prevention and control strategies.

By focusing on stringent biosecurity, minimizing long-distance transport, improving ventilation systems, and implementing surveillance and vaccination programs, the risks associated with disease transmission, particularly avian influenza, can be significantly reduced in intensive poultry farming.

## 7. CONCLUSION

This overview summarizes some of the most researched elements of intensive poultry farming in relation to their health impacts. Whilst occupational studies clearly demonstrate that intensive poultry farm exposure is harmful to health, further research is required to accurately quantify community health impacts. It is also important to establish whether current mitigation measures are sufficient to protect health, where there is a very high density of intensive poultry farms. For example, sensory issues such as noise, pollution and unsightliness, which have the potential to detrimentally affect wellbeing. There may also be an effect of these stressors on livelihoods, particularly in the hospitality industry. Poultry raised through intensive farming methods offers a cost-effective protein source. However, the potential health impacts of intensive poultry farming are broad. Some of these impacts (e.g., those caused by air pollutants) may be restricted to the local community and the workforce.

However, consumption of poultry could affect health on a national level via zoonotic disease. Indeed, there could be global implications for health when the impact of widespread anti-biotic use and emerging resistance is taken into consideration. It is vital that water and air quality is continuously monitored to gain an understanding of the current environmental burden of existing intensive poultry farms and evidence-based mitigation measures must be adopted. Thorough health impact assessments should supplement every planning application, and these should consider both the widely published health determinants and those raised by residents. They must also consider the cumulative impact of the increasing number of intensive poultry farms in the area.

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# SUCCESS STORY ON SHEEP FARMING

S. Doddannavar\*

## Introduction

Agriculture is the backbone of the Indian economy, and livestock plays an important role in providing sustainable income to farmers throughout the year. One of the interesting forms of livestock rearing is sheep rearing.

Sheep belong to the family *Bovidae*, genus *Ovis*, and species *Aries*. It is an important economic livestock species that contributes greatly to the Indian economy. They play an important role in the livelihood of a large percentage of small and marginal farmers and landless laborers. Sheep are reared for meat and wool purposes, and India is the largest exporter of sheep and goat meat to the world. It stands 5th in meat production and 2nd in chevon production in the world, and it has wool production of 43.6 million kg (Annual report DAH 2016–17).

According to the 20th Livestock Census, the total sheep population in India is 74.26 million, and 13.87% of the livestock population is made up of sheep. Karnataka stands in 9th position with a contribution of 29 million sheep. Gadag district in Karnataka supports around 4.5 lakh people. It is a semi-arid region, and the climate of this district is characterized by the tropical monsoon, which indicates the seasonal weather throughout the year, with less rainfall on the major non-irrigated lands. Therefore, the sheep are widely sustainable with great income and profitability.

I opted for one of the taluks named Shirahatti in Gadag district, where we can find many farmers dependent on sheep rearing. There are so many farmers who have been practicing sheep rearing for generations in this region, but I have studied with one shepherd who has selected the local breed Bannur (Mandy). It is a native tract of Karnataka, with a majority white to black color. It includes the physical trait of a compact body, typically reverse "U"-shaped from the ear end. Mainly, it is famous for its mutton purpose.

The family named Karigar is a well-known example of sheep-rearing activities from the past 5 generations in this region. Their ancestors, around the first 3 generations, were illiterate and purely shepherds, with 1100 sheep.

Even at present, they are continuing their rearing activities with 200 sheep. The current name of an educated farmer, Shri. Ningappa Yellappa Karigar, with qualifications of B.Sc. and B.Ed., belongs to the 4th generation and is a retired High School Head Master of Shri Jagadguru Fakkireswar Education Society Shirahatti, Gadag, and even served as a Lecturer in the Training Institute for Teachers along with his passion for agriculture and sheep rearing. Even his children are continuing the rearing activities.



Photographs showing the sheep rearing activities

Let's discuss some of their management practices which led them to continue from bunch of decades:

### **Rearing Management:**

This shepherd follows an extensive (free-range) system, which is also called a nomadic system, and it involves continuous movement with the whole flock. They have also kept three laborers for 200 sheep to look after them. An interesting one to know is that the nomadic flockers know very well how to find the best pasture for grazing as well as drinking water at different seasons.

Within a year, they will be covering Gadag, Haveri, Dharwad, Karwar, Koppal, and some parts of Belgaum districts in Karnataka. They mix a few goats with the flock of sheep, as they believe that the sheep is a dumb animal and the goat helps it along the way of grazing.

### **Feeding:**

As it is a form of extensive grazing, the animal itself will find its own fodder, and mostly they are maintained on natural vegetation grazing lands, uncultivated lands, stables of cultivated crops, and tree toppings. To gain more weight, they also feed maize grains.

While traveling in the nomadic form, the farmers usually request the shepherds to halt their sheep in their field and they will offer them to graze the leftover part after harvest and even the grains.

Due to the halt for a long time, the sheep usually defecates in the field itself and obviously, it acts as manure to the field, and the fertility of the soil increases.

If the manure is more in their field means they sell that also in Gunny bags(Rs.50/- per 20kg Bag).

### **Breeding:**

It's a vital principle that every farmer should take care of his breeding activities. They breed it in a natural way of mating, i.e., tucking. In some cases, if the male is not available, they will hire the same ram of the Bannur breed at the breeding time. During pregnancy, they will not take any kind of extra supplement.

At the time of marketing age, usually the rams are sold at 1-2 years of age, females are kept for breeding purposes (the rate depends on the marketing value and also on the demands), and sometimes the lambs at 3 months are sold at Rs. 5,000 to Rs. 6,000.

Mainly in the time of marketing season, the butchers themselves will go to the place where sheep are rearing in the field, and they will pay the cash by hand there and buy them.

It's a story of the past 15yrs where the same breed of Bannur was used for wool purposes also and weaving work was the main occupation of homemaker women of that family. By wool, they used to make blankets (Kambli), Sweaters, Caps, Bags, etc.

Shepherds select the two seasons for shearing which are before or after kaarkooli (June) and maagikooli (October–November). The best wool used to be in June, which used to be wavier than other times due to climatic conditions supported by the early monsoon. But at present, it is mainly reared for mutton purposes only, and exotic breeds have replaced this for wool purposes.

### **Treatment:**

Farmers are quite afraid of mass diseases like FMD (Foot and Mouth Disease), BT (Blue Tongue), etc., and usually farmers follow hot branding methods and also ethno-veterinary practices, also known as herbal treatment methods.

Some of the practices are listed below:

**FMD-** They use Calitropis gigantea( Cactus Milk) (Kalli Haalu)twigs and make their bed by cutting them into small bunches, the milk oozed out from the twigs acts as an Antioxidant to the wounds between the clefts and creates dryness and helps in decreasing the virulence activity of that virus.

**BT-** They feed unripened Musa acuminate (Sedded Bananas/Wild Bananas/Stone Bananas) by chopping them into small pieces +Lemon+Red Chilly powder and make it in the form of paste and they feed it by washing its mouth with KMnO<sub>4</sub>.

**Endoparasite infestations like Liver flukes, Tapeworm, and Round worms-** To reduce diarrhea they make a powder form by mixing Fenugreek, Pepper, Onion, Poppy seeds, Garlic, Turmeric, Jaggery, Cumin seeds, Curry leaves, Asafoetida and make it to eat or drink and sometimes feeding paste of soaked Greengram seeds which is rich in B Complex vitamins.

To treat the fascioliasis they feed the *Aegle marmelos* (Belavalakayi) fruit whereas nowadays the Oxyclozanide drug is used that is nothing but extracted from the same fruit itself.

### **Problems faced by the Shepherds:**

- They clearly define the afraidness about the mass diseases during October and Novemeber months.
- Lack of knowledge in the management aspects if sudden death occurs due to outbreak.
- Expectations from Government:
- To control mass diseases by Veterinary doctors through vaccination programmes.
- The Govt. should give compensation to the dead animals from Natural disasters through Aadhar linking of the individual ones, so that it is benefits directly to them.

Really, it was an amazing experience to know the secrets behind the success story of the Shepherd of Shirahatti, as it led me to learn more interesting facts about practical problems in sheep farming.

Clearly, the shepherd gave the message that "one who loves the livestock as a passion to rear, definitely he will be on the path of contributing to livelihood.

# RAMZAN SAAB: AN ETHNOVETERINARY PRACTITIONER OF KARNATAKA



S. Doddannavar\*

## Introduction

EVM(Ethno Veterinary Medicine) is an alternative method of treating the cases with herbal treatment. i.e., using the available plant based materials and its products. Its earliest concepts were set out in portion of Vedas known as Atharvaveda.

Since time immemorial ethnomedicine has existed with human beings as kind of cultural art of health and practice that helps people to solve all health related problems. It is a Traditional, Indigenous, Native knowledge.

Why EVM is important because it's a homemade facility kit available at emergency conditions, Useful for first aid treatment for all kinds of diseases, Mainly its cheap and readily available, moreover it acts as solution of no residue problem. As modern veterinary health care facilities are rare or very poor in remote areas and villages, so the traditional system of treatment is one of the most important prevailing and relevant in such areas.

The person who uses these herbal methods and techniques to treat animals is called Traditional herbal healer. I want to share some information regarding one person whom I have interviewed related to ethno veterinary practices. His name is Ramzansaab Imamsab Lakhmeshwar, a 70yrs old age person from village Soratur, taluk Shirahatti, district Gadag, state Karnataka. Who is a illiterate guy with poor background working as farmer. The most interesting part of his biodata is neither his father, grandfather nor his ancestors were in the practice of treating the animals with herbal methods. Unfortunately, one Saint(Saadhu) who is anonymous taught him and trained him when he was 20yrs old boy. That saint shared the information of the plant specimens which are indistinctly available in the local region and their special uses for treating purpose. This is how our Ramazansaab cultivated the passion of caring and treating animals, He has specialisations mainly in Bovines, at very rare emergency conditions even he attends the case of Sheep&Goat. He is equipped with special techniques of dystocia and orthopaedic treatment and all kinds of medicinal diseases. He has an experience of 50yrs in treating the animals and till now to be surprised he has dealed with approximately 7000-8000 cases till now and still counting. He is a person of most well-known herbal healer in that village, to describe his love and humble towards passion he had never charged a single rupee for his treatment procedures. If he faces a traveling procedure that amount will be given for him to fullfill his needs.

He faces the practical problem mainly in the season of summer due to non-availability and scarcity of medicinal plants due to draught. Even seasonal availability of some specific plants.

As being so helpful knowledge it's very hard to believe that it has created a generation gap in continuing such a valuable folklore knowledge. Usually it is transferred by word of mouth rather than writing. Failure of comprehensive analysis and documentation of indigenous knowledge of curing ailments in villages and remote areas. Lack of scientific validation is the major reason for non-adoption of ethno veterinary medicine by field veterinarians and trained main power.

Traditional herbal healer specially mentions that this herbal treatment method is not effective in the exotic bovine breeds like HF (Holstein Friesian) and Jersey but his orthopaedic treatment is broadly accepted for both indigenous and exotic breeds. Here I want to list few of his treatment methods, medicine preparation procedures with the plant material, They are:-

- Bloat- Mix  $\frac{1}{2}$  tsp of red kumkuma powder with 250ml of cooking oil and drench it.
- Opacity/Cataract- Extract a juice from leaves of kuntgyan balli+Potash alum+Butter of indigenous cow+Faeces of indigenous poultry, mix all these and make it in the form of paste and apply it to the internal part of eye.
- FMD(Foot&Mouth Disease) lesions- Grind the leaves of jimson weed(*Datura stramonium*) and apply it for both foot and external mouth parts.
- Maggot infestation- Grind the leaves of plant Indian acalypha(*Acalypha indica*) and fill it in a place of wound.
- Fever(Nadukund)- Mix the leaves of heart leaf moon seed(*Tinospora cardifolia*)+2-3 onions, grind both make a small bolus by adding jaggery and give it for 3days.
- Dairrohea/Bloody dairrohea- Coconut water+ plant Mangyan balli mix both and allow it to drink or allow it to eat leaves of Mallow(*Sida cardifolia*)
- Mastitis- Sweet flag(*Acorus calamus*)+Gouin soppu+Basil seeds(*Ocimum basilicum*) grind them and apply it to the udder and provide heat fomentation, if inflammation persists then apply lemon juice and turmeric both by mixing.
- After pregnancy it will not allow you to touch the udder and for milking, Take 4-5 leaves of plant Asthisamharaka(*Cissus quadrangularis*) feed it and take some more grind them and apply it to udder, due to its irritating nature it will allow you to touch the udder and we can go for milking.
- Running nose(Sasangund)-Take plant Bengal quince(*Aegle marmelos*)+Heart leaf moon seed(*Tinospora cardifolia*)+Pepper+Ginger+*Luvunga scandens*+Coriander seeds mix all these with jaggery and give it in a bolus form.
- Prolapse- protruded organ should be placed well before with hygienic measures, after that mix sweet flag(*Acorus calamus*)+Binjali leaves grind them and apply after that give heat fomentation.
- Fracture- After adjusting the bones in the right manner wrap it with a cotton cloth by supporting with bamboo sticks, Take Harad hachhaga leaves+Pepper+Garlic mix them and make a dry powder and drench it in goat milk.
- Anestrous- Allow it to eat leaves of mint
- Loss of appetite- Feed the plant Tumbi kasa
- To control fever- Feed the plant Elabsandh
- Horn fractures- Dip the wet cloth in red soil and roll it in airtight manner to the area.
- Snake bite- Mix roots of plant Indian acalypha(*Acalypha indica*)+Pepper+Cereals{Sesame+Beanie+Red sorghum} grind them in lemon juice and apply it to the bitten area to avoid effect of venom and tie it with cloth/bandage.

- Dog bite- Grind the plant material Magali beru(*Decalepis hamiltoni*) and apply it to bitten area to avoid the effect of toxin.
- Internal parasite infestation- Take the plant Tottilu balli+*Luvunga scandens*+Pepper+Sesame seeds+Garlic+sweet flag grind them all mix with jaggery and feed it in bolus form.
- Nasal block- Take plant Nelagulila+tender Turmeric+Cows butter+pinch of Salt mix all these and make ointment form. Before applying the mucus which had blocked the nose should be removed by hot iron rod.
- Burnt- Take seeds of Golden shower tree(*Cassia fistula*) dry them and make a powder mix it with coconut oil and apply to the burnt area.
- Inflammation- take some leaves of Mayura(*Achyranthes aspera*)+sweet flag grind them and apply to the inflamed area and provide heat fomentation.
- Toothache- Feed leaves of Kuruchi(*Holarrhena pubescens*)

These are few tips and practices observed in the treatment of Ramzansab, his experiences indicates that some of the practices are best and much are effective.

I have collected some pictures of medicinal plants, They are:



Kannada Name- Madagunaki eli  
English Name-Jimson weed  
Scientific Name-*Datura stramonium*



Kannada Name- Belavalakayi tapla  
English Name-Leaves of Bael or bili or Bhel or Bengli quince  
Scientific Name- *Aegle marmelos*



Kannada Name- Belavalakayi fruit  
English Name- Fruit of Bael or bili or Bhel or Bengli quince  
Scientific Name- *Aegle marmelos*



Kannada Name-Turubi soppu

English Name-Mallow, Bala plant

Scientific Name-*Sida cardifolia*

Kannada Name- Halagatti

English Name-Kuruchi or Kutaj  
Vatsak

Scientific Name- *Holarrhena  
pubescens*

Kannada Name- Kaad tulusi

English Name-Mayura or Apamarga

Scientific Name-*Achyranthes aspera*

## Events and Activities

### IVSA Nepal

**IVSA VIRTUAL EXCHANGE**



**IVSA Nepal**




**IVSA Kashmir**

**18th of January 2023**




IVSA Nepal Conducted Virtual exchange with IVSA Kashmir.



Members form IVSA Nepal visited Bareilly, Patnagar and Nainital

## Exchange between INDIA and NEPAL

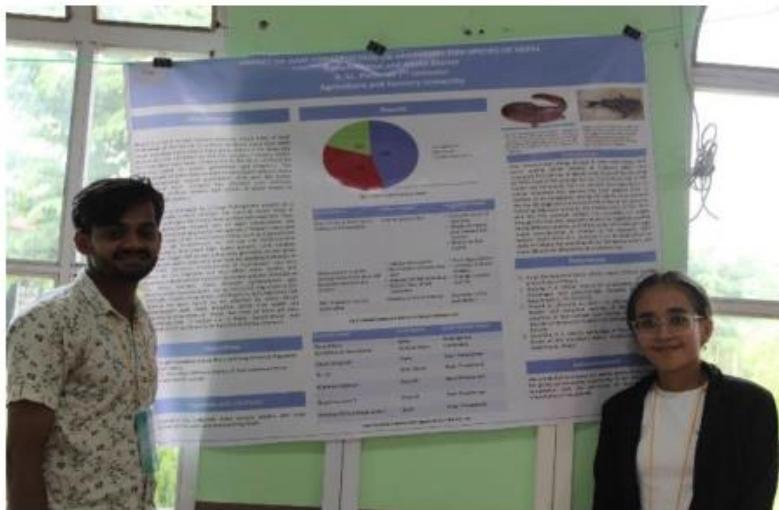


## Local Exchange



## IVSA Nepal and IVSA SCOVE Veterinary Symposium 2023 on “Advancing Animal Health and Welfare: Innovations, Challenges, & Opportunities” and Poster competition.





## IVSA Nepal General Assembly and Local Exchange 2023



# Events and Activities

## IVSA Rampur

**Presents**

**5th National Intercollege Veterinary Quiz competition 2023**

**Coming soon!!!**

[International Veterinary Students' Association, Rampur](#) [ivsarampur](#)

**Slogan Writing Competition on Antimicrobial Resistance**

**WINNER**

Krishna Sharma  
IVSA NPI

**निःशुल्क पशु स्वास्थ्य शिविर**

मिति: २०७९ पौष ०८ अंशे  
स्थान: देवीस्थान टोल, माडी न.पा.-७

**आयोजक**: IVSA Rampur, Chitwan, Ward No. 07, Madi, Municipality, Agriculture & Forestry University

**सहयोगी**: Himalaya, Cargill, Vet Biochem, VETAC, INTAS, Abamec, IMA, MDH, Vet Biochem, Vet Biochem

**UNLOCKING THE SECRETS OF BLOOD TESTS: A CLINICAL DIVE INTO LFT, KFT, AND CBC**

**FRIDAY**  
**20 MAGH, 2079**  
**3:00 PM**

**VET COMPLEX**

**ASSISTANT PROF. NAVEEN KUMAR SHREEVASTVA**  
M.Sc. Medical Biochemistry  
Department of Vet. Anatomy, Physiology & Biochemistry

[ivsarampur](#) [ivsarampur@gmail.com](mailto:ivsarampur@gmail.com)

# Activities

## IVSA Paklihawa



**Winner of Video Competition**

**Congratulations**  
for winning video competition organized by IVSA Paklihawa. We wish him best in the coming days.

**Amrit Subedi**  
IAAS, TU



**WORLD ANTIMICROBIAL AWARENESS WEEK**  
18-24 NOVEMBER

**PREVENTING ANTIMICROBIAL RESISTANCE TOGETHER**



**Call For Volunteer**

- Street animals feeding Program
- 2079/07/28
- 7:00 A.M
- Ranigau, Meudihawa, Nayagau

Come Join Us for the Noble Cause



A group of volunteers in white coats standing in front of a building, holding banners for IVSA Animal Welfare Project and International Veterinary Students' Association (IVSA) Paklihawa.



**STUDY CIRCLE Session - X**

IVSA Paklihawa Presents  
**UMMB** Preparation Training

7th Feb, 2023  
4 PM  
Paklihawa campus



**Promoting Diversity, Equity and Inclusiveness in Veterinary Profession**

**WORLD VETERINARY DAY-2023**  
विश्व मेटेरिनरी दिवस-२०२३

को अवसरमा आयोजित जनरेतनामलक

**प्रमातफेरी कार्यक्रम**

परिलहरा कार्यक्रम संसद्गत  
परिलहरा कार्यक्रम संसद्गत



**Orientation and Bird watching Program of Chhimeki Chara**

JESTHA 16, 2080  
4:00 PM  
LECTURE HALL, PAKLIHAWA CAMPUS

Mr. Sovit Raj Regmi  
Presenter  
(Bird Conservation Nepal)



**Career Campfire**  
Season 02, Episode 02

Topic: Case Studies On Some Of The More Common Equine Diseases In The UK

Rosie Meynell  
IVSA Poland Speaker

Bigyan Karki  
SCAW Coordinator Moderator

2023/05/31  
8:00 PM (GMT +5:45)

## Events and Activities

### IVSA HICAST

#### Anti-Rabies Vaccination Program



#### **CV WRITING WORKSHOP**



With  
**Miss. POONAM BHATTA**



**Street Animal Feeding Program**

#### **Empowering Kirtipur livestock and Poultry Farmers with knowledge on AMR**



## Events and Activities

### IVSA NPI

**Top Left:** A group of students in white coats stand behind a table covered with a blue cloth, displaying various supplies. A banner in the background reads "RABIES WEEK CELEBRATION".

**Top Right:** Three young men hold up a large banner for the "ROTARACT CLUB OF GAINDAKOT" during "Rabies Week Celebration".

**Middle Left:** A blue banner for the "Slogan Competition WINNER ANNOUNCEMENT". It features the IVSA-NPI logo and a quote in Nepali: "यसपाली दर्शनमा अपनाउनु पर्ने सावधानी, स्वच्छ मासू पौष्टिक तत्वको खानी, स्वादलाई मात्र होइन स्वास्थ्यको पनि लगानी।" (Dev Sah)

**Middle Right:** A blue banner for the "Drawing Competition WINNER ANNOUNCEMENT". It shows two winning drawings by IKA CHAUDHARY and AAVAS ADHIK. The first drawing is titled "Desh-Bhakti" and the second is titled "Tihar".

### Medication preparation & application Program



### Training session on “Infertility prevention and reproductive disease diagnosis



