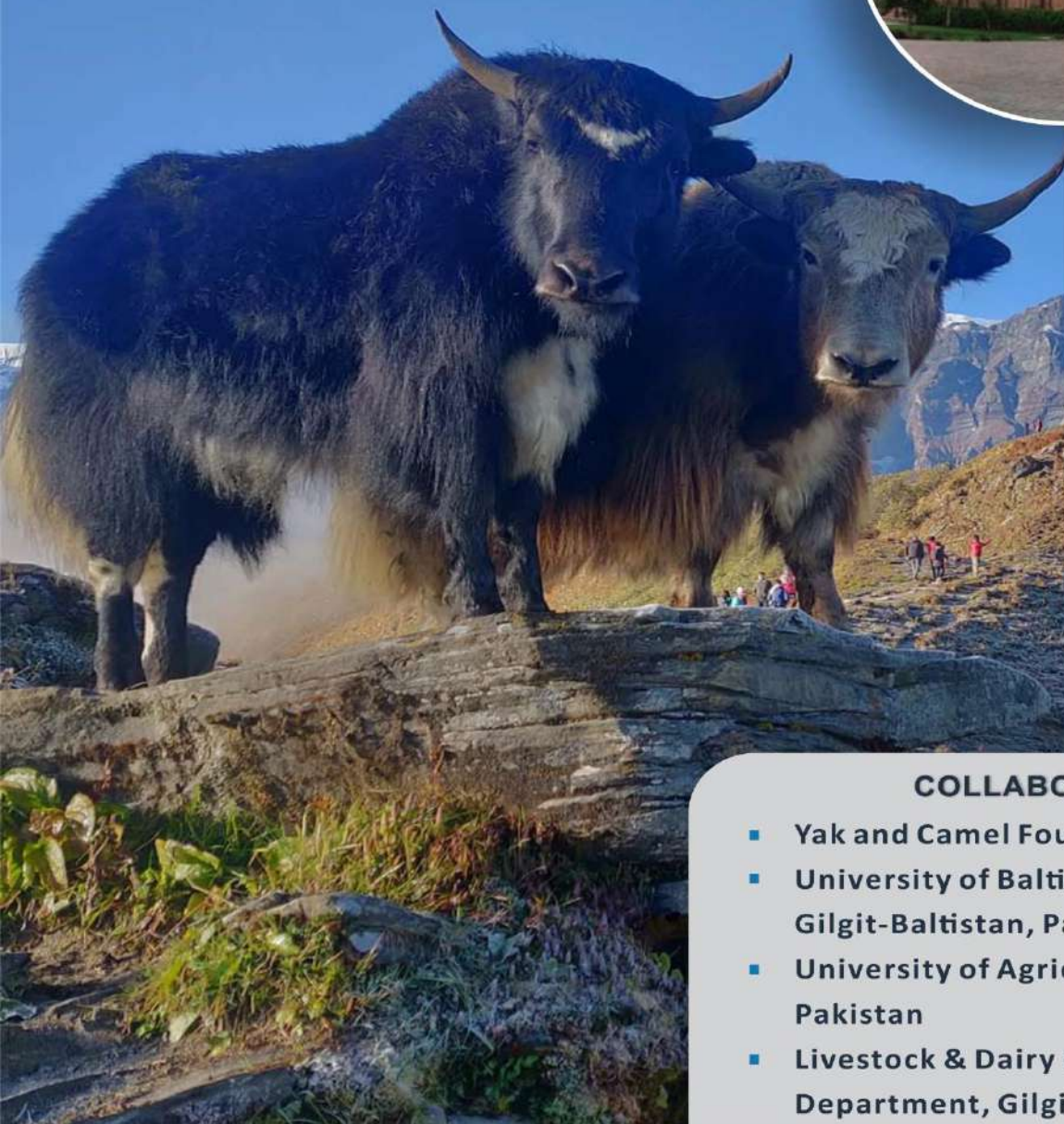


18
MARCH
2021

1st INTERNATIONAL CONFERENCE
ON
THE YAK (*Bos grunniens*)



COLLABORATORS

- Yak and Camel Foundation, Germany
- University of Baltistan, Skardu, Gilgit-Baltistan, Pakistan
- University of Agriculture, D.I. Khan, Pakistan
- Livestock & Dairy Development Department, Gilgit-Baltistan, Pakistan



1st International Conference on
“The Yak (*Bos grunniens*): Lifeline in high mountains”

18th March 2021

Organized by

**Department of Molecular Biology, Virtual University of Pakistan,
Lahore**

in collaboration with

Yak and Camel Foundation, Germany

&

University of Baltistan, Skardu, Gilgit-Baltistan, Pakistan

&

University of Agriculture, D.I. Khan, Pakistan

&

Livestock & Dairy Development Department, Gilgit-Baltistan, Pakistan

Focal Person:

Dr. Tanveer Hussain

Associate Professor, Department of Molecular Biology, Virtual University of Pakistan, Lahore,

Email: tanveer.hussain@vu.edu.pk, WhatsApp: +92 333 4955348

EVENT BROCHURE

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Virtual University

LIFELINE IN HIGH MOUNTAINS

**1st INTERNATIONAL CONFERENCE
ON THE YAK (*Bos grunniens*)**

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**VIRTUAL UNIVERSITY OF PAKISTAN,
LAHORE**

Focal Person
Dr. Tanveer Hussain,
Associate Professor, Department of Molecular Biology,
Virtual University of Pakistan, Lahore

+92-333-4955348
tanveer.hussain@vu.edu.pk

EDITORS OF THE PROCEEDINGS



Editor

Dr. Tanveer Hussain



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Ms. Amina Mustafa



Co-Editor

Mr. Syed Hassan Abbas

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Ms. Zinnia Mansoor Lecturer, Department of Biotechnology, Virtual University of Pakistan, Lahore	Member
Ms. Amina Mustafa Instructor, Department of Molecular Biology, Virtual University of Pakistan, Lahore	Member
Mr. Syed Hassan Abbas Instructor, Department of Bioinformatics & Computational Biology, Virtual University of Pakistan, Lahore	Member

SPEAKERS

<p>Dr. Han Jianlin ILRI-CAAS Joint Laboratory on Livestock and Forage Genetic Resources Institute of Animal Science, Chinese Academy of Agricultural Sciences (CAAS), Beijing 1000193, P.R. China h.jianlin@cgiar.org</p>	
<p>Dr. Tashi Dorji Coordinator, Kangchenjunga Landscape Conservation and Development Initiative, International Centre for Integrated Mountain Development, Kathmandu, Nepal Tashi.Dorji@icimod.org</p>	
<p>Dr. Takbir Ali Disease Investigation Officer, Livestock, Dairy Development and Poultry Production, Gilgit-Gilgit-Baltistan, Pakistan drtakbeerali@gmail.com</p>	
<p>Dr. Zhi-Jie Ma Qinghai Academy of Animal Science and Veterinary Medicine, Qinghai University, Xining, P. R. China zhijiema@126.com</p>	
<p>Mr. Shakoor Ali Yak expert, Skardu, Gilgit-Baltistan-Pakistan toenpabalti@gmail.com</p>	
<p>Dr. Hafiz Ashfaq Ahmad Assistant Professor, Department of Animal Breeding and Genetics University of Veterinary and Animal Sciences, Pattoki ishfaq.ahmad@uvas.edu.pk</p>	


[Document title] (*Bos grunniens*)

Department of Molecular Biology, Virtual University of Pakistan, Lahore

<p>Mr. Wazir Ejaz Hussain Chief Executive Officer/ Chairman Baltistan Culture and Development Foundation (BCDF), Skardu, Gilgit-Baltistan, Pakistan wazirejaz@gmail.com</p>	
<p>Dr. Ghulam Raza Associate Professor Department of Biological Sciences, University of Baltistan, Skardu, Gilgit- Baltistan-Pakistan ghulam.raza@uobs.edu.pk</p>	
<p>Dr. Mastan Ali Project incharge, Development of Yak, HAAP, Gilgit-Baltistan, Pakistan mastan151412@gmail.com</p>	
<p>Dr. Ishtiaq Hussain Associate Professor, University of Baltistan, Skardu, Gilgit-Baltistan, Pakistan Ishtiaq.mondog@uobs.edu.pk</p>	
<p>Mr. Habib Ur Rehman Sherani Founder & CEO, The Modern Farms Director Pakistan Avicultural Foundation thelpg@yahoo.com</p>	
<p>Mr. Manzoor Hussain Livelihood/ Development Expert, Islamabad. Pakistan manzoorbami@gmail.com</p>	

[Document title] (*Bos grunniens*)

Department of Molecular Biology, Virtual University of Pakistan, Lahore

<p>Dr. Abdul Wajid Assistant Professor, Department of Biotechnology Virtual University of Pakistan, Lahore, Pakistan abdul.wajid@vu.edu.pk</p>	
<p>Focal Person</p>	
<p>Dr. Tanveer Hussain Associate Professor, Head, Department of Molecular Biology, Virtual University of Pakistan, Lahore tanveer.hussain@vu.edu.pk</p>	

PROGRAM

18th March 2021 (Thursday) Pakistan Standard Time – UTC/GMT+5 hours	
Opening Ceremony	
10:00 a.m.	Holy Quran Recitation
10:05 a.m.	National Anthem
10:10 a.m.	Aims and Objectives of the Conference by the Focal Person
10:15 a.m.	Welcome address by the Rector, Virtual University of Pakistan
10:20 a.m.	Message from the Yak-Camel Foundation, Germany
10:25 a.m.	Message from the University of Baltistan, Skardu, Gilgit-Baltistan
10:30 a.m.	Message from Livestock, Dairy Development and Poultry Production, Gilgit-Baltistan
10:35 a.m.	Message from University of Agriculture, D.I. Khan
10:45 a.m.	Address by the Chief Guest
10:50 a.m.	Refreshments
1st Technical Session (Moderator: Ms. Zinnia Mansoor)	
11:15 a.m.	30 Years of Intensive Collaboration for Rapid and Advanced Research on Yak. Dr. Han Jianlin , ILRI-CAAS Joint Laboratory on Livestock and Forage Genetic Resources Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, P.R. China
11:45 a.m.	The Hindu Kush Himalaya Yak Network. Dr. Tashi Dorji , International Centre for Integrated Mountain Development, Kathmandu, Nepal
12:05 p.m.	Current Situation of Yak in Gilgit-Baltistan, Pakistan. Dr. Takbir Ali , Disease Investigation Officer, Livestock, Dairy Development and Poultry Production, Gilgit-Baltistan, Pakistan
12:20 p.m.	Rich Maternal and Paternal Genetic Diversity and Divergent Lineage Composition in Wild Yak (<i>Bos mutus</i>). Dr. Zhi-Jie Ma , Qinghai Academy of Animal Science and Veterinary Medicine, Qinghai University, Xining, P. R. China
12:35 p.m.	Feeding Habit of Yak (<i>Bos grunniens</i>) and the seasonal Rangeland of Baltistan. Mr. Shakoor Ali , Department of Biological Science, Public School and College, Skardu, Gilgit-Baltistan, Pakistan
12:50 p.m.	Evolutionary adaptation of IL4R gene in the yak lineage enriched in innate immune pathways. Dr. Hafiz Ashfaq Ahmad , Assistant Professor, Department of Animal Breeding and Genetics, UVAS, Pattoki.
01:00 p.m.	Lunch Break
2nd Technical Session (Moderator: Ms. Zinnia Mansoor)	
02:00 p.m.	Potential of Yak in Eco-Tourism and Socioeconomic Development Gilgit-Baltistan and Future Niche Market. Mr. Wazir Ejaz Hussain , Chief Executive Officer/Chairman, Baltistan Culture and Development Foundation (BCDF), Skardu, Baltistan, Pakistan.
02:10 p.m.	Preferences of Zomo in Baltistan (The Yak First Female offspring F1). Dr. Ghulam Raza , Associate Professor, University of Baltistan, Skardu, Gilgit-Baltistan, Pakistan

02:25 p.m.	Yak is a Comparative Advantage for Marginalized Communities of Gilgit-Baltistan. Dr. Mastan Ali , Project incharge, Development of Yak, HAAP, Gilgit-Baltistan, Pakistan
02:40 p.m.	GIS based Study on feeding potential and population dynamics of Yak in High Altitude Pastures of Baltistan. Dr. Ishtiaq Hussain , Associate Professor, University of Baltistan, Skardu, Gilgit-Baltistan-Pakistan
02:55 p.m.	Grazing and Pasture an Art. Mr. Habib Ur Rehman Sherani , CEO, The Modern Farms and Founder/ Director Pakistan Avicultural Foundation
03:10 p.m.	Marketing Opportunities of Yak Meat and Products. Mr. Manzoor Hussain , Livelihood/ Development Expert, Islamabad
03:25 p.m.	The ongoing research activities on Yak at Virtual University of Pakistan. Dr. Abdul Wajid , Assistant Professor, Virtual University of Pakistan, Lahore
Closing Ceremony	
03:40 p.m.	Holy Quran Recitation
03:45 p.m.	Conference reflections by the participants
03:50 p.m.	Remarks by the Rector, Virtual University of Pakistan
04:00 p.m.	Distribution of shields/ certificates
04:10 p.m.	Address by the Chief Guest
04:20 p.m.	Vote of Thanks by the Focal Person
04:25 p.m.	Refreshments

VIRTUAL UNIVERSITY OF PAKISTAN

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The Virtual University of Pakistan is the pioneering e-distant educational institute within Pakistan and since its inception in 2002, it has been disseminating knowledge by taking education to the doorstep of students. Using free-to-air satellite television broadcasts and the Internet, the Virtual University allows students to follow its rigorous programs regardless of their physical locations. Currently, the university has more than 200 campuses across Pakistan with an enrollment of more than 250 thousand students in over 90 degree programs. It is also the first University in Pakistan that offers degree programs in the realm of life sciences in a virtual mode. Pakistani students residing overseas in more than 50 countries are also enrolled in the

The Virtual University, Pakistan's first University based completely on modern Information and Communication Technologies, was established by the Government as a public sector, not-for-profit institution with a clear mission: to provide extremely affordable world class education to aspiring students all over the country. Using free-to-air satellite television broadcasts and the Internet, the Virtual University allows students to follow its rigorous programs regardless of their physical locations.

VU aspires to be a leading teaching and research university, recognized nationally and globally as a hub of academic excellence, producing highly skilled empowered professionals and leaders who would contribute positively to the socio-economic development of Pakistan.

AIMS AND OBJECTIVES

Yak (*Bos grunniens*) can be considered as one of the world's most significant domestic animals, as it can survive in extreme environments and ensures a livelihood for the local people. Domestic yak is distributed at high altitudes between 2000 to 5000 meters in in Pakistan, Afghanistan, India, Nepal, China and Mongolia in the mountains of Hindu Kush, Karakoram, Himalayas, Tibetan plateau and Tien Shan mountains. Yaks are multipurpose animals providing products such as milk, meat, leather, hair and manure for fuel for people living at high altitudes and are useful as riding and pack animals. In Pakistan, yak pastoralism is restrained to the Northern highlands of Skardu, Astore, Diamer and Ganche districts in Gilgit-Baltistan along with Chitral regions, lying at altitude of above 3100 meters. The unique features of this one of the most important Genetic Resource of Pakistan need the focus of scientific community to explore its potentials to get maximum benefits for the local communities.

With this background the Department of Molecular Biology, Virtual University of Pakistan, Lahore is going to host 1st International Conference on Yak to highlight the importance and usefulness of this wonderful species in Pakistan, in collaboration with Yak and Camel Foundation, Germany, University of Baltistan, Skardu, Gilgit-Baltistan, Pakistan, Livestock & Dairy Development Department, Gilgit-Baltistan, Pakistan, University of Agriculture, Dera Ismail Khan, Pakistan. Scientists and researchers from different parts of the world have been invited to share their knowledge about exploring this wonderful creature and to enhance awareness about its better utilization in future.

I hope this event will open new opportunities to collaborate and work more to uncover the hidden potentials of Yak as a unique treasure and genetic resource of our country in future. Ladies and Gentlemen, I take this as an opportunity to thank our collaborators for their input as well as esteemed panelists for joining us today despite being in different time zones. We will also continue hosting such events jointly in future to bring the scientific community to work on this unique species. I would also like to thank all for being a part of this event and hope that the sessions will bring us beneficial knowledge.

Dr. Tanveer Hussain
Focal Person,
Associate Professor, Department of Molecular Biology,
Virtual University of Pakistan, Lahore

MESSAGES FROM THE COLLABORATORS

Yak and Camel Foundation, Germany

The Yak and Camel Foundation was founded in 1992 by Prof.h.c. mult. Dr. Dr. Jürgen H. Lensch (1925-2011) in Germany.

The objective of the foundation is the advancement of science regarding the domesticated Yak in the mountainous regions of Asia, the endangered wild yak as well as the bactrician mountain camel and the endangered wild mountain camel.

These two species make human life possible in the high plains of Asia as they provide working power, meat, milk, clothing and thermic energy by way of dried dung. Nevertheless it is necessary to improve the income and finally the life standard of the nomads and herders of these species to stabilize the populations. Therefore, the Foundation supports activities in applied research as well as fundamental research in accordance with the foundations objective.

Focal points of the Foundation among other things are the awarding of research grants, research projects, doctoral candidate grants and realization of applied and scientific symposia and workshops.

For details please visit <http://www.yak-kamel-stiftung.de/Home-English> or contact as Member of the board (Secretary) Dr. Pamela Burger by email Pamela.burger @vetmeduni.ac.

Prof. Dr. habil. Georg Erhardt
President of the Yak & Camel Foundation, Germany

University of Baltistan, Skardu, Gilgit-Baltistan, Pakistan

University of Baltistan (UOB) is an International Standard University operating in Gilgit Baltistan, Pakistan. It was established by Federal Government of Pakistan with a mission to make higher education accessible for all the people living in remote areas.

UOB is glad to act as a strong collaborator in this international conference held to highlight the immense need of scientific research on Wild and domestic species of Yak.

The need for research always arises with an increasing importance of a particular species. Undoubtedly, Yak is an important source of livelihood for the people of mountainous regions of Asia. Yak is a part of their culture and an identity for them. Every part of Yak can be made into products for high end markets e.g. Yak milk, meat, wool and bones. Yak milk and meat are rich in nutrients with high medicinal values while Yak wool can be converted into high quality fabric. Sharing of knowledge and latest technologies between institutes can contribute to sustainable Yak farming in the region which is definitely a need of time.

We thank Virtual University of Pakistan for organizing an enlightenment session and greatly emphasize the contribution of our faculty as well as the entire scientific research society in this area.

Prof. Dr. Muhammad Naeem Khan
Vice Chancellor,
University of Baltistan, Skardu, Gilgit-Baltistan, Pakistan

The University of Agriculture, D.I. Khan, Pakistan

University of Agriculture (UOA) was established by the Government of Khyber Pakhtunkhwa in October 2017. It appeared as a strong institute delivering quality work in agricultural research.

University of Agriculture, Dera Ismail Khan understands the importance of Yak in the life of their herders as well as the surrounding population. For the people of Asia, Yak act as an imperative source of meat, milk and also fulfills their clothing needs. That's why UOA is in strong support of the "focused research approach" on Yak species. It can help us to squeeze out desired benefits and improve their population strength.

I was the first person to be involved in Yak Sampling and formulated an idea to further enhance my research on these species. My valued team members i.e., Dr. Tanveer and Dr. Tariq played a crucial role in executing this idea and converting it into a reality.

Highlighting the importance of the given species, I strongly recommend my associates and faculty members to play their part in this collaboration and work with Virtual University of Pakistan to favor revolutionary research work in this domain.

Prof. Dr. Masroor Ellahi Babar *T.I.*

Vice Chancellor

University of Agriculture, D.I. Khan, Pakistan

Livestock & Dairy Development Department, Gilgit-Baltistan, Pakistan

Livestock & Dairy Development and Research Centre was established in 1978 with an aim to revolutionize the research work in Dairy and Livestock Industry. The core effort of this organization was to trigger Farm and field-oriented research and to effectively increase the production of common necessities of life i.e., milk, meat, eggs and etc.

Yak is common source of all these daily life necessities. It, alone, has a magnitude to satisfy the milk, meat, medicinal and clothing needs of a large population. Almost all the people living in Himalayan areas are herding Yak species. But the lack of ideal niche and resources in other areas has put a limit to the benefits we can achieve from mass scale Yak production systems. Given the challenges facing Yak herding, there is much to be gained from knowledge sharing among institutions. The scattered nature of Yak herding needs mobilization of resources.

We are glad to be a part of such an event organized by Virtual University of Pakistan that is promoting the much-needed awareness. As a collaborator of this seminar, we will encourage our faculty members and the scientific world to liaise with Virtual University. Only working together can help us achieve long lasting and much awaited results.

Dr. Syed Ishtiaq Hussain
Director,
Livestock, Dairy Development and Poultry Production,
Gilgit-Baltistan, Pakistan.

ABSTRACTS

30 Years of Intensive Collaboration for Rapid and Advanced Research on Yak

Jian-Lin HAN

CAAS-ILRI Joint Laboratory on Livestock and Forage Genetic Resources, Institute of Animal Science, Chinese Academy of Agricultural Sciences (CAAS), Beijing 100193, China
International Livestock Research Institute (ILRI), Nairobi 00100, Kenya

h.jianlin@cgiar.org

Abstract

The domestic yak is a unique bovine species distributed throughout the Himalayan region, the Qinghai-Tibetan Plateau, and as far north as Mongolia and Siberia of Russia and as far northwest as Central Asian countries, including Gilgit-Baltistan of Pakistan. The surviving wild yak is the direct ancestor of the domestic yak. Over last 30 years, we observe rapid and significant achievements in scientific research on yak through intensive collaboration. Several changes took place, e.g., from small data on single topic; from single herd & farm, experimental station, livestock department, Agricultural University to comparative data compiled by several groups across institutions in livestock and agricultural sectors, in particular the involvement of comprehensive universities on yak research; and from simple observations and measurements to comprehensive and systematic recording and continuous data collection. To prompt the sharing and exchange of these new findings, we have initiated the organization of International Conference on Yak: the 1st in 1994 in Lanzhou, the 2nd in 1997 in Xining, the 3rd in 2000 in Lhasa, the 4th in 2004 in Chengdu, the 5th in 2015 in Lanzhou, the 6th in Xining in 2018, and the 7th to be held in Lhasa, China; the establishment of International Yak Information Center (IYIC) to facilitate the organization of international yak meetings, and to collect and compile literature on yak research; the publication of International Yak Newsletter; and the involvement of international organizations on yak research and development, e.g., FAO-RAP, ICIMOD, Yak & Camel Foundation, ILRI, etc... to significantly prompt scientific exchange and collaboration in the region. The publication of the first English book on yak "THE YAK" (edited by CAI Li and Gerald Wiener) and then an intensive revision of the English book "THE YAK" (edited by Gerald Wiener, Jianlin Han and Ruijun Long) by FAO-RAP in 1995 and 2003, respectively, made substantial contribution to the dissemination of comprehensive knowledge on yak.

A lot of data on the survey and characterization of indigenous yak genetic resources, ecotypes and/or breeds, basic nutritional values of major grasses in natural pastures as well as carrying capacity and management of natural rangelands on the Qinghai-Tibetan Plateau, baseline nutritional requirements, reproductive technology, and surveillance of regular diseases of yak have been collected and reported at the national and international yak meetings. Additional new data are being reported during this conference. The completion of the phenotypic and genetic characterization of domestic yak breeds and wild yak ecotypes led to the exploration of wild yak genetic resources to renovate the genetics of domestic yak and eventually the development of the first yak breed – the Datong yak through human selection. This new genetics has been widely disseminated for the genetic improvement of other domestic yak populations in China and other

[Document title] (*Bos grunniens*)

Department of Molecular Biology, Virtual University of Pakistan, Lahore

countries. It is also recognized that the fast adoption of the state-of-art research methods and tools, e.g., the 2nd or 3rd generation DNA sequencing technologies, contributed to the generation of BIG data for four high-quality *de novo* assembly of both wild and domestic yak reference genomes, population genomic diversity, comparative genomics, transcriptomics and metagenomics analyses.

It is evident that intensive collaboration is a prerequisite to achieve better science supporting development work for new and optional technologies. More collaboration is highly appreciated at regional and international scales, across species, using multidisciplinary approaches, and to encourage the involvement of appropriate stakeholders. There is a need to develop and apply user-friendly (e.g., use of local languages) internet-based information sharing systems and databases. The intensive training of young professionals to better understand, manage, and interpret the BIG data (e.g., genomic and environmental datasets) is also urgent, therefore new organizations and mechanisms are expected to facilitate such initiatives based on our common understanding on how and what do we need to do in the near future.

Keywords: Yak, Genetics, Data, Research, Development

The Hindu Kush Himalaya Yak Network

Tashi Dorji^{1*}, Basant Pant¹, Kamal Aryal¹, Surendra Joshi¹, Muhammad Ismail¹, Ghulam Ali¹ and Nakul Chettri¹

¹International Centre for Integrated Mountain Development, Kathmandu, Nepal

*Tashi.Dorji@icimod.org

Abstract

Yak is one of the iconic species of the Hindu Kush Himalayan (HKH) countries. Yak plays a critical role in livelihood enhancement and management of ecosystems. They are also an integral part of the culture, tradition, and social life of the high mountain communities.

Over the past decade, there has been a drastic decline in yak population across the HKH. Difficult and fragile environments impacts of climate change and socio-economic drivers has limited the competitiveness of the yak systems. In addition, yak herders across the HKH are marginalized and face challenges of limited policy outreach, low investments, and lack of dedicated institution for the development of the yak as a sector. These challenges are not well-voiced at the local, national, regional, and international forums.

Institutions such as Federations, Associations, Cooperatives and Networks are known to provide platform for collective actions and negotiations. Learning from some of the successful global forums for key livestock such as reindeers from the Arctic and camels from the Middle East and Sub-Saharan Africa, the International Centre for Integrated Mountain Development (ICIMOD) initiated mobilizing yak herder's networks in Nepal, India, Bhutan and Pakistan. The formal and informal yak groups include five in Bhutan (Haa, Paro, Laya, Wangdue and Bumthang), three in Nepal (Taplejung, Pangthar and Mustang), two in India (Sikkim and Ladakh) and two in Pakistan (Gilgit-Baltistan and Chitral). These local groups are in process of forming a federation at the National level ultimately converging into the HKH Yak Network.

The HKH Yak Network is envisaged to provide a formal platform to i) promote mutual understanding and friendship between yak herding communities and nations in the region ii) to exchange knowledge and experience on yak value chains and relevant technologies across the HKH iii) to highlight historic, cultural, social and economic importance of yak, and contribute to preservation of the transhumance natural heritage of yak rearing as part of nature based solutions and iv) represent the voices of yak herding communities at the national and international forums.

Keywords: Yak, Network, Association, Cooperatives, Hindu Kush Himalaya, Culture, Value chains

Current Situation of Yak in Gilgit Baltistan

Takbir Ali* and Syed Ishtiaq Hussain

Dairy Development and Poultry Production, Gilgit-Gilgit-Baltistan, Pakistan

*drtakbeerali@gmail.com

Abstract

Yak rearing is a centuries old tradition in Gilgit Baltistan (GB). Most historians consider yak a main reason behind life in high mountains. It is the only livelihood source of marginalized people living at the extreme end of valleys in GB. Yak in these places not only ensures food security but has a positive impact on human development in various ways. In terms of human health yak has a bigger role in providing quality protein to the poorest people living in these places. Physical characteristics like more red blood cells, capacious lungs, two-layer hair coat and non-functional sweat glands make it a strong animal capable to face tough mountainous environment. In GB yak has six different colors like black, white, grey, white brown, dark brown and light brown. However, black is the predominant color. For the people of GB yak has many comparative advantages which make it a better choice for the farmer instead of keeping other animals. Living 9 to 12 months on pasture, minimum or no labor charges, highly competitive meat market, very low maintenance ration, high altitude trekking, riding and transportation are some of the significant comparative economic benefits of yak. The current yak population of GB is 18995, which roughly 0.13% of the total world population of yak. The limited population of yak indicates that it is an endangered species. Crossing breeding of male yak with cow scientifically known as yak hybridization is practiced only in Baltistan and Astore region of GB. The F1 generation of yak and cow is famous for its milk and meat production and draught power. Male hybrid is impotent called as Zo, the female is called Zomo in Balti language. Current population of hybrid yak is 31868 in GB. Economically yak milk, meat, milk products, dung, hair and wool, skin and even tail end is also beneficial. Yak is also used for draught, sport and even for agro tourism purposes. There are 2119 farmers keeping pure yak, 6516 farmers keeping hybrid yak. As per the latest survey, 82% farmers sell yak, 51% use yak meat, 38% use yak milk, 21% use yak manure, 13% use yak for draught purpose. There are 9720 milking yak producing 1 to 1.5 litre milk per day on average. During the year 2019-20, 5617 yak were slaughtered. The yak farming pattern is a little bit different from the rest of the world where mobile yak husbandry is practiced. Here in GB the yak is kept on pasture for up to 9 to 12 months, for only 3 to 4 months, it is stall fed and managed at home by the farmer. Generally, yak is a disease resistant animal free of common diseases, however FMD, tick infestation and internal worms are some of the common diseases found in yak. Lack of research and development, very limited population, absence of official ownership, shortage of winter pasture and ration, reducing size due to inbreeding, attack by predators and harsh weather conditions are some of the major problems which need to be addressed for development of this valuable natural resource. The livestock department GB has recently carried out a survey and identified 114 potential pastures where more than 0.100 million yak can be

[Document title] (*Bos grunniens*)

Department of Molecular Biology, Virtual University of Pakistan, Lahore

reared. If the yak farming sector is properly managed and the population of yak is increased to a substantial level, then there are golden opportunities for export of yak meat, milk, hair and other products. To achieve this important goal establishment of yak research and development institute, ownership of yak at institutional capacity, initiation of yak development programs, encouragement of quality research work in higher educational institutions on yak and coordination with the neighboring yak rearing countries like China, Nepal and Bhutan and proper representation to the livestock department GB and yak farmers of GB in the events and activities taking place under the umbrella of ICIMOD related to yak are essential and must be acted upon on emergency basis.

Keywords: Zomo, Yak rearing, Milk, Meat, Yak farmers

Rich Maternal and Paternal Genetic Diversity and Divergent Lineage Composition in Wild Yak (*Bos mutus*)

Zhi-Jie Ma^{1,2*}, Guang-Zhen Li^{1,2}, Sheng-Mei Chen^{1,2}, Jian-Lin Han^{3,4}, and Quratulain Hanif^{5,6}

¹Qinghai Academy of Animal Science and Veterinary Medicine, Qinghai University, Xining, P. R. China

²Plateau Livestock Genetic Resources Protection and Innovative Utilization Key Laboratory of Qinghai Province, Xining, P. R. China

³CAAS-ILRI Joint Laboratory on Livestock and Forage Genetic Resources, Institute of Animal Science, Chinese Academy of Agricultural Sciences (CAAS), Beijing, P. R. China

⁴International Livestock Research Institute (ILRI), Nairobi, Kenya

⁵Department of Agricultural Biotechnology, Computational Biology Laboratory, National Institute for Biotechnology and Genetic Engineering, Faisalabad, Pakistan

⁶Pakistan Institute of Engineering and Applied Sciences, Nilore, Pakistan

*zhijiema@126.com

Abstract

Wild yak (*Bos mutus*) is a vulnerable bovine species on the Qinghai–Tibetan Plateau (QTP). So far, most studies on molecular genetic diversity of wild yak have focused on autosomal and mtDNA variations based on small number of samples. In this study, we analyzed 84 D-loop and 24 whole mitogenome sequences of wild yak to further comprehensively explore its maternal genetic diversity and lineage composition. Meanwhile, using six yak Y-specific polymorphic markers (i.e., *SRY4*, *USP9Y*, *UTY19*, *AMELY3*, *OFD1Y10* and *INRA189*), we assessed the paternal genetic diversity and lineage composition based on eight wild yak. Our results showed that wild yak exhibited abundant maternal genetic diversity with haplotype diversities of 0.9621 ± 0.0078 and 0.9928 ± 0.0144 in the D-loop and whole mitogenome sequences, respectively. Maternal phylogenetic analysis of wild yak uncovered three defined lineages (mt-I, mt-II and mt-III). Similarly, profuse paternal genetic diversity was observed in wild yak with Y-haplotype diversity (Hd) at 0.8214 ± 0.1007 . Two Y-haplogroups (Y1 and Y2) with four Y-haplotypes (yH1–yH4) were identified in paternal phylogenetic analysis, indicating wild yak to be of two paternal lineages. This study of genetic diversity and lineage composition of wild yak would provide useful information for the genetic resource conservation and utilization of this vulnerable wild species.

Keywords: *Bos mutus*; mtDNA; Y chromosome marker; genetic diversity; lineage composition

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Feeding Habit of Yak (*Bos grunniens*) and the Seasonal Rangeland of Baltistan

Shakoar Ali¹ and Ishtiaq Hussain^{2*}

¹ Department of Biological Science, Public School and College, Skardu, Pakistan

Abstract

Yak (*Bos grunniens*) is a Balti/Bodic word derived from *hYak*, is a domesticated breed commonly found in the mountain areas of Gilgit-Baltistan. This species is unique in nature with many aspects and local farmers have developed a cross-breeding system of their own from traditional knowledge has been prevailed over centuries. The study period covers a decade long effort in the Karakoram, Himalayas and Kailash mountain ranges of Baltistan Region, however this paper describes the feeding habit of the species and seasonal rangeland of Baltistan Region highlighting its potential for Yak farming and sustainable livelihood for rural population in Gilgit-Baltistan (G.B). In Baltistan, this species generally lives and graze in the alpine, sub alpine and reach at height maximum up to 5500 m.a.s.l and occasionally move near down valley areas (up to 2700 m.a.s.l.). This autochthonous Species of plateaus can survive up to -40° degree Celsius during extreme environment. The feeding habit is slightly different relative to other in the family of Bovidae, and significantly has peculiar feeding selection based on season, temperature and weather. It is also evident from the study that during the four seasons, Yak moves at various altitudinal range in search of different fodder Species. During Spring season, it moves in the rangeland areas at elevation ranging from 3000 to 3700 m.a.s.l, in summer (3700 m to 5000 m.a.s.l), moves up to maximum elevation along with the melting of snow, in autumn (3200 to 3700m.a.s.l.) whereas in winter (2000 to 3400 m.a.s.l.).

The Species use seasonal migratory route for food selection and most plant Species are different in different seasons. Major fodder species during summer were *Carex malanantha*, *Medicago sativa*, *Tenacetum scenecionis*, *Rosa webbiana* and *Delphenium brononianum*, during winter *Artemisia rutifolia*, *A. brevifolia*, *Seriphidium brevifolium* and *Stipa sibirica*. Whereas, some common fodder species were found to be under it use both in summer and winter were *Medicago sativa*, *Stipa sibirica* and *Artemisia spp.*

This paper explores the importance of dropping of Yak that disperse evenly in the natural environment and help to grow maximum vegetation.

This invaluable member of Bovid family is under threat and declining owing to given up the Yak keeping profession. Greater attention needs to be directed to sustain the crumbling profession of local people related to Yak.

Key words: Gilgit-Baltistan, altitudinal ranges, Fodder Species, Feeding ecology, seasonal migratory route

Evolutionary Adaptation of *IL4R* gene in the Yak Lineage Enriched in Innate Immune Pathways

Hafiz Ishfaq Ahmad^{1*}, Muhammad Bilal Bin Majeed¹, Gulnaz Afzal²

¹Department of Animal Breeding and Genetics, University of Veterinary and Animal Sciences, Lahore, Pakistan

²Department of Zoology, The Islamia University, Bahawalpur, Pakistan

*ishfaq.ahmad@uvas.edu.pk

Abstract

The cold, high altitudes require harsh conditions on domesticated yaks (*Bos grunniens*). Understanding how yaks deal with the cumulative consequences of pathogens or Pathogen-associated molecular patterns provide insights into the process of adaptive evolution. In humans and animals, the body's innate immune response is the first line of defense against pathogens. However, the evolutionary history and the selection forces on the *IL4R* gene in domesticated yak during adaptive evolution are poorly understood. This study examined the *IL4R* gene of yak compared with other mammalian species to estimate selection pressure derived by adaptive evolution. To identify the positions of amino acids under positive selection, we used various site models. We carried out a probability test that compared the various models based on the ratios to recognize the site under positive selection. Two sets of models, *M1-M2* and *M7-M8*, were used for the positive selection evaluation. The results revealed that the evaluation of this gene in *M1-M2* was significant with the probability test value $2\Delta\ln L=19.03$ ($p<0.05$). In contrast, the probability test ratio in *M7-M8* was significant, with the probability test value $2\Delta\ln L=38.52$ ($p<0.05$). Codons were found to be positively selected with $P>99\%$ and $P>95\%$ based on Bayes Empirical Bayes Experience Method (*BEB*) and Naïve Empirical Method based on Bayes (*NEB*) methods. Our analysis found two sites (*117R* and *118Q*) in the *FN3* (fibronectin) domain of *IL4R* protein were under strong positive selection in the domestic yak genome. *FN3* is a transmembrane receptor that functions as the regulators of the innate immune system and mediates the release of *TLR4* dependent cytokine in response to pathogens. However, this protein experience positive selection is conserved and exposed to purifying selection during adaptive evolution. Our results revealed robust evidence of positive selection for the *IL4R* gene in the domesticated yak. These protuberant changes in the *IL4R* gene reveal its role in innate immunity in yaks. These findings of the *IL4R* gene and the host-pathogen interaction can be used to highlight evolutionary advancements in immune processes, in which previously unknown host-pathogen interactions lead to novel methods for pathogen detection in yak population habituating at high altitude environment.

Keywords: Domestic Yak; *IL4R*; Innate Immunity; Adaptive Evolution; Positive Selection

Preferences of Zomo in Baltistan (*The Yak First Female offspring F1*)

Ghulam Raza^{1*}, Tanveer Hussain²

¹University of Baltistan, Skardu, Gilgit-Baltistan

²Virtual University of Pakistan, Lahore

*ghulam.raza@uobs.edu.pk

Abstract

The study was conducted to analyze the preferences of different breeds and their reasons of preferences in the Khaplu Baltistan region. Livestock production plays an important role for the livelihoods in Gilgit-Baltistan of Pakistan. All farmers in the area are involved in livestock production activities, which have a key role in household's economy. According to AKRSP (2000), 60% of income comes from livestock and agriculture, rising up to 84% for the poorest families in Northern Area. Wright et al. (2007), stated that the socioeconomic reasons of keeping livestock in Gilgit-Baltistan are milk, dung, butter, meat, transport, income, fiber, draught, and traditions. The milking cows reared traditionally in the area include, Zomo (Product of Yak crossed with Local cattle F1), and Local cattle, which are mainly non-described, breed due to high diversity. According to Jianlin et al. (2003), the domestic Yak (*Bos gruniens*) is found from 2000-5000 meter above sea level (m a.s.l.) in the cold and semi humid climate of Himalayas.

The study area, Khaplu, in Baltistan is located 2560 meter above sea level, and the Yak and its hybrids are found here as well. The male is called Yak and female is called Yakmo in the area. Zomo (female) is the product of crossing Yak with local cattle. The Zomo is fertile and produces more milk with higher fat content than local cattle and is therefore used for milk and butter production. The average milk production of Zomo was 4.68 liter per day, average lactation period was 10.5 months, average butter yield in 10 liters of milk was 1.05 kg. The average calving interval was 13 month and average age of puberty was 39.17 months. The male hybrid is called Zo, which is sterile and is used for draught activities or meat production. In the study area, the Zomo (F1) have been well adapted to the environment for a long time. The study conclude that due to good fat content and preferences for its butter the rearing of Zomo will be a good sources of income to local farmer and will contribute in their economy.

Keywords: Yak, Zomo, Yakmo, Milk production, Livestock

Yak is a Comparative Advantage for Marginalized Communities of Gilgit-Baltistan

Mastan Ali

mastan151412@gmail.com

Abstract

The Gilgit-Baltistan (GB) region, having huge opportunities in the form of unique species of the livestock like sheep, goats, and yak particularly remained a major source in providing the basic food in the form of meat, and milk for the marginalized inhabitants since decades. The yak also contributes in providing valuable raw material products such as mohair, hair and skin for clothing and shoes at a very small level and other household items of need. Furthermore, this breed has been played a major role in drought power and transportation in several areas especially in single cropping zones of GB.

LDDDB most current interviews with farmers revealed that about 700-800 mg mohair and 2-3 kg per yak (0.559 million yaks census conducted by LDDDB Gilgit) can be annually available (totally 4.72 tones mohair, 12 tones hairs) which remained underutilization the raw material having 87.9 million (PRS) worth goes to waste which can be properly processed in the small rural industries locally for value addition and processed into socks, sweaters, coats, shawls, caps, carpets, shoes and other valuable products and improve the socio-economic status of poor community. Furthermore, Yak milk and meat production can be value added by preparing yogurt, cheese and butter whereas, provision of hygienic meat from butchery shops are major issues. In addition, that breed improvement, disease control, feed improvement and shelter construction are major challenges.

In short, this workup (Article) proposes step towards the self-dependence of about 70% population living in the rural areas of GB by conservation of unique specie and value addition of the products available from the yak which play a major source livelihood development of marginalized and mountainous communities of GB through establishment of small entrepreneurs. This will lead to rural prosperity and socio-economic development of GB.

Keywords: Yak, Gilgit-Baltistan, Communities, Mohair, Milk, Meat

Grazing and Pasture an Art

Habib Ur Rehman Sherani

Al-iKhwan Farms

thelpg@yahoo.com

Abstract

Successful grazing management comes from understanding certain basic principles, such as how plants grow and how soil, weather and climate conditions affect the rate of plant growth and recovery after grazing. Conservation and handing down of land to future generations has been reported as one of the main reasons pastoralists remain in the livestock sector despite their mental, physical and financial difficulties. A review of previous research shows many cases in which continuous grazing outperformed rotational grazing in both production and economics of plants and animals. Sustainable and profitable grazing systems use tactical grazing management to link pasture production to pasture use and animal production. Grazing management plays a key role in this process to ensure that the pasture growth is optimized, the composition of grasses is maintained in a desirable state, the grass is used, not wasted, livestock performance responds to established growth pathways, resources are managed within environmental limits and guidelines. A grazing strategy is a plan to achieve a set of goals, based on knowledge of available resources and the production and marketing environment. Pasture management is an integral part of horse breeding. A good forage management program will not only keep horses healthy but also ensure the economic longevity of healthy pastures. Good pasture management is important for the overall management of the farm. Pasture rotation is also practiced to optimize plant growth and utilization by grazing vegetation at appropriate heights and allowing for proper rest and growth. Activities such as pulling or pruning brush, skidding to break up manure clumps, fertilization and over-seeding are also necessary components of pasture forage management.

Keywords: Management, Goals, Grazing strategy, Forage management, Pasture management

The Ongoing Research Activities on Yak at Virtual University of Pakistan

Abdul Wajid¹, Tanveer Hussain^{2*}, Qurat ul Ain¹, Ayesha Mohiuddin¹, Gohar Ayub¹, Amina Mustafa², Kamran Abbas², Akhtar Ali¹, Masroor Ellahi Babar³

¹Department of Biotechnology, Virtual University of Pakistan, Lahore

¹Department of Molecular Biology, Virtual University of Pakistan, Lahore

³University of Agriculture, Dera Ismail Khan, Pakistan

*tanveer.hussain@vu.edu.pk

Abstract

Domestic yak (*Bos grunniens*) from the Gilgit Baltistan is highly adapted to local high altitude and cold environment. Yaks are one of the world's most remarkable multipurpose animals providing products such as milk, meat, leather, hair, and manure for fuel for people living at high altitude and are useful as riding and pack animals. The research group at Virtual University of Pakistan is the leading animal research team working on animal genetics including yak. The blood samples were collected from various territories of Gilgit Baltistan and were processed at the animal genetic laboratory Virtual University of Pakistan, Davis Road Campus, Lahore. To investigate the phylogenetic status of Pakistani domestic yak, a complete cytochrome b gene (*Cyto b*) and control region (CR) of mitochondria were sequenced. Two highly divergent maternal lineages (lineages I and II) and three haplogroups (A, C and D) were identified. A total of 27 autosomal microsatellite markers were used to investigate the genetic diversity of Pakistani domestic. All the microsatellites were polymorphic and a total of 138 alleles were observed. However, the data indicated that there was no significant geographical structuring in Pakistani yak populations, which suggested that there exists strong gene flow between them. The domestic yak genome has been sequenced by low-coverage whole genome sequencing (LC-WGS) approach using illumine-based technology. It will provide a valuable genetic resource that will facilitate further study of the genetic diversity and accelerate yak breeding efforts. Since the yak is an animal of extreme environment, their territories are considered more prone to climate changes. In the study, mRNA patten of heat shock proteins (HSPs) and immunity-related protein genes were studied in the PBMCs of yak sampled during late winter through qRT-PCR. Differential gene expression pattern was detected in the PBMCs of yak during the study period. TLRs are evolutionary conserved proteins and a significant component of innate immune response in mammals. Complete *TLR2* gene [5'UTR 136bp, CDS 2355bp, and 3'UTR 1316bp] was sequenced encoding a protein of 784 amino acids long. Prolactin (PRL) is a polypeptide hormone and a potential candidate gene and genetic marker to study milk production traits in mammalian species. PRL and Interferon alpha A genes were studied and found polymorphic in the studied yak samples. These studies provided an insight into the polymorphisms pattern in various genes that may be potentially associated with to improve animal production, growth, and health.

[Document title] (*Bos grunniens*)

Department of Molecular Biology, Virtual University of Pakistan, Lahore

Key words: Yak, STRs, *Cyto b*, control region, LC-WGS, HSPs, Immunity-related genes, TLR2, PRL, IFNAA, gene sequencing, gene expression and phylogenetic analysis

MSTN Gene and its Role in Increasing Muscularity in Yak

Bilqees Bano^{1*}, Tahira Bibi², Ayesha Maqbool³, Tanveer Hussain³

¹ Department of Biology, Virtual University of Pakistan, Rawalpindi, Pakistan

² Department of Biotechnology, Virtual University of Pakistan, Rawalpindi, Pakistan

³ Department of Molecular Biology, Virtual University of Pakistan, Lahore, Pakistan

Bilqees Bano and Tahira Bibi contributed as first author.

*balqees.bano@vu.edu.pk

Abstract

Myostatin (MSTN) is a Growth and differentiation factor-8 which is one of the highly conserved important factors which regulates the formation of muscular tissue during the process of myogenesis. Muscle cells produce myostatin hormone that prevents muscular growth. It also acts on adipocytes which leads to the absence of adipogenesis. Mutation in the gene sequence of the myostatin gene leads to less production or production of non-functional myostatin protein and the loss myostatin protein leads to the double muscling or hypertrophy. There are different species of cattle which provides high quality meat and dairy products but Yak (*Bos grunniens*) is one of the important species which is adaptive to very harsh, provides these useful products. The purpose of our review is primarily stated that the different mutations in the MSTN genes in Yak. Since downregulation of myostatin can lead to muscle hypertrophy so the physical performance of the Yak can be improved by using the functionally mutated myostatin.

Key words: Hypertrophy, Transforming growth factor (TGF) β superfamily, Growth differentiation family-8 (GDF-8), Yak



Department of Molecular Biology
Virtual University of Pakistan,
M.A Jinnah Campus, Defense Road,
Off Raiwand Road, Lahore,
Pakistan (54000)





Department of Molecular Biology
Virtual University of Pakistan,
M.A Jinnah Campus, Defense Road,
Off Raiwand Road, Lahore,
Pakistan (54000)

