8TH INTERNATIONAL CONGRESS ON VETERINARY AND ANIMAL SCIENCES

20-21 October 2023 / Online

ANT ACADEMY

www.icvas.gen.tr

8TH INTERNATIONAL CONGRESS ON VETERINARY AND ANIMAL SCIENCES

20-21 October 2023 / Online



CONGRESS BOOK

EDITORS

Assoc. Prof. Dr. Mustafa YİPEL

Assoc. Prof. Dr. Hüsamettin EKİCİ





ANT ACADEMY

www.icvas.gen.tr

ISBN: 978-605-72754-8-6

THIS PAGE INTENTIONALLY LEFT BLANK

CONTENT

CONTENT 4
FOREWORD 5
ORGANIZING COMMITTEE 6
SCIENTIFIC COMMITTEE 8
INVITED SPEAKERS 11
SCIENTIFIC PROGRAM. 12
SCIENTIFIC AWARDS 22
PRESENTATIONS 23
FULL TEXTS 24
ABSTRACTS 83

Dear Colleagues,

We are pleased to announce that the 8th International Congress on Veterinary and Animal Sciences (ICVAS 2023) has been held online on 20–21 October 2023. This event has been brought together researchers to present their research innovations, to share ideas and knowledge, and discuss future perspectives of Veterinary Medicine and Animal Sciences.

In the congress program, clinical sciences such as surgery, internal diseases, obstetrics and gynecology, reproduction; preclinical sciences such as pathology, parasitology, microbiology, fundamental sciences such as biochemistry, physiology, and histology and embryology as well as zootechnics, animal nutrition, food hygiene, technology and other relevant topics presentations have been involved in.

We would like to thank all participants, collaborators, audiences, invited speakers, scientific committee members of the 8th ICVAS 2023 congress where the latest scientific findings to address current and future challenges have been presented and discussed.

With our best regards.

Sincerely,

Assoc. Prof. Dr. Hüsamettin EKİCİ

Kırıkkale University, TÜRKİYE

Assoc. Prof. Dr. Mustafa YİPEL

Hatay Mustafa Kemal University, TÜRKİYE

ORGANIZING COMMITTEE

Heads of Organizing Committee

Assoc. Prof. Dr. Hüsamettin EKİCİ DVM, PhD, Kırıkkale University, Faculty of Veterinary Medicine, TÜRKİYE

Assoc. Prof. Dr. Mustafa YİPEL DVM, PhD, Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, TÜRKİYE

Members of Organizing Committee

Prof. Dr. Narcisa MEDERLE, Banat Uni. of Agr. Sci. and Veterinary Med. of Timisoara, ROMANIA

Assoc. Prof. Dr. Nilay SEYİDOĞLU, Tekirdağ Namik Kemal University, Faculty of Veterinary Medicine, TURKİYE

Assoc. Prof. Dr. Ulaş ACARÖZ, Afyon Kocatepe University, Faculty of Veterinary Medicine, TURKİYE / Kyrgyzstan Turkey Manas University, Faculty of Veterinary Medicine, Kyrgyzstan

Assoc. Prof. Dr. Hasan ERDOĞAN, Aydin Adnan Menderes University, Faculty of Veterinary Medicine, TURKİYE

Assoc. Prof. Dr. Ishraga Gaafar IBRAHIM, Central Vet. Research Lab. SUDAN

Assoc. Prof. Shahram SAGHAEI, Orumieh Azad University, IRAN

Assoc. Prof. Dr. Gokhan ASLIM, Selcuk University, Faculty of Veterinary Medicine, TURKİYE

Assoc. Prof. Chuleui JUNG, Andong National University, KOREA

Leila KEBAL, Faculty of Nature and Life Sciences, University of Mostaganem, ALGERIA

Palagan Senopati SEWOYO, Faculty of Veterinary Medicine, Udayana University, INDONESIA

Semi Sertaç BAĞIRSAKÇI, Ankara University, Institute of Health Sciences, TURKİYE

Moraru FLORINA, Banat Uni. of Agr. Sci. and Veterinary Med. of Timisoara, ROMANIA

Beren KABASAKAL, Kırıkkale University, Faculty of Veterinary Medicine, TURKİYE

Palagan Senopati SEWOYO, Faculty of Veterinary Medicine, Udayana University, INDONESIA

SCIENTIFIC COMMITTEE

Prof. Dr. Aleš GREGORC, University of Maribor, SLOVENIA

Prof. Dr. Aneliya MİLANOVA, Trakia University, Stara Zagora, BULGARIA

Prof. Dr. Attila KARSİ, Mississippi State University, USA

Prof. Dr. Begüm YURDAKÖK-DİKMEN, Ankara University, TURKIYE

Prof. Dr. Ebru YILDIRIM, Kırıkkale University, TURKIYE

Prof. Dr. Ender YARSAN, Ankara University, TURKIYE

Prof. Dr. Fusun TEMAMOGULLARİ, Harran University, TURKIYE

Prof. Dr. Herman VİOREL, Faculty of Veterinary Medicine BUASVM Timisoara, ROMANIA

Prof. Dr. Koula DOUKANİ, University of Ibn Khaldoun, ALGERIA

Prof. Dr. Kader YILDIZ, Kırıkkale University, TURKIYE

Prof. Dr. Ki-Young KİM, Kyung Hee University, KOREA

Prof. Dr. Levent ALTINTAŞ, Ankara University, TURKIYE

Prof. Dr. Luigi INTORRE, University of Pisa, ITALY

Prof. Dr. Marcos PÉREZ-LÓPEZ, Extremadura University, SPAIN

Prof. Dr. Mehmet CENGİZ, Muğla Sıtkı Koçman University, TURKIYE

Prof. Dr. Meryem EREN, Erciyes, TURKIYE

Prof. Dr. Miyase ÇINAR, Kırıkkale University, TURKIYE

Prof. Dr. Murat YUKSEL, Hatay Mustafa Kemal University, TURKIYE

Prof. Dr. Narcisa MEDERLE, Banat Uni. of Agr. Sci. and Vet. Med. of Timisoara, ROMANIA

Prof. Dr. Pınar DEMİR, Kırıkkale University, TURKIYE

Prof. Dr. Sevil DİNCER ISOGLU, Abdullah Gul University, TURKIYE

Prof. Dr. Serife TUTUNCU, Ondokuz Mayıs University, TURKIYE

Prof. Dr. Siyami KARAHAN, Kırıkkale University, TURKIYE

Prof. Dr. Sule Yurdagul OZSOY, Aydın Adnan Menderes University, TURKIYE

Prof. Dr. Zeynep PEKCAN, Kırıkkale University, TURKIYE

Assoc. Prof. Dr. Adnan AYAN, Van Yuzuncu Yil University, TURKIYE

Assoc. Prof.Dr. Ali SOLEİMANZADEH, Urmia University, IRAN

Assoc. Prof. Dr. Andreja PREVENDAR, Crnic University of Zagreb, CROATIA

Assoc. Prof. Dr. Behnam ROSTAMİ, University of Zanjan, IRAN

Assoc. Prof. Damla Arslan ACARÖZ, Afyon Kocatepe University, TURKIYE

Assoc. Prof. Dilek DÜLGER, Karabük University, TURKIYE

Assoc. Prof Dr. Fulya ALTINOK YİPEL, Hatay Mustafa Kemal University, TURKIYE

Assoc. Prof Dr. Hidayet TUTUN, Burdur Mehmet Akif Ersoy University, TURKIYE

Assoc. Prof.Dr. Ibrahim KUÇUKASLAN, Dicle University, TURKIYE

Assoc. Prof. Dr. Kıvılcım SONMEZ, İstanbul University, TURKIYE

Assoc. Prof. Dr. Latif Emrah YANMAZ, Atatürk University, TURKIYE

Assoc. Prof. Mehmet GÜVENÇ, Hatay Mustafa Kemal University,TURKIYE

Assoc. Prof. Dr. Mian Muhammad AWAİS, Bahauddin Zakariya University, PAKISTAN

Assoc. Prof. Dr. Mokhtar BENHANİFİA, University Mustapha Stambouli, ALGERIA

Assoc. Prof. Dr.Nilay SEYİDOĞLU, Tekirdağ Namık Kemal University, TURKIYE

Assoc. Prof. Dr. Noureddine DJEBLİ, University of Mostaganem, ALGERIA

Assoc. Prof. Dr. Sami GOKPINAR, Kırıkkale University, TURKIYE

Assoc. Prof. Dr. Seyda CENGİZ, Muğla Sıtkı Koçman University, MUĞLA

Assoc. Prof. Dr. Sinasi ASKAR, Cankiri Karatekin University, TURKIYE

Assoc. Prof. Dr. Ulaş ACARÖZ, Afyon Kocatepe University, TURKIYE

Assoc. Prof.Dr. Yuksel AGCA, University of Missouri, USA

Assist. Prof. Dr. Abdur Rahman SİAL, Unv. of Veterinary & Animal Sciences, PAKISTAN

Assist. Prof Dr. Ahmad ALİ, University of Mumbai, INDIA

Assist. Prof Dr Farnaz MALEKİFARD, Urmia University, IRAN

Assist. Prof. Dr. Fatgzim LATİFİ, University of Prishtina, Pristina, KOSOVA

Assist. Prof Dr Firas ALALİ, University of Kerbala, IRAQ

Assist. Prof. Dr. Mahendra Pratap Singh TOMAR, INDIA

Dr. Abdul Shakoor CHAUDHRY, Newcastle University, Newcastle upon Tyne, UK

Dr. İbrahim ABBAS, Faculty of Veterinary Med., Mansoura University, Mansoura, EGYPT

Dr. Seda EKİCİ, Veterinary Control Central Research Institute, TURKIYE

Dr. Sedat SEVİN, Ankara University, TURKIYE

INVITED SPEAKERS

Prof. Dr. Nasim AHMAD

'Salient Research Achievements of UVAS, Lahore'

Vice Chancellor-UVAS, National Distinguished Professor, Sitara-e-Imtiaz, University of Veterinary and Animal Sciences, Lahore, PAKISTAN

Assist. Prof. Dr. Łukasz ŚWIĄTEK

'Emerging and reemerging zoonotic viruses - A global public health threat'

Department of Virology with Viral Diagnostic Laboratory, Medical University of Lublin, Lublin, POLAND

Assist. Prof. Dr. Alexander ATANASOFF

'Sturgeon gender: Can we know something for certain?'

Trakia University, Faculty of Veterinary medicine, Department of Animal Husbandry, BULGARIA

Prof. Dr. Narimane SEGUENI

'Bee products as a source of bioactive compounds and remarkable pharmacological properties'

University Salah Boubnider Constantine 3, Faculty of Medicine Constantine. ALGERIA

Prof. Dr. Zahid IQBAL

'One Health Program for Public Health Benefits'

Department of Pharmacology & Toxicology, Faculty of Veterinary and Animal Sciences,

The Islamia University, Bahawalpur, PAKISTAN

Assist. Prof. Dr. Ahmad ALI

'Diabetes in human and animal models'

Department of Life Sciences, University of Mumbai, INDIA

SCIENTIFIC PROGRAM

09:15	20 October, Friday, 2023; *OPENNING SPEECH*
09:30 - 10:00	INVITED SPEAKER: Prof. Dr. Nasim AHMAD Salient Research Achievements of UVAS, Lahore *Vice Chancellor-UVAS, National Distinguished Professor, Sitara-e-Imtiaz, University of Veterinary and Animal Sciences, Lahore, PAKISTAN*
10:00	Chair: Prof. Dr. Ebru YILDIRIM *Kırıkkale University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Kırıkkale, TÜRKİYE*
10:00 - 10:15	Rumen fermentation, enteric methane emission and feed efficiency of dairy cows fed amylase-enabled corn silage *Halil İbrahim TOSUN[1]* *David CASPER[2]* *[1]Rumico Livestock Management and Nutrition, Aydın, TÜRKİYE* *[2]North Carolina A&T University, Department of Animal Sciences, NC – USA and Colorado State University, Dept. of Animal Science, CO, USA*
10:15 - 10:30	Effects of Meteorin-Like Protein on A2780, LNCaP, Caco2 and MCF-7 Cell Lines *Furkan YUKSEL* *Guldeniz SEKERCI* *Suat TEKIN* *Inonu University, Faculty of Medicine, Department of Physiology, Malatya, TÜRKİYE*
10:45 - 11:00	A Retrospective Study About Bornavirus Infection in Cats *Elif İrem ŞENLIK[1,2]* *Tuba Çiğdem OĞUZOĞLU[2]* *[1]Ankara University, Institute of Health Science, Ankara, TÜRKİYE* *[2]Ankara University, Faculty of Veterinary Medicine, Department of Virology, Ankara, TÜRKİYE*
11:00 - 11:15	Honey-Mediated Synthesized Silver Nanoparticles: A Promising Bioactive Agent for The Prevention of Nosemasis Disease in Honeybees *Ogün BOZKAYA[1]* *Esra BOZKAYA[1,2]* *Hüsamettin EKICI[3]* *Siyami KARAHAN[4]* *[1]Kırıkkale. University, Scientific and Technological Researches Application and Research Center, Kırıkkale, TÜRKİYE* *[2]Kırıkkale. University, Hacılar Vocational School Occupational Health and Safety Pr., Kırıkkale, TÜRKİYE* *[3]Kırıkkale. University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Kırıkkale, TÜRKİYE* *[4]Kırıkkale University, Faculty of Veterinary Medicine, Department of Histology and Embryology, Kırıkkale, TÜRKİYE*

11:45	Chair: Assoc. Prof. Dr. Ulaş ACARÖZ Afyon Kocatepe University, Faculty of Veterınary, Department of Food Hygiene and Technology, Afyonkarahisar, TÜRKİYE
11:45 - 12:00	Evaluation of TLR4 Expression in the Uterus of Rats Administered Capcaicin During Puberty *Feyza KESKIN* *Serife TUTUNCU* *Nurcan DELICE* *Tugrul ERTUGRUL* *Ondokuz Mayis University, Faculty of Veterinary Medicine, Department of Histology and Embrylogy, Samsun, TÜRKİYE*
12:00 - 12:15	The Interaction of Spectral Sensitivity with Melatonin and Growth Hormone Levels in Broilers *Deniz KARAKÇI* *Tekirdağ Namık Kemal University, Faculty of Veterinary Medicine Department of Biochemistry, Tekirdağ, TÜRKİYE*
12:15 - 12:30	Determination of Some Virulence Genes and Antibiotic Resistance Profiles of *K. Pneumoniae* Strains of Cat and Dog Origin *Anwar Omer ELFAROUG AHMED* *Arzu FINDIK* *Ondokuz Mayıs University, Faculty of Veterinary Medicine, Department of Microbiology, Samsun, TÜRKİYE*
12:30 - 12:45	Investigation of Anti-Cancer Effects of Boric Acid on Neuroblastoma SH-SY5Y Cell Line *Sibel DAĞLI*[1] *Hatice Kübra YİĞİT*[2] *Hasan ULUSAL*[3] [1]*Mustafa Kemal University, Faculty of Medicine, Department of Medical Microbiology, Hatay, Turkey* [2]*Gaziantep University, Faculty of Medicine, Department of Medical Physiology, Gaziantep, Turkey* [3]*Gaziantep University, Faculty of Medicine, Department of Medical Biochemistry, Gaziantep, Turkey*
12:45 - 13:00	Effects of Meteorin-Like Protein on Pancreatic Histopathology in a Streptozotocin-Induced Experimental Diabetes Model *Furkan YUKSEL*[1] *Aslı TASLIDERE*[2] *Cigdem TEKIN*[3] *Mete OZCAN*[4] *Suat TEKIN*[1] [1]*Inonu University, Faculty of Medicine, Department of Physiology, Malatya, TÜRKİYE* [2]*Inonu University, Faculty of Medicine, Department of Histology and Embryology, Malatya, TÜRKİYE* [3]*Inonu University Vocational School of Health Services, Malatya, TÜRKİYE* [4]*Firat University Faculty of Medicine, Department of Biophysics, Elazig, TÜRKİYE*
	BREAK - POSTER PRESENTATIONS Enhacing Prolificacy in Algerian Sheep Breeds through Genetic Crossbreeding S *Missoum BENZIANE* [1] *F Z MAHAMMI* [1, 2] [1] *Higher School of Biological Sciences of Oran (ESSBO), BP 1042, Saim Mohamed Oran, Algeria.* [2]*Laboratory of Molecular and Cellular Genetics, Department of Applied Molecular Genetics, Faculty of Nature and Life Sciences, University of Sciences and Technology of Oran Mohamed Boudiaf, Oran, Algeria*

Does Taking Preventive Measures Against Neonatal Calf Diseases Affect Subsequent Performance Parameters?

Samet KÖSE[1] Adnan ŞEHU[2] Erman GÜLENDAĞ[3]

[1]Tierarztpraxis Dr. Fietze, Moorweg 2, 21261 GERMANY

[2]Ankara University, Faculty of Veterinary Medicine, Department of Animal Nutrition and Nutritional Diseases, Ankara, TÜRKİYE

[3]Siirt University, Faculty of Veterinary Medicine, Department of Biostatistics, Siirt, TÜRKİYE

13:00 - 13:30

The Effect of Different Diets on Some Reproductive Parameters in African Catfish *(Clarias gariepinus)*

Veselin PENEV Atanas BOZHKOV Galin NIKOLOV

Trakia University, Faculty of Agriculture, Department of Animal husbandry – Non-ruminants and other animals, Stara Zagora, BULGARIA

Genetic Diversity of Local Chickens in Algeria: Challenges and Conservation in the Face of Modern Poultry Practices

F Z MAHAMMI[1,2] S B S GAOUAR[2,3] D LALOE[4] R FAUGERAS[5] X ROGNON[4,6] M TIXIER-BOICHARD[4] N SAIDI-MEHTAR[2] N TABET-AOUL[2,7]

[1]Higher School of Biological Sciences of Oran, P B 1042, Saim Mohamed, Oran, Algeria.

[2]Laboratory of Molecular and Cellular Genetics, Department of Applied Molecular Genetics, Faculty of Natural and Life Sciences, University of Science and Technology of Oran, Oran, Algeria.

[3]Department of Biology, University of Tlemcen, Algeria.

[4]INRAE, UMR1313 Animal Genetics and Integrative Biology, Jouy-en-Josas, France.

[5]INRAE, Laboratory of Genetic Analysis for Animal Species (LABOGENA), Jouy-en-Josas, France.

[6]AgroParisTech, UMR1313 Animal Genetics and Integrative Biology, Paris, France.

[7]Department of Biotechnology, University of Oran Es-Senia, Oran, Algeria.

The Effect of Parvoviral Enteritis on Mineral Homeostasis in Canine

Kübra BEKARER[1] Ebru ÇETİN[2]

[1]Erciyes University, Faculty of Veterinary Medicine, Graduate School of Health Sciences Dept. of Veterinary Biochemistry Kayseri, TÜRKİYE

[2]Erciyes University, Faculty of Veterinary Medicine Department of Physiology Kayseri, TÜRKİYE

13:30 - 14:00 INVITED SPEAKER: Assist. Prof. Dr. Łukasz ŚWIĄTEK

Emerging and reemerging zoonotic viruses - a global public health threat

Department of Virology with Viral Diagnostic Laboratory, Medical University of Lublin, Lublin, POLAND

Chair: Prof. Dr. Mehmet CENGİZ

14:00

Mugla Sıtkı Kocman University, Faculty of Veterinary Medicine, Department of Obstetrics and Gynecology, Muğla, TÜRKİYE

14:00 - 14:15	Investigation of Viral Diseases Occurring in Honey Bees in Eastern Anatolia Region of Turkey *Muhammed Lütfü ACAROĞLU* *Mehmet Özkan TİMURKAN* *Atatürk University, Faculty of Veterinary Medicine, Department of Virology, Erzurum, TÜRKİYE*
14:15 - 14:30	Effect of White Chicory (*Cichorium intybus* L.) Plant Used in the Diet on Quail Live Weight *İsmail ÜLGER[1]* *Mustafa ÖZDEMİR[1]* *Yeliz TAŞÇI[2]* *Hatice ÖZSOLAK[2]* *[1]Erciyes University, Faculty of Agriculture, Department of Animal Sciences Kayseri, TÜRKİYE* *[2]Kayseri Sugar R&D Center, Kayseri Sugar Factory, Kayseri, TÜRKİYE*
14:30 - 14:45	Oncogenic Mechanisms of Retrovirus Infections in Domestic Animals *Emrah KORKULU[1,2]* *Tuba Çiğdem OĞUZOĞLU[2]* *[1]Ankara University, Institute of Health Science, Ankara, TÜRKİYE* *[2]Ankara University, Faculty of Veterinary Medicine, Department of Virology, Ankara, TÜRKİYE*
14:45 - 15:00	A pathological view of Paratuberculosis (Johne disease), which can be overlooked clinically *Ahmet UYAR* *Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pathology, Hatay, TÜRKİYE*
15:00 - 15:30	INVITED SPEAKER: Assist. Prof. Dr. Alexander ATANASOFF Sturgeon gender: Can we know something for certain? *Trakia University, Faculty of Veterinary medicine, Department of Animal Husbandry, BULGARIA*
15:30	Chair: Assoc. Prof. Dr. Adnan AYAN *Van Yüzüncü Yıl University, Faculty of Veterinary Medicine, Department of Genetics, Van, TÜRKİYE*
15:30 - 15:45	The Biological/Physiological Interactions Between the Elements *Fulya ALTINOK-YİPEL[1]* *Mustafa YİPEL[2]* *[1]Hatay Mustafa Kemal University, Samandağ Vocational School, Department of Veterinary Science, Hatay, TÜRKİYE* *[2]Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Hatay, TÜRKİYE*
15:45 - 16:00	Rectovaginal Fistula with Atresia Ani Type III in a Chihuahua Puppy-A Case Report *Büşra KİBAR KURT* *Ahmet GÜRSEL* *Hakan Buğra AVCI* *Aydın Adnan Menderes University, Veterinary Faculty, Department of Surgery, Aydin, TÜRKİYE*
16:00 - 16:15	Comparison of the Effects of Extracts from Goji Berry, Green Tea and Diospyros Kaki Leaves in a Dry Eye Model of Mice *Alper BASA[1]* *İbrahim CANPOLAT[2]* *Kadri KULUALP[3]* *Abdullah ASLAN[4]* *Yesari ERÖKSÜZ[5]* *Sema CAKIR[6]* *Gökhan GÖKDERE[7]* *[1]Firat University University, Faculty of Veterınary Medicine, Department of Surgery, Elazığ, TÜRKİYE*

[2]Dokuz Eylül University University, Faculty of Veterınary Medicine, Department of Surgery, Elazığ, TÜRKİYE

[3]Firat University University, Faculty of Science, Department of Molecular Biology and Genetics, Elazığ, TÜRKİYE

[4]Firat University University, Faculty of Veterınary Medicine, Department of Pathology, Elazığ, TÜRKİYE

[5]Bozok University, Faculty of Veterınary Medicine, Department of Surgery, Yozgat, TÜRKİYE

[6]Firat University University, Faculty of Science, Department of Statistic, Elazığ, TÜRKİYE

16:15 - 16:30	A Case of Tetanus in a Dog *Erdal KARA* *Yasin ŞENEL* *Naci ÖCAL* *Kırıkkale University, Faculty of Veterinary Medicine, Department of Internal Medicine, Kırıkkale, TÜRKİYE*
16:30	*End*

21 October, Saturday, 2023

09:30 - 10:00	INVITED SPEAKER: Prof. Dr. Narimane SEGUENI Bee products as a source of bioactive compounds and remarkable pharmacological properties *University Salah Boubnider Constantine 3, Faculty of Medicine Constantine, ALGERIA*
10:00	Chair: Prof. Dr. Kader YILDIZ *Kırıkkale University, Faculty of Veterinary Medicine, Department of Parasitology, Kırıkkale, TÜRKİYE*
10:00 - 10:15	*How to Analyse Pesticides in Urine?* *İrem KARAASLAN* *Hatay Mustafa Kemal University, Technology and Research and Development Center, Hatay, TÜRKİYE*
10:15 - 10:30	Investigation of The Presence of Dermatophytes in Domestic Dogs, Rabbits, Guinea Pigs and Hamsters *Aziz Utku ÖNEL* *Asya KAZAN* *Bilal ÖZDEMİR* *Sibel KIZIL* *Murat YILDIRIM* *Kirikkale University, Faculty of Veterinary Medicine, Department of Microbiology, Kirikkale, TÜRKİYE*
10:30 - 10:45	Organometallic Compounds in Terms of Toxicology *Meltem KOCAKAYA* *Mustafa YİPEL* *Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Hatay, TÜRKİYE*
10:45 - 11:00	Soybean and Canola Meal Effects On Plasma Amino Acid Profile, Enteric Gas Emissions, Milk Fatty Acids and Nutritional Digestibility by Lactating Cows *Halil İbrahim TOSUN[1]* *David CASPER[2]* *[1]Rumico Livestock Management and Nutrition, Aydın, TÜRKİYE* *[2]North Carolina A&T University, Department of Animal Sciences, NC – USA and Colorado State University, Dept. of Animal Science, CO, USA*

11:00 - 11:15	Effect of *Marrubium Vulgare* L. Plant Used in the Diet on Quail Live Weight *İsmail ÜLGER[1] Mustafa ÖZDEMİR[1] Yeliz TAŞÇI[2] Hatice ÖZSOLAK[2]* *[1]Erciyes University, Faculty of Agriculture, Department of Animal Sciences Kayseri, TÜRKİYE* *[2]Kayseri Sugar R&D Center, Kayseri Sugar Factory, Kayseri, TÜRKİYE*
11:15 - 11:30	Dioxins, Furans and Polychlorobiphenyls in Terms of Toxicology Mustafa YENİÇERİ Mustafa YİPEL *Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Hatay, TÜRKİYE*
11:30 - 11:45	The Contribution of Sustainability to Ensuring Food Security *Özlem AYTÜRK* *Maltepe University, Faculty of Fine Art, Department of Gastronomy and Culinary Arts, İstanbul, TÜRKİYE*
11:45	Chair: Assoc. Prof. Dr. Sabire GÜLER *Uludağ University, Faculty of Veterinary Medicine, Department of Histology and Embryology, Bursa, TÜRKİYE*
11:45 - 12:00	Evaluation of Human-Animal Interaction with Biotelemetric Instruments *Nilay SEYIDOGLU[1] Cenk AYDIN[2]* *[1]Tekirdağ Namik Kemal University, Faculty of Veterinary Medicine, Department of Physiology, Tekirdağ, TÜRKİYE* *[2]Bursa Uludag University, Faculty of Veterinary Medicine , Department of Physiology, Bursa, TÜRKİYE*
12:00 - 12:15	Netosis Reaction Originated from Neutrophils Against Helminths *Gözde Nur AKKUŞ[1] Kader YILDIZ[2]* *[1]Kırıkkale University, Graduate School of Health Science, Department of Parasitology, Kırıkkale, TÜRKİYE* *[2]Kırıkkale University, Faculty of Veterinary Medicine, Department of Parasitology, Kırıkkale, TÜRKİYE*
12:15 - 12:30	Determination of The Amoxicillin Excretion Level in The Milk of Anatolian Buffaloes *Ulas ACAROZ[1] Abdullah ERYAVUZ[2] Damla ARSLAN-ACAROZ[3] Sinan INCE[4] Ibrahim DURMUŞ[5] Azra Mila ERYAVUZ[3] Ismail KUCUKKURT[3]* *[1]Afyon Kocatepe University, Faculty of Veterinary Medicine, Department of Food Hygiene and Technology, Afyonkarahisar, TÜRKİYE* *[2]Afyon Kocatepe University, Faculty of Veterinary Medicine, Department of Physiology, Afyonkarahisar, TÜRKİYE* *[3]Afyon Kocatepe University, Faculty of Veterinary Medicine, Department of Biochemistry, Afyonkarahisar, TÜRKİYE* *[4]Afyon Kocatepe University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Afyonkarahisar, TÜRKİYE* *[5]Afyon Kocatepe University, Faculty of Veterinary Medicine, Suhut Vocational School, Suhut, TÜRKİYE*

12:30 - 12:45

A Case of Traumatic Myiasis Caused by *Wohlfahrtia magnifica* (Schiner 1862) (Diptera: *Sarcophagidae*) in a Colt (*Equus asinus*)

Aykut ZEREK *İpek ERDEM* *Mehmet YAMAN*

Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Parasitology, Hatay, TÜRKİYE

12:45 - 13:00

Determination of The Effects of *Rhizobium Leguminosarum* as an Inoculant On The Hay Quality and In Situ Ruminal Degradability Values of Forage Pea And Hungarian Vetch

Mehmet DEMİRCİ[1] *Taşkın EROL[2]* *Kamil KARA[2]* *Şevket EVCİ[1]* *Hasan Hüseyin ŞENYÜZ[3]*

[1]Kırıkkale University, Vocational School, Department of Laboratory and Veterinary Health, Kırıkkale, TÜRKİYE

[2]Kırıkkale University, Vocational School, Department of Plant and Animal Production, Kırıkkale, TÜRKİYE

[3]Necmettin Erbakan University, Department of Animal Nutrition and Nutritional Diseases, Faculty of Veterinary Medicine, Konya, TÜRKİYE

BREAK - POSTER PRESENTATIONS

Enhacing Prolificacy in Algerian Sheep Breeds through Genetic Crossbreeding

S Missoum BENZIANE [1] F Z MAHAMMI [1, 2]

[1] Higher School of Biological Sciences of Oran (ESSBO), BP 1042, Saim Mohamed Oran, Algeria.

[2]Laboratory of Molecular and Cellular Genetics, Department of Applied Molecular Genetics, Faculty of Nature and Life Sciences, University of Sciences and Technology of Oran Mohamed Boudiaf, Oran, Algeria

Does Taking Preventive Measures Against Neonatal Calf Diseases Affect Subsequent Performance Parameters?

Samet KÖSE[1] *Adnan ŞEHU[2]* *Erman GÜLENDAĞ[3]*

[1]Tierarztpraxis Dr. Fietze, Moorweg 2, 21261 GERMANY

[2]Ankara University, Faculty of Veterinary Medicine, Department of Animal Nutrition and Nutritional Diseases, Ankara, TÜRKİYE

[3]Siirt University, Faculty of Veterinary Medicine, Department of Biostatistics, Siirt, TÜRKİYE

The Effect of Different Diets on Some Reproductive Parameters in African Catfish *(Clarias gariepinus)*

Veselin PENEV *Atanas BOZHKOV* *Galin NIKOLOV*

Trakia University, Faculty of Agriculture, Department of Animal husbandry – Non-ruminants and other animals, Stara Zagora, BULGARIA

13:00 - 13:30

Genetic Diversity of Local Chickens in Algeria: Challenges and Conservation in the Face of Modern Poultry Practices

F Z MAHAMMI[1,2] S B S GAOUAR[2,3] D LALOE[4] R FAUGERAS[5] X ROGNON[4,6] M TIXIER-BOICHARD[4] N SAIDI-MEHTAR[2] N TABET-AOUL[2,7]

[1]Higher School of Biological Sciences of Oran, P B 1042, Saim Mohamed, Oran, Algeria.

[2]Laboratory of Molecular and Cellular Genetics, Department of Applied Molecular Genetics, Faculty of Natural and Life Sciences, University of Science and Technology of Oran, Oran, Algeria.

[3]Department of Biology, University of Tlemcen, Algeria.

[4]INRAE, UMR1313 Animal Genetics and Integrative Biology, Jouy-en-Josas, France.

[5]INRAE, Laboratory of Genetic Analysis for Animal Species (LABOGENA), Jouy-en-Josas, France.

[6]AgroParisTech, UMR1313 Animal Genetics and Integrative Biology, Paris, France.

[7]Department of Biotechnology, University of Oran Es-Senia, Oran, Algeria.

The Effect of Parvoviral Enteritis on Mineral Homeostasis in Canine

Kübra BEKARER[1] *Ebru ÇETİN[2]*

[1]Erciyes University, Faculty of Veterinary Medicine, Graduate School of Health Sciences Dept. of Veterinary Biochemistry Kayseri, TÜRKİYE

[2]Erciyes University, Faculty of Veterinary Medicine Department of Physiology Kayseri, TÜRKİYE

13:30 - 14:00

INVITED SPEAKER: Prof. Dr. Zahid IQBAL

One Health Program for Public Health Benefits

Department of Pharmacology & Toxicology, Faculty of Veterinary and Animal Sciences,

The Islamia University, Bahawalpur, PAKISTAN

14:00

Chair: Prof. Dr. Siyami KARAHAN

Kırıkkale University, Faculty of Veterinary Medicine, Department of Histology and Embryology, Kırıkkale, TÜRKİYE

14:00 - 14:15

COVID-19: Role of Blood Parameters

Buket FIDANCI[1] *Elisha Apatewen AKANBONG[2]* *Ali ŞENOL[3]* *Miyase ÇINAR[3]*

[1]Etlik City Hospital, Ankara, TÜRKİYE

[2]Acra Veterinary Laboratory, Veterinary Services Directorate, Acra, GHANA

[3]Kırıkkale University, Faculty of Veterinary, Department of Biochemistry, Kırıkkale, TÜRKİYE

14:15 - 14:30

Implementing The 3Rs in Desert Rodents for Biomedical Research: Current Insights and Applications

Benmouloud ABDELOUAFI[1,2,3] *Kacimi LILIA[1,2]* *Zatra YAMINA[1,2,4]* *Aknoun-Sail NAOUEL[1,2]* *Charallah SALIMA[1,2]* *Khammar FARIDA[1,2]*

[1]Houari Boumedienne University of Sciences and Technology (LRZA, FSB, USTHB), Algiers, ALGERIA

[2]University of Algiers 1 Benyoucef Benkhedda, Algiers, ALGERIA

[3]University of M'hamed Bougara Boumerdes (UMBB), Boumerdes, ALGERIA

[4]Saad Dahlab university of Blida I, Blida, ALGERIA

14:30 - 14:45

Feline Hypertrophic Cardiomyopathy: A Review

Hanaa EL ATMANI[1] *Mohammed PIRO[1]* *Alberto TARDUCCI[2]* *Faouzi KICHOU[3]* *Rahma AZRIB[1]*

[1]Department of Medicine, Surgery and Reproduction, Hassan II Institute of Agronomy and Veterinary

Medicine, Rabat, MOROCCO

[2]Department of Veterinary Science, University of Turin, Turin, ITALY

[3]Department of Veterinary Pathology and Public Health, Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, MOROCCO

Microbiological and Parasitological Health Monitoring in Laboratory Rats

14:45 - 15:00

Aziz Utku ÖNEL[1,2] *A. Begüm BUĞDAYCI[2]* *Süleyman Can ÖZTÜRK[3]* *Güneş ESENDAĞLI[3]*

[1]Kirikkale University, Faculty of Veterinary Medicine, Department of Microbiology, Kirikkale, TÜRKİYE

[2]Kobay Experimental Animals Laboratory, Ankara, TÜRKİYE

[3]Hacettepe University, Faculty Cancer Institute, Department of Basic Oncology, Ankara, TÜRKİYE

Safranal Protects Against Cyclophosphamide Induced Testicular Toxicity in Rats

15:00 - 15:15

Mustafa CELLAT [1] *İlker YAVAŞ[2]* *Ahmet UYAR[3]* *Muhammed ETYEMEZ[4]* *Mehmet GÜVENÇ[1]*

[1]Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Physiology, Hatay, TÜRKİYE

[2]Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Reproduction and Artificial Insemination Hatay, TÜRKİYE

[3]Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pathology, Hatay, TÜRKİYE

[4]Kastamonu University, Faculty of Veterinary Medicine, Department of Physiology, Kastamonu, TÜRKİYE

15:15

Chair: Assoc. Prof. Dr. Nilay SEYİDOĞLU

Tekirdağ Namık Kemal University, Faculty of Veterinary Medicine, Department of Physiology, Tekirdağ, TÜRKİYE

Diagnosis and Diagnostic Methods of *Cryptosporidium* spp. in Lambs

15:15 - 15-30

Sinem AKDENİZ[1] *Aycan Nuriye GAZYAĞCI[2]*

[1]Kırıkkale University, Graduate School of Health Science, Department of Parasitology, Kırıkkale, TÜRKİYE

[2]Kırıkkale University, Faculty of Veterinary Medicine, Department of Parasitology, Kırıkkale, TÜRKİYE

Considerations When Extracting Ancient DNA

15:30 - 15:45

Seda EKİCİ [1] *Akın YİĞİN [2]* *Mehmet DEMİRC[3]*

[1]Veterinary Control Central Research Institute, Ankara TURKIYE

[2]Harran *University, Faculty of Veterinary Medicine, Department of Genetics,* Sanliurfa*, TÜRKİYE*

[3]Kırklareli *University, Faculty of Medicine, Department of Medical Microbiology,* Kırklareli *, TÜRKİYE*

BISPHENOL A ANALOGUES:

15:45 - 16:00

Bisphenol B, Bisphenol C, Bisphenol E, Bisphenol F, Bisphenol P, Bisphenol S Bisphenol Z, and Bisphenol AF

Aysun İLHAN *Mustafa YİPEL*

Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Hatay, TÜRKİYE

16:00 - 16:15	Comparison of Fleece Quality in Turkey's Domestic Sheep Breeds *Ayşe ŞEN* *Tekirdağ Namık Kemal University, Faculty of Agriculture, Department of Animal Science, Tekirdağ, TÜRKİYE*
16:15 - 16:30	In the Health Field (Pain, neurological disorders, etc.) The Mechanism of Using Quantum Energy *Yasemin SEZGİN* *Kırıkkale. University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Kırıkkale, TÜRKİYE*
16:30 - 17:00	INVITED SPEAKER: Assist. Prof. Dr. Ahmad ALI Diabetes in human and animal models Department of Life Sciences, University of Mumbai, INDIA

17:00 *ANNOUNCEMENT of SCIENTIFIC AWARDS*

&

CLOSING SPEECH

SCIENTIFIC AWARDS

- **BEST ORAL PRESENTATION**

1) Ahmet GÜRSEL

Rectovaginal Fistula with Atresia Ani Type III in a Chihuahua Puppy-A Case Report. *Aydın Adnan Menderes Unv., Veterinary Fac., Department of Surgery, Aydin, TÜRKİYE*

2) Hanaa EL ATMANI

Feline Hypertrophic Cardiomyopathy: A Review. Dept. of Med., Surgery and Reproduction, Hassan II Institute of Agronomy and Vet. Medicine, Rabat, MOROCCO

3) İpek ERDEM

A Case of Traumatic Myiasis Caused by *Wohlfahrtia magnifica* (Schiner 1862) (Diptera: *Sarcophagidae*) in a Colt (*Equus asinus*). Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Parasitology, Hatay, TÜRKİYE

- **BEST POSTER PRESENTATION**

1) F. Z. MAHAMMI

Genetic Diversity of Local Chickens in Algeria: Challenges and Conservation in the Face of Modern Poultry Practices. Higher School of Biological Sciences of Oran, P B 1042, Saim Mohamed, Oran, Algeria. Laboratory of Molecular and Cellular Genetics, Department of Applied Molecular Genetics, Faculty of Natural and Life Sciences, University of Science and Technology of Oran, Oran, Algeria.

2) S. Missoum BENZIANE

Enhacing Prolificacy in Algerian Sheep Breeds through Genetic Crossbreeding. Higher School of Biological Sciences of Oran (ESSBO), BP 1042, Saim Mohamed Oran, Algeria.

3) Veselin PENEV

The Effect of Different Diets on Some Reproductive Parameters in African Catfish *(Clarias gariepinus)*, *Trakia University, Faculty of Agriculture, Department of Animal husbandry – Non-ruminants and other animals, Stara Zagora, BULGARIA*

8TH INTERNATIONAL CONGRESS ON VETERINARY AND ANIMAL SCIENCES

20-21 October 2023 / Online



Presentations

ANT ACADEMY

www.icvas.gen.tr

8TH INTERNATIONAL CONGRESS ON VETERINARY AND ANIMAL SCIENCES

20-21 October 2023 / Online

Full Texts

ANT ACADEMY

www.icvas.gen.tr

DETERMINATION OF SOME VIRULENCE GENES AND ANTIBIOTIC RESISTANCE PROFILES OF *K. pneumoniae* STRAINS OF CAT AND DOG ORIGIN

Anwar Omer ELFAROUG AHMED* **Arzu FINDIK**

Ondokuz Mayıs University, Faculty of Veterinary Medicine, Department of Microbiology, Samsun, TÜRKİYE

***E-mail:** Anwarouf@gmail.com

Klebsiella pneumoniae, a multidrug-resistant pathogen, causes significant infections in both animals and humans. Its pathogenicity is due to various virulence factors as well as its ability to develop antibiotic resistance, resulting in serious problems and losses due to treatment failures. In recent years, the increase of hypervirulent K. pneumoniae strains (hvKP) has become a critical concern, especially in immunocompromised patients, increasing the risk to their health. The virulence of hvKp is attributed to its higher level of capsular or extracapsular polysaccharide production than cKp, in addition to a more efficient iron acquisition system. Genes associated with hypermucoviscosity include siderophore-encoding genes such as enterobactin and the capsular polysaccharide regulatory genes rmpA and rmpA2. hvKP strains possess several virulence factors such as rmpA (regulators of mucoid phenotype), entB (catecholate siderophore), fimH and mrkD (fimbrial adhesin) that facilitate biofilm formation and binding to the extracellular matrix. The aim of this study was to investigate the antibiotic resistance profile and key virulence genes such as magA, fimH, rpmA, mrkD and entB in K. pneumoniae isolates from dogs and cats in Samsun. A total of 32 isolates were tested for hvKP by the "string" test and only one isolate was positive. Antibiotic susceptibilities of the isolates were tested by Disk Diffusion test. Accordingly, isolates were resistant to amoxicillin+clavulanic acid 53.1%, imipenem 3.1%, ampicillin 62.5%, penicillin 43.7%, cefoperazone 12.5%, gentamicin 40.6%, amikacin 9.3%, ciprofloxacin 40.6%, enrofloxacin 37.5%, nitrofurantoin 65.6%, trimethoprim+sulfamethoxazole 37.5%, oxytetracycline 46.8%, cefquinome 34.3% and chloramphenicol 28.1%, while all isolates were susceptible to meropenem. Furthermore, 20 isolates (62.5%) exhibited a multidrug resistance profile. Some virulence genes of the isolates were investigated by PCR. Accordingly, rpmA gene was not found in any of the 32 isolates, while magA, fimH, entB and mrkD genes were detected in 4, 9, 5, 5 and 15 isolates, respectively. String

test positive isolate was found to have only mrkD gene. In this study, rmpA, one of the genes important for the hyper-virulent phenotype, was not found in any of the isolates, while magA, which is thought to be responsible for the hypercapsular phenotype, was detected in 12.6% of the isolates. Accordingly, although the probability of hypervirulent phenotype among K. pneumoniae strains of feline and canine origin was low, it was concluded that other genes responsible for the occurrence of this phenotype should be investigated and associated with antibiotic resistance profile.

Keywords: Antibiotic resistance, Cat, Dog, *Klebisella pneumoniae*, Multi-drug resistance

INTRODUCTION

Klebsiella pneumoniae (Kp) is a non-motile, encapsulated Gram-negative bacterium that is prevalent in both healthcare and community settings. It is known to be a leading cause of various infections such as urinary tract infections, bacteremia, and pneumonia (Rastegar et al., 2021a). *K. pneumoniae* has been found to cause a diverse range of diseases in animals, such as pneumonia, bacteremia, and septicemia, as revealed by numerous studies. The extensive utilization and misuse of antimicrobial agents for growth promotion and disease treatment in animals have contributed to the development of high levels of antibiotic resistance in *K. pneumoniae*, rendering it resistant to the majority of available antibiotics (Yang et al., 2019). The extensive utilization of antibiotics, including β-lactam antibiotics, fluoroquinolones, aminoglycosides, and carbapenems, for infection prevention and control has resulted in the emergence of highly resistant strains. Notably, bacteria harbouring resistance genes such as blaKPCs, MBLs, and mcr-1 have become increasingly prevalent (Fu et al., 2018).

A new type of *K. pneumoniae* called hypervirulent *K. pneumoniae* (hvKp) has emerged as a concern for public health. This particular variant is known for being highly invasive leading to conditions like pyogenic liver abscess, bacteremia and pneumonia. It can also form metastases. It is considered dangerous than the classical strains of *K. pneumoniae* (cKp). Importantly hvKp mainly affects individuals in community settings including those who're generally healthy. These unique characteristics highlight the need to address and understand the implications of hvKp in order to effectively manage and reduce its impact, on health (Massinga et al., 2021).

A number of putative virulence factors, notably the mucoviscosity-related gene A (magA) and the regulator of mucoid phenotype A (rmpA), were considered to be associated with hvKP. Alongside magA and rmpA there are virulence genes that are commonly found in hvKp compared to classical *K. pneumoniae* (cKp). These include enterobactin (EntB) which is involved in production of siderophores, as well as fimH and mrkD genes responsible, for encoding type 1 and type 3 fimbriae respectively. These specific virulence factors play roles in colonization, invasion and pathogenicity by aiding

attachment to host cells. Together these factors contribute significantly to the virulence observed in hvKp strains and their ability to cause infections (Rastegar et al., 2021a).

The emergence of MDR clones containing relevant resistance genes, especially those encoding extended-spectrum beta-lactamases (ESBLs) or carbapenemases (CPs), is considered a significant issue in relation to gram-negative bacteria with public health significance (Carvalho et al., 2020). *K. pneumoniae* isolates may inherently possess resistance to amoxicillin, ampicillin, and ticarcillin, but they are typically not resistant to ESBL antibiotics. The transfer of plasmids and transposons has caused *K. pneumoniae* subtypes to become multidrug resistant (MDR) and extremely drug resistant (XDR). The high prevalence of MDR and XDR *K. pneumoniae* is due to factors like the spread of resistant genetic lineages, acquisition of resistant plasmids, and acquisition of resistance genes carried by transposons. *K. pneumoniae* is a major source of carbapenem resistance worldwide, as its plasmids are easily transferred to other species. This transfer of plasmids encoding ESBLs and carbapenemases poses a significant threat, turning bacteria into MDR and XDR strains (Effah et al., 2020). Furthermore, *K. pneumoniae* plays a significant role in the transmission of antimicrobial resistance genes from environmental bacteria to clinically relevant bacteria. This poses a concerning challenge as there are multiple mechanisms of antimicrobial resistance that can adversely impact therapeutic effectiveness. Recognizing the severity of the issue, the World Health Organization (WHO) has declared antibiotic resistance as one of the top three global concerns (Nirwati et al., 2019).

This study aimed to investigate the antimicrobial resistance profile and some virulence genes especially contributing to hypervirulent phenotype among *K. pneumoniae* isolates isolated from cats and dogs in Samsun.

MATERIAL AND METHODS

Bacterial Isolates:

Totally 32 Klebsiella pneumoniae isolates from cats and dogs stored in the culture collection in the laboratory of Ondokuz Mayıs University, Department of Veterinary Microbiology. *K. pneumoniae* atcc700603 was used as a reference strain.

String test:

The K. pneumoniae isolates were grown on TSA agar and incubated at 37 °C for 18-24 hours. To assess the hmv phenotype, an inoculation loop was gently pressed onto the surface of the colonies and then lifted slowly. A positive test was determined if a viscous string measuring ≥5 mm in length.

Antibiotic Susceptibility Testing:

The antibiotic susceptibilities of K. pneumoniae isolates were tested using Kirby–Bauer disk diffusion method, in accordance with the guidelines provided by the Clinical and

Laboratory Standards Institute (CLSI, 2018).For this purpose, various antibiotic discs (amoxicillin + clavulonic acid, imipenem, meropenem, ampicillin, cefoperazone,, gentamicin, amikacin, ciprofloxacin, enrofloxacin, nitrofurantoin, trimethoprim + sulfamethoxazole, oxytetracycline, cefquinom, cefoxitin, cefepime, chloramphenicol) from different antibiotic groups. *K. pneumoniae* atcc700603 was used as the quality control strain for antimicrobial susceptibility testing. The determination of multidrug-resistant (MDR) isolates was conducted by categorizing isolates as MDR if they exhibited resistance to three or more classes of antibiotics.

Detection of Virulence Genes:

DNA extraction from isolates was performed by boiling method. Detection of virulence genes that contributes especially to hypervirulence such as rmpA, mrkD, magA and entB were investigated by a multiplex PCR using specific primers (Compain et al., 2014). Primers were shown in Table 1. The PCR conditions were as follows: initial temperature at 95°C for 15 min, followed by 30 cycles at 94°C for 30 s, 60°C for 90 s, and 72°C for 60 s, and a final extension at 72°C for 10 min. To determine fimH gene, another PCR protocol was used (Massinga et al., 2021). The primers were shown in Table 1 and the PCR conditions as follow: initial denaturation step at 95 °C for 2 min, followed by 35 amplification cycles with denaturation at 94 °C for 30 s, annealing for 1.5 min, an elongation at 72 °C for 1.5 min and a final extension step at 72 °C for 10 min. The amplicons were analysed by electrophoresis on a 2% agarose gel containing ethidium bromide.

Table 1. Primers used for PCR assays

Target gene	Nucleotide sequence (5′-3′)	Size of amplicon(bp)	Reference
rmpA_ for rmpA_rev	CATAAGAGTATTGGTTGACAG CTTGCATGAGCCATCTTTCA	461	Compain et al., 2014
magA_for magA_rev	GGTGCTCTTTACATCATTGC GCAATGGCCATTTGCGTTAG	1283	
mrkD_for mrkD_rev	AAGCTATCGCTGTACTTCCGGCA GGCGTTGGCGCTCAGATAGG	340	
fimH_for fimH_rev	ATGAACGCCTGGTCCTTTGC GCTGAACGCCTATCCCCTGC	688	Massinga et al., 2021
entB_for entB_rev	GTCAACTGGGCCTTTGAGCCGTC TATGGGCGTAAACGCCGGTGAT	400	Compain et al., 2014

RESULTS

***String test*:**

Out of 32 strains, only 1 isolate was string test positive, i.e., hypermucoviscous.

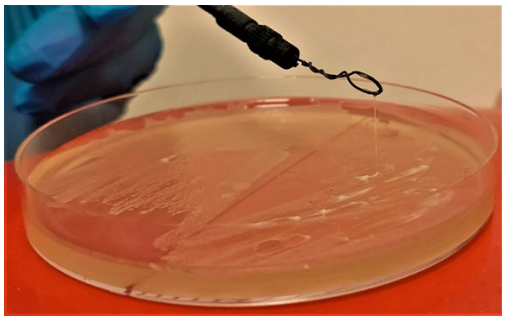


Figure 1 String test positive isolate, isolates show ≥5 considered to be positive.

Antibiotic Susceptibility:

The rates of antibiotic resistance were as follow: 53.1% of the isolates showed resistance to amoxicillin-clavulanic acid, 3.1% to imipenem, 62.5% to ampicillin, 43.75% to penicillin, 12.5% to cefoperazone, 40.6% to gentamicin, 9.3% to amikacin, 40.6% to ciprofloxacin, 37.5% to enrofloxacin, 65.6% to nitrofurantoin, 37.5% to trimethoprim+sulfamethoxazole, and 46.8% to oxytetracycline. It was observed that 34.3% of them exhibited resistance to cefquinome, and 28.1% displayed resistance to chloramphenicol. Furthermore, all of the isolates demonstrated sensitivity to meropenem which is shown in Figure 2. Consequently, the analysis revealed that 20 (62.5%) of the isolates exhibited resistance to multiple antibiotics. Specifically, 6 (18.75%) isolates were resistant to three antibiotic classes, 4 (12.5%) isolates were resistant to four antibiotic classes, 6 (18.75%) isolates were resistant to five antibiotic classes, and 4 (12.5%) isolates were found to be resistant to six antibiotic classes. Detailed findings regarding multiple antibiotic resistance can be found in Figure 3.

***Determination of Virulence Genes*:**

The analysis revealed that among the isolates, 4 were positive for the magA gene, 15 were positive for the mrkD gene, and 5 were positive for the entB gene. Conversely, none of the isolates exhibited the rpmA gene. The results of the multiplex PCR conducted on all isolates can be found in Table 2, while Figure 4 and 4 provide visual representations of these results. Specifically, it was observed that four isolates possessed both the entB and mrkD genes simultaneously, while one isolate contained both the magA and mrkD genes. Notably, none of the isolates harbored all of the investigated genes.

Table 2 The status of isolates carrying the examined genes

No	*magA*	*rpmA*	*mrkD*	*entB*	*FlmH*	No	*magA*	*rpmA*	*mrkD*	*entB*	*FlmH*
1	-	-	+	-	-	27	-	-	-	-	+
2	-	-	+	-	-	28	-	-	-	-	-
3	-	-	+	-	-	29	-	-	+	+	-
4	-	-	+	-	-	31	-	-	-	-	+
5	-	-	-	+	+	32	-	-	+	-	+
6	-	-	-	-	-						
7	-	-	+	-	-						
8	-	-	-	-	-						
9	-	-	+	+	-						
10	+	-	-	-	-						
11	-	-	+	-	-						
12	+	-	+	-	-						
13	-	-	-	-	-						
14	-	-	-	-	-						
15	-	-	+	-	-						
16	+	-	-	-	-						
17	-	-	+	+	-						
18	-	-	-	-	+						
19	-	-	+	-	+						
20	-	-	-	-	-						
21	-	-	+	+	+						
22	-	-	-	-	-						
23	-	-	+	-	+						
24	-	-	-	-	-						
25	-	-	-	-	-						
26	+	-	-	-	+						

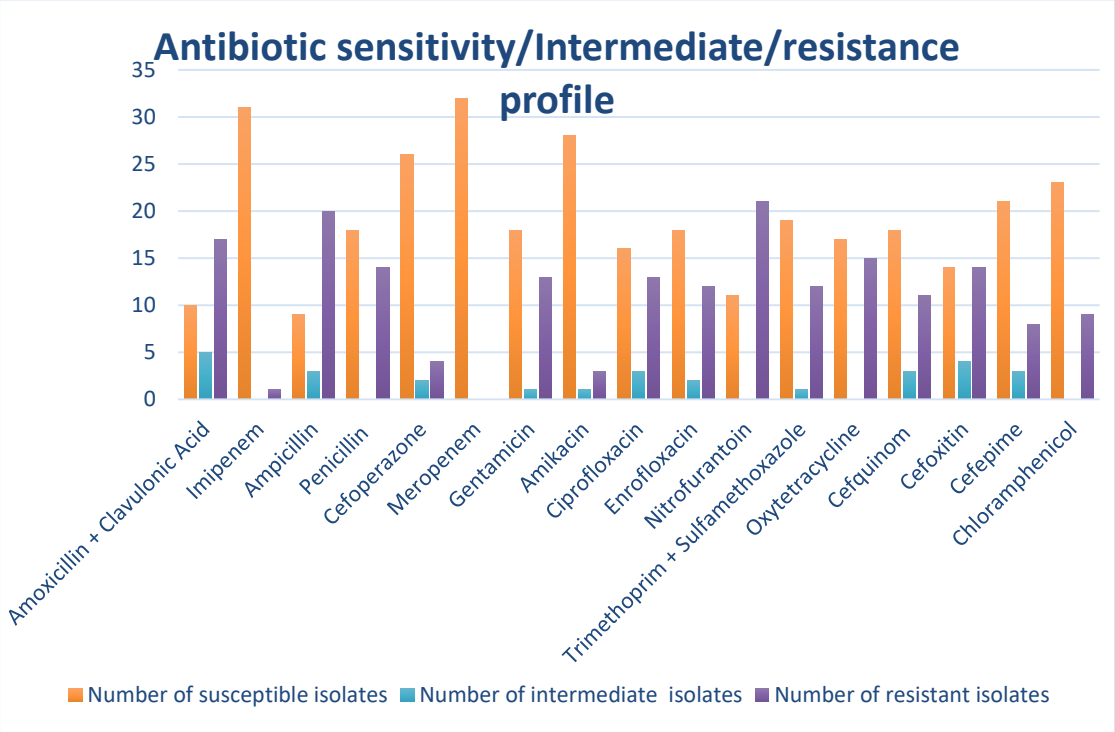


Figure 2 Antibiotic sensitivity/Intermediate/resistance profile.

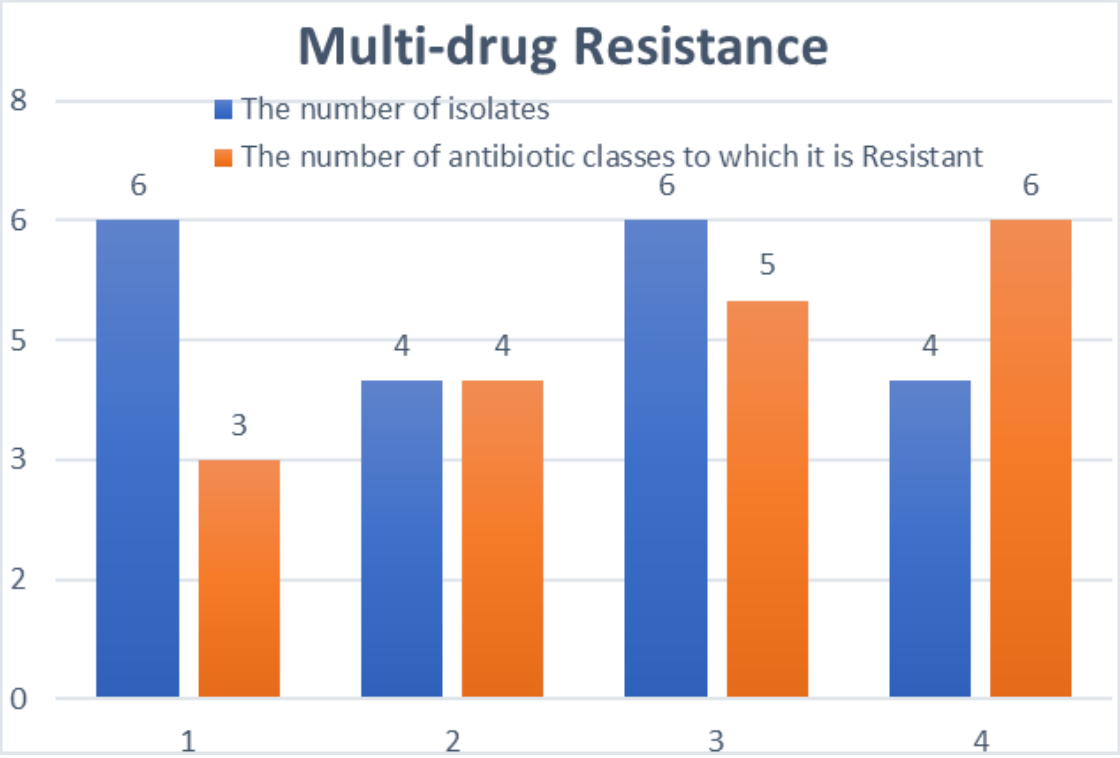


Figure 3 Determination of Multi-drugs resistance of isolates.

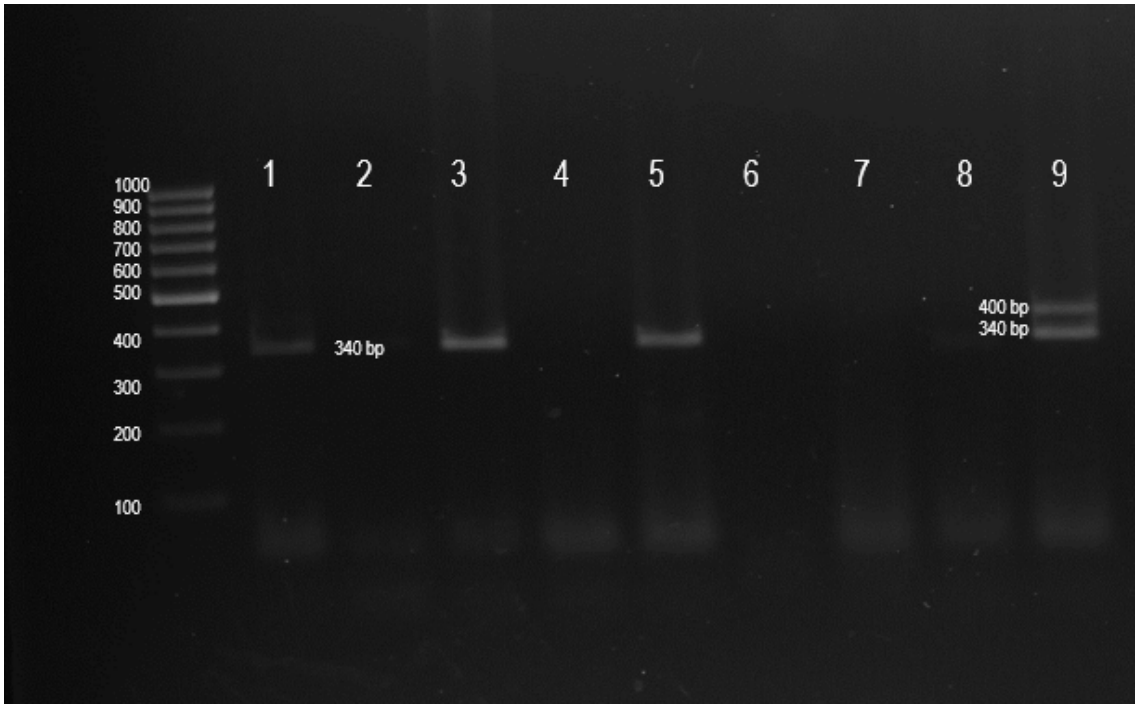


Figure 4 Gel electrophoresis image of bands specific for *entB* and *mrkD* genes. The gene *entB* shows in 400bp and gene *mrkD* in 340bp.

DISCUSSION AND CONCLUSION

The ability of *K. pneumoniae* to cause disease is due to a number of virulence factors. These factors include capsule production, hypermucoviscosity, the presence of lipopolysaccharides and iron acquisition systems. Combined, these features allow the bacterium to evade and overcome the innate immunity of mammalian hosts. They also enable the establishment and maintenance of infections in these hosts (Yang et al., 2019). *rmpA* and *magA* are two genes known to contribute to the hypermucoviscous phenotype in *K. pneumoniae*. In the current study, rmpA was not detected in any of the isolates, which is consistent with the findings reported by (Caneiras et al, 2019; Kus et al, 2017; Rastegar et al, 2021b). Furthermore, the prevalence of *magA* was higher compared to the rates reported by Hao et al. (2022), Khalil et al. (2019), Mirzaie and Ranjbar (2021) and Yang et al. (2019), consistent with the rates of 12.8% and 11.6% reported by Fu et al. (2018) and Kim et al. (2019), respectively. The association between the occurrence of these factors and hypermucoviscosity was not represented in this study, as only one isolate tested positive for string. Some studies suggest that there may be additional mucoid factors beyond the presence of *magA* and *rmpA* genes, such as variations in lipopolysaccharide (LPS) composition (Rastegar et al., 2021a; Yang et al., 2019). Other genes that contributed to virulence of *K. pneumoniae* are *fimH* and *mrkD* genes which has an important role in biofilm formation. In this study, *fimH* and *mrkD*

genes were found at the rates of 28% and 46.9% respectively. These were lower than the most of other studies (El Fertas-Aissani et al., 2013; Kus et al., 2017; Fu et al., 2018; Kim et al., 2019; Yang et al., 2019; Massinga et al., 2021; Mirzaie & Ranjbar, 2021; Ranjbar et al., 2019; Rastegar et al., 2021a; Hao et al., 2022).

Siderophores are molecules produced by bacterial cells to efficiently bind and acquire ferric iron (Fe3+) from iron-binding proteins in the host. These high-affinity extracellular chelators play a crucial role in bacterial virulence. In the case of Klebsiella, an extracellular pathogen, it does not have direct access to iron in the host's body. Therefore, to overcome the iron limitation encountered in vivo, Klebsiella produces siderophores as an iron acquisition strategy (El Fertas-Aissani et al., 2013). In this study, the rates of isolates carrying the entB gene (15.6%).

MDR *K. pneumoniae* strains pose a significant threat as they are responsible for serious and potentially life-threatening infections on a global scale. The widespread use of antimicrobial agents has contributed to the widespread occurrence of MDR *K. pneumoniae* strains. The increasing prevalence of *K. pneumoniae* strains showing resistance to multiple antimicrobials is an urgent problem with implications for public health worldwide (Mirzaie & Ranjbar, 2021). In this study, the prevalence of MDR *K. pneumoniae* isolates (Figure 2) was 62.5% was lower than those found in some studies. For example, Mirzaie & Ranjbar (2021) and El Fertas-Aissani et al. (2013) have reported 92% and 74.1%, respectively.

K. pneumoniae has demonstrated the ability to develop resistance to a large number of antibiotics, particularly third generation cephalosporins. The acquisition of multidrug resistance by *K. pneumoniae* increases its virulence capacity. Beta-lactam antibiotics commonly used to treat bacterial infection are frequently weakened by the production of beta-lactamase enzymes, which constitute a common mechanism of bacterial resistance (Shaikh et al., 2015; Vasaikar et al., 2017). Furthermore, the observed resistance of *K. pneumoniae* to cephalosporins may be attributed to the presence of the KPC gene. Because the KPC enzyme specifically degrades broad-spectrum cephalosporins (Effah et al., 2020). In this study, the resistance rate to amoxicillin-clavulanic acid was 53.1%, which was lower compared to 62.3% (Banerjee et al., 2020), 72% (Kus et al., 2017) and 82.9% (Z. Zhang et al., 2022) in some other studies. However, it was higher than the rate reported by Jazayeri Moghadas et al (2018). The resistance rate to imipenem (3.1%) was very close to that reported by Zhang et al. The highest resistance rate was reported by Mirzaie & Ranjbar (2021) in contrast to Banerjee et al. (2020) who reported that all isolates were antibiotic sensitive. In the present study, all isolates showed susceptibility to meropenem, contrary to what was reported by Mirzaie and Ranjbar (2021).

Most Klebsiella isolates are naturally resistant to ampicillin due to constitutively expressed chromosomal A beta-lactamase (Gündoğan, 2014). In this study, 62.5% of

the isolates were resistant to ampicillin, which is significantly lower than the 100% reported by Kus et al. This report is also inconsistent with the findings of Nirwati et al. (2019), in which 100% of *K. pneumoniae* isolates were resistant to ampicillin. Furthermore, 43.7%, 12.5% and 34.3% of the isolates were resistant to penicillin, cefoperazone and cefquinome, respectively (Figure 1).

When the resistance of *K. pneumoniae* to aminoglycosides was evaluated, it was revealed that 40.6% of the isolates were resistant to gentamicin in this study. This rate is significantly higher than 31.25% (Ahmed and Alaa, 2016) and 39.6% (Kus et al., 2017), but lower than 54.8% (Banerjee et al., 2020), 62.9% (Eghbalpoor et al., 2019) and 75.7% (Z. Zhang et al., 2022), respectively. The resistance rate to amikacin was higher than the 4.8% reported by Pereira and Vanetti (2015), but lower than that reported by Ahmed and Alaa (2016), Derakhshan et al. (2016a), Z. Zhang et al. (2022) and Derakhshan et al. (2016b) Liu et al. (2014), Peerayeh et al. (2014), 10%,27%, 28.12%, 31.5%, 31.4% and 50%, respectively.

In this study, 40.6% of the isolates were resistant to ciprofloxacin, a quinolone antibiotic. This rate is higher than the 32.1% rate reported by Kus et al. (2017) and significantly lower than the rates of 75.3% (Eghbalpoor et al., 2019) and 83.9% (Banerjee et al., 2020) reported in two studies.

Nitrofurantoin resistance rate was found to be 65.6% in this study. This rate is higher than 35.8% reported by Jazayeri Moghadas et al. (2018) and slightly lower than 68% reported by Mirzaie and Ranjbar (2021). In this study, 37.5% of the isolates were resistant to trimethoprim+sulfamethoxazole, which is lower than the rates of 56.6%, 73% and 77% reported by Kus et al. (2017), Mirzaie and Ranjbar (2021) and Zhang et al. (2022), respectively. It was observed that 46.8% of the isolates were resistant to oxytetracycline. In this study, the resistance rate to chloramphenicol was 28.1%, which is quite different from the result of Banerjee et al. (2020) where 100% resistance was reported.

In conclusion, the study of antibiotic resistance and virulence genes in *K. pneumoniae* is crucial for understanding the pathogenesis of infections and developing effective strategies for their prevention and treatment. Continued research and surveillance efforts are necessary to counter the emerging threat of antibiotic resistance in *K. pneumoniae* and to ensure effective management of infections caused by this pathogen. Detailed analysis of the hypermucoviscous *K. pneumoniae* strains that cause a distinctive syndrome of community-acquired invasive *K. pneumoniae* infections, which were identified in reports from Taiwan between the mid-1980s and 1990s, will be useful both for epidemiologic studies and for combating these infections.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to my supervisor, Prof. Dr. Arzu Fındık, and Research Assistant Dr. M. Gizem Sezener, for their unwavering commitment, invaluable guidance, and constant encouragement throughout the completion of my thesis project. I am also thankful to the BAP Unit of Ondokuz Mayıs University for providing financial support under project number PYO.VET.1904.22.021, which includes the thesis work of the primary author.

FINANCIAL SUPPORT

This study was supported by the ONDOKUZ MAYIS ÜNİVERSİTESİ BAP BİRİMİ project numbered PYO.VET.1904.22.021 and includes the thesis work of the first named author.

CONFLİCT OF INTEREST

The authors declared that there is no conflict of interest.

REFERENCES

Ahmed AJA, Alaa HAA. Virulence factors and antibiotic susceptibility patterns of multidrug resistance Klebsiella pneumoniae isolated from different clinical infections. African Journal of Microbiology Research. 2016; 10(22): 829–843.

Albasha AM, Osman EH, Abd-Alhalim S, Alshaib EF, Al-Hassan L, Altayb, HN. Detection of several carbapenems resistant and virulence genes in classical and hyper-virulent strains of Klebsiella pneumoniae isolated from hospitalized neonates and adults in Khartoum. BMC Research Notes. 2020; 13(1).

Banerjee A, Batabyal K, Singh AD, Joardar SN, Dey S, Isore DP, Sar TK, Dutta TK, Bandyopadhyay S, Samanta I. Multi-drug resistant, biofilm-producing high-risk clonal lineage of Klebsiella in companion and household animals. Letters in Applied Microbiology. (2020); 71(6), 580–587.

Caneiras C, Lito L, Mayoralas-Alises S, Díaz-Lobato S, Melo-Cristino J, Duarte A. Virulence and resistance determinants of Klebsiella pneumoniae isolated from a Portuguese tertiary university hospital centre over a 31-year period. Enfermedades Infecciosas y Microbiologia Clinica. (2019). 37(6); 387–393.

Carvalho I, Alonso CA, Silva V, Pimenta P, Cunha R, Martins C, Igrejas G, Torres C, Poeta P. Extended-Spectrum Beta-Lactamase-Producing Klebsiella pneumoniae Isolated from Healthy and Sick Dogs in Portugal. Microbial Drug Resistance. 2020; 26(6): 709–715.

Compain F, Babosan A, Brisse S, Genel N, Audo J, Ailloud F, Kassis-Chikhani N, Arlet G, Decré D. Multiplex PCR for detection of seven virulence factors and K1/K2 capsular serotypes of Klebsiella pneumoniae. Journal of Clinical Microbiology. 2014; 52(12): 4377–4380.

Derakhshan S, Peerayeh SN, Bakhshi B. Association between presence of virulence genes and antibiotic resistance in clinical klebsiella pneumoniae isolates. Lab Medicine. 2016a; 47(4): 306–311.

Derakhshan S, Peerayeh SN, Bakhshi B. Genotyping and characterization of CTX-M-15 - producing Klebsiella pneumoniae isolated from an Iranian hospital. Journal of Chemotherapy. (2016b); 28(4): 289–296.

Effah CY, Sun T, Liu S, Wu Y. Klebsiella pneumoniae: An increasing threat to public health. In Annals of Clinical Microbiology and Antimicrobials. BioMed Central Ltd. 2020; 19(1).

Eghbalpoor F, Habibi M, Azizi O, Karam MRA, Bouzari S. Antibiotic resistance, virulence and genetic diversity of Klebsiella pneumoniae in community- And hospital-acquired urinary tract infections in Iran. Acta Microbiologica et Immunologica Hungarica. 2019;66(3): 349–366.

El Fertas-Aissani, R, Messai Y, Alouache S, Bakour R. Virulence profiles and antibiotic susceptibility patterns of Klebsiella pneumoniae strains isolated from different clinical specimens. Pathologie Biologie. 2013; 61(5): 209–216.

Fu L, Huang M, Zhang XZ, Yang XY, Liu Y, Zhang LH, Zhang ZK, Wang GX, Zhou YS. Frequency of virulence factors in high biofilm formation blaKPC-2 producing Klebsiella pneumoniae strains from hospitals. Microbial Pathogenesis. 2018; 116: 168–172.

Gundogan N. Klebsiella. In Encyclopedia of Food Microbiology: Second Edition. Elsevier Inc. 2014. 383–388.

Hao Y, Jiang Y, Ishaq HM, Liu W, Zhao H, Wang M, Yang F. Molecular Characterization of Klebsiella pneumoniae Isolated from Sputum in a Tertiary Hospital in Xinxiang, China. Infection and Drug Resistance. 2022; 15: 3829–3839.

Jazayeri Moghadas A, Kalantari F, Sarfi M, Shahhoseini S, Mirkalantari S. Evaluation of virulence factors and antibiotic resistance patterns in clinical urine isolates of klebsiella pneumoniae in Semnan, Iran. Jundishapur Journal of Microbiology. 2018; 11(7).

Khalil MAF, Hager R, Abd-El Reheem F, Mahmoud EE, Samir T, Moawad SS, Hefzy EM. A Study of the Virulence Traits of Carbapenem-Resistant Klebsiella pneumoniae Isolates in a Galleria mellonella Model. Microbial Drug Resistance. 2019; 25(7): 1063–1071.

Kim D, Park BY, Choi MH, Yoon EJ, Lee H, Lee KJ, Park YS, Shin JH, Uh Y, Shin K., Shin JH, Kim YA, Jeong SH. Antimicrobial resistance and virulence factors of Klebsiella pneumoniae affecting 30 day mortality in patients with bloodstream infection. Journal of Antimicrobial Chemotherapy. 2019; 74(1): 190–199.

Kus H, Arslan U, Dagi HT, Findik D. Hastane Enfeksiyonu Etkeni Klebsiella pneumoniae Izoiatlannda Cesitli Virulans Faktorlerinin Arastinlmasi. Mikrobiyoloji Bulteni. 2017; 51(4): 329–339.

Liu YM, Li BB, Zhang YY, Zhang W, Shen H, Li H, Cao B. Clinical and molecular characteristics of emerging hypervirulent Klebsiella pneumoniae bloodstream infections in mainland China. Antimicrobial Agents and Chemotherapy. 2014; 58(9): 5379–5385.

Massinga AJ, Garrine M, Messa A, Nobela NA, Boisen N, Massora S, Cossa A, Varo R, Sitoe A, Hurtado JC, Ordi J, Mucavele H, Nhampossa T, Breiman RF, Whitney CG, Blau DM, Bassat Q, Mandomando I. Klebsiella spp. cause severe and fatal disease in Mozambican children: antimicrobial resistance profile and molecular characterization. BMC Infectious Diseases. 2021; 21(1).

Mirzaie A, Ranjbar R. Antibiotic resistance, virulence-associated genes analysis and molecular typing of Klebsiella pneumoniae strains recovered from clinical samples. AMB Express. 2021; 11(1).

Nirwati H, Sinanjung K, Fahrunissa F, Wijaya F, Napitupulu S, Hati VP, Hakim MS, Meliala A, Aman AT, Nuryastuti T. Biofilm formation and antibiotic resistance of Klebsiella pneumoniae isolated from clinical samples in a tertiary care hospital, Klaten, Indonesia. BMC Proceedings. 2019; 13.

Peerayeh SN, Rostami E, Siadat SD, Derakhshan S. High rate of aminoglycoside resistance in CTX-M-15 producing klebsiella pneumoniae isolates in Tehran, Iran. Lab Medicine. (2014); 45(3): 231–237.

Pereira SCL, Vanetti MCD. Potential virulence of Klebsiella sp. Isolates from enteral diets. Brazilian Journal of Medical and Biological Research. 2015; 48(9): 782–789.

Ranjbar R, Kelishadrokhi AF, Chehelgerdi M. Molecular characterization, serotypes and phenotypic and genotypic evaluation of antibiotic resistance of the Klebsiella pneumoniae strains isolated from different types of hospital-acquired infections. Infection and Drug Resistance. 2019; 12: 603–611.

Rastegar S, Moradi M, Kalantar-Neyestanaki D, Dehdasht AG, Hosseini-Nave H. Virulence factors, capsular serotypes and antimicrobial resistance of hypervirulent klebsiella pneumoniae and classical klebsiella pneumoniae in Southeast Iran. Infection and Chemotherapy. 2021a; 53(1).

Rastegar S, Moradi M, Kalantar-Neyestanaki D, Dehdasht AG, Hosseini-Nave H. Virulence factors, capsular serotypes and antimicrobial resistance of hypervirulent klebsiella pneumoniae and classical klebsiella pneumoniae in Southeast Iran. Infection and Chemotherapy. (2021b); 53(1).

Shaikh S, Fatima J, Shakil S, Rizvi SMD, Kamal MA. Antibiotic resistance and extended spectrum beta-lactamases: Types, epidemiology and treatment. Saudi Journal of Biological Sciences. 2015; 22(1), 90–101.

Vasaikar S, Obi L, Morobe I, Bisi-Johnson M. Molecular characteristics and antibiotic resistance profiles of klebsiella isolates in mthatha, eastern cape province, South Africa. International Journal of Microbiology, 2017.

Yang F, Deng B, Liao W, Wang P, Chen P, Wei J. High rate of multiresistant klebsiella pneumoniae from human and animal origin. Infection and Drug Resistance. 2019; 12: 2729–2737.

Zhang Z, Zhang L, Dai H, Zhang H, Song Y, An Q, Wang J, Xia Z. Multidrug-Resistant Klebsiella pneumoniae Complex from Clinical Dogs and Cats in China: Molecular Characteristics, Phylogroups, and Hypervirulence-Associated Determinants. Frontiers in Veterinary Science. 2022; 9.

COVID-19: ROLE OF BLOOD PARAMETERS

Buket FIDANCI[1] Elisha Apatewen AKANBONG[2]* Ali ŞENOL[3] Miyase ÇINAR[3]

[1] *Etlik City Hospital, Ankara, TÜRKİYE*

[2] *Acra Veterinary Laboratory, Veterinary Services Directorate, Acra, GHANA*

[3] *Kırıkkale University, Faculty of Veterinary, Department of Biochemistry, Kırıkkale, TÜRKİYE*

***E-mail:** akanbongelisha605@gmail.com

COVID-19 is known to disproportionately infect individuals based on race, genetics and hormonal differences. Predisposing factors, including old age, male gender, hypertension, diabetes, obesity, chronic lung diseases, underlying factors such as heart, liver and kidney diseases, tumors and immunodeficiencies such as early type I interferon secretory capacity and pregnancy may increase one's risk of contracting COVID-19. However, the biochemistry underlying the correlation between these risk factors and COVID-19 has not been elucidated. Biochemical parameters are needed to examine and follow the course of the disease. Increments and decrements in many blood parameters such as WBC, RBC, Hb, PLT, CRP, D-dimer, neutrophil, neutrophil-lymphocyte ratio, platelet-lymphocyte ratio are also observed. Increased cytokine levels (IL-6, IL-10, and TNF-α), lymphopenia (in CD4+ and CD8+ T cells), and decreased IFN-γ expression in CD4+ T cells are associated with COVID-19 severity. In addition, it has been reported that COVID-19 significantly altered the laboratory test results of severely infected patients. COVID-19 has a tremendous impact on host biochemistry. However, only limited studies have been performed on the Covid-19 biochemistry. This review aimed to bridge this existing gap. In conclusion, a healthy, balanced and adequate nutrition habit can provide immunotherapeutic effects. Especially antioxidant vitamins; A, C, E and D, B12 and minerals have a crucial effect on the immune system. Consequently, for better clinical outcomes, it should be considered that nutrients play a role in reducing the severity of COVID-19 by supporting the treatment of the active immune system.

Keywords: Blood parameters; COVID-19; Host biochemistry; Immune system

INTRODUCTION

Severe Acute Respiratory Syndrome - Coronavirus-2 (SARS-CoV-2) is a global epidemic that first appeared in Wuhan, China, on the 2nd of December 2019 and has affected the whole world since then (Chen et al., 2020; Wu et al., 2020). The coronavirus was named as novel Coronavirus (2019-nCoV) by the World Health Organization (WHO) on January 12, 2020 and subsequently changed to Coronavirus Disease-2019 (COVID-19) by WHO on February 11, 2020 (Aslım et al., 2020). Generally, coronaviruses are enveloped, positive-sense, and single-stranded RNA viruses that are divided into 4 groups: alpha, beta, gamma, and delta coronaviruses. However, due to mutation, there are other variants such as Epsilon, Zeta, Eta, Theta, Iota etc and recently the omicron variant has been discovered (Choudhary and Manish, 2022). The coronavirus was first encountered in the 60s, and pieces of evidence suggest that it causes cold and respiratory tract infections. Common clinical findings in infected individuals include dry cough, fever, headache, pneumonia, and shortness of breath (Aslım et al., 2020). Predisposing factors, including old age, male gender, hypertension, diabetes, obesity, chronic lung diseases, underlying factors such as heart, liver and kidney diseases, tumors and immunodeficiencies such as early type I interferon secretory capacity and pregnancy may increase one's risk of contracting COVID-19. However, the biochemistry underlying the correlation between these risk factors and COVID-19 has not been elucidated. In addition, diagnostically lymphopenia and eosinopenia are indicators of COVID-19. Moreover, laboratory parameters such as lactate dehydrogenase, procalcitonin, high-sensitivity C-reactive protein, Krebs von den Lungen-6, ferritin and proinflammatory cytokines such as interleukin (IL)-6, IL-1β are used to monitor the progression of the disease (Gao et al., 2020). It has been reported that COVID-19 significantly altered the laboratory test results of severely infected patients. Besides significant changes in acute phase proteins such as C-reactive and ferritin, there are significant differences in hematological and homeostasis parameters including procalcitonin, lymphocyte and neutrophil granulocyte count, D-dimer and lactate dehydrogenase, cardiac troponins, serum albumin, aminotransferase and creatinine (Zhou et al., 2020; Wang et al., 2020; Huang et al., 2020; Aloisio et al., 2020).

Inferencing from the above, COVID-19 has a tremendous impact on host biochemistry, and since there is no literature, if any, little, reviewing this subject, this review aimed to bridge this existing gap

Effects of COVID-19 on Hematological Parameters

Blood testing is important for early detection of COVID-19 as it gives doctors early information about the inflammatory process. Such information usually includes the leukocyte count; It includes change in neutrophil or lymphocyte values. In addition, leukocytes, neutrophils, neutrophil-lymphocyte ratio (NLR), systemic inflammatory index (SII), platelet count and hemoglobin are included in the diagnosis of Covid-19. In a study

conducted on patients with (positive group) and without (negative group) COVID-19 infection; While there was no statistically significant difference between the 2 groups in terms of lymphocyte and platelet ratio values ($p>0.05$), there was a statistically significant difference between the 2 groups in terms of platelet, hemoglobin, leukocyte, neutrophil, NLR and SII values. ($p<0.05$) (Usul et al., 2020).

Effects of COVID-19 on Acute Phase Proteins

COVID-19 affects the usability of APPs to a certain extent. It has been stated that COVID-19 significantly increases CRP and serum amyloid A (SAA) levels and significantly reduces complement C3, complement C4 and prealbumin (PA) levels, so that acute phase proteins can be used in the prognosis of the disease. In addition, it has been revealed that while the SAA and CRP levels increase significantly in COVID-19 patients, the procalcitonin (PCT) level is in the normal range, and as the disease progresses from mild to severe, SAA and CRP levels gradually increase and show a positive correlation (Li and Chen, 2020).

Effects of COVID-19 on Cytokines

It is known that COVID-19 infection has an effect on cytokine release. COVID-19 infection causes local and systemic inflammation mediated by pro-inflammatory cytokines, primarily IL-1 and IL-6 SARS-CoV2-activated release of IL-1 triggers the release of IL-6 and tumor necrotic factor (TNF) and can subsequently lead to cytokine storm and deleterious effects both in the lungs and systemically (Conti et al., 2020).

D-Dimer in COVID-19

Abnormal D-dimer levels are a helpful parameter in understanding deep vein thrombosis in cardiovascular disorders (Giannitsis et al., 2017). These abnormal D-dimer levels are associated with a poor prognosis and are seen in severe cases of COVID-19 (Zhou et al., 2020; Tang et al., 2020; Hunt and Levi, 2020). Zhou et al. (2020) reported that not only D-dimer increased, but also acute inflammatory plasma markers such as C-reactive protein (CRP), serum ferritin and fibrinogen. Intake of D-dimer in the increase in plasma is to detect coagulopathy (Tang et al., 2020; Hunt and Levi, 2020).

COVID-19's Relationship with Minerals

In the whole world, which is in the pandemic process caused by COVID-19, no medicine has yet been developed, and it has become important to keep immunity strong to protect against the corona virus. Minerals and vitamins are nutrients that help keep immunity strong and protect the body against infections (Karaağaç and Koyu, 2020). Micronutrients such as zinc, iron, selenium, copper and magnesium are needed for the continuity of the immune system (Kussman, 2010). Minerals have effects on the immune system such as ensuring the differentiation of neutrophils, macrophages and

natural killer (NK) cells, ensuring the development of cells, and regulating the B and T lymphocyte response (Karaağaç and Koyu, 2020).

COVID-19's Relationship with Vitamins

It is known that vitamins A, C, E, D and B12 have an important role in the immune system. Of these vitamins, A, C, E cannot be synthesized in the body, and vitamin D needs sunlight to be synthesized. Vitamins A, C, E, D, B12 have their own specific functions. They are essential nutrients with immune system supporting functions and antioxidant properties in the prevention and treatment of COVID-19 infection (Bakan et al., 2020). Sufficient intake of these nutrients plays an important role in protection against viral infections, many other infections, and in establishing the definitive treatment of COVID-19 (Güneş et al., 2020).

Thioles in COVID-19

Thiol-disulfide homeostasis (TDH), which is a marker of oxidative stress and plays a role in the detection of different clinical disorders, is a new parameter. In severe cases of COVID-19 disease, excess cytokine formation due to damaged tissue creates cytokine storms (Kalem et al., 2021). Cytokinin overproduction, reactive oxygen species (ROS) ultimately developing oxidative stress (OS) and absence of antioxidant mechanisms play a role in the pathogenesis of viral replication and the next virus-associated disease (Esen et al., 2015; Kalem et al., 2021).

CONCLUSION

From the first moment it emerged, the novel corona virus disease has become the most important public health problem of the 21st century, threatening the health of many people by affecting the whole world. Biochemical parameters are needed to examine and follow the course of the disease. In COVID-19, increments and decrements in many blood parameters such as WBC, RBC, Hb, PLT, CRP, D-dimer, neutrophil, neutrophil-lymphocyte ratio, platelet-lymphocyte ratio are also observed. Again, in COVID-19, increased cytokine storm, IL-6 and acute hypoxic respiratory ability are probably developing. An acute increase in APP and SAA is an important sign in the diagnosis of COVID-19. There are immunotherapeutic approaches in the treatment of COVID-19, and a healthy, balanced and adequate nutrition process can provide immunotherapeutic effects. Especially antioxidant vitamins; A, C, E and D, B12 play an important role on the immune system. Minerals such as magnesium, zinc, selenium, copper and iron are also nutrients that play a role in adaptive immunity. As a result, for better clinical outcomes, it should be considered that these nutrients play a role in reducing the severity of COVID-19 by supporting the treatment of the active immune system.

REFERENCES

Aslım HP, Dik I, Gülbahçe R, Bulut O. Modern çağın sorunu: Covid-19. Eurasian Journal of Veterinary Sciences Covid-19 Special Issue. 2020; 11-16.

Bakan S, Deveboynu ŞN, Kartal FT. COVID-19 Pandemisinde Bağışıklık Üzerine Antioksidan Vitaminlerin Etkisi. *Avrasya Sağlık Bilimleri Dergisi*. 2020; *3*(COVID-19), 140-148.

Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, Zhang L. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *The lancet*. 2020; *395*(10223), 507-513.

Choudhary OP, Manish Dhawan P. Omicron variant (B. 1.1. 529) of SARS-CoV-2: Threat assessment and plan of action. *International journal of surgery (London, England)*. 2022; *97*, 106187.

Conti P, Caraffa A, Gallenga CE, Ross R, Kritas SK, Frydas I, Ronconi G. Coronavirus-19 (SARS-CoV-2) induces acute severe lung inflammation via IL-1 causing cytokine storm in COVID-19: A promising inhibitory strategy. J Biol Regul Homeost Agents. 2020; 34(6), 1971-1975.

Esen R, Aslan M, Kucukoglu ME, Cıkman A, Yakan U, Sunnetcioglu M, Selek S. Serum paraoxonase activity, total thiols levels, and oxidative status in patients with acute brucellosis. Wiener Klinische Wochenschrift. 2015; 127(11), 427-433.

Gao YD, Ding M, Dong X, Zhang JJ, Azkur AK, Azkur D, Gan H, Sun YL, Fu W, Li W, Liang HL, Cao YY, Yan Q, Cao C, Gao HY, Brüggen MC, van de Veen W, Sokolowska M, Akdis M, Akdis CA. Risk factors for severe and critically ill COVID-19 patients: A review. *Allergy*. 2021; 76(2): 428-455.

Giannitsis E, Mair J, Christersson C, Siegbahn A, Huber K, Jaffe AS Biomarker Study Group of the European Society of Cardiology (ESC) Acute Cardiovascular Care Association (ACCA). How to use D-dimer in acute cardiovascular care. *European Heart Journal: Acute Cardiovascular Care*. 2017; *6*(1), 69-80.

Güneş AGM, Demirer AGB, Şimşek AGA. COVID-19 özelinde immün sistemi güçlendirici beslenme ve fiziksel aktivite stratejileri. COVID-19- Tedavi Belirleyicileri, ED: Nilgün Ulutaşdemir, Part 3, Iksad Publications, Ankara, Turkey, 2020; 125-157.

Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Cao B. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The lancet*. 2020; *395*(10223), 497-506.

Hunt BJ, Levi M. Re The source of elevated plasma D-dimer levels in COVID-19 infection. *British Journal of Haematology*. 2020; *190*(3), e133-e134.

Kalem AK, Kayaaslan B, Neselioglu S, Eser F, Hasanoglu İ, Aypak A, Guner R. A useful and sensitive marker in the prediction of COVID-19 and disease severity: Thiol. Free Radical Biology and Medicine. 2021; 166, 11-17.

Karaağaç Y, Koyu EB. Viral Enfeksiyonlarda Vitamin ve Mineraller: COVID-19 Odağında Bir Derleme. *İzmir Kâtip Çelebi Üniversitesi Sağlık Bilimleri Fakültesi Dergisi*. 2020; *5*(2), 165-173.

Kussmann M. Nutrition and immunity. Mass Spectrometry and Nutrition Research. 2010; 9, 268.

Li L, Chen C. Contribution of acute-phase reaction proteins to the diagnosis and treatment of 2019 novel coronavirus disease (COVID-19). Epidemiology & Infection. 2020; 148.

Tang N, Bai H, Chen X, Gong J, Li D, Sun Z. Anticoagulant treatment is associated with decreased mortality in severe coronavirus disease 2019 patients with coagulopathy. *Journal of thrombosis and haemostasis*. 2020; *18*(5), 1094-1099.

Usul E, Şan İ, Bekgöz B, Şahin A. Role of hematological parameters in COVID-19 patients in the emergency room. Biomarkers in Medicine. 2020; 14(13), 1207-1215.

Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, Peng Z. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia in Wuhan, China. *Jama*. 2020; *323*(11), 1061-1069.

Wu F, Zhao S, Yu B, Chen YM, Wang W, Song ZG, Zhang YZ. A new coronavirus associated with human respiratory disease in China. *Nature*. 2020; *579*(7798), 265-269.

Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, Cao B. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *The lancet*. 2020; *395*(10229), 1054-1062.

NETOSIS REACTION ORIGINATED FROM NEUTROPHILS AGAINST HELMINTHS

Gözde Nur AKKUŞ* **Kader YILDIZ**

Kırıkkale University, Graduate School of Health Science, Department of Parasitology, Kırıkkale, TÜRKİYE

***E-mail:** goznurak06@gmail.com

Neutrophils are the most abundant leukocyte type in peripheral blood. These cells are the first line of immune defence against infections. Neutrophils fight pathogens through phagocytosis and degranulation. Recently, it has been reported that neutrophils also use a way of fighting pathogens called NETosis. Some structures called "extracellular traps" are formed during the NETosis reaction. As a result of nuclear, granular and cytoplasmic changes, DNA decorated with granular content is released into the extracellular space during the NETosis reaction. Some studies are showing the NETosis reaction against some helminth parasites. The extracellular traps were reported some helminth species, including the eggs of *Schistosoma japonicum*, *Schistosoma mansoni*, the infective stage larvae of *Strongloides stercoralis*, the infective stage larvae, the larval and adult parasite antigen of *Haemonchus contortus*, the microfilariae of *Brugia malayi*, the infective larvae and microfilariae of *Dirofilaria immitis*, the larvae extract and the fourth stage larvae of *Ostertagia ostartagi*, the young *Fasciola gigantica* released from metacercariae, the third stage larvae of *Nippostrongylus brasiliensis* and the larvae of *Strongyloides ratti*, the eggs, metacercariae and young *Fasciola hepatica* and its antigen, the larvae and the excretory-secretory products of hookworms, the excretory and secretory products of *Trichinella spiralis* and the protoscoleces of *Echinococcus granulosus*. This study aims to provide information about the NETosis reaction formed by neutrophils against helminths.

Keywords: Neutrophis; NETosis; Helminth; Polimorphonuclear leucocyte; Immunity

INTRODUCTION

Neutrophils are the most abundant leukocyte type in the mammalian immune system (Papayannopoulos, 2018). Neutrophils are the first line of defence that pathogens entering the body encounter in the immune system (Kanashiro et al., 2020). Neutrophils

fight pathogens through phagocytosis and degranulation in the body (Kaplan and Radic, 2012). In addition to these fighting ways, they have recently been reported to use a new fighting strategy called NETosis (Brinkmann et al., 2004). It has been reported that extracellular trap formations develop from neutrophils against helminth parasites as a result of the NETosis reaction (El-Naccache et al., 2020). The aim of this study is to provide information about the NETosis reaction formed by neutrophils against helminths.

Trematodes

Schistosoma japonicum and *Schistosoma mansoni* are a parasite that causes human schistosomiasis. These parasites are localised in the portal and mesenteric veins of the host (Doğanay, 2021). Thin and long NET structures were developed from human PMNs after four hours incubation with the eggs of *S. japonicum* in vitro (Chuah et al., 2014). It was observed that NET structures adhered to the surface of *S. japonicum* eggs, however; they did not kill them (Chuah et al., 2014). In a study of hepatic granulomas formed by *S. japonicum* and *S. mansoni* in a mouse model, neutrophil infiltrations were reported both in the centre and around the *S. japonicum* granulomas and NET structures were observed surrounding the parasite eggs. In contrast, only a few neutrophils were observed in the around of *S. mansoni* granuloma, but NET structures were not observed (Chuah et al., 2013).

Ruminants such as cattle, sheep, goats and other mammals are hosts to *Fasciola giganttica* and *Fasciola hepatica* parasites. These parasites are localised in the liver. However, migratory parasites are observed in the liver parenchyma and adult parasites in the bile ducts and bile bladder (Doğanay, 2021). The formation of NET structures was observed from in buffalo-derived PMN after incubating with the young *F. gigantica* in vitro. These structures may prevent the migration of young flukes into the body (Guo et al., 2020). After in vitro incubation of *F. hepatica* eggs, metacercariae and young flukes and the antigens with bovine PMN, it was determined that the weak extracellular traps developed against the young flukes. It was observed that the parasites were still viable at the end of the incubation period. Although a few PMNs were observed to bind to *F. hepatica* eggs and activate bovine PMNs, the formation of NET structures was not observed. Bovine PMN incubated with *F. hepatica* metacercariae and the antigene induced the formation of NET structures (Peixoto et al., 2021).

Cestodes

Echinococcus species are the smallest parasite of the Taenidae family. The final host of *Echinococcus granulosus* is mainly the dog. Adults of this parasite are localised in the small intestine of the final hosts (Doğanay, 2021). The NET structures were reported after in vitro incubation of *E. granulosus* protoscoleces with sheep PMN. No significant relationship was found between the number of protoscoleces and the amount of

extracellular DNA. However, an increase in the amount of extracellular DNA was observed in parallel with the incubation time. Some of the protoscoleces were reported as damaged after incubation with sheep PMN, suggesting that neutrophils can destroy these parasites (Yıldız et al., 2022).

Nematodes

Strongyloides stercoralis, which has hosts such as dog, cat, human and monkey species, is localised in the small intestine (Doğanay, 2021). *Strongyloides stercoralis* larvae were incubated with PMN originating from human blood and bone marrow of mice in vitro. The NET structures were observed in human PMN after being cultured with the inactive and active larvae. It has been reported that human neutrophils alone were not sufficient to destroy larvae. It was observed that the NET structures were not developed from the neutrophils obtained from mice bone marrow against *S. stercoralis* larvae in vitro (Bonne- Annee et al., 2014).

The hosts of *Strongyloides ratti* are wild and laboratory rodents and the parasite localised in the small intestine (Doğanay, 2021). The experimental *S. ratti*-mice infection is established as a model for intestinal helminths migrating in the host tissues. In this model; it was observed that the larvae of *S. ratti* were destroyed in the tissues mainly the skin during the first infection, thus the larvae did not reach the lungs and intestines of the host. ETosis reactions originating from neutrophils and eosinophils can be responsible for the inhibition of the larvae *S. ratti* (Ehrens et al., 2021).

Haemonchus contortus is localised in the abomasum of ruminants such as cattle, sheep, goats, deer, camels and llamas (Doğanay, 2021). The NET structures are formed from bovine PMN to the infective stage larvae of *H. contortus* in vitro, however; they did not destroy the larvae, but they prevent the parasite migration in the body. A time-dependent relationship was reported in the bovine PMN and *H. contortus* larvae co-cultures, the amount of extracellular traps was increased related to incubation time (Munoz-Caro et al., 2015). The extracellular trap structures were developed PMNs obtained from St. Croix sheep that resistant to the infective stage of *H. contortus* larvae and from Suffolk sheep that sensitive to these parasitic larvae (Garza et al., 2018).

The final hosts of *Brugia malayi* are humans, monkeys and carnivores. The adults parasitise in the blood and lymph vessels, and its microfilariae are localised in the blood (Doğanay, 2021). Another interesting finding was recorded from *B. malayi*. The NET structures were developed from human PMN after incubation with *B. malayi* microfilariae in vitro. These structures were observed around of the larvae but these larvae were still active. Time- dependend activity was detected in the co-culture of *B. malayi* microfilariae and human PMN (McCoy et al., 2017).

Nippostrongylus brasiliensis localised in the small intestine of rats, mice, gerbils and rabbits (Doğanay, 2021). The NET structures were observed in the ear skin of mice after

experimental inoculated with the third stage larvae of *N. brasiliensis* (Pellefigues et al., 2017). Neutrophils were observed to aggregate rapidly around *N. brasiliensis* larvae and NET structures were only around inactive larvae. According to Authors'opinion, the active larvae can produce an enzyme that degrade the DNA structure of NET filaments (Bouchery et al., 2020).

Necator americanus is located in the small intestine of human (Doğanay, 2021). It has been also observed that the NET structures were developed to the infective stage larvae of *N. americanus* in vitro. The NET-like structures can trap and inactivate to the infective stage of hookworm larvae in the skin. Thus, the hookworms can develop an immune evasion mechanism by production of DNase II (Bouchery et al., 2020).

The final hosts of *Dirofilaria immitis* are dogs and cats, foxes, wolves, other wild carnivores and humans. The adult parasite localised in the pulmonary arteries and heart, the microfilariae are observed in the blood (Doğanay, 2021). The extracellular traps were reported from the co-cultures of dog PMN and the third-stage larvae (L3) and microfilariae. A time-dependent increase in the extracellular DNA amount was observed. The NET structures were observed to the microfilariae and L3 after being inactivated by heat. The NET reaction did not affect the viability of the parasite (Munoz-Caro et al., 2018).

Ostertagia ostertagi is a parasite of cattle. However, it is rarely seen in ruminants such as goats, sheep, deer and horses (Doğanay, 2021). The NET structures were observed in the cattle PMN after incubation with the larvae extract of *O. ostertagi*. The four-stage larvae of *O. ostertagi* also triggered developing the NET structures (Mendez et al., 2018).

Trichinella spiralis parasitises in many animals including domestic and wild pigs, horses, dogs, cats, red foxes, rats, and also humans (Doğanay, 2021). The NETosis reaction was observed in the healthy donor PMNs after incubation with different concentrations of *T. spiralis* excretory and secretory products (Rios-Lopez et al., 2022; Kobpornchai et al., 2022).

REFERENCES

Bonne-Année S, Kerepesi LA, Hess JA, Wesolowski J, Paumet F, Lok JB, Nolan TJ, Abraham D. 2014. Extracellular traps are associated with human and mouse neutrophil and macrophage mediated killing of larval *Strongyloides stercoralis*. Microbes. Infect. 16, 502-511.

Bouchery T, Coakley G, Harris NL. 2020. Preparation of *Nippostrongylus brasiliensis* larvae for the study of host skin response. Bio. Protocol. 10, e3849.

Bouchery T, Moyat M, Sotillo J, Silverstein S, Volpe B, Coakley G, Tsourouktsoglou TD, Becker L, Shah K, Kulagin M, Guiet R, Camberis M, Schmidt A, Seitz A, Giacomin P, Gros

GL, Papayannopoulos V, Loukas A, Harris NL. 2020. Hookworms evade host ımmunity by secreting a deoxyribonuclease to degrade neutrophil extracellular traps. Cell. Host. Microbe. 27, 277–289.

Brinkmann V, Reichard U, Goosmann C, Fauler B, Uhlemann Y, Weiss DS, Weinrauch Y, Zychlinsky A. 2004. Neutrophil extracellular traps kill bacteria. Science. 303, 1532-5.

Chuah C, Jones MK, Burke ML, Mcmanus DP, Owen HC, Gobert GN. 2014. Defining a pro-inflammatory neutrophil phenotype in response to schistosome eggs. Cell. Microbiol. 16, 1666–1677.

Chuah C, Jones MK, Burke ML, Owen HC, Anthony BJ, McManus DP, Ramm GA, Gobert GN. 2013. Spatial and temporal transcriptomics of *Schistosoma japonicum*-induced hepatic granuloma formation reveals novel roles for neutrophils. J. Leukoc. Biol. 94, 353–365.

Doğanay A. Helmintoloji. Second Edition, Ankara Nobel Tıp Kitapevleri. 2021; 18-337.

Ehrens A, Rüdiger N, Heepmann L, Linnemann L, Hartmann W, Hübner MP, Breloer M. 2021. Eosinophils and neutrophils eliminate migrating *Strongyloides ratti* larvae at the site of infection in the context of extracellular DNA trap formation. Front. İmmunol. 12, 715766.

El-Naccache DW, Chen F, Chen N, Gause WC. 2020. The NET effect of neutrophils during helminth infection. Cell. Host. Microbe. 27,12.

Garza JJ, Greiner SP, Bowdridge SA. 2018. Ovine vital neutrophil extracellular traps bind and impair *Haemonchus contortus* L3 in a breed-dependent manner. Parasite. Immunol. 40, e12572.

Guo AJ, Wang L, Meng XL, Zhang SH, Sheng ZA, Wei ZK, Luo XN, Huang WY, Zhu XQ, Zhang XC, Cai XP. 2020. Newly excysted juveniles of *Fasciola gigantica* trigger the release of water buffalo neutrophil extracellular traps in vitro. Exp. Parsitol. 211, 107828.

Kanashiro A, Hiroki CH, Fonseca DM, Birbrair A, Ferreira RG, Bassi GS, Fonseca MD, Kusuda R, Cebinelli GCM, Silva KP, Waderley CW, Menezes GB, Alves-Fiho JC, Oliveira AG, Cunha TM, Pupo AS, Ulloa L, Cunha FR. 2020. The role of neutrophils in neuro-immune modulation. Pharmacol. Res. 151, 104580.

Kaplan MJ, Radic M. 2012. Neutrophil extracellular traps: double-edged swords of innate immunity. J. Immunol. 189, 2689-95.

Kobpornchai P, Reamtong O, Phuphisut O, Malaitong P, Adisakwattana P. 2022. Serine protease inhibitor derived from *Trichinella spiralis* (TsSERP) inhibits neutrophil elastase and impairs human neutrophil functions. Front. Cell. Infect. Microbiol. 12, 919835.

McCoy CJ, Reaves BJ, Giguère S, Coates R, Rada B, Wolstenholme AJ. 2017. Human leukocytes kill *Brugia malayi* microfilariae independently of DNA-based extracellular trap release. PLOS Negl. Trop. Dis. 11, e0005279.

Mendez J, Sun D, Tuo W, Xiao Z. 2018. Bovine neutrophils form extracellular traps in response to the gastrointestinal parasite *Ostertagia ostertagi*. Sci. Rep. 8, 17598.

Muñoz-Caro T, Conejeros I, Zhou E, Pikhovych A, Gärtner U, Hermosilla C, Kulke D, Taubert A. 2018. *Dirofilaria immitis* microfilariae and third-stage larvae induce canine NETosis resulting in different types of neutrophil extracellular traps. Front. Immunol. 9, 968.

Muñoz-Caro T, Rubio RMC, Silva LM, Magdowski G, Gärtner U, McNeilly TN, Taubert A, Hermosilla C. 2015. Leucocyte-derived extracellular trap formation significantly contributes to *Haemonchus contortus* larval entrapment. Parasit. Vectors. 8, 607.

Papayannopoulos V. 2018. Neutrophil extracellular traps in immunity and disease. Nat. Rev. Immunol. 18, 134-147.

Peixoto R, Silva LMR, López-Osório S, Zhou E, Gärtner U, Conejeros I, Taubert A, Hermosilla C. 2021. *Fasciola hepatica* induces weak NETosis and low production of intra- and extracellular ROS in exposed bovine polymorphonuclear neutrophils. Dev. Comp. Immunol. 114, 103787.

Pellefigues C, Tang SC, Schmidt A, White RF, Lamiable O, Connor LM, Ruedl C, Dobrucki J, Le Gros G, Ronchese F. 2017. Toll-Like Receptor 4, but not neutrophil extracellular traps, promote IFN type I expression to enhance Th2 responses to *Nippostrongylus brasiliensis*. Front. Immunol. 8, 1575.

Rios- Lopez AL, Hernandez- Bello R, Gonzalez GM, Sanchez- Gonzalez A. 2022. *Trichinella spiralis* excretory-secretory antigens selectively inhibit the release of extracellular traps from neutrophils without affecting their additional antimicrobial functions. Cell. Immunol. 382, 104630.

Yıldız K, Simsek NS, Gurcan IS. 2022. Determination of extracellular traps structures from sheep polymorphonuclear leukocytes to *Echinococcus granulosus* protoscoleces. Exp. Parasitol. 239, 108283.

INVESTIGATION OF VIRAL DISEASES OCCURRING IN HONEY BEES IN EASTERN ANATOLIA REGION OF TURKEY

Muhammed Lütfü ACAROĞLU* **Mehmet Özkan TİMURKAN**

Atatürk University, Faculty of Veterinary Medicine, Department of Virology, Erzurum, TÜRKİYE

***E-mail:** acaroglumuhammed@gmail.com

In this study, it was planned to investigate the presence of viral diseases that cause disease in bees in the provinces in the Eastern Anatolia Region and to determine the relationship and molecular prevalence of these diseases in the region. For this purpose, bees were collected from Erzurum, Erzincan, Elazığ, Muş, Kars, Iğdır, Ağrı, Ardahan, Tunceli, Bayburt and Bingöl provinces in the Eastern Anatolia region, especially Erzurum province. Bees from the provinces and from different enterprises within the province were pooled in groups of ten and viral diseases were investigated molecularly by RT-PCR method from these samples. Single and mixed cases were also investigated.

A total of 1510 bees were collected from 22 bee apiaries. A total of 151 bee pools were created so that at least 10 bees would form a pool without mixing samples from different provinces. In this study, Deformed wing virus, Sacbrood virus, Israeli acute bee paralysis virus, Acute bee paralysis virus, Acute bee paralysis virus, Black queen cell virus and Chronic bee paralysis virus; samples from the Eastern Anatolia region were analyzed using RT-PCR technique for diagnosis.

In the sampling of the provinces included in the study, the molecular prevalence of viral agents were determined as Deformed wing virus 50.3%, Sacbrood virus 49.0%, Black queen cell virus 15.2% and Acute bee paralysis virus 3.9%. Chronic bee paralysis virus and Israeli acute bee paralysis virus positivity were not detected.

This study provided an understanding of the molecular prevalence of bee viral diseases in Eastern Anatolia and their negative impact on beekeeping in the region. It has provided information on honey bee viruses in Eastern Anatolia for future research in Turkey, which has the highest number of managed colonies in Europe in terms of viral bee diseases that need to be combated.

In Turkey, which has a very important share in the number of hives and honey production in the world, we need to control the infectious diseases of bees in order to increase this yield and our share in the world markets and to maintain the existence of bee populations. In the light of the data obtained from our study, it has been concluded that by combating bee diseases in our country, healthy bee colonies will be established and thus yield will be increased and serious contributions will be made to the national economy.

Keywords: Bee, Molecular Detection, PCR, Viral Disease, Virus.

INTRODUCTION

Bees have always existed as an important animal in terms of human history. The first known bee fossil dates back 100 million years and the first human fossil dates back 300 thousand years, meaning that bees began to exist in the world long before human history. Bees, known for honey production, are also an integral part of the ecological system. In addition to honey, bees play an active role in plant and fruit production by fertilizing plants by carrying pollen to the hive. Today, bees are vital for sustaining the world ecosystem as well as fighting various disease agents. In addition, bees are not a single species; there are many different species of bees in the world (Burucu et al., 2017).

Beekeeping is of great importance for the continuity of animal production and crop production. It is known that beekeeping has been practiced since the first periods of humanity. In addition, it contributes to significant economic gain and employment both in the world and in our country. In addition, beekeeping activities contribute to nature as sustainability. Beekeeping is carried out for the production of products that are important for human consumption such as honey, pollen, propolis and royal jelly. The contribution of healthy honey bee colonies to the agricultural production of our country should not be ignored (Burucu et al. 2017)

The geographical conditions, vegetation and climate of our country have a positive effect on beekeeping activities. The sustainability of this effect is only possible by maintaining our healthy colony presence. Our country ranks 3rd in the world in terms of the number of hives and 2nd in terms of honey production. Considering these data, it is seen that the beekeeping and honey bee potential of our country is quite high. The total number of colonies in our country reached 8.7 million in 2021.

Honey production decreased by 7.4% compared to the previous year and was 96 thousand tons (TÜİK 2022). Bee diseases and unconscious beekeeping activities play a major role in this decrease. Like all living things, bees have to be strong and healthy. Healthy colonies can survive and produce in natural environments. There are many reasons for the low yield of honey and other products per hive in our country. These are

care-feeding deficiencies, unconscious beekeepers, bee breed selection errors and diseases (Çağırgan, 2018).

Bee diseases are classified as bacterial, fungal, parasitic and viral agents. Viral agents cause significant colony losses in bees as in all living things. There are 24 honey bee viruses identified in the world. The most important honey bee viruses are Deformed wing virus (DWV), Sacbrood virus (SBV), Israeli acute bee paralysis virus (IAPV), Acute bee paralysis virus (ABPV), Black queen cell virus (BQCV) and Chronic bee paralysis virus (CBPV).

In our study on 6 important honey bee viruses, samples collected from the provinces of the Eastern Anatolia Region were analyzed using RT-PCR technique for the diagnosis of these viruses.

In this study, it was planned to investigate the presence of viral diseases that cause disease in bees in the provinces in the Eastern Anatolia Region and to determine the relationship and molecular prevalence of these diseases in the region.

For this purpose, bees were collected from the provinces of Erzurum, Erzincan, Elazığ, Muş, Kars, Iğdır, Ağrı, Ardahan, Tunceli, Bayburt and Bingöl in the Eastern Anatolia region, especially Erzurum. Bees from the provinces and bees obtained from different enterprises within the province were pooled in groups of ten bees and viral diseases were investigated molecularly by RT-PCR method. Single and mixed infections were also detected.

The results to be obtained from the study, the presence/absence of Deformed wing virus (DWV), Sacbrood virus (SBV), Israeli acute bee paralysis virus (IAPV), Acute bee paralysis virus (ABPV), Black queen cell virus (BQCV) and Chronic bee paralysis virus (CBPV) viral infections in honey bees collected from Erzurum and surrounding provinces were determined. After the detection of positive samples related to viruses, it was aimed to perform molecular characterization of the virus from the determined samples. In our country, there are not many studies on honey bee viruses. Therefore, this study has made an important contribution to the literature.

The results obtained from this region, the causative agents of viral diseases, which cause a significant decrease in honey production and which are not thought of in the first place, have been accurately and precisely revealed and their presence and prevalence in this region have been clarified. As a result of these, it is thought that it will contribute to the prevention of colony losses and thus to the prevention of low yield in honey production, as it offers the opportunity to fight viral diseases more accurately.

Honey Bee

Bees are creatures that produce honey, propolis, pollen, royal jelly, royal jelly, royal jelly, bee venom, beeswax and other bee products that have been used for various purposes for many years and are of great importance for human health. Bees also pollinate many plant products. Therefore, bees have always attracted the attention of scientists, beekeepers and countries due to their importance in beekeeping products and pollination. This increases the importance of diagnosing bee diseases and maintaining bee colony health. Due to migratory beekeeping, various bee species come into contact with local bee colony species (Doğaroğlu, 2019).

Beekeeping

Beekeeping is a branch of animal husbandry. It is one of the oldest professions of humans. Beekeeping can be done as a second production branch within other agricultural enterprises. At the same time, beekeeping is a form of production where high profit is obtained with a low budget.

Within the livestock sector, beekeeping is a sub-sector that can be considered as a very important developing sector. Honey is one of the leading products produced in this sub-sector. In addition, there is also beeswax, the bee itself, that is, bee production, royal jelly, bee venom used in some cosmetic parts and propolis, which is used as a very important food or food additive. Therefore, it has a wide range and capacity of products and provides significant economic returns (Doğaroğlu, 2019). In addition to the various products listed above, over 1 million tons of honey is produced every year in the beekeeping sector in the world. While China ranks first in terms of honey and honey products, our country ranks second in the world with 6 million bees in hives according to TUIK data. However, our country, which ranks 13th in honey production, is not among the top ten in the world ranking. Considering the flora and fauna of Turkey, it is seen that although Turkey has a rich ecosystem, honey production is low. These findings show that hive and colony management is not done properly enough and that the control of parasitic, bacterial and viral diseases is inadequate (Muz et al 2012).

The number of bee colonies in the world was approximately 74 million in 2005 and increased by 22.5% in 2017. This shows that beekeeping has become an important branch of livestock production over the years. According to FAO, our country ranks 3rd in the world in beekeeping with around 7.8 million hives / colonies as of 2017, ranks 3rd again with approximately 4 thousand tons of beeswax production and ranks 2nd with 114 thousand tons of honey production. According to TUIK data, in 2021, there were 89 thousand beekeeping enterprises in our country, while there were 8.5 million new hives and 280 thousand old hives. In the same year, 96 thousand tons of honey was produced, while 3700 tons of beeswax was produced. In 2021, there are 1906 beekeeping apiaries in Erzurum (TÜİK, 2022).

When we look at the problems in itinerant beekeeping, inadequate training is at the forefront. However, insufficient accommodation areas and lack of infrastructure are also important. In addition, it is seen that there are many problems such as not fully complying with protective and biosecurity measures to prevent the spread of bee diseases, lack of security services, lack of bees raised as breeding (queen or other bees) and adaptation to environmental and environmental rules, problems in the coordination of suitable gathering areas and flowering/tree areas for winter.

Most of these problems affect stationary beekeepers who are not itinerant beekeepers and their production decreases. For this reason, it is very important to protect the health of honey bees and control / combat diseases. Preventing and minimizing unexplained colony losses, especially in hives, is essential for the future and sustainability of honey bee breeding in the world.

Honey Bee Viruses

It has been reported that the majority of the viruses causing diseases in bees are single-stranded RNA viruses with positive polarity in their genomic structure.6 In the studies conducted, six viruses that both show symptoms and cause severe losses from few to many have been identified (Shumkova et al. 2018). These diseases have been reported with prevalence values above 20 percent in the reported studies. These viruses are deformed wing virus (DWV), acute bee paralysis virus (ABPV), chronic bee paralysis virus (CBPV), sacbrood virus (SBV), Israeli acute paralysis virus (IAFV) and black queen cell virus (BQCV).

Deforming Wing Virus (DWV); It is one of the most common honey bee viruses in the world (Allen et al. 1996). In previous studies, it has been reported that DWV, a member of the Iflaviridae family, shortens the lifespan of adult worker bees during overwintering and causes serious problems in colonies infested by the parasitic mite Varroa destructor (Khongphinitbunjong et al. 2015). Symptoms include bee deformity, defective joints and wings, defective appendages (shriveled/blunted wings), shortened abdomens, reduced body weight, exhausted and sluggish movements, a reduction in life span and consequently severe damage to the internal balance of the colony, such as irregular broodings and reduced bee numbers (Karapınar et al. 2018).

When we look at the presence of DWV in the world, it is seen that it has been reported in many countries. In Thailand, it has been found to be the most common honey bee virus, closely associated with infestation by varroa and tropilaelaps mites (Khongphinitbunjong et al. 2015). In a study conducted in Germany, all German bees infested by a varroa endemic to that region were compared with Swedish bees from Sweden, where varroa had not been reported until that moment. The German bees were 100% positive for DWV nucleic acid, whereas only about 40% of the Swedish bees were positive for DWV. In the same study, it was reported that the disease agent was seen not

only in the thorax and abdomen of the bees, but also in the head (Yue et al. 2005). In a study conducted in the Aclun region of Jordan using RT-PCR method, it was determined that bee colonies were lost and DWV was found at high rates in these colonies (Haddad et al. 2008).

Chronic Bee Paralysis Virus (CBPV) is the first bee virus isolated and is known to be quite common in our country. Although the agent does not have a complete classification as a family, it is a single-stranded RNA virus with positive polarity. In general, paralysis, tremors, flightless bee communities at the entrance of the hive and crawling occur in bees. Infection shows two types of course. Type 1 Syndrome form; trembling, paralyzed, flightless, In Type 2 Syndrome, bees with dislocated wings and swollen abdomens fill the hive floor and death is observed within 2-4 weeks with the increase of the virus that progresses to the brain. The hive may suddenly deflate (Oliver et al. 2008). In Type 2 Syndrome, called "hairless black syndrome", it has been determined that the bees, which have started to become hairless, have a shiny, greasy, slippery and black appearance, cannot tremble and fly, crawl and look smaller than normal because there are no hairs. Symptoms result in death. It has been determined that the agent is transmitted horizontally and vertically and a significant amount of the agent is found in the feces. Varroa destructor is thought to play a role in the transmission of the agent (Tutkun et al. 2003).

Acute Bee Paralysis Virus (ABPV) is a single-stranded RNA genome of the Aparavirus genus of the Dicistroviridae family. The infection, which is known to increase in the summer months, results in wing and body tremors, paralysis, sudden death and sudden colony collapse following a short incubation period (3-5 days). It is thought that the parasite may act as an activator as well as a vector in the infection, which has been determined to occur together with Varroa destructor. In addition to horizontal and vertical transmission, the detection of the agent in semen indicates that the disease can also be transmitted genitally (Benjeddou et al. 2001).

Black Queen Cell Virus (BQCV); The agent in the Triatovirus genus of the Dicistroviridae family has a single-stranded RNA genome. Thickening of the cell wall of larvae and pupae, death in queen bee larvae, diarrhea, intestinal edema and enlarged abdomen in adult bees are the signs of infection and it has been determined that it is latent. In addition to the horizontal and vertical transmission of the disease, which increases in spring and summer months, the detection of the agent in eggs indicates that the disease is also transmitted transovarially. Nosema apis parasite has been found to carry the infection and Varroa destructor is also thought to play a role in transmission (Benjeddou et al. 2001; Beneryi et al. 2006).

Sacbrood Virus (SBV) is one of the most common viruses of honey bees. This virus can infect both adults and larvae, but 2-day-old larvae are the most affected. This disease is so named because the larvae turn from white to yellow and the body fluid accumulates subcutaneously, showing clinical signs of bag formation. The disease is transmitted through worker bees. Sacbrood virus belongs to the family Iflaviridae and genus Iflavirus; it is a positive single-stranded RNA virus. The virus is 28 nm in diameter, non-enveloped and cubic symmetric. The viral genome is 8832 bp long and contains a large open reading frame encoding a polyprotein of 2858 amino acids. The viral genome is monopartite monocistronic with structural genes at the 5' end (VP2, VP3, VP1) and non-structural genes at the 3' end (RNA helicase, 3C cysteine protease and RNA-dependent RNA polymerase). The VP4 protein has not been detected (Beneryi et al. 2006).

Israeli Acute Bee Paralysis Virus (IAPV); first emerged in Israel in 2004 and is named after the region. The causative agent is an Aparavirus from the Dicistroviridae family. Genetically similar viruses are KBV and ABPV. They also have similar transmission routes, life cycles and titers required for mortality. The virus can show activity by infecting all biological stages of bees. Varroa destructor is a factor in the transmission of the disease. The presence of this agent has been previously reported in our country.

The honey bee (Apis mellifera) is an important social insect that plays a vital role in agriculture by pollinating a wide variety of crops and flowers. Although many species are known to provide pollination services, honey bees (Apis mellifera) are generally known to provide the majority of these services to agriculture. It is estimated that about one-third of the world's agricultural crops depend on honey bee pollination. The dependence of crops worldwide on pollinators is profound, and in 2005 the global economic value of insect pollination was estimated at $212 billion per year, representing 9.5% of the total economic value of world agricultural production for human consumption (Gallai et al. 2009).

Honey bees provide an important ecosystem service that is essential for the maintenance of a sustainably productive agricultural and non-agricultural ecosystem. Pollination services are essential for the production of different crops such as fruits, nuts and fiber foods. Many agricultural crops that do not require pollination have also been shown to be significantly improved by pollination. Numerous species have been found to be honeybee-pollinated plants, including blueberries. Bees also help pollinate many fruit and vegetable crops such as apples and pears, almonds, melons and squash.

A study by Sushil et al. (2013) found that honey bees have a key role in increasing seed production in similar crops, including broccoli, kohlrabi and Chinese cabbage.[19] Honey bees are of great economic importance in terms of increasing the yield and quality of pollination of commercially grown insects and also help self-pollinated crops around the world. It has been assessed that without pollinators, yields of some fruit, seed and nut crops could be reduced by more than 90% (Sushil et al. 2013).

Several factors have been shown to negatively affect the longevity of honey bee colonies. These factors include parasites (primarily Varroa mites and Nosema microsporidia), including viruses (24 different viruses), various bacterial and fungal brood pathogens, pesticide exposure, malnutrition, reduced genetic diversity and management practices (Chen et al. 2007).

In 2006, a phenomenon called Colony Collapse Disorder (CCD) emerged. In this phenomenon, beekeepers and scientists noticed that large numbers of adult honey bees were leaving their hives and not returning. This has had serious negative consequences for farmers and breeders who use honeybees for pollination. In recent years, Colony Collapse Disorder (CCD) has gained attention both in the scientific and public spheres, but its causes and significance remain unclear. Recent studies suggest that several factors play a role in CCD, including parasites, infectious agents, pesticides (and other environmental stressors) and their interactions (Nazzi et al. 2012).

Colony Collapse Disorder (CCD) is characterized by a sudden loss of hives (up to 90%) in apiaries without a clear previous history of disease. CCD syndrome can be distinguished from colony losses caused by other factors by a rapid reduction in the adult bee population with no signs of dead bees inside the hives or in the apiary area. Colonies with CCD usually have an abundance of honey and pollen, while the brood area is neglected. Often the queen is seen staying with a small group of young workers. It is noteworthy that shrinking hives (fewer bees) are not attacked by other bees and honey or other products are not stolen by other bees, and even when an abandoned hive is left in a field, the hive is not entered and the wax is not spoiled by the wax moth. These hives can be interpreted as if both honey bees and moths were rejecting their products. Nevertheless, the cause of CCD is not fully known. However, stress factors weakening bees and opportunistic pathogens infecting and eventually killing colonies have been identified as contributing to the occurrence of CCD (Cox-Foster et al. 2007).

Several studies show that the combination of the destructive power of Varroa and certain virus infections poses a serious threat to honey bee welfare. In fact, the global picture is that Varroa is the main factor in colony losses (Yang et al.2007).

Varroa directly contributes to poor colony health and altered bee behavior, but also spreads secondary infections within and between colonies. Within these secondary infections, a general consensus is emerging that its association with a range of honey bee viruses is a major factor in the global loss of honey bee colonies. In the last decade, honey bee viral infections have been the subject of increased research and have emerged as one of several causes of honey bee colony losses(Cox-Foster et al. 2007).

Recently, Israel Acute Paralysis Virus (IAPV) infection was recognized as a marker and highlighted as the pathogen responsible for CCD, or at least as a co-factor. Later, it was similarly emphasized that Kashmir Bee Virus (KBV) and Acute Bee Paralysis Virus

(ABPV) infections were also linked to this syndrome(Cox-Foster et al. 2007). However, it has been shown that further studies are needed to clarify the precise role(s) these viruses play in this syndrome and whether they act alone in the cause of the disease or require external factors that may increase their virulence (Andersen et al. 2008). Among honey bee pathogens, viruses are one of the greatest threats to the health and welfare of honey bees. Viruses were first identified as a new class of pathogens infecting honey bees at the turn of the 20th century when a US scientist discovered that an agent that could be filtered from diseased bee larvae could cause bag rot disease in honey bees. To date, 24 different viruses have been reported to infect honey bees worldwide. These viruses are primarily positive-stranded RNA viruses in the Dicistroviridae and Iflaviridae families. They can infect different developmental stages of honey bees, including eggs, larvae, pupae and adults. Bee viruses usually persist as invisible infections and do not usually cause any overt signs of disease, but under certain conditions they can significantly affect honey bee health and shorten the lives of infected bees. Furthermore, although not usually associated with clinical symptoms, in certain cases viruses can cause severe or fatal diseases in individual bees or the collapse of entire colonies (Beneryi et al. 2006).

Honey bee diseases can have many causes, such as environmental and beekeeping parameters that cause stress and pathogenic agents that often act simultaneously. In particular, 6 of these viruses that threaten the world beekeeping are recognized as serious causes of disease in honey bees. These are; Acute bee paralysis virus, Black queen cell virus, Chronic bee paralysis virus, Deformed wing virus, Israeli acute bee paralysis virus and Sacbrood virus infections.

MATERIAL AND METHODS

Positive Controls

Positive RNAs or homogenates required for optimization of RT-PCR were obtained from Bornova Veterinary Control Institute-Izmir and Department of Virology, Faculty of Veterinary Medicine, Balıkesir University.

Provision of Samples to be Used in the Study

Bee samples to be used in this study were collected from 22 bee apiaries in the provinces located in the Eastern Anatolia region (Erzurum (Palandöken, Pasinler, Oltu, Narman districts), Erzincan, Elazığ, Muş, Kars, Iğdır, Ağrı, Ardahan, Tunceli, Bayburt and Bingöl), especially in Erzurum province during the period when beekeeping was active in 2021-2022. Bees from the provinces and bees obtained from different enterprises within the province were pooled in groups of ten and viral diseases were investigated molecularly by RT-PCR method. It was also aimed to determine the risk factors in single and mixed infections.

Homogenization of Bee Samples

Ten of the bees collected and sent to our laboratory were placed in a mortar as a group. The bees were crushed with the help of liquid nitrogen. Then the whole mixture was taken into a 15 ml tube and 5 ml of sterile distilled water was added. The vortexed mixture was then centrifuged. 250 micro liters of the supernatant at the top of the tubes centrifuged at 4000 rpm was taken and stored at -80 0C until extraction.

RNA Extraction and Complementary DNA (cDNA) synthesis

For RNA extraction, bee homegenizate supernatants were extracted with various viral RNA or total nucleic acid extraction kits (High Pure Viral Nucleic Acid Kit, Roche, USA). Extracted RNA complementary

The complementary DNA kit (First Strand cDNA synthesis kit, Thermo Fisher Scientific, Germany) was used to convert RNA into complementary DNA before the PCR step. The complementary DNA products were stored at -80oC until use.

PCR analysis

The samples converted into complementary DNA were subjected to PCR analysis. Taq DNA polymerase (Taq DNA Polymerase enzyme, Thermo Fisher Scientific, Germany) was used for this purpose. Primers were also used in the study. These primers were primers specific to specific viral diseases that were previously used in various studies in our country.

PCR was prepared by using the primers of the related disease. The conditions in the reference studies found for PCR conditions were taken as basis. Again, the given primers were used in our study. After the mixture was prepared, 3 µl cDNA was added and a total of 30.15 µl mixture was placed in a thermal cycler for PCR.

Gel Electrophoresis of PCR products

Agarose gel (Agarose Gel, Prona, Germany) was prepared to determine possible positivity after PCR. PCR products were loaded into agarose gel wells and run on 1.5% agarose gel at 90 V for 25 minutes. Samples aligned with the marker (DNA marker, 100-300 bp marker, Thermo Fisher Scientific, Germany) were considered positive according to the appropriate size. Positive controls were used in all PCR steps of the study.

RESULTS

The prevalence of viral agents was determined as DWV 50.3%, SBV 49.0%, BQCV 15.2% and ABPV 3.9% in the enterprises sampled in the Eastern Anatolia Region. CBPV and IAPV were found to be negative.

In our study, an average of 50.3% positivity was found for DWV, with the highest positivity in Elazığ (90.9%) and the lowest positivity in Bayburt (0%). The second highest positivity among the diseases we studied was detected in SBV infection (49%). The highest positivity for this infection was in Kars (86.2%), while no positivity was detected in Elazığ, Muş and Bingöl provinces. BQCV was detected in the third highest positivity rate (15.2%). The highest positivity for this infection was in Muş (40%), while no positivity was detected in Ağrı, Ardahan, Bingöl, Bayburt and Iğdır provinces. The fourth and last positive infection was ABPV (3.9%). There were three provinces where we detected positivity for this infection. These are Erzurum (9.5%), Ardahan (11.1%) and Erzincan (10%).

Within the scope of our study, mixed infections also attracted attention. Dual mix infections were detected in 82 different samples in 6 different combinations.

Triple mix infections were also found in our study. Triple mix infections were observed in 20 bee pools in four different combinations.

In our study, one sample was found positive for four infections. We have also detected double and triple infections on district and province basis. The highest positivity in dual infection was detected in Palandöken district (39.02%) and Pasinler district (18.29%). On a provincial basis, the highest positivity was detected in Kars province (21.95%) and Erzincan province (10.97%).

DISCUSSION AND CONCLUSION

Beekeeping is a branch of animal husbandry. It is one of the oldest professions of humans. Beekeeping can be done as a second production branch within other agricultural enterprises. At the same time, beekeeping is a form of production where high profit is obtained with a low budget.

Honey bee breeding has an important place in the livestock sector and is constantly developing. Honey is the leading product of this sector. Beeswax, bee production, royal jelly, bee venom used in cosmetics and propolis are also among the products of this sector. It provides economic benefits with a wide range of products (Dodaroğlu et al. 2009).

Over 1 million tons of honey is produced every year all over the world. While China ranks first in the world in the production of honey and honey products, our country reaches 6 million bees in hives and bees according to 2021 TÜİK data and ranks second in the world with this value. However, despite this high capacity, Turkey ranks 13th in honey production. Considering that Turkey has a rich ecosystem with its flora and fauna, it is noteworthy that it is not where it should be. Among the reasons for this situation, it is

seen that hive and colony management is not done correctly and the fight against parasitic, bacterial and viral diseases is not sufficient (Muz et al. 2012).

The number of bee colonies in the world was approximately 74 million in 2005 and this rate increased by 22.5% in 2017. These data show that beekeeping has become an important branch of livestock production over the years. According to FAO, our country ranks 3rd in the world in beekeeping with the number of hives / colonies around 7.8 million as of 2017, ranks 3rd again with approximately 4 thousand tons of beeswax production and ranks 2nd with 114 thousand tons of honey production. According to TUİK data for 2021, there were 89 thousand beekeeping apiaries in 2021, while there were 8.5 million new hives and 280 thousand old hives. In the same year, 96 thousand tons of honey was produced, while 3700 tons of beeswax was produced. In 2021, there are 1906 beekeeping enterprises in Erzurum (TÜİK, 2021).

One of the most important problems of itinerant beekeeping is the insufficient training in this field. In addition, the inadequacy of accommodation areas and the lack of infrastructure are also important. In addition, lack of full compliance with preventive, protective and biosecurity measures to prevent the spread of bee diseases, lack of security services, lack of bees raised as breeders (queen or other bees) and compliance with environmental and environmental rules, There are many problems such as difficulties in the coordination of suitable winter gathering areas and flowering/tree areas. Many or most of these problems affect non-nomadic stationary beekeepers and their production decreases. Therefore, it is very important to ensure the healthy continuity of honey bees, to protect them and to control / combat their diseases. In particular, preventing and minimizing unexplained or unpredictable colony losses in hives and minimizing these losses is essential for the future and sustainability of the world.

This is the first study to investigate the prevalence of six honey bee viruses in apparently healthy bee colonies randomly selected from 22 apiaries in the Eastern region of Turkey using RT-PCR technique. In addition, the risk status of the detected positivities at the level of mixed infections was revealed on a province and disease basis. The results showed that the virus with the highest prevalence was DWV, followed by SBV, BQCV, and ABPV. CBPV and IABP infections were not detected in our study area. In our study, in which we did not differentiate between adult and larvae, the prevalence of DWV and SBV was higher in our study, while the prevalence of DWV and BQCV was noteworthy when compared to the studies conducted throughout Turkey. The main reason for this may be that adult bees may have acquired the agent from the environment and direct transmission may be more likely.

DWV is one of the most widespread honey bee viruses in the world. The presence of DWV has been reported in apiaries with completely extinguished colonies in Hatay province of Turkey (Blanchard et al. 2009). The incidence of DWV infections in samples

from Turkey is lower than that found in other European regions, including Austria, Croatia, Hungary and Denmark (97%, 91%, 95.12%, 72%, 68%, respectively) (Beneryi et al. 2006; Gülmez Et al. 2009; Karapınar et al. 2018). Our results are similar to those of Amiri et al. (2015), Sguzza et al. (2013) and Molineri et al. (2017). The study with the highest rate of positivity for DWV infection was conducted by Muz et al. (2009) in Hatay province. The researchers detected 100% positivity. The lowest rate was found to be 19.8% in the study conducted by Çağırgan and Yazıcı (2021) in the Aegean region in 2021. In addition, Rüstemoğlu et al. (2019) found 23% in Hakkari province, Gülmez et al.(2009) found 98% in Ordu province, Karapınar et al.(2018) found 69.23% in Van province, Avcı et al. (2022) 29% in a study conducted in Central Anatolia, Yıldırım et al. (2020) 74.19% in a study conducted in Burdur province, Güller et al.(2022) 21.87% in a study conducted in Bingöl province. The high prevalence in the present study suggests that the most important reason for the high prevalence in the present study may be due to direct transmission and inadequate control of the varroa agent. The lack of conscious beekeeping activities and the transmission of diseases by nomadic beekeeping. In addition, considering that DWV is transmitted through the Varroa parasite, it seems that effective Varroa control in some apiaries may contribute to reducing the prevalence of DWV.

In some studies conducted in Europe, SBV (sacbrood virus) was found to have a high prevalence (Nereyi et al. 2006; Muz et al 2028). Forgach et al.(2008) found SBV prevalence in 2% of 52 beehives. The results obtained by Baker and Schroeder, (2008) with a positive prevalence of 1.4% in 23 apiaries are similar to the present study. The study in which the highest rate of positivity in terms of SBV infection was detected is the study conducted by Yıldırım et al.(2020) in Burdur province in 2020. The researchers detected a positivity rate of 33.3%. The lowest rate was found to be 2.7% in the study conducted by Çağırgan and Yazıcı (2020) in the Aegean region in 2021. In addition, in our country, Rüstemoğlu et al.(2019) found 12% in Hakkari province in 2019, Kalaycı et al. (2019) found 12.5% in Muğla province in 2019, Yıldırım et al.(2020) found 13.3% in Burdur province in 2020, Güller and Kurt(2022) found 7.03% in Bingöl province in 2022. The reason for the higher rate in Eastern Anatolia compared to other provinces of the country can be interpreted as the rapid seasonal transitions with the effect of climate, disruption of brood care in bee colonies and lack of attention to larvae and high direct transmission rate.

Previous studies have revealed the high prevalence of BQCV in Turkey and European countries (Oguz et al.(2017); Baker et al. (2008). The study in which the highest rate of positivity in terms of BQCV infection was detected is the study conducted by Avcı et al. (2022) in the Central Anatolia Region. The researchers detected a positivity rate of 90%. The lowest rate was found to be 11.7% in the study conducted by Güller and Kurt ((2022) in Bingöl province in 2022. However, Rüstemoğlu et al. (2018) found 32% in Hakkari province, Karapınar et al. (2018)[39] found 88.46% in Van province, Muz and

Muz.(2009) found 47.6% in Turkey in 2018, Oğuz et al. (2017) found 88.5% in Van province, Usta and Yıldırım (2022) found 25.81% in Burdur province, Çağırgan and Yazıcı (2020) found 18% in Aegean Region, Bayrakal et al. (2020) found negative in Marmara Region in 2020. The results obtained in the study are compatible with the results (21.42%) obtained by Gümüşova et al.(2010) in the Black Sea Region. In a study conducted by Rodriguez et al.(2012) in 2010 in 21 apiaries, it was reported that the prevalence was 82% and serious colony losses occurred in these apiaries. The same group of researchers conducted a random sampling in 60 apiaries in the following years. In a study, the prevalence of BQCV was reported to be 10%. In another study conducted by random sampling in Bulgaria, the prevalence was found to be low. This disease is closely associated with the Nosema parasite. However, a risk analysis was not performed in our study. ABPV is frequently found in European countries. In this study, the prevalence of ABPV was found to be 3.9%. The study in which the highest rate of positivity was detected in terms of ABPV infection was the study conducted by Usta and Yıldırım47 (2022) in Burdur province. The researchers detected a positivity rate of 74.19%. The lowest rate was found to be 2.2% in the study conducted by Rüstemoğlu and Sipahioğlu36 in the Aegean region in 2016. However, in our country, Çağırgan and Yazıcı (2020) found 3.6% positivity in their study conducted in the Aegean region, Karapınar et al.(2018) found negative positivity in their study conducted in Van province, Avcı et al. (2022) found 62% positivity in their study conducted in Central Anatolia, and Usta and Yıldırım (2020) found 74.19% positivity in their study conducted in Burdur province. ABPV was not detected in a previous study conducted in the Black Sea Region. The positivity value obtained in our study was similar to previous studies.

In this study, positivity for CBPV and IAPV could not be detected. In our country, while these diseases were detected in some regions (CBPV, Hakkari, 9% , CBPV Black Sea, 25%), they were not detected in some regions (Hakkari, not detected.). We argue that this may be due to the regional character of the disease.

Another remarkable point in our study is the cases of double, triple and quadruple mix infections. In total, in 6 different combinations, 82 different pools in 82 different pools, in 4 different combinations in 20 different pools, 3 different pools in 3 different combinations and in 1 combination in 1 different pools, 1 4 infection was detected. Not only the excess of single infections but also the prevalence of mixed infections, especially viral infections, may cause colony extinction and serious yield decreases. Therefore, in our study, it is emphasized that a rapid diagnosis should be made in viral infections, the importance of viral infections, which is a forgotten factor in beekeeping, and this situation should not be forgotten in prevention and control strategies.

In conclusion, there are many studies on the prevalence, genetic diversity and phylogeny of honey bee viruses worldwide. However, there are limited studies on honey bee viruses in Turkey. Turkey has an important geographical position and ranks first in Europe in

terms of colony number and honey production. It is also a geopolitically important country as it is a transit region that serves as a bridge between Asia and Europe. Therefore, it is very important to identify the honey bee viruses present in Turkey and their rapid diagnosis and to ensure prevention and control.

Parasites, which have a key role in the spread of bee viral diseases and the formation of mixed infections, are important. Varroa mite is the most important of these. The parasite, which has no food source other than bee hemolymph, reduces the resistance of bees to diseases by both sucking the hemolymph of bees and opening bite wounds on the bee body. In addition, Nosema species, a bee internal parasite, should not be forgotten. It accelerates the entry of other agents into the body by creating a persistent infection, especially in chronic bee paralysis disease. Thus, opportunistic viral agents can find a host in the environment and cause the extinction of colonies. One of the most important issues that should not be overlooked in the fight against viral diseases is the correct and decisive parasitic control. In this context, country-based control efforts should be carried out and eradication strategies should be established.

Bees are creatures that produce honey, propolis, pollen, royal jelly, royal jelly, royal jelly, bee venom, beeswax and other bee products that have been used for various purposes for many years and are of great importance for human health. Bees also pollinate many plant products. Therefore, bees have always attracted the attention of scientists, beekeepers and countries due to their importance in beekeeping products and pollination. This increases the importance of diagnosing bee diseases and maintaining bee colony health. Due to migratory beekeeping, various bee species come into contact with local bee colony species. Bee diseases generally affect young and adult bees in the world and in our country. Infectious diseases are very common in bees. These agents include viruses, bacteria, fungi and parasites. However, the importance of viral agents increases one more time due to their difficult diagnosis, lack of treatment and easier contagiousness. Viral bee diseases reduce the productivity of bees and therefore the yield of bee products and directly affect the loss of bee colonies. Bee viruses can have serious negative effects on bee colonies. So far, more than 20 bee viruses have been detected in bees. Among these agents; Black queen bee virus, Deformed wing virus, Sacbrood bee virus, acute bee paralysis virus, chronic bee paralysis virus, cashmere bee virus and Israeli acute paralysis virus are the viruses frequently detected in the world.

In this study, DWV (50.3%), BQCV (15.2%), SBV (49.0%), ABPV (3.9%), IAPV and CBPV were identified in samples collected from beekeeping enterprises in Eastern Anatolia region, while IAPV and CBPV were not detected. BQCV and DWV have been shown to be highly similar to reports from Turkey and other countries. However, SBV and ABPV rates showed different values when compared to previous studies in Turkey. Further investigation of honey bee viruses is needed to reveal their geographical distribution, pathogenesis and genetic variability.

This study is important for bee diseases and bee losses in Eastern Anatolia Region. After our study, it can be thought that the intensity of nomadic beekeeping activities is the reason for the intensity of viral bee diseases in the regions where samples were collected. In addition, unconscious beekeeping activities and care and feeding conditions are also among the reasons. Viral diseases have an important place among the reasons for limiting beekeeping activities and experiencing bee colony losses of unknown cause. In the study, it was revealed that beekeepers' knowledge was insufficient and the causes of colony losses without much clinical picture were viral bee diseases. There is no treatment for viral diseases. For this reason, they are dangerous diseases that cause very large colony losses and should be included among the notifiable diseases. For this reason, weak bee colonies spread diseases and cause transmission of diseases between colonies. In addition, informing about viral bee diseases and organizing trainings on this subject is important for the healthy continuity of honey bee breeding.

ACKNOWLEDGEMENTS

This study was supported by Atatürk University Scientific Research Projects Coordination Unit. Project No: TYL – 2022 - 10787.

FINANCIAL SUPPORT

This study was supported by Atatürk University Scientific Research Projects Coordination Unit. Project No: TYL – 2022 - 10787.

CONFLICT OF INTEREST

The authors declared that there is no conflict of interest

REFERENCES

Amiri E, Meixner M, Nielsen SL, Kryger P. Four categories of viral infection describe the health status of honey bee colonies. *PLoS One* 2015; 10(10): e0140272.

Anderson D, East IJ. The latest buzz about colony collapse disorder. *Science.* 2008;319(5864):724-5.

Allen M, Ball B. The incidence and world distribution of honey bee viruses. *Bee world*. 1996;77(3):141-62.

Avcı O, Öz E, Doğan M, Silent threat in honey bee colonies: infection dynamics and molecular epidemiological assessment of black queen cell virus in Turkey, *Archives of Virology,* 2022; 1499-1508.

Baker AC, Schroeder DC. Occurrence and genetic analysis of picorna-like viruses infecting worker bees of Apis mellifera L. populations in Devon, South West England. *Journal of Invertebrate Pathology* 2008; 98: 239-242.

Bayrakal M, Ekici G, Akkaya H, Sezgin F, Dümen E, Detection and Molecular Examination of Pathogens in Honey and Bees in the Northern Marmara Region, Turkey, *Kafkas Universitesi Veteriner Fakultesi Dergisi*, 2020; 313-319.

Benjeddou M, Leat N, Allsopp M, Davison S. Detection of acute bee paralysis virus and black queen cell virus from honeybees by reverse transcriptase PCR. *Applied and Environmental Microbiology*. 2001;67(5):2384-7.

Berényi O, Bakonyi T, Derakhshifar I, Köglberger H, Nowotny N. Occurrence of six honeybee viruses in diseased Austrian apiaries. *Applied and environmental microbiology*. 2006;72(4):2414-20.

Blanchard P, Schurr F, Olivier V, Celle O, Antùnez K, Bakonyi T, Berthoud H, Haubruge E, Higes M, Kasprzak S, Koeglberger H, Kryger P, Thiéry R, Ribière M. Phylogenetic analysis of the RNA-dependent RNA polymerase (RdRp) and a predicted structural protein (pSP) of the chronic bee paralysis virus (CBPV) isolated from various geographic regions. *Virus Res* 2009;144(1-2):334-8.

Burucu V, Bal H. Türkiye'de arıcılığın mevcut durumu ve bal üretim öngörüsü. *Tarım ekonomisi araştırmaları dergisi.* 2017;3(1):28-37.

Çağirgan AA. Ege bölgesinde virus nedenli arı hastalıklarının multipleks polimeraz zincir reaksiyonu ile araştırılması. Doktora Tezi, Ondokuz Mayıs Üniversitesi Sağlık Bilimleri Enstitüsü, 2018.

Çağırgan, AA, Yazıcı, Z The prevalence of seven crucial honeybee viruses using multiplex RT-PCR and theirphylogenetic analysis," *Turkish Journal of Veterinary & Animal Sciences*:2021, 45: 44-55.

Çağırgan A, Yazıcı Z, The prevalence of se alence of seven crucial hone en crucial honeybee viruses using multiplex ybee viruses using multiplex RT-PCR and theirphylogenetic analysis, *Turkish Journal of Veterinary & Animal Sciences,* 2021, 44-55.

Crotti E, Sansonno L, Prosdocimi EM, Vacchini V, Hamdi C, Cherif A, et al. Microbial symbionts of honeybees: a promising tool to improve honeybee health. *New biotechnology.* 2013;30(6):716-22.

Chen YP, Siede R. Honey bee viruses. *Advances in virus research*. 2007;70:33-80.

Cox-Foster DL, Conlan S, Holmes EC, Palacios G, Evans JD, Moran NA, et al. A metagenomic survey of microbes in honey bee colony collapse disorder. *Science*. 2007;318(5848):283-7.

Forgach P, Bakonyi T, Tapaszti S, Nowotny N, Rusvai M. Prevalence of pathogenic bee viruses in Hungarian apiaries: situation before joining the European Union. *Journal of Invertebrate Pathology* 2008; 98: 235–238.

Doğaroğlu M. Modern Arıcılık Teknikleri. 3. Basım. Doğa Arıcılık San. Tic Ltd Şti Tekirdağ. 2009.

Muz MN, Solmaz H, Yaman M, Karakavuk M. Kış salkımı erken bozulan arı kolonilerinde paraziter ve bakteriyel patojenler. *Yüzüncü Yıl Üniversitesi Veteriner Fakültesi Dergisi.* 2012;23(3):147-150.

McMenamin AJ, Flenniken ML. Recently identified bee viruses and their impact on bee pollinators. *Current opinion in insect science*. 2018;26:120-129.

Nazzi F, Brown SP, Annoscia D, Del Piccolo F, Di Prisco G, Varricchio P, et al. Synergistic parasite-pathogen interactions mediated by host immunity can drive the collapse of honeybee colonies. *PLoS pathogens.* 2012;8(6):e1002735.

Khongphinitbunjong K, De Guzman LI, Tarver MR, Rinderer TE, Chantawannakul P. Interactions of Tropilaelaps mercedesae, honey bee viruses and immune response in Apis mellifera. *Journal of Apicultural Research*. 2015;54(1):40-7.

Karapınar Z, Oğuz B, Dinçer E, Öztürk C. Phylogenetic analysis of black queen cell virus and deformed wing virus in honeybee colonies infected by mites in Van, Eastern Turkey. *Medycyna Weterynaryjna,* 2018, 74, 7, 460-465.

Kalaycı G, Çağırgan A, Pekmez K, Özkan B, Kaplan M. Molecular detection and phylogenetic analysis of the honeybee (Apis mellif (Apis mellifera) sacbr a) sacbrood virus in T ood virus in Turkey, *Turkish Journal of Veterinary & Animal Sciences,* 2019; 551-554.

Haddad N, Brake M, Migdadi H, de Miranda JR. First detection of honey bee viruses in Jordan by RT-PCR. *Jordan Journal of Agricultural Sciences.* 2008;4(3):242-7.

Govan V, Leat N, Allsopp M, Davison S. Analysis of the complete genome sequence of acute bee paralysis virus shows that it belongs to the novel group of insect-infecting RNA viruses. *Virology*. 2000;277(2):457-63.

Gallai N, Salles J-M, Settele J, Vaissière BE. Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. *Ecological economics*. 2009;68(3):810-21.

Güller A, Balkaya A, Usta M, Kurt Z. Türkiye'nin Bingöl ili bal arı kolonilerinde Deforme kanat virüsü ve Kronik arı felci virüsü'nün prevalansı, *Iğdır Üniversitesi Fen Bilimleri Enstitüsü Dergisi* 2023; 44-53.

Güller A, Kurt Z, Occurrence And Molecular Phylogeny of Economıcally Relevant Vıruses Infectıng Honey Bees (apıs mellıfera l.) of Bıngöl Provınce, Turkey, *Survey of some viruses infecting honey bees,* 2022, 85-96.

Gumusova S, Albayrak H, Yazıcı Z, Kurt M. Prevalence of three honey bee viruses in Turkey. *Veterinarski Arhiv* 2010; 80 (6): 779-785.

Gülmez Y, Bursalı A, Tekin Ş. First molecular detection and characterization of deformed wing virus (DWV) in honeybees (Apis mellifera L.) and mite (Varroa destructor) in Turkey. *African Journal of Biotechnology* 2009; 8 (16): 3698-3702.

Muz D, Muz NM. Survey of the occurrence of deformed wing virus and multiple parasites of queens (Apis mellifera L.) in apiaries with collapsed colonies in Hatay, Turkey. *Journal of Apicultural Research* 2009; 48 (3): 204-208.

Muz D, Muz NM. A molecular epidemiological study of black queen cell virus in honeybees (Apis mellifera) of Turkey: the first genetic characterization and phylogenetic analysis of field viruses, *Apidologie* (2018); 49:89–100.

Özkırım A, Schiessera A. Israeli acute paralysis virus (IAPV) in Turkish bees. J Apicult Research. 2013; 52(2): 56-57.

Rustemoglu M, Sipahioglu HM. Occurrence and prevalence of six honey bee viruses in Hakkari (Turkey) and their genomic divergence. *Munis Entomology & Zoology Journal* 2019; 14 (2): 574-583.

Oguz B, Karapinar Z, Dincer E, Deger MS. Molecular detection of Nosema spp. and black queen-cell virus in honeybees in Van Province, Turkey. *Turkish Journal of Veterinary and Animal Sciences* 2017; 41: 221-227.

Karapınar Z, Oğuz B, Dinçer E, Öztürk C. Phylogenetic analysis of black queen cell virus and deformed wing virus in honeybee colonies infected by mites in Van, Eastern Turkey. Med Weter 2018; 74 (7): 460-465.

Olivier V, Massou I, Celle O, Blanchard P, Schurr F, Ribière M, et al, In situ hybridization assays for localization of the chronic bee paralysis virus in the honey bee (Apis mellifera) brain. *Journal of virological methods*. 2008;153(2):232-7.

Rodriguez M, Vargas M, Gerding M, Navarro H, Antunez K. Viral infection and Nosema ceranae in honey bees in Chile. *Journal of Apicultural Research* 2012; 51: 285-287.

Shumkova R, Georgieva A, Radoslavov G, Sirakova D, Dzhebir G, Neov B, et al. The first report of the prevalence of Nosema ceranae in Bulgaria. *PeerJ*. 2018;6:e4252.

Sushil S, Stanley J, Hedau N, Bhatt J. Enhancing seed production of three Brassica vegetables by honey bee pollination in north-western Himalayas of India. *Universal Journal of Agricultural Research*. 2013;1(3):49-53.

Sguazza GH, Reynaldi FJ, Galosi CM, Pecoraro MR. Simultaneous detection of bee viruses by multiplex PCR. J *Virol Methods* 2013; 194 (1): 102−106.

Tutkun E, Boşgelmez A. Balarısı zararlıları ve hastalıkları teşhis ve tedavi yöntemleri: Bizim Büro Basımevi; 2003.

TÜİK, Arıcılık Araştırmaları. Türkiye İstatistik Kurumu (TÜİK). Erişim Tarihi: 06.06.2022, www.tuik. gov tr/ PreHaberBultenleri. 2022.

Molineri AI, Pacini A, Giacobino A, Bulacio-Cagnolo N, Aignasse A, et al. Prevalence of honey bee (Apis mellifera) viruses in temperate and subtropical regions from Argentina. *Revista Argentina de Microbiologí* 2017; 49: 166-173.

Usta A, Yıldırım Y, Investigation of deformed wing virus, black queen cell virus, and acute bee paralysis virus infections in honey bees using reverse transcriptase-polymerase chain reaction (RT-PCR) method, *Ankara Universitesi Veteriner Fakültesi Dergisi*,2022; 303-311.

Yang X, Cox-Foster D. Effects of parasitization by Varroa destructor on survivorship and physiological traits of Apis mellifera in correlation with viral incidence and microbial challenge. *Parasitology*. 2007;134(3):405-12.

Yıldırım Y, Çağırgan A, Usta A, Phylogenetic analysis of sacbrood virus structural polyprotein and nonstructural RNA dependent RNA polymerase gene: Differences in Turkish strains, *Journal of Invertebrate Pathology*, 2020; 1-7.

Yue C, Genersch E. RT-PCR analysis of Deformed wing virus in honeybees (Apis mellifera) and mites (Varroa destructor). *Journal of General Virology*. 2005;86(12):3419-24.

EVALUATION OF HUMAN-ANIMAL INTERACTION WITH BIOTELEMETRIC INSTRUMENTS

Nilay SEYIDOGLU[1]* **Cenk AYDIN[2]**

[1] *Tekirdag Namik Kemal University, Faculty of Veterinary Medicine, Department of Physiology, Tekirdag, TÜRKİYE*

[2] *Bursa Uludag University, Faculty of Veterinary Medicine, Department of Physiology, Bursa, TÜRKİYE*

***E-mail:** nseyidoglu@nku.edu.tr*

Human-animal interaction is fascinating to everyone, from scientists to average pet owners. There are several reasons why the use of animals is critical for biomedical research. Animals are very similar to humans in a biological way. Mice indeed share a genetic resemblance of over 98 percent with humans. Furthermore, it is well-established that animals exhibit sensitivity to a wide array of health issues that parallel those encountered by humans. The studies of the human animal bond is linked to the psychological, social and physiological relationship between human and animal. However, the evolution of research on the reciprocal benefits of human-animal interaction is limited. In recent years, there has been an extraordinary expansion of research on the links and interactions between human animals. External telemetry system is one of the recently preferred methods in the determination of human-animal interaction. Applied smart technologies (External telemetry, biotelemetry, biosensors, etc.) are alternative methods to record important physiological parameters and behavioral characteristics of animals. The development of biotelemetry instruments for monitoring the physiologic activity (e.g. body temperature, ECG, heart rate, respiratory rate) of the animals led to the development of several successful devices for assessing and altering physiologic activities of human-animal interaction studies. The system ensures that the animal remains unrestrained during the monitoring process in a search. Telemetry studies assist researchers in the development of effective and ethical procedures. Additionally, telemetry systems can assume a crucial role in studies related to animal behaviour and welfare. In this regard, animal welfare is both guaranteed and safeguarded. This system has been effectively utilized in numerous studies, particularly in the context of the human-animal interactions. In this study, our aim is to elucidate the significance of the human-animal bond and interactions for animal welfare. Additionally,

we will examine the contributions of external telemetric systems to recent research in the field of human-animal bond studies. As a result, we aspire to offer a perspective from the animals' point of view regarding human-animal bonds and interactions.

Keywords: Animal science, behaviour, external telemetry human animal bond, human animal interaction.

INTRODUCTION

The human-animal bond is defined as a “mutually beneficial and dynamic relationship between people and other animals that are essential to the health and well-being of both” by the American Veterinary Medical Association (Wollrab, 1998). The physical, physiological and social achievements of this bond have been revealed by researches over the years (Ham ve Epping 2006; Motooka ve ark., 2006).

The behaviour of organism, which includes physiological mechanisms, is important for ensuring and maintaining the internal and external balance, called as homeostasis. Stress factors initiate a sequence of physiological and behavioural responses, which are regulated by the central nervous system. Moberg (1985) demonstrated that the physiological and neuroendocrine responses can vary based on an animal's capacity to predict and manage stress factors. Stress represents a non-specific response by an organism, exerting a pronounced influence on the sympathetic nervous system and the HPA axis (hypothalamic-pituitary-adrenal gland). Consequently, this triggers the activation of thermoregulation, cardiovascular and respiratory systems, as well as behavioral mechanisms in an attempt to restore homeostasis (Koolhaas et al 1993). Besides the simple reflex responses and habits, animal behaviors are shaped on concept maps which based on learning and understanding, comprehensively (Halliday et al 1983; Sharp et al 1998).

The animal scientists have been studying the physiological, nutritional, psychological and behavioral consequences to explore the human animal bond. Numerous studies have illustrated the relationship between animals and humans, highlighting their social, therapeutic, and developmental effects. In earlier reviews, it was noted that studies primarily relied on methods involving estrus detection, milk analysis, and enhancements in livestock farming practices, often incorporating various equipment such as cameras, digital cameras, or accelerometers. Presently, new technologies are being harnessed to better understand the impact of these bonds on various animals, with a specific focus on dogs and horses. Various methods and measurements have been employed for this purpose.

In this presentation, our objective is to elucidate the significance of the human-animal bond. Additionally, we will examine the roles played by various methods, devices, and

systems in studies concerning the human-animal bond. Consequently, we aim to provide an insight into the human-animal bond using emerging technologies.

BENEFITS OF HUMAN ANIMAL BOND AND INTERACTION

Over the years, science and technology have played a crucial role in addressing significant questions related to the human-animal bond. Researchers have endeavored to uncover the mechanisms behind how and why animals respond to humans. In essence, the findings provide us with insights into the characteristics and potential of human-animal bonds and interactions.

People possess an emotional inclination towards forming connections with animals, and the significance of the human-animal bond has been a subject of study throughout history. Scientific investigations into the human-animal bond commenced in the 1970s, primarily focusing on human emotions and needs. Although there are many studies revealing the positive effects of animal-human interaction on humans in the field of health, studies revealing the effects of this interaction on the health of animals are limited. The majority of the studies were about companion animals especially dogs. Odendaal (1999) conducted a study exploring the impact of the human-animal bond on both human and animal subjects, revealing diverse physiological parameters. Several researchers have reported the effects of dog owners visiting on pain levels and blood pressure (Johnson et al. 2010, 2011, 2012). In a study by Dears et al. (2010), an external telemetry system was employed to investigate the impact of owner visits on heart rate, blood pressure, and pain levels in hospitalized dogs. The results of the study indicated that such visits had a positive effect on pain scores, heart rate, and blood pressure. While horses may not be considered companion animals in the same sense as dogs, various researchers have demonstrated the strong and meaningful relationships that exist between these remarkable creatures and humans (Chamove and Crawley-Hartrick 2002; Jaeggin et al., 2005; Aydin and Seyidoglu 2023). In recent years, numerous studies have been designed to explore the human-horse bond. Drawing from the literature, these studies have identified a range of physiological and psychological methods used to assess emotional changes in horses.

The science of the human-animal bond constitutes an expanding field, encompassing the exploration of the mechanisms underlying the minds of animals and their relationships with humans. Moreover, it remains imperative to conduct additional studies and develop novel methods and instruments for quantifying the effects of interactions between humans and animals.

THE BIOTELEMETRIC INSTRUMENTS AND STUDIES

The human-animal bond can encompass various sensory modalities, including visual, tactile, auditory, and olfactory perceptions. Throughout its lifespan, an animal may engage with these sensory perceptions, resulting in either positive or negative interactions. In earlier research, a variety of cameras, such as digital, thermal, or high-resolution digital cameras, were reported to be utilized for purposes like assessing body condition, early disease detection, identifying estrus periods, and quantifying stress levels in animals. Monitoring systems are vital for observing animal behaviors, yet visual monitoring alone may not capture all changes in animal behavior. However, the changes of animal behaviors may be missed by visual monitoring. So, sensors, collars, holter systems, leg sensors, smartwatches, accelereometers, several modified monitors and GPS sensors can be designed for determining the behavioral patterns. In addition, these instruments have been accepted practical and economical for human animal bond researches (Ferguson et al., 2006; Wathes et al., 2008; Halachmi et al., 2019). Today, there are some wearable sensors and smart technologies based on telemetric instruments used for animal science. Also, researchers studied with more micro structure instruments which accepted as convenient, cheaper, and also more safety. Besides measurements of behaviors, the technology has a room in clinical applications and therapeutic field. Therefore, technology, wearable sensors and monitoring devices can be called as an important promising strategy.

In recent years, micro technology for wearable instruments and tools have been important. Sensors, wearable belts, implantable devices and surface sensors (electrodes) can record the electrocardiographic and respiration changes (Katja et al., 2013; Ravi et al., 2017; Taewoong Um et al., 2017; Xin et al., 2019). All the parameters can be drawn regarding the animal behaviors in a comfortable manner. Also, some studies about continuous automated monitoring system with telemetry systems were reported (Khelifi et al., 2017; Weinert et al 2020). This telemetric system include wearable devices, smartphone, powerful device and sensors (Casella et al., 2019; Equilab 2019).

Researchers have widely adopted the external telemetry system as a proven alternative method for measuring physiological parameters (Napoleoni ve ark. 2011; Roche ve ark. 2011; Bailey ve ark. 2012). Moreover, it has become the primary system for conducting preclinical studies involving non-invasive techniques. External telemetry is an important system which records instantly the physiological parameters (body temperature, heart rate, electrocardiographic parameters, respiratory rate and depth, the body's spatial location, locomotor activity e.g.) with electrodes placed on the skin. This system is applied to the animals via a jacket, and collected datas are evaluated by a software programme. External telemetry also enabled the animals freely moving and eliminated

the stress factors. In recent years, researchers have been paid an important attention on animal well being and health with telemetric instruments.

Animal monitoring systems not only provide insights into the well-being of animals but also offer valuable information to owners, veterinarians, and clinicians. As a result, smart technology can contribute to enhancing various aspects of animal health, behavioral characteristics, issues related to human-animal bonding, animal training, and more.

CONCLUSION

The human-animal bond has a history spanning over a thousand years. In recent times, there has been a growing interest in the consequences of human-animal bonding and interactions, impacting both humans and animals. While companion animals have been the primary focus of research, horses and certain farm animals have also garnered attention from researchers. Consequently, the human-animal bond holds significant importance in addressing the needs of both humans and animals.

CONFLICT OF INTEREST

The authors declared that there is no conflict of interest

REFERENCES

Aydin C, Seyidoglu N. 2023. Assessment of Horse-Human Interaction with New Technologies, In: Poggi CG, Ambrojo KS. (Eds), Equine Science, Applications and Implications of New Technologies. IntecOpen press, United Kingdom pp.67-79.

Bailey E, Grant C, Barnard C, Lainee P. 2011.Inclusion of blood pressure measurements in canine toxicology studies. AstraZeneca, Global Safety Assessment, Alderley Park, Macclesfield, United Kingdom.

Casella JE, Khamesi AR, Silvestri S. 2020 A Framework for the Recognition of Horse Gaits Through Wearable Devices. Pervasive and Mobile Computing, 67: 101213.

Chamove AS, Crawley-Hartrick OJE, Stafford KJ. 2002. Horse reactions to human attitudes and behaviour. Anthrozoos, 15: 323-331.

Dears K, Johnson R, Mann FA, McKenney C. 2010. Owner visitation: Clinical effects on dogs hospitalized in an intensive care unit. Phi Zeta (Pi Chapter) Veterinary Medical Honor Society Annual Research Day. University of Missouri, Columbia, MO. Poster.

Equilab, Equilab (2019). URL https://www.equilab.horse

Ferguson JD, Azzaro G, Licitra G. 2006. Body condition assessment using digital images. J. Dairy Sci, 89: 3833-41.

Hallachmi I, Guarino M, Bewley J, Pastell M. 2019. Smart Animal Agriculture: Application of Real-Time Sensors to Improve Animal Well-Being and Production. Annu. Rev. Anim. Biosci., 7: 403-425.

Halliday TR, Slatter PJB. 1983. Animal Behaviour, Oxford: Blackwell Science Publising, US.

Ham, SA, Epping J. 2006. Dog walking and physical activity in the United States. Preventing Chronic Disease. 3(2): 47.

Jaeggin S, Furst A, Auer J. 2005. Kick injuries of veterinarians during examination and treatment of horses: a retrospective study in Switzerland. Schweiz. Arch. Tierheilkd.,147: 289-295

Johnson R, Mann FA, McCune S. Owner visitation: Clinical effects on dogs hospitalized in an intensive care unit. 12th International Association of Human-Animal Interaction Organizations (IAHAIO) Conference, July 1-4 2010. Stockholm, Sweden. [Abstract 62]

Johnson RA, Mann FA, McKenney CA, McCune S. Owner visitation: Clinical effects on dogs hospitalized in an intensive care unit. 45th Congress of the International Society for Applied Ethology, August 4 2011. Indianapolis, Indiana. [Session 13]

Johnson RA, Mann FA, McKenney CA, McCune S. Owner visitation: Clinical effects on dogs hospitalized in an intensive care unit. NIH/Mars-WALTHAM Research Consortium Meeting, July 9-10 2012. Waltham-on-the-Wolds, UK.

Liebal K, Waller BM, Slocombe KE, Burrows AM. 2013. Primate communication: a multimodal approach. Cambridge University Press, England.

Khelifi A, Al Tamimi S, Al Hamli R, Al Ali R. 2017. An Automated System for Monitoring Horses Vital Signs Using Heart Beat Sensors. In Palestinian International Conference on Information and Communication Technology (PICICT 2017), Gaza Strip, Palestine: IEEE; 8-9 May 2017, pp. 53-59

Koolhaas JM, Baumans V, Blom HJM, VonHolst D, Timmermans PJA, Wiepkema PR. 1993. Behaviour, stress and well-being. In: Zutphen LFM, Baumans V, Beynen AC. Principles f Laboratory Animal Science. Amsterdam: Elsevier Science Publisher, 75-99.

Moberg GB. 1985. Animal Stress. Bethesda: American Physiological Society, US.

Motooka M, Koike H, Yokoyama T, Kennedy N. 2006. Effect of dog walking on autonomic nervous activity in senior citizens. Medical Journal of Australia, 184: 60-63,

Napoleoni JG, Froget G, Simonnard A. 2011. Non-invasive blood pressure monitoring in ambulatory beagle dogs, Journal of Pharmacological and Toxicological Methods, 2010: 62(2).

Odendaal J. 1999. A physiological basis for animal-facilitated psychotherapy. Unpublished doctoral dissertation, University of Pretoria, South Africa.

Ravi D, Wong C, Lo B, Yang G-Z. 2017. A deep learning approach to on-node sensor data analytics for mobile or wearable devices. IEEE journal of biomedical and health informatics., 21(1): 56–64.

Roche B, Vinci T, Armentrout S, Smith J, Behringer S, Gonzalez E, Wood B, Hassler C. 2011. Evaluation of a non-invasive telemetry method for determining blood pressure in dogs. Journal of Pharmacological and Toxicological Methods - J Pharmacol Toxicol Method, 01/2011: 64(1).

Sharp Patrict E, La Regina MC.1998. A volume in The Laboratory Animal Pocket Reference Series. The Laboratory Rat. CRC Pres, New York.

Taewoong Um T, Babakeshizadeh V, Kulić D.2017. Exercise motion classification from large-scale wearable sensor data using convolutional neural networks. In Intelligent

Robots and Systems (IROS), 2017 IEEE/RSJ International Conference on, pp 2385–2390.

Wathes CM, Kristensen HH, Aerts JM, Berckmans D. 2008. Is precision livestock farming an engineer's daydream or nightmare, an animal's friend or foe, and a farmer's panacea or pitfall? Comput. Electron. Agric., 64: 2–10

Weinert JR, Werner J, Williams CA. 2020. Validation and Implementation of an Automated Chew Sensore Based Remote Monitoring Device as Tool for Equine Grazing Research. Journal of Equine Veterinary Science, 88(2020): 102971

Wollrab TI. 1998. Human-animal bond issues. Journal of the American Veterinary Medical Association, 212, 1675.

Zhao X, Wei H, Wang H, Zhu T, Zhang K. 2019. 3d-cnn-based feature extraction of ground-based cloud images for direct normal irradiance prediction. Solar Energy, 181: 510–518.

DIAGNOSIS AND DIAGNOSTIC METHODS OF *CRYPTOSPORIDIUM* SPP. IN LAMBS

Sinem AKDENİZ* **Aycan Nuriye GAZYAĞCI**

[1]Kırıkkale University, Graduate School of Health Science, Department of Parasitology, Kırıkkale, TÜRKİYE

***E-mail:** sinemakdeniz72@gmail.com

Cryptosporidiosis is an infection caused by protozoan parasites of the genus *Cryptosporidium,* responsible for a potentially serious disease in newborn ruminants. Although most data on the incidence of *Cryptosporidium parvum* infection in ruminants relate to cattle, Cryptosporidiosis has been reported worldwide as a disease causing yield loss in other ruminant species such as sheep and goats. Diagnosis is mainly based on the detection of oocysts in fecal samples, but it involves a wide range of techniques, from microscopic examination of histopathological sections of the intestine and staining methods that reveal characteristic features of the parasite to molecular methods. However, clinical findings are not pathognomic and the oocysts are small in size and intermittent in excretion, and oocysts are difficult to distinguish from other substances such as fungi and algae in the stool. Therefore, various staining methods and modifications of these methods have been developed over time. For the direct detection of the causative agent, humoral antibodies formed against Cryptosporidium in blood serum; Passive hemagglutination, latex agglutination, Enzyme-Linked ImmunoSorbent Assay, Immunoflourence Antibady, techniques can be performed serologically. Many advanced molecular techniques for the detection of parasite DNA such as PCR are also used. In recent years, techniques to detect antigens in feces using monoconal antibodies have become more preferred due to the possibility of cross-reactions with other microorganism in methods based on antibody detection. Commercial kits have sensitivity and specificity ranging from 58-95% higher than microscopic methods, and these tests enable the detection of *C. parvum* antigens in unconcentrated stool within minutes and can be used in the field.

Keywords: *Cryptosporidium* spp; Commercial kit; Diagnosis Methods; Newborn; Lambs.

INTRODUCTION

Cryptosporidiosis is an infection caused by protozoan parasites of the genus *Cryptosporidium*, responsible for a potentially serious disease in neonatal ruminants (Paraud and Chartier, 2012). Infection is a major problem for animal health, often in neonates, and causes economic losses associated with reduced growth rate and high mortality rate in infected animals, thereby increasing the cost of animal health and veterinary services (Santin, 2020). Cryptosporidium, a protozoan parasite genus, has species that cause infection in mammals, poultry, fish, amphibians and reptiles (Fayer, 2004). Although most data on the incidence of *Cryptosporidium parvum* infection in ruminants relate to cattle, Cryptosporidiosis has been reported worldwide as a disease causing yield loss in other ruminant species such as sheep and goats (Viu et al., 2000). The presence of this agent, which first caused the disease in sheep in the world, was reported in 1974 in Australia in lambs with diarrhea (Baker and Carbonell, 1974).

Diagnostic Methods

Diagnosis is mainly based on the detection of oocysts in fecal samples, but it involves a wide range of techniques from microscopic examination of histopathological sections of the intestine and staining methods that reveal characteristic features of the parasite to molecular methods (Robinson and Chalmers, 2020; Kerie, 2019). Various traditional techniques such as Sheather's flotation with sugar/zinc sulphate solution, formol ether concentration method, formal ethyl acetate sedimentation are also used for oocyst identification (Rekha, 2016). However, clinical findings are not pathognomic, the size of the oocysts is small, excretion is intermittent, and oocysts are difficult to distinguish from other substances such as fungi and algae in the stool, which causes difficulties in diagnosis. Therefore, various staining methods and modifications of these methods have been developed over time.

Today, many acid-fast staining techniques such as Safranin-Methylene Blue, Kinyoun, Ziehl-Neelsen, Carbol Fuchsin are used (Sevinç, 2004; Santin, 2013; Khurana and Chaudhary 2018). Stained with Safranin-Methylene Blue, oocysts appear bright orange on a blue background and the wall surrounding the oocysts appears light in color (Casemore et al., 1985). Carbol fuchsin, a staining technique used for the identification of oocysts, is a simple and non-permanent method (Ahmed and Karanis, 2018). Oocysts are known to appear as strongly reactive, small, round, shiny spheres in the Carbol-funchsin staining method, which do not stain unlike other factors in feces. In another method, Ziehl-Neelsen staining technique, oocysts appear as round to oval structures with pink color (Potters and Van Esbroeck, 2010). In the Kinyoun acid staining method, oocysts appear red on a dark blue background (Rekha, 2016). In addition, the identification of *C. parvum* oocysts by staining methods is time-consuming and requires experienced personnel if a large number of samples are examined. In addition, oocysts excreted in feces from infected animals are often undetectable when the amount of

oocysts excreted is small or intermittent. Therefore, their sensitivity and specificity are low. For the direct detection of the causative agent, humoral antibodies to *Cryptosporidium* in blood serum; Passive hemagglutination, latex agglutination, Enzyme-Linked ImmunoSorbent Assay, Immunoflourence Antibady, techniques can be performed serologically. Many advanced molecular techniques for the detection of parasite DNA such as PCR are also used. In recent years, techniques for detecting antigens in feces using monoclonal antibodies have become more preferred due to the possibility of cross-reactions with other microorganisms in methods based on antibody detection. Although Acid-fast staining techniques are generally used as a reference test in many studies on Cryptosporidiosis, techniques based on fecal antigen detection such as direct fluorescent antibody and Elisa tests are more widely used in the diagnosis of Cryptosporidiosis. Compared to routine acid-fast staining methods, these tests have the advantages of being more sensitive, not always requiring specialized personnel and being able to examine many samples in a short time (Sevinç, 2004; Kar et al., 2011).

PCR, a molecular diagnostic method, is highly sensitive and can provide a significant advantage in the detection of diarrhea of unknown cause in livestock and in the treatment of immunocompromised animals, allowing easy diagnosis before the onset of clinical signs. In addition, the rapidity and high reliability of the technique facilitates the interpretation of the results. However, it cannot be used for routine diagnosis of oocysts due to PCR inhibitors (such as bilirubin, bile salts and complex polysaccharides) that reduce the sensitivity of the technique. However, these inhibitors can be eliminated by purification of oocysts from fecal samples to eliminate their consequences (Kerie 2019).

In recent years, methods such as enzyme immunoassays, PCR and immunochromatography have been developed to detect *Cryptosporidum* spp. with a good range of specificity and sensitivity to detect the presence of antigen. Occasionally, discrepancies are encountered between microscopic diagnostic results and PCR for the diagnosis of *Cryptosporidium*. If *Cryptosporium* spp. is positive in microscopic diagnosis and PCR is negative, this may be due to the low number of oocysts in the samples or the presence of PCR inhibitory substances that damage the oocysts. In contrast, in cases where microscopy is negative and PCR is positive, these methods are more sensitive in the absence of oocysts and PCR inhibitors (Cheun et.al., 2013).

Commercial kits have sensitivity and specificity ranging from 58-95% higher than microscopic methods. The basic working principle of these commercial kits is that one of the antigen or antibody is fixed to the nitrocellulose membrane in the card assay base and the sample remains mobile, forming a complex. These tests enable the detection of C. parvum antigens in non-concentrated feces within a few minutes and can be used in the field (Gerace et al., 2019; Papini et al., 2018; Kaya et al. 2014). Despite the few disadvantages of these tests, they have many advantages, such as; easy

production, low cost, single application of the tests, no need for a device, can be performed in the field, long expiry date, easy application of the analysis method and no need for special training, visualization of the result, easy enough to be applied by anyone without the need for specialists have taken their place among the diagnostic methods for the detection of the presence of the agent (Kaya et al. 2014). In addition, kits that detect the presence of more than one pathogen working by this mechanism have now been produced.

REFERENCES

Ahmed SA, Karanis P. 2018. Comparison of current methods used to detect *Cryptosporidium* 562 oocysts in stools. Int J Hyg Environ Health.221, 743–763.

Barker IK, Carbonel PL. 1974. *Cryptosporidium* agni sp. N. from lambs, and Cryptosporidium bovis sp. N. from a calf, with observations on the oocyst. Z. Parasitenkd, 44, 289-298.

Casemore DP, Armstrong M, Sands RL. 1985. Laboratory diagnosis of cryptosporidiosis. J. Clin. Pathol. 38, 1337-1341.

Cheun H, Chung B-S. Ma D-W, Goo B-L, Cho S-H, Ji M-J, Lee W-J. 2013 Development of a diagnostic kit to detect *Cryptosporidium parvum* and *Giardia lamblia.* Osong Public Health Res. Perspect. 4 (3), 146–151.

Fayer R. 2004. Cryptosporidium: a water-borne zoonotic parasite. Volume 126, Issues 1–2, 9 December 2004, Pages 37-56.

Gerace E, Lo Presti VDM, Biondo C. 2019. Cryptosporidium infection: epidemiology, pathogenesis, and differential diagnosis. Eur. J. Immunol. 9, 119-123.

Kar S, Gawlowska S, Daugschies A, Bangoura B, 2011. Quantitative comparison of different purification and detection methods for *Cryptosporidium parvum* oocysts, Vet. Parasitol 177, 366-370.

Kaya E, Akata I, Bakırcı S, Dereli D, Küçükgüven E, Yılmaz İ, 2014. Immünokromatografik kart testlerin çalışma prensibi ve üretim teknikleri. Duzce Medical Journal. 16(3).

Kerie Y. 2019. Cryptosporidiosis: its importance and diagnostic techniques in farm animals. Int J Vet Heal Sci Res. 7(2):236–41.

Khurana S, Chaudhary P. 2018. Laboratory diagnosis of cryptosporidiosis. Tropical parasitology. 8(1), 2-7.

Papini R, Bonelli F, Montagnani M, Sgorbini M. 2018. Evaluation of three commercial rapid kits to detect *Cryptosporidium parvum* in diarrhoeic calf stool. Ital J Anim Sc:1–6.

Paraud C, Chartier C. 2012. Cryptosporidiosis in small ruminants. Small Rumin. Res. 103, 93–97.

Potters I, Esbroeck MV. 2010. Negative Staining Technique of Heine for the Detection of Cryptosporidium spp.: A Fast and Simple Screening Technique. Parasitol. Open. 4: 1–4.

Rekha HKM, Puttalakshmamma GC, D'Souza PE. 2016. Comparison of different diagnostic techniques for the detection of cryptosporidiosis in bovines. Vet World. 9:211–215.

Robinson G, Chalmers RM. 2020. Sayfa 1. *Cryptosporidium* Methods and Protocols. Editör: Mead J. R., Arrowood M. J. Newyork: Springer.

Santin M. 2013. Clinical and subclinical infections with *Cryptosporidium* in animals. New Zealand Veterinary Journal. 61, 1–10.

Santín M. 2020. *Cryptosporidium* and *Giardia* in ruminants. Vet. Clin. North Am. Food Anim. Pract. 36, 223–238.

Sevinc, F. 2004. Cryptosporidiosis in ruminants. Veteriner Bilimleri Dergisi, Konya, Turkey. 20 (4), 79-84.

Viu M, Quilez J, Sanchez-Acedo, C, del Cacho E, Lopez-Bernad F. 2000. Field trial on the therapeutic efficacy of paromomycin on natural *Cryptosporidium parvum* infections in lambs. Vet. Parasitol. 90, 163–170.

8TH INTERNATIONAL CONGRESS ON VETERINARY AND ANIMAL SCIENCES

20-21 October 2023 / Online

Abstracts

ANT ACADEMY

www.icvas.gen.tr

RECTOVAGINAL FISTULA WITH ATRESIA ANI TYPE III IN A CHIHUAHUA PUPPY- A CASE REPORT

Büşra KİBAR KURT Ahmet GÜRSEL* Hakan Buğra AVCI

Aydın Adnan Menderes University, Faculty of Veterinary Medicine, Department of Surgery, Aydın, TÜRKİYE

*E-mail: vet.ahmetgursel@yandex.com

Atresia ani (AA) is characterised by the anal opening being closed and ending in the form of a blind sac under the skin. Congenital rectovaginal fistula (RVF) is the connection of the dorsal wall of the vagina and the ventral part of the rectum seen mostly in type II AA but rarely in Type III AA. The study consists of a 50-day-old, 900-gram female, intact Chihuahua dog brought to the clinic with the complaints of defecation problem, discomfort, straining and weakness. In the clinical examination; abdominal distension, absence of anus, feces releasing from the vulva and tail agenesis were detected. After the retrograde fistulograpphy, the diagnosis of AA type III and rectovaginal fistula was confirmed. The distance between the rectal blind pouch and unopened anus was 1.8 cm on the radiography. The dog was prepeared according to the standard aseptic procedures. An incision was made on anal dimple. The perineal soft tissues were retracted to reach the distal rectal sac which was then pulled out through this incision. It was incised and sutured to the surrounding skin with simple interrupted sutures of a 3-0 multifilament absorbable suture material. An episiotomy incision was made to connect the vulvar opening to the anal dimple for access to the fistula. The fistula was incised in half and both rectal and vaginal margins were closed with simple interrupted sutures of a 4-0 absorbable monofilament suture material. Laxative and tinned dog food were prescribed post-operatively for 5 days. 1 month after the surgery, the patient started defecating simultaneously from the anus and vagina, thus a revision surgery was decided. In the revision surgery episiotomy incision extended to the fistula at the level of its dorsal vaginal opening and dissected free from vagina. Same suture techniques were applied as in the previous surgery. 2 months after the revision surgery, the patient had no problems with defecation and urination. AA and concomitant RVF can be rarely seen in dogs and cats. This case report sugest that succesful results can

be obtained with surgical intervention in dogs having this uncommon combination of AA Type III and concominant RVF.

Keywords: Anorectal Anomaly, Congenital Anomaly, Dog, Rectovaginal fistula, Type III Atresia Ani

A PATHOLOGICAL VIEW OF PARATUBERCULOSIS (JOHNE DISEASE) THAT CAN BE OVERLOOKED CLINICALLY

Ahmet UYAR

Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pathology, Hatay, TÜRKİYE

E-mail: ahmetuyar@mku.edu.tr, uyarahmet@hotmail.com

Paratuberculosis is known as a herd disease that causes many economic problems in animals, such as decreased milk yield, body weight loss, increased incidence of mastitis and infertility. In this report, it is aimed to present a case of paratuberculosis observed in a sheep in Van region with pathological findings. In the anamnesis, it was stated that the animal had diarrhea and progressive body weight loss for several months. In addition, it was stated that parasite medication was first administered by a clinician veterinarian and then antibiotics were administered, but the clinical picture still did not improve. Systemic necropsy of the sheep was performed in our pathology department. Macroscopically, the intestinal mucosa extending from the ileum to the rectum had increased folds and thickened, like the cerebral gyri. Transmural granulomatous enteritis characterized by diffuse hypertrophy was observed. Lymphangitis in the form of white cords was observed in the lymph vessels throughout the mesentery. There was subserosal edema in the mesentery. The iliosecal and mesenterial lymph nodes were enlarged, pale, and cord or half-moon shaped. The cut surface of the lymph nodes was yellow-brownish, edematous and necrotic. Microscopically, lymphoplasmacyter cells infiltration, Langhans-type giant cells, macrophage proliferation and edema were observed in the propria and submucosa, especially in the ileum region. There was granulomatous lymphadenitis characterized by multifocal macrophage proliferation foci in the lymph nodes. As a result, this case is presented to draw the pay attention of clinician veterinarians to Paratuberculosis disease, which poses a potential risk for ruminants, and to contribute to the literature.

Keywords: Paratuberculosis, Pathological findings, Sheep

COMPARISON OF THE EFFECTS OF EXTRACTS FROM GOJI BERRY, GREEN TEA AND DIOSPYROS KAKI LEAVES IN A DRY EYE MODEL OF MICE

Alper BASA[1]* İbrahim CANPOLAT[1] Kadri KULUALP[2] Abdullah ASLAN[3] Yesari ERÖKSÜZ[4] Sema CAKIR[5] Gökhan GÖKDERE[6]

[1] *Firat University University, Faculty of Veterınary Medicine, Department of Surgery, Elazığ, TÜRKİYE*

[2] *Dokuz Eylül University University, Faculty of Veterınary Medicine, Department of Surgery, Elazığ, TÜRKİYE*

[3] *Firat University University, Faculty of Science Department of Molecular Biology and Genetics, Elazığ, TÜRKİYE*

[4] Firat University *University, Faculty of Veterınary Medicine, Department of Pathology, Elazığ, TÜRKİYE*

[5] Bozok *University, Faculty of Veterınary Medicine, Department of Surgery, Yozgat, TÜRKİYE*

[6] Firat University *University, Faculty of Science Department of Statistic, Elazığ, TÜRKİYE*

***E-mail:** alperbasa32@hotmail.com*

The aim of this study wasto investigate the effects of goji berry (GB), green tea (GT), and diospyros kaki (DK)leaf extracts on mouse model of dry eye (DE). 56 eyes of 28 female BALB/c mice were equally divided into the following groups: control, GB, GT, and DK (left eye groups); DE, DE+GB, DE+GT, DE+DK (right eye groups). In the control group, 0.9% saline was instilled for thirty days.GB, GT, DK groups were instilled 0.9% saline for 14 days, and then 0.1% solution of the GB, GT and DK extracts was instilled between days 15 and 30, respectively.DE model was induced in all right eye groups bytopical administration of 5µl of 0.2% benzalkonium chloride (BAC) twice a day for 14 days. 1% solution of the GB, GT and DK extracts was instilledin DE+GB, DE+GT, DE+DK groups between days 15 and 30, respectively.In the DE group, only 0.9% saline was instilled on these days.All groups were evaluated for aqueous tear production rate, corneal fluorescein staining, and tear break-up time (TBUT) tests during the study period.Histopathological(corneal neovascularization, number of inflammatory cells) and

western blot analyses (IL-1α, TNF-α, Nrf-2 and NF-κB protein expression)were performed after the mice were sacrificed. In the baseline measurements of the study, there was no statistical difference between the groups in terms of all parameters (P>0.05). On day 15, aqueous tear production rate decreased, corneal fluorescein staining scores increased, and TBUTwas shortened in right eye groups compared to left eye groups (P<0.05). At the end of the study, there was no significant difference between the DE+extractgroups in terms of clinical parametric tests (P>0.05), but when compared according to histopathological and molecular analyses, it was found that the GT group showed the most beneficial effect without any side effects (P<0.05). There was no significant difference between the left eye groups (P>0.05). These results show that 0.1% GT leaf extract may be used as an alternative therapeutic agent in DE cases.

Keywords Mice, dry eye, treatment, goji berry, diospyros kaki, green tea.

Acknowledgement: This thesis study was carried out by Fırat University Scientific Research Projects (Project No. V.F.19.15) was supported. In this regard, Firat University Scientific for contributions to the Research Institution and Fırat University we gratitude.

INVESTIGATION OF THE PRESENCE OF DERMATOPHYTES IN DOMESTIC DOGS, RABBITS, GUINEA PIGS AND HAMSTERS

Aziz Utku ÖNEL **Asya KAZAN***

Bilal ÖZDEMİR **Sibel KIZIL** **Murat YILDIRIM**

Kirikkale University, Faculty of Veterinary Medicine, Department of Microbiology, Kirikkale, TÜRKIYE

***E-mail:** asyakazan1998@gmail.com

Dermatophytosis are zoonotic diseases, can affect both animals and public health. Domestic animals are an important source of causative agents of mycotic skin diseases that can be transmitted to humans. This study aimed detectection of dermatophytosis agent from skin lesions of dogs, rabbits, guinea pigs and hamsters which kept in household. Feather and skin scrapings taken from a total of 68 animals (40 dogs, 9 rabbits,13 guinea pigs, 6 hamsters) presented to veterinary clinics with suspected dermatophytosis in Ankara province. For this purpose, the affected area was disinfected with 70% ethyl alcohol and after the area was dried, materials were collected by using scalpel. Materials were cultured on Sabourand Dextrose Agar (Oxoid) and Dermatophyte Test Medium (Condalab), then incubated at 22±3ºC for 7-14 days. After this incubation period, macroscopical examination of cultures done by examining top-bottom colony morphology and surface pigmentation. For microscopic examination materials stained by using lactophenol cotton blue and observed at 40x magnification under light microscope. As a result, 5 isolates of *Microsporum canis*, 1 isolate of *M. gypseum* (6/40) were obtained from dogs; 1 isolate of *M. canis* (1/9) from rabbits; and 1 isolate of *Epidermophyton floccosum* (1/13) from guinea pigs. Dermathophyte agents were not detected in hamster scrapings. In addition to these results which include 4 *Alternaria alternata* and 2 *Candida spp.* (6/40,15%) in dogs; 2 *Cladosporium spp.*, 1 *Mucor spp.* (3/9, 33.33% in rabbits; 3 *Alternaria alternata*, 1 *Cladosporium spp.* (4/13, 30.77%) in guinea pigs; 1 *Cladosporium spp.* (1/6, 16.66%) in hamsters were detected. When total results considered 8 fungal dermatophytosis agents (11.76%) were isolated from 68 different animal. The highest rate of dermatophytes detected in animals was 15% in dogs, 11.11% in rabbits and 7.69% in guinea pigs, respectively. Fungal agents can

cause various diseases in animals and zoonotic significance has great importance. This is crucial for the establishment of appropriate treatment protocols ensuring the well-being of both animals and humans.

Keywords: Animal; Fungal dermatophytosis; Microbiology; Mycology.

BISPHENOL A ANALOGUES: BISPHENOL B, BISPHENOL C, BISPHENOL E, BISPHENOL F, BISPHENOL P, BISPHENOL S BISPHENOL Z, AND BISPHENOL AF

Aysun İLHAN* **Mustafa YİPEL**

Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Hatay, TÜRKİYE

***E-mail:** aysunnilhann1@gmail.com

It is known that Bisphenol A (BPA), a chemical used in the production of polycarbonate plastic (in the production of plastic containers such as feeding bottles, children's toys, water bottles, cans, food storage bags) and epoxy resins (plastic film production that covers the inner surface of food and beverage cans such as seafood, vegetables, milk powder, in the automotive industry and compact disc production), affects female and male gender hormone levels, fertility and sperm quality in living things, while high doses affect liver and kidney functions and low doses affect the endocrine system. Exposure to BPA generally occurs through consumption of contaminated food and drinking water. BPA was considered a toxic substance for the environment and human health in 2008 and was banned in baby bottles in Canada (France in 2010, the United States in 2012). In France, as of January 2015, a law bans the use of BPA in any food or beverage packaging. Therefore, there is a need to find alternatives to BPA for various industrial applications, as BPA is about to be withdrawn from the market. Since studies have documented adverse effects of BPA, public concern and government regulations regarding BPA have encouraged the development and production of alternative substances to replace BPA. Bisphenol S (BPS), a structural analogue, has been found in canned foods, canned soft drinks, thermal bill papers. Bisphenol B (BPB) has been found in canned beers, canned soft drinks, and canned tomatoes. Bisphenol F (BPF) is being increasingly used due to low viscosity and better resistance to solvents than BPA epoxy resins. It is known that BPS and BPF are used without restrictions around the world. Since there is generally limited information about the dangers of BPA analogues, the aim of this study is to provide information about these analogues.

Keywords: Bisphenol A; Bisphenol F; Bisphenol S; Bisphenol B; Analogues

COMPARISON OF FLEECE QUALITY IN TURKEY'S DOMESTIC SHEEP BREEDS

Ayşe ŞEN

Tekirdağ Namık Kemal University, Faculty of Agriculture, Department of Animal Science, Tekirdağ, TÜRKİYE

E-mail: aysesen@nku.edu.tr

Considering the physical, human and economic factors of Turkey, sheep is one of the most suitable livestock species for breeding, which the intensity of varies changes according to regions. Sheep, which have been utilized for centuries not only for meat and milk production but also for their skin and fleece, have cultural importance for Turkey and especially Anatolia. According to the Food and Agriculture Organization of the United Nations (FAO) data for the years 1994-2021, Turkey ranks 8th in world wool production. In 2022, according to data from the Turkish Statistical Institute (TÜİK), the entire domestic sheep population, which is reported to be approximately 41 million heads, is sheared and approximately 73 thousand tons of wool is obtained. Depending on the physical (fineness, length, strength, elasticity, elasticity, color, etc.) and chemical (%C, %N, %O, etc.) properties of its fibers, wool has a wide range of uses from the textile sector to cosmetics, insulation and even space stations. In our country, the wool obtained is utilized in different sectors according to its quality characteristics. In this study, it was aimed to compare the breeds by utilizing the studies on the fleece properties of Turkish domestic sheep breeds.

Keywords: Wool; Fleece Quality; Domestic Sheep Breeds

MICROBIOLOGICAL AND PARASITOLOGICAL HEALTH MONITORING IN LABORATORY RATS

Aziz Utku ÖNEL[1,2*] A. Begüm BUĞDAYCI[2] Süleyman Can ÖZTÜRK[3] Güneş ESENDAĞLI[3]

[1] *Kirikkale University, Faculty of Veterinary Medicine, Department of Microbiology, Kirikkale, TÜRKİYE*

[2]*KOBAY Experimental Animals Laboratory, Ankara, TÜRKİYE*

[3] *Hacettepe University, Faculty Cancer Institute, Department of Basic Oncology, Ankara, TÜRKİYE*

***E-mail:** dvmazizuonl@gmail.com

Health monitoring of laboratory rats is very crucial for ensuring animal health and standardisation. In this paper, it is aimed to provide information on the investigation of the presence of some bacterial, viral and parasitic agents included in The European Federation of Laboratory Animal Science Associations standards. In this study, a total of 30 rats maintained in the laboratory were examined for bacterial (*Streptobacillus moniliformis*, *Citrobacter rodentium*, *Rodentibacter spp.*, *Corynebacter kutscheri*, *Streptococcus agalactiae*, *Streptococcus pneumoniae*, *Mycoplasma pulmonis*, *Salmonella enterica*, *Pasteurella multocida*, *Clostridium piliforme* and *Helicobacter pylori*), viral (Minute virus, Mouse adenovirus and Mouse parvovirus) and parasitic (*Aspiculuris spp., Syphacia spp., Giardia spp., Eimeria spp., Cryptosporidium spp., Polyplax spinulosa, Radfordia spp., Notoedres muris*) agents. For this purpose, feather samples were collected from the bodies of the animals by cellophane tape for the identification of ectoparasites. The collected samples were examined under a light microscope with a 10x objective. For the examination of endoparasites, the materials collected from the perianal region of the animals with cellophane tape and the preparations of faecal samples prepared by flotation method were examined under a light microscope with a 10x objective. Bacterial and viral agents were analysed by Real Time Polymerase Chain Reaction (RT-PCR). As a result of these studies, when bacterial and viral agents were examined in 30 rats, only the presence of *Helicobacter pylori* (1/30) was diagnosed at a rate of 3.33% and no other agents were found. In addition to these results, only *Aspiculuris spp.* (11/30) and *Syphacia spp.* (19/30) were diagnosed as parasitic agents with a rate of 36.66% and 63.33%, respectively. In laboratories

where experimental animal production and experiments are carried out, it is crucial to establish a health monitoring programme integrated into the quality assurance system. It is thought that health monitoring scopes will improve with the development of microbiological quality of laboratory animals over time.

Keywords: Health Monitoring, Microbiology, Laboratory Animals, Parasitology

IMPLEMENTING THE 3RS IN DESERT RODENTS FOR BIOMEDICAL RESEARCH: CURRENT INSIGHTS AND APPLICATIONS

Benmouloud ABDELOUAFI[1,2,3*] **Kacimi LILIA**[1,2] **Zatra YAMINA**[1,2,4]

Aknoun-Sail NAOUEL[1,2] **Charallah SALIMA**[1,2] **Khammar FARIDA**[1,2]

[1] *Houari Boumedienne University of Sciences and Technology (LRZA, FSB, USTHB), Algiers, ALGERIA*

[2] *University of Algiers 1 Benyoucef Benkhedda, Algiers, ALGERIA*

[3] *University of M'hamed Bougara Boumerdes (UMBB), Boumerdes, ALGERIA*

[4] *Saad Dahlab university of Blida I, Blida, ALGERIA*

***E-mail:** a_ouafibenmouloud@yahoo.fr

Rodent models play a essential role in the most areas of biomedical research through their potential contributions to understand different pathological and biological processes. Moreover, they allow for the development and testing of drugs, vaccines, and surgical procedures used in human and veterinary medicine. The use of wild rodent species in research is predicated on some similarities with human physiology. Animals living in desert environment as *Gerbillinae* subfamily are adapted to survive despite severe temperature, intense solar radiation and dehydration. Most of *Gerbillinae* are granivorous, nocturnal and inhabitants of harsh environments. They are frequently used as models for human diseases in physiopathology and metabolism, endocrinology, nutrition and neurological researches. As these species play a role in maintaining Saharan biodiversity, the wildlife protection and preservation laws prohibit killing of the wild animals, ensure their undisturbed breeding, regulate hunting and avoid using inhumane methods. However, increased interest for the welfare of the animals used, and a growing consciousness of the approach of animal rights, has put more emphasis on the related ethical issues. In our laboratory, we carry out behavioral and physiological research on five species of desert rodents. In this review, we will present our experience in keeping, breeding and studying some physiological aspects of these wild rodents. Well-being care of desert rodents under standard laboratory conditions influences energy balance regulation and metabolic health outcomes. The principles of the 3Rs (reduction, refinement and replacement) form the basis of ethically acceptable research

using animal models for human and/or animal benefits. If alternatives to the use of wild desert rodents (replacement) are not available, the importance of reduction and refinement cannot be overstated. We will also, focus on 'practical refinements to avoid or reduce suffering and we intend to present some examples on how desert rodents are used in the biomedical research as well as to encourage debate around the application of ethics in the use of wild animals in research and education. These elements have the potential to affect experimental outcomes used in desert rodent models of human disease. Increased awareness and insighting of the specific metabolic consequences of wild rodent housing practices and breeding conditions can support reproducibility and improvement of study results.

Keywords: Wild Rodents; 3; Ethics; Animal Research; Biomedical Research

Acknowledgement: The authors thank the Directorate General for Scientific Research and Technological Development (DGRSDT) for providing the help, technical assistant and facilities to carry out the research work.

THE INTERACTION OF SPECTRAL SENSITIVITY WITH MELATONIN AND GROWTH HORMONE LEVELS IN BROILERS

Deniz KARAKÇI

*Tekirdağ Namık Kemal University, Faculty of Veterinary Medicine Department of Biochemistry, Tekirdağ, TÜRKİYE

E-mail: dkarakci@nku.edu.tr

The utilization of artificial light is prevalent in the field of poultry. Appropriate lighting conditions have the potential to enhance the body weight and improve the feed conversion ratio in broilers. The spectrum of light influences the photoperiodic response of avian species. Melatonin (ML) has the ability to modulate a wide range of diurnal and seasonal patterns or rhythms in many physiological systems of vertebrates, encompassing the cardiopulmonary, reproductive, excretory, thermoregulatory, behavioral, immunological, and neuroendocrine systems. Also, ML stimulates growth hormone secretion and, thus, affects the growth performance of poultry positively. The aim of this study was to determine the effects of spectral sensitivity on melatonin and growth hormone levels in broilers. A total of one hundred sixty broilers were used for the study. Animals were allocated to four experimental groups according to the different colors of lighting. Blood samples were collected at 21th and 42th days of the study. Melatonin and growth hormone concentrations were measured by using the ELISA method with a microplate reader. The blue color application group had the highest level of melatonin compared to the other groups statistically ($p<0.05$) on 21thday. On the 42th day of the study growth hormone level was the highest in the blue group. As a result, it was indicated that the application of blue LED spectral light has a beneficial impact on the levels of ML and GH hormones in broilers.

Keywords: Broiler, Growth Hormone, Melatonin, Spectral Sensitivity

A RETROSPECTIVE STUDY ABOUT BORNAVIRUS INFECTION IN CATS

Elif İrem ŞENLIK[1,2*] **Tuba Çiğdem OĞUZOĞLU[2]**

[1] *Ankara University, Institute of Health Science, Ankara, TÜRKİYE*

[2]*Ankara University, Faculty of Veterinary Medicine, Department of Virology, Ankara, TÜRKİYE*

***E-mail:** elifsenlikirem@gmail.com

Bornavirus infection causes by fatal neurological disorders and behavioral changes in different animal species and humans. Taxonomically, there are two genotypes of Bornavirus (family *Bornaviridae*, within the order *Mononegavirales*) reported in mammals, BoDV-1 and BoDV-2. In the first studies on Bornavirus disease, it was stated that natural infection was found only in horses and sheep, but in the following period, the virus was found in many animal species (cattle, cats, dogs, avians, rabbits and ostriches) and was reported in many countries including northern and central Europe, North America, Japan, China, Israel, Iran and Türkiye. The aim of this study was to provide general information about the epidemiology, etiology, pathogenesis, clinical findings, treatment and control of Bornavirus disease. Additionally, it have been investigated by using molecular techniques retrospectively in cats (n=170), which are clinically suspected (neurological findings), presence of this infection.

Keywords: BoDV-1; Bornavirus infections; Neurological disease; RNA virus

ONCOGENIC MECHANISMS OF RETROVIRUS INFECTIONS IN DOMESTIC ANIMALS

Emrah KORKULU[1,2*] **Tuba Çiğdem OĞUZOĞLU[2]**

[1]Ankara University, Institute of Health Science, Ankara, TÜRKİYE

[2]Ankara University, Faculty of Veterinary Medicine, Department of Virology, Ankara, TÜRKİYE

***E-mail:** korkuluemrah@icloud.com

Taxonomically, the subfamily *Orthoretrovirinae* is further divided into six genera, namely *Alpharetrovirus*, *Betaretrovirus*, *Gammatrovirus*, *Deltaretrovirus*, *Epsilonretrovirus* and *Lentivirus,* while the subfamily *Spumaretrovirinae* includes only the genus *Spumavirus*. Retroviruses infect many animal species, including mammals, reptiles, fish and birds. These viruses known as oncogenic agents, depending on the associated disease, may involve different pathogenic mechanisms, including inflammation, neuro-degeneration and immunodeficiency. At the same time, the members of the genera *Lentivirus* and *Spumavirus* are not oncogenis. Tumor-inducing genes (oncogenes) have been discovered through the study of retroviruses and associated animal tumors. Retroviruses have the ability to transform cells through at least three different pathways: (1) the process of insertional mutagenesis; (2) the "capture" of a host cell proto-oncogene; and (3) certain retroviruses, for example bovine leukemia virus, Jaagsiekte sheep retrovirus and enzootic nasal tumor virus, contain genes encoding protein products that are directly oncogenic to infected cells. The purpose of this presentation is to provide an overview of the mechanisms of retrovirus infections with oncogenic potential that infect domestic mammals.

Keywords: Oncogene mechanism; Retrovirus infection; RNA virus

EVALUATION OF TLR4 EXPRESSION IN THE UTERUS OF RATS ADMINISTERED CAPCAICIN DURING PUBERTY

Feyza KESKIN* **Serife TUTUNCU** **Nurcan DELICE** **Tugrul ERTUGRUL**

Ondokuz Mayis University, Faculty of Veterinary Medicine, Department of Histology and Embrylogy, Samsun, TÜRKİYE

***E-mail:** feyza98keskin@gmail.com

Capsaicin is the active ingredient of the red chili pepper, which is grown mainly in Mexico. It is called Capsicum annuum and belongs to the Solanaceae family. Capsaicin is used to treat various diseases gastrointestinal disorders, cardiovascular diseases, respiratory diseases and dermatological disorders. TLR4 is the first identified in mammals Toll-like receptor (TLR). It serves as a receptor for lipopolysaccharide, the endotoxic component of Gram-negative bacteria. The presence of TLR4 has been demonstrated in association with cells of the immune system in the reproductive, respiratory, nervous, and gastrointestinal system. A total of 30 female Sprague-Dawley rats at 21 days of age were used as study material. During puberty (42 days of age), the rats were divided into three subgroups: Experimental, vehicle and control groups. The experimental group was subcutaneously injected daily with a solution containing 1 mg/kg capsaicin from 21 to 42 days of life; the vehicle group received a subcutaneous injection of a solution consisting of 0.3 cc of 10% Tween 80, 10% ethanol, and 80% distilled water. The control group was not subjected to any treatment. At the end of the study, the uterine tissue was removed by cervical dislocation under anaesthesia and routine histologic tissue examination was performed. Tissues were stained with Crossmon's trichrome staining method and immunohistochemical staining technique to observe TLR4 expression. Consequently, the weakest TLR4 expression was observed in the lamina propria and myometrium. Compared with the control group, a decrease in TLR4 expression was observed in the experimental group. This decrease suggests that capsaicin may have an inhibitory effect on TLR4. We believe that the results obtained will be important for future studies.

Keywords: Capsaicin, TLR4, Uterus

THE BIOLOGICAL/PHYSIOLOGICAL INTERACTIONS BETWEEN THE ELEMENTS

Fulya ALTINOK-YİPEL[1]* **Mustafa YİPEL[2]**

[1] Hatay Mustafa Kemal University, Samandağ Vocational School, Department of Veterinary Science, Hatay, TÜRKİYE

[2] Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Hatay, TÜRKİYE

***E-mail:** fulyip@hotmail.com*

Some macro and micro elements are essential to maintain health and growth for all mammals. Body concentrations may vary depending on conditions such as disease, physiological changes, metabolism, drug applications, diet, and food supplements. As a result of this change, insufficiency or excess of other elements due to the biological/physiological interaction between the elements (such as Cu-Zn, Al-Ca, S-Tl/K, Fe-Cu/Zn) can lead to various biochemical pathways imbalances, function losses, diseases, and poisoning. It is very important to understand the roles of macro and micro elements in the organism, and their relationships with each other, determine and monitor the body concentrations, and obtain data that can be clinically associated with physiological or pathological conditions. Elements can interact with each other or reverse their effects. As a result of interaction between elements, exposure to non-essential elements leads to reversed beneficial effects of essentials. Toxic metals can disrupt metabolism or limit the absorption of other elements. This presentation aims to give information about the deficiency/excess status of the elements, and their interactions with each other with a clinical approach. Determining and monitoring the body concentrations of the elements is extremely important in terms of the negative effects that occur as a result of their deficiencies or excesses.

Keywords: Essential Elements; Non-Essential Elements; Macro Elements, Micro Elements Interaction

EFFECTS OF METEORIN-LIKE PROTEIN ON A2780, LNCAP, CACO2 AND MCF-7 CELL LINES

Furkan YUKSEL* **Guldeniz SEKERCI** **Suat TEKIN**

Inonu University, Faculty of Medicine, Department of Physiology, Malatya, TÜRKİYE

***E-mail:** furkanyuksel@gmail.com

Cancer is one of the biggest health problems threatening humanity, and the fight against cancer continues with different methods around the world. Despite advances in cancer prevention and treatment, the low success rate and tumor recurrence make the discovery of new alternative agents important. Adipokines are among those known to be associated with cancer. The relationship of the peptide-structured Meteorin-like protein (Metrnl), a member of the adipokine family, discovered in 2012, with cancer remains a mystery. This study was conducted to examine the cytotoxic effects of Metrnl on human ovarian (A2780), prostate (LNCap), colon (Caco2) and breast (MCF-7) cancer cell lines. In the study, A2780, LNCaP, Caco-2 and MCF-7 cell lines were used. After the cells were incubated with 1, 5, 10, 50, 100 and 200 ng/ml concentrations of Metrnl for 24 hours, the cytotoxicity level in the cells was determined by the 3-(4,5-dimethylthiazol-2-yl)- 2,5diphenyltetrazolium bromide (MTT) assay method. determined. Comparisons between groups were made with the Kruskal Wallis H-Test. 200 ng/ml concentration of Metrnl in A2780, LNCaP, Caco-2 and MCF-7 cell lines; 100 ng/ml concentration in LNCaP and MCF-7 cell lines; The concentration of 50 ng/ml significantly reduced cell viability in the MCF-7 cell line ($p<0.05$). These results show that Metrnl may have anticarcinogenic activity on A2780, LNCaP, Caco-2 and MCF-7 cells, but further studies are needed on this subject.

Keywords: A2780; LNCaP; Caco2; MCF-7; Metrnl; Cytotoxicity.

Effects of Meteorin-Like Protein on Pancreatic Histopathology in a Streptozotocin-Induced Experimental Diabetes Model

Furkan YUKSEL[1]* Aslı TASLIDERE[2] Cigdem TEKIN[3] Mete OZCAN[4] Suat TEKIN[1]

[1] *Inonu University, Faculty of Medicine, Department of Physiology, Malatya, TÜRKİYE*

[2] *Inonu University, Faculty of Medicine, Department of Histology and Embryology, Malatya, TÜRKİYE*

[3] *Inonu University Vocational School of Health Services, Malatya, TÜRKİYE*

[4] *Firat University Faculty of Medicine, Department of Biophysics, Elazig, TÜRKİYE*

***E-mail:** furkanyuksel@gmail.com

Diabetes is a metabolic disease that occurs due to irregularity/impairment in the secretion or activity of the insulin hormone and is characterized by hyperglycemia. It causes serious tissue damage due to complications such as nephropathy and neuropathy. It is thought that meteorin-like protein(Metrnl), which has been determined to regulate insulin resistance by studies, may be therapeutic for obesity, cardiovascular diseases and type 2 diabetes. This study was planned to determine whether Metrnl has a healing effect against possible pancreatic damage in mice created as an experimental diabetes model. In the study, normoglycemic male *Balb-C* mice (ethics committee 2022/7-5) were randomly divided into 4 groups: control, diabetic neuropathy (DN), DN+Metrnl 2 µg/kg, DN+Metrnl 4 µg/kg. (for each group n=10). A single intraperitoneal (ip) injection of streptozotocin (STZ) (150mg/kg) was administered to all groups except the control group. By measuring the blood glucose level after 72 hours, animals with blood glucose levels above 250 mg/dL were considered diabetic and 14-day injections were started 21 days after the onset of diabetes. No injection was given to the control group for 14 days. Physiological saline was administered to the DN group, and 2 and 4 µg/kg/day ip Metrnl was administered to the treatment groups, respectively. At the end of 14 days, the animals were decapitated and pancreatic tissues were removed. The taken pancreatic tissues were examined histopathologically. In statistical analysis, p value <0.001 was considered significant. In the control group, pancreatic lobules with normal histological appearance were observed to be separated by thin connective tissue septa. It was observed that the acinus cells had a normal pyramidal structure and the islets of Langerhans consisted of cell groups. As a result of STZ-induced hyperglycemia,

deterioration in acini and lobule structures, hemorrhage, separation areas between lobules, inflammatory cell infiltration, vascular congestion, vacuolization and edema were detected in the DN group. It was determined that these histopathological damages seen in the DN group were significantly reduced in the Metrnl 2 and 4 µg/kg groups. The results obtained show that Metrnl helps protect pancreatic integrity in pancreatic damage in the STZ-induced experimental diabetes model and has an improving effect on the histopathological condition.

Keywords: Metrnl; Diabetes; Pancreas; Histopathology; Inflammation.

Acknowledgement: This study was supported by İnönü University Scientific Research Projects Unit (TDK-2022-3168) and YÖK 100/2000 PhD Scholarship.

RUMEN FERMENTATION, ENTERIC METHANE EMISSION AND FEED EFFICIENCY OF DAIRY COWS FED AMYLASE-ENABLED CORN SILAGE

Halil İbrahim TOSUN[1]* David CASPER[2]

[1]*Rumico Livestock Management and Nutrition, Aydın, TÜRKIYE*

[2]*North Carolina A&T University, Department of Animal Sciences, NC, USA and Colorado State University, Department of Animal Science, CO, USA*

***E-mail:** halil.tosun@rumico.com.tr*

Recently, corn hybrids were developed to contain amylase for increasing ethanol production from the grain. This alpha-amylase is a transgenic bacterial enzyme that is incorporated into the corn endosperm that improves glucose release from starch for fermentaiton to ethanol. Several studies have evaluated this technology for use in livestock (ruminant and non-ruminant) nutrition. This study will report and discuss the results from a recent feeding experiment utilizing 48 early lactation (78.8 days in milk) Holstein dairy cows. This study harvested the corn hybrid as corn silage which was fed at 40% of the ration dry matter in a total mixed ration. The control corn silage was an isogentic control containing 37.5% NDF and 32% starch compared with 36.7% NDF and 37.0% starch for the enzyme corn silage. The total mixed ration NDF and starch concentrations were 33.9% and 24.0$ for control and 33.6 and 25.2% for enzyme corn silage treatments, respectively. Rumen samples were collected for measuring volatile fatty acid concentrations along with measuring methane production using the Green Feed system. Milk production was increased 5.2% for cows fed enzyme corn silage compared with cows fed control (38.8 and 40.8 kg/d for control and eznyme corn silage, respectively) with similar dry matter intake (26.5 and 26.3 kg/d) and a trend for improved dry matter digestibility (71.3 and 72.5%), resulting in improving feed efficiency for cows fed enzyme corn silage (1.47 and 1.55 milk/dry matter intake) compared with cows fed the control corn silagae. Milk protein yield (1.20 and 1.25 kg/d) was incrreased for cows fed enzyme corn silage compared with cows fed control corn silage. Milk urea nitrogen concentrations (14.0 and 12.7 mg/dL) were reduced for cows fed the enzyme corn sialge compared with cows fed control corn silage. There was reduction in ruminal concentrations of butyrte (14.6 and 11.3 molar %) and an numerical increase in propionate (22.8 and 26.4 molar %) concentrations that

demonstrated a dramatic reduction in methane produced per kg of milk (11.4 and 10.3 g/kd) for cows fed enzeyme corn silage compared with cows fed control corn silage. The feeding of an enzyme corn silage can shift ruminal ferementation by improving dry matter digestion to reduce methane emissions and enhance milk production and feed efficiency. The use of amylase-enabled corn hybrids affecting starch concentrations and especially ruminal starch digestion should find greater widespread use in the livestock sector.

Keywords Animal nutrition, Rumen fermentation, Feed efficiency, Enteric methane emission, Amylase-enabled corn hybrids

SOYBEAN AND CANOLA MEAL EFFECTS ON PLASMA AMINO ACID PROFILE, ENTERIC GAS EMISSIONS, MILK FATTY ACIDS AND NUTRITIONAL DIGESTIBILITY BY LACTATING COWS

Halil İbrahim TOSUN[1]* **David CASPER[2]**

[1]Rumico Livestock Management and Nutrition, Aydın, TÜRKIYE

[2]North Carolina A&T University, Department of Animal Sciences, NC, USA and Colorado State University, Department of Animal Science, CO, USA

***E-mail:** halil.tosun@rumico.com.tr*

Prices of various protein sources have recently started to consideraby increase. Therefore, increasing prices of protein sources used to meet the animals protein requirement directly increases ration costs. This study will report and discuss the results from a recent feeding experiment utilizing 15 lactating (95±20 days in milk) Holstein dairy cows. This study compared feeding solvent extracted canola meal (CM), extruded soybean meal (ESBM), or solvent-extracted soybean meal (SSBM) fed on an iso-crude protein basis in a total mixed ration (TMR) containing 17.1% CM, 14.2% ESBM, or 13.6% SSBM (dry matter basis) on plasma AA profiles, enteric gas emissions, milk fatty acids, and nutrient digestibility by lactating dairy cows. However, canola oil for CM or soybean oil for SSBM was added to the TMR to equalize the ether extract concentrations across treatments. The experimental design was a replicated 3 *x* 3 Latin square design with 28 day periods with the first 18 days for TMR acclimination followed by 10 d of data collection. Cows fed the CM TMR demonstrated 6 and 9% greater ($P < 0.05$) dry matter intake (DMI) compared with cows fed ESBM or SSBM (26.9, 25.3 and 24.5 kg/d for CM, ESBM, and SSBM, respectiviely). Milk production was greater ($P < 0.05$) for cows fed CM and ESBM compared with cows fed SSBM (43.8, 42.6, and 41.1 kg/d), but greater DMI and milk yields resulted in similar feed conversions among cows fed all treatments. Milk composition was similar for cows fed all protein sources. Cows fed CM demonstrated the lowest MUN values compared with cows fed ESBM, with cows fed SSBM being intermediate and different (9.2, 12,0, and 10.4 mg/dL). Cows fed CM produced less methane per kg of DMI compared with cows fed ESBM and SSBM (15.0, 16.9, and 17.0 g methane/kg DMI) however methane production per unit of energy correct milk (ECM; 9.53, 9.94, and 10.4 g methane/kg ECM) was similar for cows fed all protein sources.

Although SSBM contains greater lysine than CM, but CM can be an alternative to replace SBM in high producing dairy cow rations when protein levels are equalized to reduce the feed cost of producing milk while being more envioromentally friendly, i.e. reduce methane. Further work is needed to ascertain if the methane reduction reported herre was due to the CM or the extra fat added to the ration.

Keywords Canola meal, soybean meal, methane, nutrient digestibility, lactating dairy cows.

FELINE HYPERTROPHIC CARDIOMYOPATHY: A REVIEW

Hanaa EL ATMANI[1*] Mohammed PIRO[1] Alberto TARDUCCI[2]

Faouzi KICHOU[3] Rahma AZRIB[1]

[1] *Department of Medicine, Surgery and Reproduction, Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, MOROCCO*

[2] *Department of Veterinary Science, University of Turin, Turin, ITALY*

[3] *Department of Veterinary Pathology and Public Health, Hassan II Institute of Agronomy and Veterinary Medicine, Rabat, MOROCCO*

***E-mail:** elatmanihanaa.iav.ac.ma

Cardiovascular diseases are among the 5 most common causes of death in cats. While cardiomyopathies are the most prevalent heart disorders, Hypertrophic Cardiomyopathy (HCM) is by far, the most encountered form, with an estimated prevalence of 15% in the general feline population, and up to 29% in older cats. HCM was first reported in humans in late 1950s, and soon after, described in cats for the first time in 1977 by Tilley et al. Since then, numerous studies have been enrolled to characterize this disorder, especially after several similarities were discovered between the two species. Later on, in 2020, a consensus statement on feline cardiomyopathies was published by the American College of Veterinary Internal Medicine, establishing a new phenotype-based classification scheme, recommendations on diagnostic approaches and management guidelines. By definition, HCM is a concentric left ventricular (LV) hypertrophy (thickened LV walls with a non-dilated LV chamber) in the absence of hemodynamic or metabolic causes. Primarily affecting all age ranges, both sexes, and a variety of pure and mixed breed cats. A genetic etiology has been identified in some, but for many affected patients the cause has not yet been elucidated. Widely known for its heterogeneity, HCM represents a real diagnostic challenge in practice, with diverse morphological echocardiographic patterns and variable clinical presentations, ranging from a subclinical form with normal life expectancy, to clinical forms with serious life-threatening cardiovascular complications, and even unexpected sudden cardiac death.This review aims to provide updated

information on pathophysiological mechanisms, clinical presentations, diagnosis and management of feline HCM.

Keywords: Cat; Feline Hypertrophic Cardiomyopathy; Echocardiography; Cardiovascular Complications

Effect of Marrubium Vulgare L. Plant Used in the Diet on Quail Live Weight

İsmail ÜLGER[1]* Mustafa ÖZDEMİR[1] Yeliz TAŞÇI[2] Hatice ÖZSOLAK[2]

[1] *Erciyes University, Faculty of Agriculture, Department of Animal Sciences Kayseri, TÜRKİYE*

[2] *Kayseri Sugar R&D Center, Kayseri Sugar Factory, Kayseri, TÜRKİYE*

***E-mail:** hatice.ozsolak@kayseriseker.com.tr*

Efficiency is one of the most important parameters in animal breeding. Increasing live weight in meat production will also increase the yield per unit. For this reason, live weight is important in animals raised for meat production. This study was carried out to determine the effect of Marrubium vulgare L. added to the diet on quail live weight. The study used 45 female and 45 male quails and artificial lighting was adjusted to 16 hours of light and 8 hours of darkness. In addition to the KM, HK, HY, HS, TSBM, ADF, NDF and ADL values of Marrubium vulgare L. plant, live weight increase was observed in the 3 groups (control, 0.5%g/kg, 1%g/kg). While there was no statistically significant difference between the groups in quail live weights, the highest live weight was observed in the group in which 1% g/kg was added to the ration. This study is the first to investigate the effect of adding Marrubium vulgare L. to the diet on quail live weight. While the study results show that Marrubium vulgare L. supplementation may have a positive effect on live weight, further studies are needed to determine the appropriate dose and amount of effect.

Keywords: *Marrubium Vulgare* L., Quail, Feed source

A CASE OF TRAUMATIC MYIASIS CAUSED BY *WOHLFAHRTIA MAGNIFICA* (SCHINER 1862) (DIPTERA: *SARCOPHAGIDAE*) IN A COLT (*EQUUS ASINUS*)

Aykut ZEREK[1] **İpek ERDEM[1]** **Mehmet YAMAN[1]**

Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Parasitology, Hatay, TÜRKİYE

***E-mail:** ipek.atasever@gmail.com

On examination of a colt brought to the Department of Surgery clinic of Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, with open wounds on various parts of the body, 3 fly larvae were found in the open wound between the semitendinosus and semimembranosus muscles of the left hind leg and 9 fly larvae were found in the open wound on the upper part of the left gastric pit. No larvae were found in the open wound in the sacral region. Twelve larvae collected by the clinician with forceps were transferred to the parasitology laboratory in a container of 70% ethyl alcohol. The larvae were identified by the morphological characteristics of the anterior and posterior spiracles and cephalo-pharyngeal skeleton. As a result of microscopic examination, the larvae were determined to be third instar larvae of Wohlfahrtia magnifica. According to the literature, traumatic myiasis cases in donkeys are rare in the worldwide. This study is the first case of traumatic myiasis caused by W. magnifica in a colt in Türkiye.

Keywords: Traumatic myiasis, Donkey, Larvae, *Wohlfahrtia magnifica,* Türkiye

HOW TO ANALYSE PESTICIDES IN URINE?

İrem KARAASLAN

Hatay Mustafa Kemal University, Technology and Research and Development Center, 31060, Hatay, TÜRKİYE

E-mail: iremkaraaslan@hotmail.com

Pesticides are chemical compounds that are used to kill pests, including herbicides, insecticides, nematicides, fungicides, miticides, algicides, and rodenticides. According to the World Health Organization (WHO), more than 1000 pesticides are used in agriculture. The extensive use of pesticides has led to their frequent detection and their metabolites in environmental matrices, as well as in human samples. Biomonitoring of exposure is a useful tool for assessing exposure to pesticides of human. Biomonitoring involves the measurement of the parent pesticide, its metabolite or reaction product in biological media, to determine if an exposure has occurred and the extent of that exposure. Over the years, several procedures have been developed with this aim. There are several approaches employed. Urine is to date the most classically used matrix for the assessment of human exposure to pesticides. The selection of the instrumental technique for the measurement depends on the physicochemical properties of the target substances and their concentration. On the other hand, for the measurement, two different approaches are necessary for the analysis of pesticides in a laboratory. The method selection depends on which pesticides will be targeted for analysis. This study aims to examine the importance of the targeted pesticides and analysis method selection relationship, the steps for pesticide analysis in urine by routinely used method or by method development, the method validation parameters and performance criteria, and analysis of the real samples after optimizing the method.

Keywords: Pesticides; Urine; Exposure; Instrumental Analyse; Biomonitoring

DETERMINATION OF THE EFFECTS OF *RHIZOBIUM LEGUMINOSARUM* AS AN INOCULANT ON THE HAY QUALITY AND *IN SITU* RUMINAL DEGRADABILITY VALUES OF FODDER PEA AND HUNGARIAN VETCH

Mehmet DEMİRCİ[1]* **Taşkın EROL[2]** **Kamil KARA[2]**

Şevket EVCİ[1] **Hasan Hüseyin ŞENYÜZ[3]**

[1]*Kırıkkale University, Vocational School, Department of Laboratory and Veterinary Health, Kırıkkale, TÜRKİYE*

[2] *Kırıkkale University, Vocational School, Department of Plant and Animal Production, Kırıkkale, TÜRKİYE*

[3] *Necmettin Erbakan University, Faculty of Veterinary Medicine, Department of Animal Nutrition and Nutritional Diseases, Konya, TÜRKİYE*

***E-mail:** m.demirci.tr@hotmail.com*

In this study, the effects of a bacterial inoculant (*Rhizobium leguminosarum*) on forage quality and ruminal degradability of Hungarian vetch (*Vicia pannonica*) and fodder pea (*Pisum arvense*) were investigated. The study was carried out in the experimental field of Kırıkkale University campus located in Kırıkkale province, which has a continental climate in the central Anatolia region of Türkiye. In the study, plant seeds with and without inoculant were sown separately in 3 replications in areas with plot sizes of 1.5 × 5 meters. The plants were harvested manually at 25% flowering period and weighed. After harvesting forages, the amount of green forage yields per hectare area was calculated and chemical content analysis was carried out. Dry matter (DM), organic matter (OM), crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), ash contents of the forage samples were analyzed; approximate metabolic energy (ME) and net energy lactation (NE_L) values were calculated. *In situ* ruminal dry matter degradability (ISDMD; incubation times were 0, 3, 6, 12, 24, 48 hours) were also determined using 3 different non-lactating dairy cows with rumen cannula. While Hungarian vetch green forage yield was 12.300 kg/ha with inoculant addition, this value remained at 9.150 kg/ha without inoculant; in fodder pea, while the yield reached 29.930 kg/ha with inoculant, it remained at 21.500 kg/ha without inoculant. Addition of inoculant significantly increase green forage yields of both plant species ($P<0.05$). The DM, OM, ash, CP, NDF, ADF, ME, NEL contents of both forages were not significantly

affected by inoculant use (P>0.05). However, the use of inoculant significantly reduced the ISDMD of fodder pea but did not cause any significant change in Hungarian vetch. Since the use of inoculant in both plant types increased the green forage yield, it has been concluded that the use of inoculant may increase the productivity as it may increase the amount of nutrients to be obtained per unit area.

Keywords: *Rhizobium*; Hungarian Vetch; Fodder Pea; Chemical Composition; Degradability

SAFRANAL PROTECTS AGAINST CYCLOPHOSPHAMIDE INDUCED TESTICULAR TOXICITY IN RATS

Mustafa CELLAT [1] İlker YAVAŞ [2] Ahmet UYAR[3]

Muhammed ETYEMEZ[4] Mehmet GÜVENÇ[1]

[1] Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Physiology, Hatay, TÜRKİYE

[2] Hatay Mustafa Kemal University University, Faculty of Veterinary Medicine, Department of Reproduction and Artificial Insemination Hatay, TÜRKİYE

[3] Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pathology, Hatay, TÜRKİYE

[4] Kastamonu University, Faculty of Veterinary Medicine, Department of Physiology, Kastamonu, TÜRKİYE

***E-mail:** mguvenc@mku.edu.tr, vetguvenc@gmail.com

In this study, the effects of safranal against cyclophosphamide (CP) induced reproductive damage were investigated in 32 male Wistar albino male rats. Oral gavage of cyclophosphamide at a dose of 15 mg/kg once a week for 56 days was used to administer cyclophosphamide in CP induced- toxicity in experimental rat models. The rats in the treatment group were given cyclophosphamide at a dose of 200 mg/kg once a day for 56 days via oral gavage. Biochemical and histological analyses of the tissues, collected from spermatological examinations, were performed at the end of the treatment. The results revealed that cyclophosphamide treatment increased the dead/live and abnormal sperm ratios, as well as MDA, TNF-α, IL-6, and Nf-kβ expression levels, while decreasing sperm motility and density, Nrf-2 expression, GSH, and GSH.Px activity. However, there were therapeutic effects in the specified parameters in the safranal-treated group. As a result, safranal prevented the reproductive damage caused by cyclophosphamide and showed protective effects.

Keywords: Safranal, Cyclophosphamide, Male Infertility, Testicular Toxicity

Acknowledgement: This study was supported by the Scientific Research Project Coordination of the Hatay Mustafa Kemal University, Turkey (Grant number 20.M.032).

ORGANOMETALLIC COMPOUNDS IN TERMS OF TOXICOLOGY

Meltem KOCAKAYA* **Mustafa YİPEL**

Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Hatay, TÜRKİYE

***E-mail:** meltemkocakayaa93@gmail.com

Environmental toxicology, which is a sub-branch of toxicology; It examines the substances that cause environmental and food pollution and the effects they have on living things and the environment. Environmental pollutants exist as organic and inorganic. One of the inorganic pollutants are organometallic compounds. The first organometal compounds were studied by Löwig in 1852, and the synthesis of many organometallic compounds increased subsequently. Organometallic compounds; Ethyl, methyl, propyl, butyl, hexyl and octyl groups are commonly used. They are hydrophobic. They accumulate permanently in tissues. It has a metal carbon bond and a metal complex bond. Organometallic compounds can act covalently and ionicly in chemical reactions. Because they have lipophilic bonds, they facilitate passage through lipid membranes and cause more toxic effects. They interact with the thiol protein. They cause damage to the myelin membrane on nerve cells. Medically; They are used in various diseases such as malaria, arthritis, anemia, tuberculosis and in the treatment of cancer. Industrially; It is used as a catalyst in PVC production, as a biocide in PVC coatings and windows, and in antifouling paints. They cause oxidative stress through the increase of reactive oxygen species (ROS). It causes bond damage in DNA. Affects mitochondrial DNA. There are many types of trimethyltin, tributyltin, methylmercury, dibutyltin, monobutyltin, methyltin, tributyltin, triphenyltin. organometallic compound poisoning; Symptoms such as neurological disorders, headache, insomnia, and tonic-clonic seizures occur. It causes a decrease in dopamine and serotonin levels in the frontal cortex and impairments in learning. They reduce neurotransmitter levels. It has hepatotoxic effects. Astrocyte activation causes cytokine expression. It is immunotoxic. They reduce estrogen levels. They cause Na+ imbalance in the hippocampal region. İmportant organometallic compound poisonings; Stalinon incident it was the medicine used in France for staphylococcus and skin infections. Although the active ingredient should be diethyltin di-iodide, monoethyltin and triethyltin contamination was a mass poisoning incident in which at least 217 people were poisoned and 100 people died.

Minamata incident It occurred in Minamata Bay, Japan, between 1953 and 1956. The catalyst manganese dioxide from a nearby factory producing vinyl acetaldehyde was replaced with iron sulfide. The amount of methylmercury released into the bay caused sensory disturbances, ataxia, muscle weakness, abnormal eye movements, hearing, taste and smell disorders. The aim of this systematic review is to emphasize the importance of the toxic effects of organometallic compounds on living things in the ecosystem.

Keywords: Organometalic compounds; Environmental toxicology; Organometallic poisonings; Environmental pollution; Toxicology

DIOXINS, FURANS AND POLYCHLOROBIPHENYLS IN TERMS OF TOXICOLOGY

Mustafa YENİÇERİ* **Mustafa YİPEL**

Hatay Mustafa Kemal University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Hatay, TÜRKİYE

***E-mail:** yenicerimustafa351@gmail.com

With the increase in the production and use of pollutants, their involvement in the ecosystem is increasing day by day. This increase increases the amount, frequency and duration of exposure to living beings in the ecosystem, either directly or indirectly through the food chain, and causes an increase in social concerns over potential toxic risks. Among these chemical pollutants, dioxins (TCDD, PCDD, HCDD, OCDD), furans (TCDF, PCDF, HCDF, OCDF) and polychlorobiphenyls (PCB), which are in the organic pollutant class, environmental issues due to their toxic effects, diversity and increasing areas of use are important for ecosystem, public health and animal health. Due to their increasing use and high toxic potential, the toxic effects of these pollutants, their toxicodynamic and kinetic properties, and their presence in land and aquatic ecosystems (water, soil, sediment, etc.) and wild and domestic animals (tissue, organs, etc.) need to be revealed through scientific research. Especially with biological monitoring studies carried out with bioindicator organisms, toxic effects can be detected at an early stage and prevented from reaching the population and ecosystem level. In parallel, determining the levels of living things in the food chain and other foods and performing risk assessment through different exposure scenarios is also important in preventing or minimizing potential risks to public health.

Keywords: Pollutants; Dioxins; Public health; Ecosystem; Potantial toxic risk.

HONEY-MEDIATED SYNTHESIZED SILVER NANOPARTICLES: A PROMISING BIOACTIVE AGENT FOR THE PREVENTION OF NOSEMASIS DISEASE IN HONEYBEES

Ogün BOZKAYA[1*] Esra BOZKAYA[1,2] Hüsamettin EKICI[3] Siyami KARAHAN[4]

[1] Kırıkkale. University, Scientific and Technological Researches Application and Research Center, Kırıkkale, TÜRKİYE

[2] Kırıkkale. University, Hacılar Vocational School Occupational Health and Safety Program, Kırıkkale, TÜRKİYE

[3] Kırıkkale. University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Kırıkkale, TÜRKİYE

[4]Kırıkkale University, Faculty of Veterinary Medicine, Department of Histology and Embryology, Kırıkkale, TÜRKİYE

***E-mail:** ogunbozkaya@kku.edu.tr

Nosemosis is a disease of honeybees caused by microorganisms of the genus Nosema. Nosemosis species, *Nosema cerena (NC)* and *Nosema apis (NA)*, are protozoa that belong to the class Microsporidia. These species multiply in the intestines of bees and affect the digestive system. The disease is highly contagious and spreading increasing in many parts of the world. Bees infected with *NA* live 18-54 days while those infected with *NC* die within 8 days. Previous studies focus on treating the disease *in vitro* and *in vivo* using various drugs including albendazole, fumagillin, ovalicin, thalidomide and octreotide. However, none of these drugs have been effective particularly on *NA*. Having shown to be bioactive agents which are proven to be effective against many pathogens including bacteria, fungi, viruses, and mycoplasmas, silver nanoparticles (AgNPs) have been implemented to treatment of various diseases. In the present study, we aimed to synthesize and characterize AgNPs coated with bioactive molecules contained in the bee's own honey to be used in the treatment of bees infected with Nosemosis in future studies. Synthesized by the method of green-synthesis, honey-AgNPs were characterized by UV-Vis, Zeta measurements and FTIR. The peak between 370-500 nm revealed by the UV-Vis analyses was considered as the most important evidence of AgNPs synthesized. The average zeta (electrokinetic) potential and hydrodynamic diameter of honey-AgNPs were found to be -31.6 mV and 29.77 nm, respectively. The zeta measurements revealed that the synthesized nanosized particles had negative surface

with a stable condition in aqueous solution. Moreover, honey coating of the surface of AgNPs was confirmed with FTIR analyses that showed the peaks of bioactive molecules. Further studies should focus on biocompatibility of honey-AgNPs and its possible use as a broad-spectrum anti-microsporidia agent for the treatment and prevention of Nosemosis.

Keywords: Silver nanoparticles; Honeybee; Nosemosis; Microsporidia; *Nosema apis,*

Acknowledgement: Authors would like to thank Kırıkkale University Scientific and Technological Researches Application and Research Center (KUBTUAM).

THE CONTRIBUTION OF SUSTAINABILITY TO ENSURING FOOD SECURITY

Özlem AYTÜRK

Maltepe University, Faculty of Fine Art, Department of Gastronomy and Culinary Arts, İstanbul, TÜRKİYE

E-mail: *ozlemayturk@maltepe.edu.tr*

Taking into account the latest developments and practices, this review examines the contribution of sustainability to food safety. Based on data from the 1996 World Food Summit, food security is defined as follows ; everyone should have physical and economic access to enough, safe and nutritionally adequate food to meet dietary needs and food preferences for active and healthy lives. Threats to food security - that is, the stability of food supplies - include economic factors such as natural disasters, climate change, conflict and volatile price fluctuations. Food insecurity mean not having enough food (in terms of quantity) or not having enough food of the right quality and variety. Food insecurity is measured by the FAO using the Food Insecurity Experience Scale (FIES) as a global reference scale. In the present review, this issue has been examined mainly in the light of the most recent theoretical data. In the second plan, the advantages and disadvantages of the practices that will ensure the sustainability of the food and agriculture industry have been emphasised. It also includes the most recent developments on the subject from the European Food Safety Authority (EFSA), the European Union body that contributes to the safety of the European food and feed chain. In conclusion, it has to be said that sustainable agriculture is seen as an important means of helping to ensure that food continues to be safe to eat.

Keywords: Sustainability; Food security; Climate change; EFS.

CONSIDERATIONS WHEN EXTRACTING ANCIENT DNA

Seda EKİCİ[1]* Akın YİĞİN[2] Mehmet DEMİRCİ[3]

[1] *Veterinary Control Central Research Institute, Ankara, TÜRKİYE*

[2] *Harran University, Faculty of Veterinary Medicine, Department of Genetics, Sanliurfa, TÜRKİYE*

[3] *Kırklareli University, Faculty of Medicine, Department of Medical Microbiology, Sanliurfa, TÜRKİYE*

***E-mail:** seda.ergen@hotmail.com*

aDNA is generally fragmented into lengths shorter than 100 nucleotide pairs and then accumulates unique changes (such as the conversion of the cytosine base to time) through various chemical processes; It means DNA obtained from soft tissues, data or fossils of a dead organism. aDNA studies began in 1984, when Russell Higuchi et al. isolated aDNA from the museum of an extinct zebra species *(Equus quagga quagga)* known as guagga. A new process begins in which the molecules disperse. About a year after this development, Svante Pääbo announced that DNA from a human mummy had been exposed. With the addition of PCR technology, aDNA studies have created an important field within studies by providing archaeologists and anthropologists with a new method of illuminating the history of living things. With the techniques used in ancient DNA systems, more information is obtained about creatures that lived in the past in order to answer archaeological, paleontological and anthropological questions in ancient details. In addition, thanks to the studies carried out with animal and plant DNAs, it contributes to the increase of evolution by determining the living species that have lived since the past and the sales between species. With aDNA studies, these genetic codes and code groups, extending from historical process to the present, can be determined. Ancient DNA studies are used to expand genetic differences and genes between fragments, access phylogenetic trees, and determine other demographic details over time in the world. Various bioarchaeological materials obtained from archaeological excavations are used for aDNA studies. Generally, bones, teeth, dried soft tissue, hair, coprolite and plant remains are used as materials in aDNA studies. Ancient DNA studies are a complex and challenging field of research due to several factors, as low DNA Quantity, Sample Deterioration, Contamination Risk. To successfully

extract and analyze ancient DNA, researchers must follow rigorous protocols and take various precautions at every step of the process: Sample Collection: Careful excavation and handling of the samples are crucial. Researchers must use sterile equipment, wear protective clothing, and work in clean environments to minimize the risk of contamination. DNA Extraction: Specialized methods are used to extract DNA from ancient samples. This typically involves breaking down the bone or tissue and using chemical processes to isolate the DNA. Sequencing and Analysis: Once DNA is successfully extracted, it must be sequenced and analyzed. High-throughput sequencing techniques have greatly improved our ability to work with low-quality and low-quantity ancient DNA. Contamination Control: Researchers use various controls and techniques to identify and minimize contamination. For example, they may use negative controls in the lab to detect contamination, and they may analyze multiple samples to ensure the consistency of results. Reference Databases: Comparing the ancient DNA to reference databases of modern and ancient genomes is crucial for understanding the genetic relationships and historical context of the samples. When these steps are carried out successfully, ancient DNA studies can provide valuable insights into the past, including information about human migration, evolution, and interactions with other species. These studies have significantly expanded our understanding of human history and prehistory.

Keywords: Adna; Bioarchaeological Material; Contamination; Genomes; Prehistory

INVESTIGATION OF ANTI-CANCER EFFECTS OF BORIC ACID ON NEUROBLASTOMA SH-SY5Y CELL LINE

Sibel DAĞLI[1*] Hatice Kübra YİĞİT[2] Hasan ULUSAL[3]

[1] *Mustafa Kemal University, Faculty of Medicine, Department of Medical Microbiology, Hatay, TÜRKİYE*

[2] *Gaziantep University, Faculty of Medicine, Department of Medical Physiology, Gaziantep, TÜRKİYE*

[3] *Gaziantep University, Faculty of Medicine, Department of Medical Biochemistry, Gaziantep, TÜRKİYE*

***E-mail:** sibel-dagli-@hotmail.com*

Neuroblastoma is a disease of the sympathetic nervous system arising from the adrenal medulla or paraspinal tissue during childhood and adolescence; It is the fourth most frequently recurring and fatal cancer type. Neuroblastoma is characterized by a poor prognosis. Treatment success and survival rates with current approaches are not high enough. Therefore, there is a need to develop new agents and treatment methods. SH-SY5Y neuroblastoma-like cells are a subclone of the parental neuroblastoma cell line SK-N-SH. This cell line is frequently chosen in the study of neurological diseases due to its human origin, catecholaminergic (though not fully dopaminergic) neuronal properties, and ease of maintenance. Boric acid constitutes 96% of boron in body fluids and boron derivatives are absorbed by the human body. Boric acid is known to have anticancer, anti-microbial and anti-bacterial properties. However, no studies have been found examining the effectiveness of boric acid on SH-SY5Y cells. In this study, we investigated the anti-cancer properties of boric acid in the neuroblastoma SH-SY5Y cell line. $5x10^3$ SH-SY5Y cells were planted in 96-cell plates, incubated for 24 hours under 5% CO_2, 95% humidity and 37°C conditions, and boric acid solutions prepared at various concentrations (100, 50, 30, 20, 10, 5, 1, 0.5, 0.1 mM) were added. At the end of the 24- and 48-hour incubation periods, cell viability test was performed by adding 10 µL of CCK-8 reagent. Absorbance values were read at 450 nm 2.5 hours after adding reagent. The boric acid dose (IC_{50}) value that killed half of the cells was calculated using Graphpad Prism 10.0.2. As a result of the analyses, boric acid IC_{50} values were found to be 25.67 mM and 20.75 mM with a 95% confidence interval for 24 and 48 hours. In the

results of working, boric acid was found to have cytotoxic effects on SH-SY5Y cells, the most frequently recurring important childhood and adolescence cancer. The findings show that boric acid can be used as a complementary treatment method for neuroblastoma. By examining apoptotic pathways by combining boric acid with cancer drugs through in vivo and in vitro studies, the mechanisms of action can be better elucidated.

Keywords: Boric Acid; SH-SY5Y Cell Line; Neuroblastoma; CCK-8

DETERMINATION OF THE AMOXICILLIN EXCRETION LEVEL IN THE MILK OF ANATOLIAN BUFFALOES

Ulas ACAROZ[1]* Abdullah ERYAVUZ[2] Damla ARSLAN-ACAROZ[3] Sinan INCE[4]

Ibrahim DURMUŞ[5] Azra Mila ERYAVUZ[3] Ismail KUCUKKURT[3]

[1] *Afyon Kocatepe University, Faculty of Veterinary Medicine, Department of Food Hygiene and Technology, Afyonkarahisar, TÜRKİYE*

[2] *Afyon Kocatepe University, Faculty of Veterinary Medicine, Department of Physiology, Afyonkarahisar, TÜRKİYE*

[3] *Afyon Kocatepe University, Faculty of Veterinary Medicine, Department of Biochemistry, Afyonkarahisar, TÜRKİYE*

[4] *Afyon Kocatepe University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Afyonkarahisar, TÜRKİYE*

[5] *Afyon Kocatepe University, Faculty of Veterinary Medicine, Suhut Vocational School, Suhut, TÜRKİYE*

***E-mail:** ulasacaroz@hotmail.com*

This study aimed to determine the amoxicillin residue in the milk of lactating Anatolian buffaloes following intramuscular injection of amoxicillin. Collection of milk samples was carried out twice a day until the 14th milking following amoxicillin injection, and liquid chromatography tandem mass spectrometry (LC/MS/MS) was used for residue analysis. The highest amoxicillin concentration was determined as 13.65 µg/kg. It was determined that the amoxicillin residue level in buffalo milk samples was lower than the maximum residue limit (4 µg/kg) after the fifth milking. Consequently, the results of this study showed that the amoxicillin residue levels in the milk of lactating Anatolian buffaloes decreased significantly after intramuscular injection. The residues remained below the established maximum residue limit which ensured the safety of buffalo milk for consumption.

Keywords: Amoxicillin, Anatolian Buffalo, Milk, LC/MS/MS

Acknowledgement: This study received financial support from the Scientific Research Council of Afyonkocatepe University, Afyonkarahisar, Turkey (project number 17.VF.10).

IN THE HEALTH FIELD (PAIN, NEUROLOGICAL DISORDERS, ETC.) THE MECHANISM OF USING QUANTUM ENERGY

Yasemin SEZGİN

Kırıkkale. University, Faculty of Veterinary Medicine, Department of Pharmacology and Toxicology, Kırıkkale, TÜRKİYE

E-mail: yaseminsezgin@kku.edu.tr

Pain is an unpleasant sensory, emotional and emotional experience that is associated with, accompanied, or can be identified by actual or potential tissue damage. It is defined as "pain is a protection mechanism". Pain is one of the vital functions of the nervous system that produces signals to warn our body against possible tissue damage, and the receptors that recognize the stimulus that causes pain transmit these warnings to the upper centers. Quantum mechanics is a fundamental theory that has been successfully used to explain microscopic phenomena in all branches of physics, as well as scientific principles that explain the behavior of matter, atoms and their interactions with energy at the scale of particles within atoms. Quantum technology is the technology that uses the principles of quantum mechanics and benefits from the field of physics and engineering. Quantum energy treatment, on the other hand, is an understanding that evaluates human beings holistically and aims to ensure biological balance. It is mostly used for support purposes. Such therapy methods are also preferred by health professionals who think that people are not only physical bodies, but also energy and frequency-based structures. Uncovering the varied methods that energetically affect these networks will hopefully direct future efforts to elicit the underlying mechanistic explanation for the rapid cellular energy changes and the clinical observation of rapid mitigation of pain. In our country, in vivo treatment studies are carried out with QUANTUM ENERGY.

Keywords: Quantum Energy; Pain; technology

A CASE OF TETANUS IN A DOG

Erdal KARA **Yasin ŞENEL*** **Naci ÖCAL**

[1]*Kırıkkale University, Faculty of Veterinary Medicine, Department of Internal Medicine, Kırıkkale, TÜRKİYE*

***E-mail:** yasinsenel@kku.edu.tr

All mammals are susceptible to the Clostridium tetani toxins that cause the lethal Tetanus disease. Due to innate tolerance to the Tetanus toxin, clinical instances of Tetanus in cats and dogs are quite uncommon. A 16-month-old male mongrel dog served as the case's material. When the dog's owner saw his dog in the yard laying on his side and unable to stand, he immediately brought the patient to our hospital. When examined for the first time, the patient noticed strong muscular spasms and stiffness, however it was found that the extremities and neck could be moved. A clinical examination revealed no substantial changes in vital signs, complete blood count and 6-parameters (ALP, Cre, ALT, Glucose, TP, BUN) blood biochemistry panel results. The patient was treated with a preliminary diagnosis of toxicity. Within the scope of the treatment, aggressive fluid replacement, diuretics, diazepam were administered to reduce muscle contractions and penicillin was added to the treatment considering the risk of Tetanus. On the 2nd day of treatment, the patient was seen to be in full muscle contraction. The patient was conscious but could not do extension, abduction, or adduction motions. The patient hospitalized for close monitoring and emergency intervention if necessary. In this period the patient showed and effort to move when exposed to any visual or auditory stimulus from his owner. Tetanus was altered as a potential diagnosis and the patient was transferred to an isolation room that was quiet and dark in order to prevent physical stimulation. Total parenteral nutrition, rectal diazepam every six hours and daily penicillin continued. After that the patient was fitted with a single-lumen nasogastric feeding catheter on the third day. Then fed with pate wet food diluted at a 1/2 ratio via tube twice a day along with continuing fluid replacement. During the course of the treatment, urination and defecation were observed. In order to prevent decubitus, the patient was turned over every six hours while being put throughout this treatment on a wipeable soft bed with a visco mattress, where his urine and feces were cleansed. After undergoing treatment for a week, the patient developed decubitus and required care for an open wound. At the beginning of

the treatment the patient's muscles completely contracted, including his jaw. On the 9th day, the jaw muscles began to relax and on the 11th day it was seen that he was attempting to stand up and moving his tail in response to auditory stimuli. However, it was noted that the patient's stomach contents leaked out multiple times before the overall amount of food, liquid, and water decreased. The patient afterwards manifested aspiration pneumonia symptoms, most likely as a result of the patient's lateral recumbent position during which he aspirated stomach contents into the mouth. Despite proper treatment, full clinical recovery was not observed. The patient remained stable for next 6 days but passed away on the 18th day of treatment. In this case report, we wanted to highlight the fact that medical treatment and careful patient care directly affect the prognosis in cases of tetanus, which is uncommon in dogs but well-known in veterinary medicine. We also wanted to highlight the possibility that treatment may fail even in cases with partial recovery if an accompanying aspiration pneumonia is present.

Keywords: Dog; Tetanus; Treatment; Prognosis

EFFECT OF WHITE CHICORY (*CICHORIUM INTYBUS* L.) PLANT USED IN THE DIET ON QUAIL LIVE WEIGHT

İsmail ÜLGER[1*] Mustafa ÖZDEMİR[1] Yeliz TAŞÇI[2*] Hatice ÖZSOLAK[2]

1 Erciyes University, Faculty of Agriculture, Department of Animal Sciences Kayseri, TÜRKİYE

[2]Kayseri Sugar R&D Center, Kayseri Sugar Factory, Kayseri, TÜRKİYE

***E-mail:** yeliz.bayar@kayseriseker.com.tr*

One of the most important parameters in meat production is live weight gain. There are studies to increase the development of animals by using alternative feed sources. This study was carried out to investigate the effect of the white chicory plant used in the diet on quail live weight. In the study, 45 female and 45 male quails were used and the photoperiod was adjusted to 16 hours of light and 8 hours of darkness. In addition to the KM, HK, HY, HS, TSBM, ADF, NDF and ADL values of the white chicory plant, live weight gain was observed in the 3 groups (control, 0.5%g/kg, 1%g/kg). While there was no statistically significant difference between the groups in quail live weights, it was observed that the highest live weight was reached in the group in which 1% g/kg white chicory was added to the diet. The study results show that adding white chicory to the diet can have a positive effect on live weight gain. However, more studies are needed to determine the dose and effect amount to be used.

Keywords: White Chicory; Quail; Alternative Feed Sources

GENETIC DIVERSITY OF LOCAL CHICKENS IN ALGERIA: CHALLENGES AND CONSERVATION IN THE FACE OF MODERN POULTRY PRACTICES

F Z MAHAMMI[1,2] S B S GAOUAR[2,3] D LALOE[4] R FAUGERAS[5] X ROGNON[4,6] M TIXIER-BOICHARD[4] N SAIDI-MEHTAR[2] N TABET-AOUL[2,7]

[1] Higher School of Biological Sciences of Oran, P B 1042, Saim Mohamed 31003, Oran, ALGERIA

[2] Laboratory of Molecular and Cellular Genetics, Department of Applied Molecular Genetics, Faculty of Natural and Life Sciences, University of Science and Technology of Oran, Oran, 31000, ALGERIA

[3] Department of Biology, University of Tlemcen, ALGERIA

[4] INRAE, UMR1313 Animal Genetics and Integrative Biology, Jouy-en-Josas, FRANCE

[5] INRAE, Laboratory of Genetic Analysis for Animal Species (LABOGENA), Jouy-en-Josas, FRANCE

[6] AgroParisTech, UMR1313 Animal Genetics and Integrative Biology, Paris, FRANCE

[7] Department of Biotechnology, University of Oran Es-Senia, Oran, ALGERIA

***E-mail:** fmahammi@gmail.com

Poultry farming has experienced significant growth in Algeria, especially since the development of intensive poultry industry in the 1970s. However, this expansion has led to policies favoring hybrids, weakening rural poultry structures and endangering local chicken populations. These populations have been subjected to indiscriminate crosses, threatening their genetic uniqueness and their ability to withstand variable feeding and housing conditions. Despite their current importance and future potential, little information is available on the genetic diversity of local chickens in Algeria. This study sought to fill this gap by characterizing the genetic variability of village chickens in the western regions of coastal (CT), inland plains (IP) and highlands (HL) of Algeria. A set of 233 chickens was genotyped with a panel of 23 microsatellite markers. Geographical coordinates were individually recorded. Eight reference populations were included in the study: four highly selected commercial pure lines and four lines of French slow-growing chickens. The objective was to reveal the underlying genetic structure and assess

potential genetic introgressions from commercial lines. The results of the genetic analysis showed high genetic diversity within local chicken populations, with low genetic differentiation between ecotypes. Genetic distances were greater between local populations and commercial lines, emphasizing their distinct origins. However, signs of genetic introgression from commercial lines were observed in a significant proportion of individuals, especially in the coastal ecotype. In conclusion, this study provides valuable information on the genetic diversity of local chickens in Algeria, emphasizing both their importance as a genetic reservoir and the challenges they face due to modern poultry practices. The conservation of these populations and the sustainable management of local poultry production will require efforts to prevent the loss of genetic diversity and minimize the impact of genetic introgression.

Keywords: Ecotypes; Gene Flow; Genetic Diversity; Genetic Introgression; Structure; Village Chickens.

THE EFFECT OF PARVOVIRAL ENTERITIS ON MINERAL HOMEOSTASIS IN CANINE

Kübra BEKARER[1]* **Ebru ÇETİN[2]**

[1] *Erciyes University, Faculty of Veterinary Medicine, Graduate School of Health Sciences Department of Veterinary Biochemistry Kayseri, TÜRKİYE*

[2] *Erciyes University, Faculty of Veterinary Medicine Department of Physiology, Kayseri, TÜRKİYE*

***E-mail:** kubrayigit891@gmail.com

Parvoviral enteritis is a highly contagious and potentially life-threatening gastrointestinal disease in canine, primarily affecting puppies. While clinical aspects of parvoviral enteritis are well-documented, the specific impact on mineral homeostasis in affected canine remains a subject of limited research. This study aims to elucidate alterations in essential and trace element levels in canine with parvoviral enteritis. By understanding these changes, we can potentially refine clinical management strategies for affected animals. A total of 52 male and female puppies blood plasma samples were collected from 26 healthy and 26 diseased dogs, aged between 6 weeks and 6 months, brought to the private veterinary clinics in Kayseri. Mineral substance measurement in plasma samples was carried out using the inductively coupled plasma-mass spectrometry (ICP-MS) method at Erciyes University Technology and Application Center (TAUM). The findings indicated that in dogs with parvoviral enteritis, plasma levels of Ca, P, Mo, Fe, and Se are significantly lower compared to healthy dogs ($p<0.05$). On the other hand, there was no statistically significant difference observed between the groups in terms of Na, K, Mg, Cr, Mn, Zn, Co, and Cu levels ($p>0.05$). In conclusion, the observed alterations in plasma mineral profiles highlight the complexity of mineral homeostasis in dogs with parvoviral enteritis. These findings emphasize the need for tailored nutritional support and potential mineral supplementation in the management of affected animals. Lower levels of Ca and P, essential for bone health and growth, may require special attention in puppies and young dogs affected by parvoviral enteritis. Ensuring adequate intake of these minerals is important for their long-term skeletal development. Also, supplementing or modifying the diet to include foods rich in Mo, Fe, and Se could support overall metabolic function and immunity.

Keywords: Canine, Parvoviral Enteritis, Mineral Homeostasis

Acknowledgement: This work was financially supported by Scientific Research Projects Coordination of Erciyes University (Project no: TYL-2023-12847).

ENHACING PROLIFICACY IN ALGERIAN SHEEP BREEDS THROUGH GENETIC CROSSBREEDING

S MISSOUM BENZIANE [1] **F Z MAHAMMI** [1, 2]

[1] *Higher School of Biological Sciences of Oran (ESSBO), BP 1042, Saim Mohamed Oran, ALGERIA*

[2] *Laboratory of Molecular and Cellular Genetics, Department of Applied Molecular Genetics, Faculty of Nature and Life Sciences, University of Sciences and Technology of Oran Mohamed Boudiaf, Oran, ALGERIA*

***E-mail:** smissoum@gmail.com

Prolificacy, the ability of ewes to give birth to multiple lambs in one reproductive cycle, is a critical factor in global sheep production systems, profoundly affecting efficiency and profitability. Understanding its genetic basis is paramount for enhancing reproductive performance and flock productivity. Major candidate genes associated with prolificacy include BMPRIB, BMP15, GDF9, B4GALNT2, and LEPR. Our study focuses on analyzing polymorphisms within these prolificity-associated genes in Algerian sheep breeds. The primary objectives are to establish associations between genetic variations and prolificity levels and to identify mutations conducive to enhancing prolificacy. Our methodology centers on crossbreeding D'man and Ouled Djellal sheep breeds. This pivotal step allows us to assess the genetic improvements resulting from this cross and analyze subsequent production performance. We collect blood samples and comprehensive phenotypic data, including gender, weight, dimensions, wool quality, and reproductive characteristics such as fertility and prolificity rates. Genotyping, relying on DNA extraction and molecular biology techniques like PCR-RFLP and allele-specific PCR, aims to identify causal mutations in major genes implicated in prolificacy among Algerian sheep breeds. The anticipated outcomes of this study will provide invaluable insights for optimizing the genetic and physiological management of Algerian sheep populations. Special attention will be given to the genetic enhancements achieved through the "D'man x Ouled Djellal" crossbreeding. This research will also facilitate the identification of selection criteria in prolific ewes through in-depth statistical analysis. Ultimately, the findings will contribute to the development of a targeted selection plan aimed at increasing the overall productivity of the sheep sector in Algeria.

Keywords: Prolificacy; Major Genes; Sheep; Fertility; Crossbreeding.

DOES TAKING PREVENTIVE MEASURES AGAINST NEONATAL CALF DISEASES AFFECT SUBSEQUENT PERFORMANCE PARAMETERS?

Samet KÖSE[1]* Adnan ŞEHU[2] Erman GÜLENDAĞ[3]

[1]Tierarztpraxis Dr. Fietze, Moorweg 2, 21261 GERMANY

[2] Ankara University, Faculty of Veterinary Medicine, Department of Animal Nutrition and Nutritional Diseases, Ankara, TÜRKİYE

[3] Siirt University, Faculty of Veterinary Medicine, Department of Biostatistics, Siirt, TÜRKİYE

***E-mail:** sametkose1987@googlemail.com

The aim of this study is to investigate the effects of preventive measures against diarrhea and respiratory diseases during the neonatal period of female calves on the disease profile and some productivity parameters in later stages. In this study, twentytwo crossbred Holstein-Friesian female calves born between November 27, 2018 and May 16, 2019, and raised under the same conditions on a private farm were used. In the experimental group (n=11), Diakur© Plus was administered along with milk for the first two weeks. No intervention was performed in the control group (n=11). In both groups, a single dose of a commercial intranasal vaccine containing Parainfluenza 3 (PI3) virus and bovine respiratory syncytial virus (BRSV) was administered on the 9th day. Calves were monitored for diarrhea (D) and respiratory diseases (R) between 0-2 months of age, and heifers were monitored for the age at insemination resulting in pregnancy (AIRP), pre-pregnancy weight (PPBW), the number of inseminations per pregnancy (NIPP) between 15-18 months of age. Also initial calving body weight (ICBW) and daily milk yield in the first two months (MY) between 24-27 months of age. At the end of the study, in the control group, 4 (36%) calves had diarrhea, and 3 (27%) calves had respiratory system problems, while in the experimental group, these numbers were 3 (27%) and 2 (18%), respectively. In the experimental group, heifers had an AIRP that was 16 days shorter than the control group (467.91±56.14 vs. 483.55±51.55, $p>0.05$). Additionally, the NIPP was less (1.09±0.30 vs. 1.36±0.67, $p>0.05$), the PPBW was lower (331.73±39.42 vs. 342.55±37.77, $p>0.05$). Also the ICBW (561.55±41.19 vs. 547.23±35.49, $p>0.05$) and the MY (30.97±2.50 vs. 26.32±0.90, $p<0.05$) parameters were found to be higher.

Dairy farm sustainability and profitability heavily depend on many factors influencing the performance of heifers, including breed, age, body weight, care, nutrition, etc. It is believed that diarrhea and respiratory system diseases occurring during the neonatal period may be among the factors affecting the performance of heifers in the later stages. Therefore, it has been concluded that taking measures against diseases that can develop during the neonatal period may play a significant role in achieving more efficient animals in the future.

Keywords: Calf; Diarrhea; Heifer; Insemination; Milk yield; Reproduction

THE EFFECT OF DIFFERENT DIETS ON SOME REPRODUCTIVE PARAMETERS IN AFRICAN CATFISH (*CLARIAS GARIEPINUS*)

Veselin PENEV* **Atanas BOZHKOV** **Galin NIKOLOV**

Trakia University, Faculty of Agriculture, Department of Animal husbandry, Non-Ruminants and Other Animals, Stara Zagora, BULGARIA

***E-mail:** veskoroni@gmail.com

Nutritional components and feeding strategies are very important in the reproductive process amongst different fish species. Therefore, this experiment aimed to investigate the possibility of using by-products from fish and to evaluate the impact of them on reproductive performances in African catfish (*Clarias gariepinus*). For 45 days, the fish (average weight of 3560.47±234 g) were reared in recirculaton aquaculture system (RAS) and were fed a standard fish feed (FF) with a ration of 1.5% of their body weight per day, while the second group (EE) was fed with trash fish from by-catch (*Engraulis encrasicolus*) was ad libitum. For control of water quality, following hydrochemical parameters SO_4-, NO_3-N, NO_2-N, NH_3-N, PO_4- and permanganate oxidizability were measured daily before feeding and one hour after feeding of fish. No significant differences were found between the groups in the monitored parameters of seminal fluid and fertility, but an increase in EE group was found. The obtained results emphasize the importance of ration in the reproductive process, confirming the rule that feed can improve fertility.

Keywords: African Catfish; By-Product; Commercial Feed; Reproduction

THIS PAGE INTENTIONALLY LEFT BLANK

8TH INTERNATIONAL CONGRESS ON VETERINARY AND ANIMAL SCIENCES

20-21 October 2023 / Online

ANT ACADEMY

www.icvas.gen.tr