



Source details

Veterinary World

Open Access ⓘ

Scopus coverage years: from 2008 to Present

Publisher: Veterinary World

ISSN: 0972-8988 E-ISSN: 2231-0916


Subject area: Veterinary: General Veterinary

Source type: Journal

[View all documents >](#)

[Set document alert](#)

[Save to source list](#) [Source Homepage](#)



Check whether you can access Scopus remotely through your institution

[Maybe later](#) [Check access](#)

CiteScore 2022

3.2

SJR 2022

0.433 ⓘ

SNIP 2022

0.858 ⓘ

[CiteScore](#) [CiteScore rank & trend](#) [Scopus content coverage](#)

Improved CiteScore methodology

CiteScore 2022 counts the citations received in 2019-2022 to articles, reviews, conference papers, book chapters and data papers published in 2019-2022, and divides this by the number of publications published in 2019-2022. [Learn more >](#)

CiteScore 2022 ▾

$$3.2 = \frac{4,721 \text{ Citations } 2019 - 2022}{1,462 \text{ Documents } 2019 - 2022}$$

Calculated on 05 May, 2023

CiteScoreTracker 2023 ⓘ

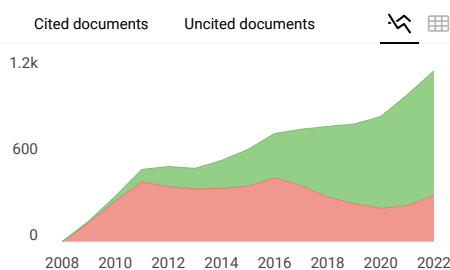
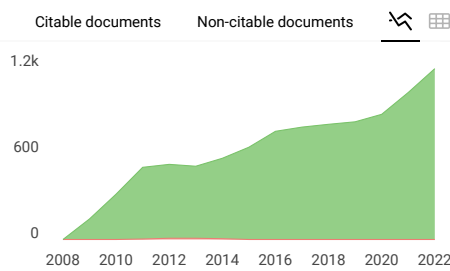
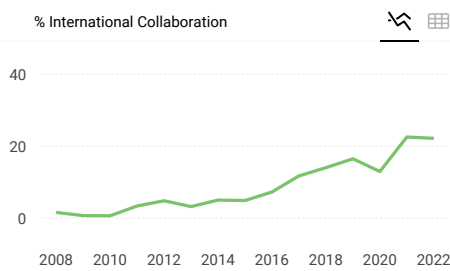
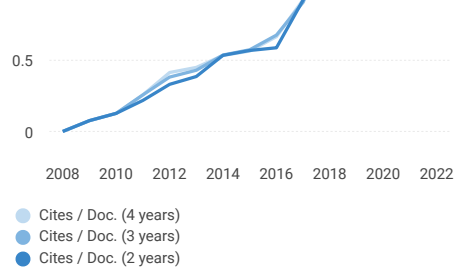
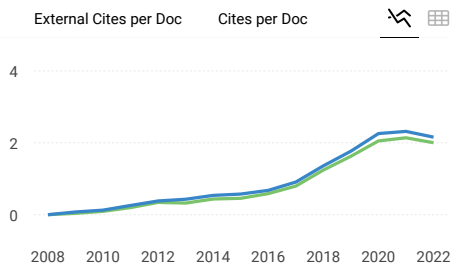
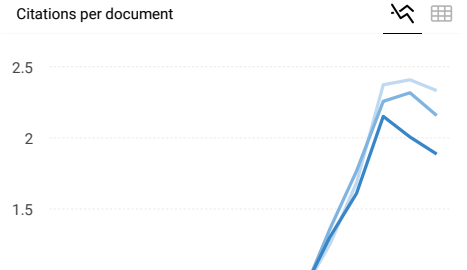
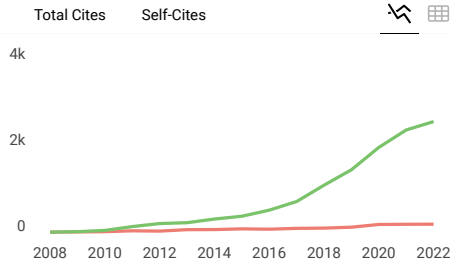
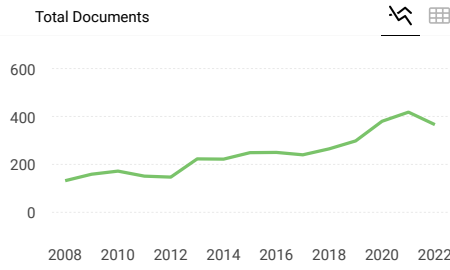
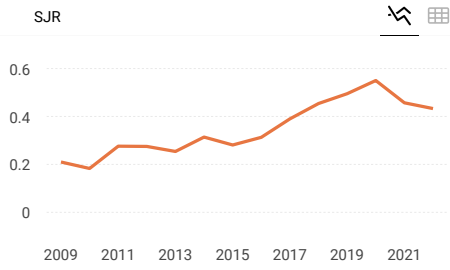
$$2.7 = \frac{3,437 \text{ Citations to date}}{1,254 \text{ Documents to date}}$$

Last updated on 05 July, 2023 • Updated monthly

CiteScore rank 2022 ⓘ

| Category | Rank | Percentile |
|--------------------|---------|------------|
| Veterinary | | |
| General Veterinary | #37/186 | 80th |

[View CiteScore methodology >](#) [CiteScore FAQ >](#) [Add CiteScore to your site ↗](#)



Veterinary World

← Show this widget in your own website

Q2 Veterinary (miscellaneous) best quartile

SJR 2022 0.43

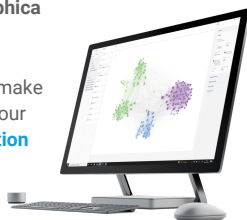
powered by scimagojr.com

Just copy the code below and paste within your html code:

https://www.scimagojr.com



Explore, visually communicate and make sense of data with our [new data visualization tool](#).



Metrics based on Scopus® data as of April 2023

March 2023, Vol.16 No.3**Research (Published online: 15-03-2023)****1. Effect of waste mango silage on the *in vitro* gas production, *in situ* digestibility, intake, apparent digestibility, and ruminal characteristics in calf diets**

Ulises Remo Cañaverl-Martínez, Paulino Sánchez-Santillán, Nicolás Torres-Salado, David Hernández-Sánchez, Jerónimo Herrera-Pérez, and Marco Antonio Ayala-Monter

Veterinary World, 16(3): 421-430

Abstract (<https://www.veterinaryworld.org/Vol.16/March-2023/1.html>)

PDF (<https://www.veterinaryworld.org/Vol.16/March-2023/1.pdf>)

Research (Published online: 15-03-2023)**2. Physiological characteristics and virulence gene composition of selected serovars of seafood-borne *Salmonella enterica***

Fathima Salam, Manjusha Lekshmi, Parmanand Prabhakar, Sanath H. Kumar, and Binaya Bhusan Nayak

Veterinary World, 16(3): 431-438

Abstract (<https://www.veterinaryworld.org/Vol.16/March-2023/2.html>)

PDF (<https://www.veterinaryworld.org/Vol.16/March-2023/2.pdf>)

Research (Published online: 16-03-2023)**3. Virome diversity of *Hyalomma dromedarii* ticks collected from camels in the United Arab Emirates**

Nighat Perveen, Biduth Kundu, Naganeeswaran Sudalaimuthuasari, Raja Saeed Al-Maskari, Sabir Bin Muzaffar, and Mohammad Ali Al-Deeb

Veterinary World, 16(3): 439-448

Abstract (<https://www.veterinaryworld.org/Vol.16/March-2023/3.html>)

PDF (<https://www.veterinaryworld.org/Vol.16/March-2023/3.pdf>)

Research (Published online: 16-03-2023)**4. Antimicrobial resistance pattern of avian pathogenic *Escherichia coli* with detection of extended-spectrum β -lactamase-producing isolates in broilers in east Algeria**

Chahrazed Aberkane, Ahmed Messai, Chafik Redha Messai, and Tarek Boussaada

Veterinary World, 16(3): 449-454

Abstract (<https://www.veterinaryworld.org/Vol.16/March-2023/4.html>)

PDF (<https://www.veterinaryworld.org/Vol.16/March-2023/4.pdf>)

[PDF \(https://www.veterinaryworld.org/Vol.16/March-2023/18.pdf\)](https://www.veterinaryworld.org/Vol.16/March-2023/18.pdf)

Research (Published online: 22-03-2023)

19. Molecular prevalence and phylogenetic confirmation of bovine trichomoniasis in aborted cows in Iraq

Hasanain A. J. Gharban

Veterinary World, 16(3): 580-587

[Abstract \(https://www.veterinaryworld.org/Vol.16/March-2023/19.html\)](https://www.veterinaryworld.org/Vol.16/March-2023/19.html)

[PDF \(https://www.veterinaryworld.org/Vol.16/March-2023/19.pdf\)](https://www.veterinaryworld.org/Vol.16/March-2023/19.pdf)

Research (Published online: 22-03-2023)

20. Effect of feeding pomegranate seed pulp on Awassi lambs' nutrient digestibility, growth performance, and carcass quality

Belal S. Obeidat

Veterinary World, 16(3): 588-594

[Abstract \(https://www.veterinaryworld.org/Vol.16/March-2023/20.html\)](https://www.veterinaryworld.org/Vol.16/March-2023/20.html)

[PDF \(https://www.veterinaryworld.org/Vol.16/March-2023/20.pdf\)](https://www.veterinaryworld.org/Vol.16/March-2023/20.pdf)

Research (Published online: 24-03-2023)

21. Psychological dominant stressor modification to an animal model of depression with chronic unpredictable mild stress

Lisa Pangemanan, Irwanto Irwanto, and Margarita M. Maramis

Veterinary World, 16(3): 595-600

[Abstract \(https://www.veterinaryworld.org/Vol.16/March-2023/21.html\)](https://www.veterinaryworld.org/Vol.16/March-2023/21.html)

[PDF \(https://www.veterinaryworld.org/Vol.16/March-2023/21.pdf\)](https://www.veterinaryworld.org/Vol.16/March-2023/21.pdf)

Research (Published online: 24-03-2023)

22. Expression profiling of heat shock protein genes in whole blood of Romosinuano cattle breed

Juan Camilo Taborda-Charris, Roy Rodríguez-Hernández, María Paula Herrera-Sánchez, Heinner Fabian Uribe-García, Rafael J. Otero-Arroyo, Juan Sebastian Naranjo-Gomez, Kelly Johanna Lozano-Villegas, and Iang Schroniltgen Rondón-Barragín

Veterinary World, 16(3): 601-606

[Abstract \(https://www.veterinaryworld.org/Vol.16/March-2023/22.html\)](https://www.veterinaryworld.org/Vol.16/March-2023/22.html)

[PDF \(https://www.veterinaryworld.org/Vol.16/March-2023/22.pdf\)](https://www.veterinaryworld.org/Vol.16/March-2023/22.pdf)

Research (Published online: 26-03-2023)

23. A cross-sectional survey for the assessment of biosecurity measures in small-scale duck farms in Qalyoubia, Egypt: Comprehensive evaluation and procedural recommendations

Amany Adel, Hemat S. El-Sayed, Abdelhafez Samir, May F. Abdelaty, Engy A. Hamed, and Heba Roshdy

Veterinary World, 16(3): 607-617

Editor-in-Chief

Anjum V. Sherasiya - Ex-Veterinary Officer, Department of Animal Husbandry, Gujarat State, India
<https://orcid.org/0000-0002-1598-1820>

Founding Associate Editor

R. G. Jani - Ex-Coordinator of Wildlife Health, Western Region Centre, Indo-US Project, Department of Veterinary Medicine, Veterinary College, Anand Agricultural University, Anand - 388001, Gujarat, India.

Associate Editors

B. A. Lubisi - Virology, MED Programme, ARC - Onderstepoort Veterinary Institute, No. 100 Old Soutpan Road, Onderstepoort, Tshwane, 0110, South Africa
Google Scholar profile: <https://scholar.google.com/citations?user=Wwcc5-8AAAAJ&hl=en>
Interest area: Virology

Girija Regmi - Department of Cardiovascular Biology, Oklahoma Medical Research Foundation, Oklahoma City, Oklahoma, USA
<https://orcid.org/0000-0001-6827-3783>
Google Scholar profile: <https://scholar.google.com/citations?user=JRhk5-sAAAAJ&hl=en>
Interest area: Anatomy - Animal Hygiene, Husbandry, Nutrition, and Food Control - Animal Nutrition - Animal Reproduction - Animal Science - Antimicrobial resistance - Bacteriology - Biological Sciences - Biomedical Sciences - Hematology - Immunohistochemistry - Microbiology - Molecular Biology - Veterinary Anatomy, Histology, and Physiology - Veterinary Medicine - Veterinary Medicine and Infectious Diseases - Veterinary Pathology - Veterinary Science - Zoonoses

Widya Paramita Lokapirnasari - Professor, Department of Animal Husbandry, Airlangga University, FKH, Kampus C Unair, Jl Mulyorejo, Surabaya, Indonesia
<https://orcid.org/0000-0002-0319-7211>
Google Scholar profile: <https://scholar.google.co.id/citations?user=eS3yVQQAAAAJ&hl=id>
Interest area: Animal Nutrition - Cattle Husbandry - Feed Supplements - Polymerase Chain Reaction - Poultry Husbandry - Probiotics

Ayman Abdel-Aziz Swelum - Professor of Theriogenology, Faculty of Veterinary Medicine, Zagazig University, Zagazig, Egypt; Department of Animal Production, College of Food and Agriculture Sciences, King Saud University, Riyadh, Saudi Arabia
<http://orcid.org/0000-0003-3247-5898>
Google Scholar profile: <https://scholar.google.com/citations?user=OZTI3poAAAAJ&hl=en>
Profile: <http://www.staffdata.zu.edu.eg/en/ShowData/18313>

<https://faculty.ksu.edu.sa/ar/aswelum>

Interest area: Animal Reproduction - Animal Production - Embryo transfer - Artificial Insemination

Mario Manuel Dinis Ginja Department of Veterinary Sciences, Center for Research and Agro-Environmental and Biological Technologies, University of Tras-os-Montes and Alto Douro, Portugal

<https://orcid.org/0000-0002-0464-7771>

Publons profile: <https://publons.com/researcher/1180094/mario-manuel-dinis-ginja/>

Interest area: Orthopaedics - Radiology (Diagnostic) - Sonography - Veterinary Medicine - Veterinary Science

Panagiotis E Simitzis - Laboratory of Animal Breeding and Husbandry, Department of Animal Science, Agricultural University of Athens, 75 Iera Odos, 11855, Athens, Greece

<http://orcid.org/0000-0002-1450-4037>

Google Scholar profile: <https://scholar.google.com/citations?user=14F6cAQAAAAJ&hl=en>

Interest area: Dietary Antioxidants - Feed Supplements - Animal Behaviour - Animal Welfare - Livestock Management - Poultry Husbandry - Sheep Husbandry - Swine Husbandry - Products' Quality Assessment

Gul Ahmad - Associate Professor of Biology (Tenured), Department of Natural Sciences, School of Arts & Sciences, Peru State College, Peru, Nebraska 68321, USA

Google Scholar profile: <https://scholar.google.com/citations?user=WOIDNKUAAAAJ&hl=en>

Bartosz Kieronczyk - Poznan University of Life Sciences, Poznan, Greater Poland, Poland

<https://orcid.org/0000-0001-6006-117X>

Google Scholar profile: <https://scholar.google.pl/citations?user=SyprUmAAAAJ&hl=en>

Interest area: Animal Nutrition - Animal Science - Antimicrobial resistance - Aquaculture - Feed Supplements - Livestock Management - Livestock Products Technology - Microbiology - Physiology - Poultry Science - Waste Management of Agro Products

Alberto Elmi - University of Bologna, Ozzano dell'Emilia, Bologna, Italy

<https://orcid.org/0000-0002-7827-5034>

Google Scholar profile: <https://scholar.google.it/citations?user=ej4LzNgAAAAJ&hl=it>

Interest area: Animal Reproduction - Laboratory Animal Research - Laboratory Medicine - Physiology - Swine Medicine - Wildlife

Editorial board

Suresh H. Basagoudanavar - FMD Vaccine Research Laboratory, Indian Veterinary Research Institute, Bangalore- 560024, Karnataka, India

<https://orcid.org/0000-0001-7714-3120>

ResearchGate profile: <https://www.researchgate.net/profile/Suresh-Basagoudanavar>

Interest area: Biotechnology - Immunology - Virology

Gyanendra Gongal - Senior Public Health Officer (Food safety, zoonoses and One Health). World Health Emergency Programme, WHO Regional Office for south East Asia, New Delhi, India

<https://orcid.org/0000-0002-6539-7569> Google Scholar profile:

<https://scholar.google.com/citations?user=XNCypDcAAAAJ&hl=en>

Interest area: Public Health - Zoonoses - One Health

Md. Tanvir Rahman - Department of Microbiology and Hygiene, Faculty of Veterinary Science, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh

<https://orcid.org/0000-0001-5432-480X>

Google Scholar profile: [https://scholar.google.com/citations?](https://scholar.google.com/citations?user=vp6xgh0AAAAJ&hl=en)

[user=vp6xgh0AAAAJ&hl=en](https://scholar.google.com/citations?user=vp6xgh0AAAAJ&hl=en)

Interest area: Antimicrobial resistance - Virulence-Food hygiene- Public Health - Vaccine - One Health

Fouad Kasim Mohammad - Professor Emeritus, Pharmacology & Toxicology, College of Veterinary Medicine, University of Mosul, Mosul, Iraq

Google Scholar profile: [https://scholar.google.com/citations?](https://scholar.google.com/citations?user=zgCIA4UAAAAJ&hl=en)

[user=zgCIA4UAAAAJ&hl=en](https://scholar.google.com/citations?user=zgCIA4UAAAAJ&hl=en)

Interest area: Pharmacology - Toxicology

Joao Simoes - Universidade de Tras-os-Montes e Alto Douro, Vila Real, Portugal

<https://orcid.org/0000-0002-4997-3933>

Google Scholar profile: [https://scholar.google.com/citations?user=ftLFW-](https://scholar.google.com/citations?user=ftLFW-sAAAAJ&hl=en)

[sAAAAJ&hl=en](https://scholar.google.com/citations?user=ftLFW-sAAAAJ&hl=en)

Interest area: Large Animal Medicine - Mastitis - Reproductive medicine - Veterinary Medicine

Abdelaziz ED-DRA - Department of Biology, Faculty of Science, Moulay Ismail University, BP. 11201 Zitoune, Meknes, Morocco

<https://orcid.org/0000-0003-3273-1767>

Google Scholar profile: [https://scholar.google.com/citations?user=ftL-](https://scholar.google.com/citations?user=ftL-1V0AAAAJ&hl=en)

[1V0AAAAJ&hl=en](https://scholar.google.com/citations?user=ftL-1V0AAAAJ&hl=en)

Interest area: Antimicrobial resistance - Clinical Microbiology - Food - Food/Meat Hygiene - Polymerase Chain Reaction

Filippo Giarratana - Department of Veterinary Medicine, University of Messina, Polo Universitario dell'Annunziata, 98168 Messina, Italy

<https://orcid.org/0000-0003-0892-4884>

Google Scholar profile: [https://scholar.google.com/citations?user=lut-](https://scholar.google.com/citations?user=lut-WbIAAAAAJ&hl=it)

[WbIAAAAAJ&hl=it](https://scholar.google.com/citations?user=lut-WbIAAAAAJ&hl=it)

Interest area: Antimicrobial resistance - Bacteriology - Food/Meat Hygiene - Plant Science - Essential oils

Eduardo Jorge Boeri - Institute of Zoonosis Luis Pasteur, Buenos Aires, Argentina

<https://orcid.org/0000-0001-8535-0306>

Google Scholar profile: [https://scholar.google.com/citations?](https://scholar.google.com/citations?user=aerl_4oAAAAJ&hl=en&oi=sra)

[user=aerl_4oAAAAJ&hl=en&oi=sra](https://scholar.google.com/citations?user=aerl_4oAAAAJ&hl=en&oi=sra)

Interest area: Brucellosis - Microbiology - Veterinary Medicine - Veterinary Public Health - Zoonoses

Kumar Venkitanarayanan - Graduate Programs Chair, Honors and Pre-Vet Programs Advisor, Department of Animal Science, University of Connecticut, Storrs, CT 06269, USA

Google Scholar profile: [https://scholar.google.com/citations?](https://scholar.google.com/citations?hl=en&user=Nr9CY28AAAAJ)

[hl=en&user=Nr9CY28AAAAJ](https://scholar.google.com/citations?hl=en&user=Nr9CY28AAAAJ)

Interest area: Bacteriology - Clinical Microbiology - Infectious Diseases - Veterinary Medicine

Karim El-Sabrou - Poultry Production Department, Alexandria University, Alexandria, Egypt

<https://orcid.org/0000-0003-2762-2363>

Google Scholar profile: <https://scholar.google.com/citations?hl=en&user=q-1jH8AAAAAJ>

Interest area: Poultry Husbandry

Ali Aygun - Selçuk University, Agriculture Faculty, Department of Animal Science, Konya, TURKEY

<https://orcid.org/0000-0002-0546-3034>

Google Scholar profile: [https://scholar.google.com/citations?](https://scholar.google.com/citations?hl=en&user=nZsp5iAAAAAJ)

[hl=en&user=nZsp5iAAAAAJ](https://scholar.google.com/citations?hl=en&user=nZsp5iAAAAAJ)

Interest area: Poultry Husbandry - Poultry Medicine

Ionel D. Bondoc - Associate Professor, Department of Public Health, Faculty of Veterinary Medicine Iasi, University of Life Sciences "Ion Ionescu de la Brad" Iasi, Romania

<https://orcid.org/0000-0002-5958-7649>

Google Scholar profile: <https://scholar.google.ro/citations?user=-dUf6oYAAAAJ&hl=ro>

Publons Profile: <https://publons.com/researcher/741287/ionel-bondoc/>

Interest area: Dairy Science - Epidemiology - Food Science - Food Technology - Food Law - One Health - Parasitology - Meat Inspection - Pathogens - Foodborne Diseases - Food Toxicology - Veterinary Public Health - Wildlife Diseases - Zoonoses

Liliana Aguilar-Marcelino - National Center for Disciplinary Research in Animal Health and Safety, National Institute for Agricultural and Livestock Forestry Research, Mexico

<https://orcid.org/0000-0002-8944-5430>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=ZbMMP-UAAAAJ)

[hl=ro&user=ZbMMP-UAAAAJ](https://scholar.google.ro/citations?hl=ro&user=ZbMMP-UAAAAJ)

Interest area: Biology - Ethnoveterinary - Parasitology - Veterinary Medicine - Veterinary Public Health

Anut Chantiratikul - Department of Agricultural Technology, Faculty of Technology, Mahasarakham University, Muang, Mahasarakham Province 44150 Thailand

<https://orcid.org/0000-0002-8313-5802>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=QogjWpgAAAAJ)

[hl=ro&user=QogjWpgAAAAJ](https://scholar.google.ro/citations?hl=ro&user=QogjWpgAAAAJ)

Interest area: Biology - Animal Nutrition

Nuh Kilic - Department of Surgery, Faculty of Veterinary Medicine, Adnan Menderes University, Turkey

<https://orcid.org/0000-0001-8452-161X>

Google Scholar profile: <https://scholar.google.ro/citations?>

hl=ro&user=APVrx1cAAAAJ

Interest area: Large Animal Medicine - Surgery - Veterinary Medicine

Hanna Markiewicz - Milk Examination Laboratory, Kazimierz Wielki

University in Bydgoszcz, Poland

<https://orcid.org/0000-0001-8225-0481>

ResearchGate profile: <https://www.researchgate.net/scientific-contributions/H-Markiewicz-10381112>

Interest area: Large Animal Medicine - Mastitis

N. De Briyne - Federation of Veterinarians of Europe, Brussels, Belgium

<https://orcid.org/0000-0002-2348-930X>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=BOhfORAAAAAJ)

hl=ro&user=BOhfORAAAAAJ

Interest area: Animal Science - Antimicrobial resistance

Hasan Meydan - Akdeniz University, Faculty of Agriculture, Antalya, Turkey

<https://orcid.org/0000-0003-4681-2525>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=T2uHga0AAAAJ)

hl=ro&user=T2uHga0AAAAJ

Interest area: Biotechnology - Genetics - Veterinary Medicine

Suleyman Cilek - Kirikkale Universitesi, Kirikkale, kirikkale, Turkey

<https://orcid.org/0000-0002-2352-649X>

ResearchGate profile: <https://www.researchgate.net/scientific-contributions/Suleyman-Cilek-2092525513>

Interest area: Animal Nutrition - Animal Nutrition - Animal Reproduction - Animal Reproduction - Animal Reproduction - Breeding - Cattle Husbandry - Cattle/buffalo management - Equine Medicine - Genetics - Livestock Management - Mastitis - Molecular Genetics - Poultry Husbandry - Poultry Husbandry - Sheep Husbandry - Sheep Husbandry - Small Animal Medicine - Swine Husbandry - Veterinary Medicine

Rodrigo Alberto Jerez Ebensperger - University of Zaragoza, Spain

Interest area: Animal Reproduction - Artificial Insemination - Biotechnology - Breeding - Embryo Transfer Technology - Equine Medicine - Large Animal Medicine - Livestock Management - Small Animal Medicine - Veterinary Medicine - Wildlife

Parag Nigam - Department of Wildlife Health Management, Wildlife Institute of India, Dehradun, India

ResearchGate profile: <https://www.researchgate.net/profile/Parag-Nigam>

Interest area: Veterinary Medicine - Veterinary Public Health - Wildlife - Zoonoses

Alessandra Pelagalli - Department of Advanced Biomedical Sciences, University of Naples Federico II, Italy

<https://orcid.org/0000-0002-1133-4300>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=T1iZqmMAAAAJ)

hl=ro&user=T1iZqmMAAAAJ

Interest area: Physiology

Jamal Gharekhani - Senior researcher, Iranian Veterinary Organization (IVO), Hamedan, Iran

<https://orcid.org/0000-0001-5882-8861>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=vlhjoBEAAAAJ)

[hl=ro&user=vlhjoBEAAAAJ](https://scholar.google.ro/citations?hl=ro&user=vlhjoBEAAAAJ)

Interest area: Parasitology - Pathobiology - Veterinary Public Health

Ipsita Mohanty - Postdoctoral Research Fellow, Children's Hospital of Philadelphia Research Institute, (CHOP), Philadelphia

<https://orcid.org/0000-0003-0894-4770>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=anWIO7IAAAAAJ)

[hl=ro&user=anWIO7IAAAAAJ](https://scholar.google.ro/citations?hl=ro&user=anWIO7IAAAAAJ)

Interest area: Pharmacology - Toxicology - Physiology - Cardiology

Alejandro Hidalgo - Preclinical Science Department, Faculty of Medicine, Universidad de La Frontera, Temuco, Chile

<https://orcid.org/0000-0002-2247-4878>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=5vejgSAAAAAJ)

[hl=ro&user=5vejgSAAAAAJ](https://scholar.google.ro/citations?hl=ro&user=5vejgSAAAAAJ)

Interest area: Zoonotic parasitic diseases - Parasite phylogeny - Zoology - Parasitology

Hua-Ji Qiu - Professor, Harbin Veterinary Research Institute (HVRI), Chinese Academy of Agricultural Sciences (CAAS), Harbin, Heilongjiang, 150069, P.R. China

<https://orcid.org/0000-0003-4880-5687>

Profile:

http://www.hvri.ac.cn/zzjg/cxtd/zlxzrbcxtd/sx_20180726100149743651/index.htm

Interest area: Classical swine fever - African swine fever - Pseudorabies - Innate and adaptive immunity - Virus-host interactions - Pathogenesis - Epidemiology - Vaccines - Diagnostic assays - Probiotics

Hasria Alang - Biology Lecturer at STKIP-PI Makassar, Makassar, Indonesia

<https://orcid.org/0000-0001-9393-9575>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=NpwjancAAAAJ)

[hl=ro&user=NpwjancAAAAJ](https://scholar.google.ro/citations?hl=ro&user=NpwjancAAAAJ)

Interest area: Microbiology - Molecular Biology

Belgin Siriken - Professor, Department of Water Products Diseases, Faculty of Veterinary Medicine, Ondokuz Mayıs University, Kurupelit Campus, 55200 Samsun, Turkey

<https://orcid.org/0000-0002-5793-1792>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=JpuWvaUAAAAJ)

[hl=ro&user=JpuWvaUAAAAJ](https://scholar.google.ro/citations?hl=ro&user=JpuWvaUAAAAJ)

Interest area: Food - Food science - Food Technology - Food borne diseases - Antibiotic resistance - One Health - Veterinary Public Health

Hussein Awad Hussein - Professor of Internal Veterinary Medicine, Department of Animal Medicine, Faculty of Veterinary Medicine, Assiut University, Assiut 71526, Egypt

<https://orcid.org/0000-0003-0449-8283>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=oJySPI8AAAAJ)

[hl=ro&user=oJySPI8AAAAJ](https://scholar.google.ro/citations?hl=ro&user=oJySPI8AAAAJ)

Interest area: Internal Medicine - Spectrophotometry - Ultrasonography - Parasitological analysis - Blood gas analysis - Metabolic profiling - Veterinary Medicine - Large Animal Medicine - Equine Medicine - Mastitis

Tanko Polycarp Nwunuji - Senior lecturer, Department of Veterinary Microbiology and Pathology, Faculty of Veterinary Medicine, University of Jos, Plateau State, Nigeria

<https://orcid.org/0000-0003-1459-2564>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=MD7ehVwAAAAJ)

[hl=ro&user=MD7ehVwAAAAJ](https://scholar.google.ro/citations?hl=ro&user=MD7ehVwAAAAJ)

Interest area: Clinical and Anatomic Pathology - Oncology - Fisheries with special interest in bacterial diseases of fishes and other diseases associated with aquaculture management - Diseases of small and large ruminants - Laboratory animal medicine - Diseases of Dogs, horses and pigs as well as non-infectious diseases such as Diabetes and stress-induced pathologies

Md. Ahaduzzaman - Associate Professor, Department of Medicine and Surgery, Faculty of Veterinary Medicine, Chittagong Veterinary and Animal Sciences University, Bangladesh

<https://orcid.org/0000-0002-0568-0506>

Google Scholar profile: [https://scholar.google.ro/citations?](https://scholar.google.ro/citations?hl=ro&user=u6x_8FkAAAAJ)

[hl=ro&user=u6x_8FkAAAAJ](https://scholar.google.ro/citations?hl=ro&user=u6x_8FkAAAAJ)

Interest area: Antimicrobial resistance - Infectious Diseases - Poultry Medicine - Veterinary Medicine - Veterinary Microbiology and Parasitology - Veterinary Public Health - Veterinary Science - Meta-analysis - Phylogenetic analysis

Vanessa S. Cruz - Professor, Department of Veterinary Medicine, Catholic University Center of East Minas (Unileste), Avenue President Tancredo de Almeida Neves, 3500, University District, Coronel Fabriciano - MG, Brazil

<https://orcid.org/0000-0002-8914-5964>

Profile: <http://lattes.cnpq.br/8788967925940484>

Interest area: Cancer - Molecular Biology - Veterinary Medicine - Veterinary Pathology - Small Animal Clinic and Surgery (oncology, geriatrics, breeding and behavior of dogs and cats)

R.Umaya Suganthi - Principal Scientist, ICAR-National Institute of Animal Nutrition and Physiology (ICAR-NIANP), Government of India, Bangalore 560 030, Karnataka, India

<https://orcid.org/0000-0002-7710-6271>

Google Scholar Profile: [https://scholar.google.co.in/citations?](https://scholar.google.co.in/citations?user=6VEZ7XMAAAAJ&hl=en)

[user=6VEZ7XMAAAAJ&hl=en](https://scholar.google.co.in/citations?user=6VEZ7XMAAAAJ&hl=en)

Interest area: Antimicrobial resistance - Antibiotic growth promoters in poultry and their alternatives - Phytochemicals - Oxidative stress and antioxidants - Mycotoxin toxicity and amelioration - Selenium and selenoproteins

Last updated on 23-03-2022

Site Links

Editorial board

(<http://www.veterinaryworld.org/editorial.html>)

Instruction for authors

(<http://www.veterinaryworld.org/manuscript.html>)

Author declaration certificate

([http://www.veterinaryworld.org/author declaration certificate.pdf](http://www.veterinaryworld.org/author%20declaration%20certificate.pdf))

Tutorial for online submission

(http://my.ejmanager.com/scopemed_tutorial_authors.pdf)

Manuscript template

(<http://www.veterinaryworld.org/Manuscripttemplate.pdf>)

Submit your manuscript (<http://my.ejmanager.com/vetworld/>)

FAQ (<http://www.veterinaryworld.org/FAQ.html>)

Reviewer guidelines (http://www.veterinaryworld.org/Reviewer_guideline.pdf)

Open access policy (<http://www.veterinaryworld.org/subscription.html>)

Most cited articles ([http://scholar.google.co.in/citations?](http://scholar.google.co.in/citations?hl=en&authuser=1&user=vWiG7DoAAAAJ)

[hl=en&authuser=1&user=vWiG7DoAAAAJ](http://scholar.google.co.in/citations?hl=en&authuser=1&user=vWiG7DoAAAAJ))

Archive (<http://www.veterinaryworld.org/tableofcontent.html>)

Editorial Office

Veterinary World Star, Gulshan Park, NH-8A, Chandrapur Road,

Wankaner - 363621, Dist. Morbi (Gujarat), India

E-mail: editorveterinaryworld@gmail.com

Website: www.veterinaryworld.org

Editor-in-Chief



Dr. Anjum V. Sherasiya

E-mail: editorveterinaryworld@gmail.com

Publisher: Veterinary World, E-mail: veterinaryworldpublisher@gmail.com

Designed By [Madni Infoway \(http://www.madniinfoway.com/\)](http://www.madniinfoway.com/)

Psychological dominant stressor modification to an animal model of depression with chronic unpredictable mild stress

Lisa Pangemanan^{1,2} , Irwanto Irwanto³ , and Margarita M. Maramis⁴ 

1. Doctoral Program of Medical Science, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia;
2. Department of Child Health, Faculty of Medicine, Widya Mandala Catholic University, Surabaya, Indonesia;
3. Department of Child Health, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia;
4. Department of Psychiatry, Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia.

Corresponding author: Irwanto Irwanto, e-mail: irwanto@fk.unair.ac.id

Co-authors: LP: lisa.pangemanan-2020@fk.unair.ac.id, MMM: margarit@fk.unair.ac.id

Received: 10-12-2022, **Accepted:** 09-02-2023, **Published online:** 24-03-2023

doi: www.doi.org/10.14202/vetworld.2023.595-600 **How to cite this article:** Pangemanan L, Irwanto I, and Maramis MM (2023) Psychological dominant stressor modification to an animal model of depression with chronic unpredictable mild stress, *Veterinary World*, 16(3): 595–600.

Abstract

Background and Aim: Chronic unpredictable mild stress (CUMS) is a protocol widely used to create an animal model of depression with food deprivation, water deprivation, and physical-dominant stressors as routine procedures. However, human depression mainly involves psychological stressors and does not always involve a lack of food and water; thus, CUMS procedures should be modified accordingly. Therefore, this study aimed to create an animal model of depression, mainly focusing on a psychologically dominant stressor without food and water deprivation.

Materials and Methods: The CUMS and control groups, respectively, received CUMS modification (psychologically dominant stressors without food and water deprivation) for 21 days. A 24-h sucrose preference test (SPT) was used to assess the successful creation of an animal model of depression. Daily food intake measurements, weekly weight monitoring, and weight gain calculations were performed. Either an independent sample t-test or the Mann–Whitney test was used.

Results: Of the 42 rats included, 39 completed the study. Chronic unpredictable mild stress procedures for 21 days significantly reduced the SPT ($p < 0.05$), mean body weight ($p < 0.05$), and weekly weight gain ($p < 0.05$) in the CUMS group compared to the control group. However, the weekly average food intake did not statistically differ between the two groups.

Conclusion: Psychological dominant CUMS modification to an animal model of depression resulted in lower SPT, body weight, and weekly weight gain in the CUMS group than in the control group.

Keywords: body weight, chronic unpredictable mild stress, modification, psychological, rat, sucrose preference test.

Introduction

Major depression is an increasing mental problem during adolescence [1–4]. Anhedonia and weight loss without diet, among others, are depression criteria based on the Diagnostic and Statistical Manual of Mental disorders (DSM)-V [3]. An animal depression model is needed to investigate the symptomatology, pathophysiology, and treatment of depression [5, 6]. Chronic unpredictable mild stress (CUMS) is widely used to create a reliable animal depression model [7, 8]. It consisted of repeated, unpredicted, and uncontrollable stressors lasting for weeks [9]. A lower weight gain [8] and anhedonia (decreased sucrose preference test [SPT]) that can be reversed by antidepressant treatment is found in an animal depression model [9–12]. Katz first developed chronic stressors to create an animal depression model using strong stressors such as physical-dominant stressors, psychological stressors, food deprivation, and water

deprivation [13]. Willner modified these protocols using a milder stressor still incorporated with food and water deprivation [14]. Water/food deprivation periods can lead to weight loss [15]. Most human stressors are psychological, and the resulting weight loss is not related to diet [16–19]. As various stressors will elicit different manifestations [20, 21], a suitable animal model of depression with stressors mimicking human stressors is needed [22, 23]. Modified CUMS protocols should be designed if a psychologically dominant stressor without food and water deprivation is needed.

This study aimed to develop an animal depression model using psychologically dominant CUMS modification.

Materials and Methods

Ethical approval

The protocols were reviewed and approved by the Animal Care and Use Committee, Faculty of Veterinary Medicine, Universitas Airlangga, Surabaya, Indonesia with the number: 2.KE.120.10.2021. All efforts were conducted to ensure the minimal number of animals used and minimize suffering.

Study period and location

The study was conducted from January to March 2022 in the experimental animal laboratory (LPHC),

Copyright: Pangemanan, et al. Open Access. This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated.

Table-1: Chronic unpredictable mild stress.

| No. | Stressor | Definition | Type |
|-----|--|---|---------------|
| 1 | Immobilization for 2 h | Rats were individually restrained in a plastic cylinder for 2 h. | Psychological |
| 2 | Cold swimming for 3 min | Rats were placed in a cylindrical clear plastic container filled with 4°C water for 3 min. | Physical |
| 3 | No bedding for 24 h | Rats were placed in a cage without bedding for 24 h. | Psychological |
| 4 | Bright light 300–400 lux for 45 min, 2 times | Rats were given white bright light 300–400 lux for 45 min, 2 times. | Psychological |
| 5 | Tail tied for 1 h | Rats' tail was tied to restrict their movement for 1 h. | Psychological |
| 6 | Foot shocks for 10 min | Rats were given 1.5 mA, 35 volt, 4 times for 30 s with 120 s interval foot shock. | Physical |
| 7 | Forced swimming for 5 min | Rats were placed in a cylindrical clear plastic container filled with 24°C water for 5 min. | Physical |
| 8 | Isolation in a narrow dark space for 4 h | Rats were placed in a narrow dark space for 4 h. | Psychological |
| 9 | Predator exposure for 4 h | Rats were exposed to a cat along with a recording of angry cat's sound (80 dB) for 4 h. | Psychological |
| 10 | Tail pierced for 1 h | Rats' tail was pierced 1cm apart from the base for 1 h. | Physical |
| 11 | Wet bedding for 24 h | Rats were placed in a cage with 200 mL water in 100 g sawdust bedding for 24 h. | Psychological |
| 12 | Continuous light for 24 h | Rats were given 24 h of light. | Psychological |

Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia.

Animals

A total of 42 male Wistar rats were obtained from PT. Indoanilab (Bogor, Indonesia). The inclusion criteria were male 12-week-old rats, whereas the exclusion criteria were physical illness and disability (assessed by a veterinarian) and death. All animals were group-housed, 2/cage, isolated by a wire mesh separator, and weighed weekly. Subsequently, food, water, and sucrose 1.5% were given *ad libitum* daily every morning, and the leftovers were measured the next day. Fresh water and sucrose solutions were provided daily in separate bottles. A normal 12:12-h light/dark cycle was initiated with lights on at 6:00 am. Laboratory conditions were kept at 23°C ± 2°C with humidity of 40%–70%. After 1 week of the acclimatization period, the animals were randomly assigned to the CUMS and control groups.

The chronic unpredictable mild stress procedure

The CUMS was performed for 21 days based on the previously established protocols (including cold swimming, foot shock, forced swimming, and tail piercing) with psychologically dominant stressor modifications (including immobilization, no bedding, bright light, tail tied, isolation in a narrow dark space, predator exposure, wet bedding, and continuous light) [24–26]. Stressors were randomly initiated once or twice daily. It consists of psychological dominant and physical stressors, as presented in Table-1. The same stressors were not repeated for two consecutive days. Day-by-day protocols are indicated in Table-2, whereas detailed procedures are shown in Figure-1.

Test procedures

The body weight of each rat was measured weekly with an electronic scale. Weekly average meals, weekly weight gain, and SPT were assessed and recorded. The weekly weight gain was defined as

Table-2: Chronic unpredictable mild stress procedure day by day.

| Day | Stressor |
|-----|---|
| 1 | Immobilization for 2 h |
| 2 | No bedding for 24 h |
| 3 | • Cold swimming for 3 min • Bright light 300–400 lux for 45 min, 2 times |
| 4 | • Tail tied for 1 h • Forced swimming for 5 min |
| 5 | • Isolation in a narrow dark space for 4 h • Foot shocks for 10 min |
| 6 | Predator exposure for 4 h |
| 7 | Tail pierced for 1 h |
| 8 | Wet bedding for 24 h |
| 9 | Continuous light for 24 h |
| 10 | Cold swimming for 3 min |
| 11 | • Bright light 300–400 lux for 45 min, 2 times • Foot shocks for 10 min |
| 12 | • Isolation in a narrow dark space for 4 h • Tail pierced for 1 h |
| 13 | • Continuous light for 24 h • Tail tied for 1 h |
| 14 | Immobilization for 2 h |
| 15 | Predator exposure for 4 h |
| 16 | Wet bedding for 24 h |
| 17 | No bedding for 24 h |
| 18 | Forced swimming for 5 min |
| 19 | Cold swimming for 3 min |
| 20 | Immobilization for 2 h |
| 21 | Tail pierced for 1 h |
| 22 | SPT, FST for 15 min (day 1) Bright light 300–400 lux for 45 min, 2 times |
| 23 | FST for 5 min (day 2) |

SPT=Sucrose preference test, FST=Forced swim test

the difference in the current minus the prior week. The consumed meal was calculated from the total food given minus the leftovers. The weekly average meal is the mean food consumed by rats in 1 week. An SPT was used to assess the animal depression model and carried out twice, that is, before and 22 days after the CUMS procedure. The preference test was calculated as follows: sucrose percentage (%) = sucrose consumption (mL)/sucrose consumption (mL) + water

consumption (mL) × 100%. A forced swimming test was assessed on days 0 and 22; however, due to technical problems, the result cannot be interpreted.

Statistical analysis

Data were presented as mean ± standard deviation and the difference between variables was analyzed using the independent sample t-test or Mann–Whitney test (non-parametric). p < 0.05 was

considered statistically significant. The data analysis was performed using IBM SPSS Statistics software version 23.0 (IBM Corp., Armonk, NY, USA).

Results

A total of 42 rats were included in this study (33 and nine rats in CUMS and control groups, respectively). Three rats in the CUMS group were excluded



Figure-1: (A) immobilization for 2 h, (b) isolation in a narrow dark space for 4 h, (c) no bedding for 24 h, (d) cold swimming for 3 min, (e) continuous light for 24 h, (f) forced swimming for 5 min, (g) predator exposure for 4 h, (h) tail pierced for 1 h, (i) tail tied for 1 h, (j) wet bedding for 24 h (k) foot shocks for 10 min, and (l) bright light 300–400 lux for 45 min, 2 times.

Table-3: Mean weight of the rats.

| Time | Weight (g) mean ± SD | | p-value |
|------------------|----------------------|------------------|----------------------|
| | CUMS (n = 30) | Control (n = 9) | |
| Pre CUMS | 168.467 ± 21.591 | 170.555 ± 14.170 | 0.787 ^a |
| Week 1 post CUMS | 177.800 ± 21.385 | 192.667 ± 16.658 | 0.064 ^a |
| Week 2 post CUMS | 190.133 ± 22.227 | 212.889 ± 20.907 | 0.010 ^{*a} |
| Week 3 post CUMS | 197.333 ± 21.037 | 226.222 ± 24.030 | 0.001 ^{**a} |

^at-test, ^{*}significant with p < 0.05, ^{**}significant with p < 0.01. CUMS=Chronic unpredictable mild stress, SD=Standard deviation

Table-4: Weekly weight gain of the rats.

| Time | Weekly weight gain (g) mean ± SD | | p-value |
|------------------|----------------------------------|-----------------|----------------------|
| | CUMS (n = 30) | Control (n = 9) | |
| Week 1 post CUMS | 9.333 ± 9.076 | 22.111 ± 7.688 | 0.000 ^{**a} |
| Week 2 post CUMS | 12.333 ± 8.125 | 20.222 ± 9.615 | 0.019 ^{*a} |
| Week 3 post CUMS | 7.200 ± 7.522 | 13.333 ± 6.041 | 0.032 ^{*a} |

^at-test, ^{*}significant with p < 0.05, ^{**}significant with p < 0.01. CUMS=Chronic unpredictable mild stress, SD=Standard deviation

(two died during the swimming procedure and another one due to illness). Finally, 39 rats completed the study. The weight of the rats, weekly weight gain, and average meal were normally distributed; thus, t-test was used for statistical analysis. The results indicated that the mean body weight on day 22 ($p < 0.01$) after CUMS procedures significantly differed from that of the control group, as presented in Table-3. Weekly weight gain between groups showed a significant difference ($p < 0.01$) in the 1st week and persisted until the 3rd week (Table-4). However, no significant difference ($p > 0.05$) was observed in the weekly average meals between groups (Table-5). Non-parametric tests were used in non-normally distributed SPT data, whereas T-tests were applied in normally distributed data. The 24-h SPT revealed significant differences between the CUMS ($p < 0.01$) and control groups (Table-6).

Discussion

A good animal model should have adequate face, construct, and predictive validity [5]. CUMS is one of the available protocols to create an animal depression model with good validity [5, 9, 27]. It is a well-validated method to model a depressive-like behavior that develops gradually and naturally over time [14], consisting of exposure to various chronic and unpredictable mild stressors [7]. Anhedonia (marked by decreased SPT) is the core symptom of depression found in an animal depression model [5, 12, 28].

Stressors that are commonly found in CUMS procedures include periods of food and water deprivation, shock, cold swim, heat stress, shaker stress, continuous lighting, cage tilt, paired housing, soiled cage, reduced temperature exposure, stroboscopic lighting, novel odors, intermittent white noise (85dB), and presence of foreign objects [14]. Different types of stressors will elicit various responses [29–32]. Multiple and more severe stressors will change the CUMS phenotype [8]. Social stressors are the major of stressors that lead to psychopathology in humans [1, 33]. Since the

original CUMS protocols are physically dominant and involve food and water deprivation, modifications to mimic human depression should be performed.

Environmental lighting changes, with the bright light of 300–400 lux for 45 min twice and continuous light for 24 h, will affect mood and result in depression [28, 34–37]. Inescapable foot shock will also create learned helplessness, anhedonia, and despair [7, 38–41]. Foot shock will increase learned helplessness [42, 43]. Restraining stressors such as immobilization for 2 h as well as tail tied for 1 h and isolation in a narrow dark space for 4 h lead to learned helplessness [44, 45]. Predator exposure is a type of psychological stressor that can elicit depressive-like behavior [7, 46]. Cold swimming has also been identified as a cause of learned helplessness [47, 48]. Social isolation is part of CUMS procedures, where the rat is single-housed [8]. Tail pierced, tail tied, foot shock, isolation in narrow dark spaces, and predator exposure were performed based on Maramis *et al.*'s [24] study. Meanwhile, immobilization, no bleeding, bright light, and cold and forced swimming were used in the procedures by He *et al.* [48] with some modifications. Depressive-like behavior can be observed after 21 days of CUMS [49]. In this study, mild stressors with psychological dominant stressors were administered 1–2 stressors daily, with random time to administer for 21 days to make it unpredictable. A total of 12 stressors were chosen to be included in this experiment to obtain the dominant psychological stressor, resulting in learned helplessness and anhedonia. Water and food deprivation was not included as it decreases body weight. Psychologically dominant stressors were carried out to mimic human stressors.

A significant decrease in SPT compared to the control group is a marker of the successful creation of an animal depression model [24, 50]. Additional symptoms of human depression, such as weight/appetite change and psychomotor alteration can be easily assessed in animals [7, 51–53]. Lower weight and reduced weight gain than controls are found in the animal depression model [12, 49, 54]. Weight loss in depression was caused by decreased peripheral leptin [55]. In this study, decreased SPT occurred gradually and became statistically significant after 21 days of CUMS procedures. No significant differences were observed in terms of appetite changes and the amount of food consumed between groups.

Table-5: Weekly average meal of the rats.

| Time | Average meal (g) mean \pm SD | | p-value |
|--------|--------------------------------|--------------------|--------------------|
| | CUMS (n = 30) | Control (n = 9) | |
| Week 1 | 56.015 \pm 6.743 | 59.981 \pm 6.309 | 0.125 ^a |
| Week 2 | 54.675 \pm 8.753 | 57.299 \pm 6.867 | 0.415 ^a |
| Week 3 | 53.094 \pm 7.873 | 55.822 \pm 7.109 | 0.358 ^a |

^at-test. CUMS=Chronic unpredictable mild stress, SD=Standard deviation

Table-6: Sucrose preference test of the rats.

| Time | Sucrose preference test (%) mean \pm SD | | p-value |
|------------------|---|---------------------|---------------------|
| | CUMS (n = 30) | Control (n = 9) | |
| Pre CUMS | 69.627 \pm 14.008 | 68.500 \pm 15.230 | 0.837 ^a |
| Week 1 post CUMS | 71.152 \pm 13.746 | 69.908 \pm 18.171 | 0.907 ^b |
| Week 2 post CUMS | 75.929 \pm 16.405 | 74.876 \pm 25.059 | 0.604 ^b |
| Week 3 post CUMS | 57.526 \pm 14.870 | 82.622 \pm 13.107 | 0.000 ^{*a} |

^at-test, ^bMann-Whitney test* significant with $p < 0.01$. CUMS=Chronic unpredictable mild stress, SD=Standard deviation

However, the body weight and weekly weight gain were significantly different between the groups.

This modification protocol can be used if other researchers need an animal depression different with psychologically dominant stressors without food and water deprivation. There are some limitations in this study. First, corticosterone levels were not measured before and after CUMS. Second, neurotransmitter analysis was not performed before and after CUMS. Third, the response to an antidepressant after creating the animal depression model was not analyzed.

Conclusion

Psychological dominant CUMS modification resulted in an animal depression model with decreased SPT, body weight, and weekly weight gain in the CUMS group compared to the control group. This model resembles psychologically dominant stressors in humans.

Recommendations

This protocol can be used to create a psychologically dominant animal model of depression. Successful creation of the model can be assessed using the 24-h SPT, body weight, and weekly body weight gain.

Authors' Contributions

LP, II, and MMM: Designed the research, methodology, validation, formal analysis, and review and editing. LP: Data collection, and writing original draft preparation. All authors have read, reviewed, and approved the final manuscript.

Acknowledgments

The authors are thankful to the LPHC and Physiology Laboratory, Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia, for providing the necessary facilities. The authors did not receive any funds for this study.

Competing Interests

The authors declare that they have no competing interests.

Publisher's Note

Veterinary World remains neutral with regard to jurisdictional claims in published institutional affiliation.

References

- Maramis, M.M., Pantouw, J.G. and Lesmana, C.B.J. (2021) Depression screening in Surabaya Indonesia: Urgent need for better mental health care for high-risk communities and suicide prevention for men. *Int. J. Soc. Psychiatry*, 67(5): 421–431.
- Robert, J.B., Marcia, L.V. and Ruiz, P. (2021) Depressive disorders and suicide in children and adolescents. In: Robert, J.B., Marcia, L.V. and Ruiz, P., editors. *Kaplan and Sadock's Synopsis of Psychiatry*. 12th ed. Wolters Kluwer, Philadelphia, PA. p555–575.
- Walter, H.J. and DeMaso, D.R. (2020) Major and other depressive disorder. In: Kliegman, R.M., Blum, N.J., Shah, S.S., Tasker, R.C. and Wilson, K.M., editors. *Nelson Textbook of*

- Pediatrics*. 21st ed. Elsevier, Philadelphia, PA. p217–222.
- Wantini, A.A. (2019) The validity test of depression screening instrument in adolescences. *J. Berkala Epidemiol.*, 7(2): 155.
- Yan, H.C., Cao, X., Das, M., Zhu, X.H. and Gao, T.M. (2010) Behavioral animal models of depression. *Neurosci. Bull.*, 26(4): 327–337.
- Beirão, D., Monte, H., Amaral, M., Longras, A., Matos, C. and Villas-Boas, F. (2020) Depression in adolescence: A review. *Middle East Curr. Psychiatry*, 27(1): 50.
- Planchez, B., Surget, A. and Belzung, C. (2019) Animal models of major depression: Drawbacks and challenges. *J. Neural Transm. (Vienna)*, 126(11): 1383–1408.
- Sequeira-Cordero, A., Salas-Bastos, A., Fornaguera, J. and Brenes, J.C. (2019) Behavioural characterisation of chronic unpredictable stress based on ethologically relevant paradigms in rats. *Sci. Rep.*, 9(1): 17403.
- Willner, P. (1997) Validity, reliability and utility of the chronic mild stress model of depression: A 10-year review and evaluation. *Psychopharmacology (Berl)*, 134(4): 319–329.
- Young, C.B., Chen, T., Nusslock, R., Keller, J., Schatzberg, A.F. and Menon, V. (2016) Anhedonia and general distress show dissociable ventromedial prefrontal cortex connectivity in major depressive disorder. *Transl. Psychiatry*, 6(5): e810.
- Watson, R., Harvey, K., McCabe, C. and Reynolds, S. (2020) Understanding anhedonia: A qualitative study exploring loss of interest and pleasure in adolescent depression. *Eur. Child Adolesc. Psychiatry*, 29(4): 489–499.
- Willner, P., Gruca, P., Lason, M., Tota-Glowczyk, K., Litwa, E., Niemczyk, M. and Papp, M. (2019) Validation of chronic mild stress in the Wistar-Kyoto rat as an animal model of treatment-resistant depression. *Behav. Pharmacol.*, 30: 239–250.
- Katz, R.J., Roth, K.A. and Schmaltz, K. (1981) Amphetamine and tranlycypromine in an animal model of depression: Pharmacological specificity of the reversal effect. *Neurosci. Biobehav. Rev.*, 5(2): 259–264.
- Willner, P., Towell, A., Sampson, D., Sophokleous, S. and Muscat, R. (1987) Reduction of sucrose preference by chronic unpredictable mild stress, and its restoration by a tricyclic antidepressant. *Psychopharmacology (Berl)*, 93(3): 358–364.
- Dietze, S., Lees, K.R., Fink, H., Brosda, J. and Voigt, J.P. (2016) Food deprivation, body weight loss and anxiety-related behavior in rats. *Animals (Basel)*, 6(1): 4.
- Schneiderman, N., Ironson, G. and Siegel, S.D. (2005) Stress and health: Psychological, behavioral, and biological determinants. *Annu. Rev. Clin. Psychol.*, 1(1): 607–628.
- Adams, J.S., Chien, A.T. and Wisk, L.E. (2019) Mental illness among youth with chronic physical conditions. *Pediatrics*, 144(1): e20181819.
- Putera, A.M., Irwanto, I., Maramis, M.M., Prasetyo, R.V., Soemyarso, N.A. and Noer, M.S. (2020) Effect of mental health problems on the quality of life in children with lupus nephritis. *Neuropsychiatr. Dis. Treat.*, 16: 1583–1593.
- Suryawan, A., Ningtiar, H.W., Irwanto, I. and Ugrasena, I.D.G. (2021) Determinant factors of depression in beta major thalassemia children. *Folia Med. Indones.*, 57(1): 46–52.
- Tommasi, M., Toro, F., Arnò, S., Carrieri, A., Conte, M.M., Devastato, M.D., Picconi, L., Sergi, M.R. and Saggino, A. (2020) Physical and psychological impact of the phase one lockdown for COVID-19 on Italians. *Front. Psychol.*, 11: 563722.
- Pico-Alfonso, M.A., Garcia-Linares, M.I., Celda-Navarro, N., Blasco-Ros, C., Echeburúa, E. and Martinez, M. (2006) The impact of physical, psychological, and sexual intimate partner violence on women's mental health: Depressive symptoms, posttraumatic stress disorder, state anxiety, and suicide. *J. Womens. Health (Larchmt)*, 15(5): 599–611.
- Hershner, S.D. and Chervin, R.D. (2014) Causes and consequences of sleepiness among college students. *Nat. Sci.*

- Sleep*, 6: 73–84.
23. Mullen, S. (2018) Major depressive disorder in children and adolescents. *Ment. Health Clin.*, 8(6): 275–283.
 24. Maramis, M.M., Mahajudin, M.S. and Khotib, J. (2020) Impaired cognitive flexibility and working memory precedes depression: A rat model to study depression. *Neuropsychobiology*, 80(3): 225–233.
 25. Pandey, D.K., Pati, D., Joshi, A. and Mahesh, R. (2010) Chronic unpredictable stress: Possible animal model of comorbid depression. *Int. J. Preclin. Pharm. Res.*, 1(1): 54–63.
 26. López, A.L.L., Villanueva, M.C.E., Padilla, M.B., Jaime, H.B., Aguilar, F.J.A. (2018) Chronic unpredictable mild stress progressively disturbs glucose metabolism and appetite hormones in rats. *Acta. Endocrinol. (Buchar.)*, 14(1): 16–23.
 27. Yang, L., Zhao, Y., Wang, Y., Liu, L., Zhang, X., Li, B. and Cui, R. (2015) The effects of psychological stress on depression. *Curr. Neuropharmacol.*, 13(4): 494–504.
 28. Yuan, M., Liu, L.J., Xu L.Z., Guo, T.Y., Yue, X.D. and Li, S.X. (2016) Effects of environmental stress on the depression-like behaviors and the diurnal rhythm of corticosterone and melatonin in male rats. *Sheng Li Xue Bao*, 68(3): 215–223.
 29. Nishikawa, T. and Tanaka, M. (1978) Altered behavioral responses to intense foot shock in socially-isolated rats. *Pharmacol. Biochem. Behav.*, 8(1): 61–67.
 30. Lukkes, J.L., Mokin, M.V., Scholl, J.L. and Forster, G.L. (2009) Adult rats exposed to early-life social isolation exhibit increased anxiety and conditioned fear behavior, and altered hormonal stress responses. *Horm. Behav.*, 55(1): 248–256.
 31. Boero, G., Pisu, M.G., Biggio, F., Muredda, L., Carta, G., Banni, S., Paci, E., Follesa, P., Concas, A., Porcu, P. and Serra, M. (2018) Impaired glucocorticoid-mediated HPA axis negative feedback induced by juvenile social isolation in male rats. *Neuropharmacology*, 133: 242–253.
 32. Singhal, G., Jaehne, E.J., Corrigan, F. and Baune, B.T. (2014) Cellular and molecular mechanisms of immunomodulation in the brain through environmental enrichment. *Front. Cell Neurosci.*, 8(1): 97.
 33. Finning, K., Moore, D., Ukoumunne, O.C., Danielsson-Waters, E. and Ford, T. (2017) The association between child and adolescent emotional disorder and poor attendance at school: A systematic review protocol. *Syst. Rev.*, 6(1): 121.
 34. Leach, G., Adidharma, W. and Yan, L. (2013) Depression-like responses induced by daytime light deficiency in the diurnal grass rat (*Arvicanthis niloticus*). *PLoS One*, 8(2): e57115.
 35. Boyce, P. and Barriball, E. (2010) Circadian rhythms and depression. *Aust. Fam. Physician*, 39(5): 307–310.
 36. De Berardis, D., Marini, S., Fornaro, M., Srinivasan, V., Iasevoli, F., Tomasetti, C., Valchera, A., Perna, G., Quera-Salva, M.A., Martinotti, G. and di Giannantonio, M. (2013) The melatonergic system in mood and anxiety disorders and the role of agomelatine: Implications for clinical practice. *Int. J. Mol. Sci.*, 14(6): 12458–12483.
 37. Kripke, D.F., Elliott, J.A., Welsh, D.K. and Youngstedt, S.D. (2015) Photoperiodic and circadian bifurcation theories of depression and mania. *F1000Research*, 4: 107.
 38. Dagyte, G., Van der Zee, E.A., Postema, F., Luiten, P.G.M., Den Boer, J.A., Trentani, A. and Meerlo, P. (2009) Chronic but not acute foot-shock stress leads to temporary suppression of cell proliferation in rat hippocampus. *Neuroscience*, 162(4): 904–913.
 39. Palermo-Neto, J., De Oliveira Massoco, C. and De Souza, W.R. (2003) Effects of physical and psychological stressors on behavior, macrophage activity, and Ehrlich tumor growth. *Brain Behav. Immun.*, 17(1): 43–54.
 40. Jung, J.M., Park, S.J., Lee, Y.W., Lee, H.E., Hong, S.I., Lew, J.H., Hong, E., Shim, J.S., Cheong, J.H. and Ryu, J.H. (2013) The effects of a standardized *Acanthopanax koreanum* extract on stress-induced behavioral alterations in mice. *J. Ethnopharmacol.*, 148(3): 826–834.
 41. Handa, R.J., Nunley, K.M., Lorens, S.A., Louie, J.P., McGivern, R.F. and Bollnow, M.R. (1994) Androgen regulation of adrenocorticotropin and corticosterone secretion in the male rat following novelty and foot shock stressors. *Physiol. Behav.*, 55(1): 117–124.
 42. Bogdanova, O.V., Kanekar, S., D’Anci, K.E. and Renshaw, P.F. (2013) Factors influencing behavior in the forced swim test. *Physiol. Behav.*, 118(12): 227–239.
 43. Wood, G.E., Norris, E.H., Waters, E., Stoldt, J.T. and McEwen, B.S. (2008) Chronic immobilization stress alters aspects of emotionality and associative learning in the rat. *Behav. Neurosci.*, 122(2): 282–292.
 44. Lu, Y., Liu, M., Shi, S., Jiang, H., Yang, L., Liu, X., Zhang, Q. and Pan, F. (2010) Effects of stress in early life on immune functions in rats with asthma and the effects of music therapy. *J. Asthma*, 47(5): 526–531.
 45. Becker, M., Pinhasov, A. and Ornoy, A. (2021) Animal models of depression: What can they teach us about human disease? *Diagnostics (Basel)*, 11(1): 123.
 46. Drugan, R.C., Hibl, P.T., Kelly, K.J., Dady, K.F., Hale, M.W. and Lowry, C.A. (2013) Prior cold water swim stress alters immobility in the forced swim test and associated activation of serotonergic neurons in the rat dorsal raphe nucleus. *Neuroscience*, 253(1): 221–234.
 47. López-Rubalcava, C. and Lucki, I. (2000) Strain differences in the behavioral effects of antidepressant drugs in the rat forced swimming test. *Neuropsychopharmacology*, 22(2): 191–199.
 48. He, L.W., Zeng, L., Tian, N., Li, Y., He, T., Tan, D.M., Zhang, Q. and Tan, Y. (2020) Optimization of food deprivation and sucrose preference test in SD rat model undergoing chronic unpredictable mild stress. *Animal Model Exp. Med.*, 3(1): 69–78.
 49. Hao, Y., Ge, H., Sun, M., and Gao, Y. (2019) Selecting an appropriate animal model of depression. *Int. J. Mol. Sci.*, 20(19): 4827.
 50. Qi, X., Lin, W., Li, J., Pan, Y. and Wang, W. (2006) The depressive-like behaviors are correlated with decreased phosphorylation of mitogen-activated protein kinases in rat brain following chronic forced swim stress. *Behav. Brain Res.*, 175(2): 233–240.
 51. Rice, F., Riglin, L., Lomax, T., Souter, E., Potter, R., Smith, D.J., Thapar, A.K. and Thapar, A. (2019) Adolescent and adult differences in major depression symptom profiles. *J. Affect. Disord.*, 243: 175–181.
 52. Bondar, J., Caye, A., Chekroud, A.M. and Kieling, C. (2020) Symptom clusters in adolescent depression and differential response to treatment: A secondary analysis of the treatment for adolescents with depression study randomised trial. *Lancet Psychiatry*, 7(4): 337–343.
 53. Mills, J.G., Larkin, T.A., Deng, C. and Thomas, S.J. (2019) Weight gain in Major Depressive Disorder: Linking appetite and disordered eating to leptin and ghrelin. *Psychiatry Res.*, 279: 244–251.
 54. Maxwell, M.A. and Cole, D.A. (2009) Weight change and appetite disturbance as symptoms of adolescent depression: Toward an integrative biopsychosocial model. *Clin. Psychol. Rev.*, 29(3): 260–273.
 55. Iio, W., Takagi, H., Ogawa, Y., Tsukahara, T., Chohnan, S. and Toyoda, A. (2014) Effects of chronic social defeat stress on peripheral leptin and its hypothalamic actions. *BMC Neurosci.*, 15: 72.
