

Editorial Board

Editorial Board

FILIPIC Bratko, PhD

Professor, Department of Experimental and Translation Oncology

Croatian Institute for experimental and translation oncology, Zagreb, Croatia, Croatia

Dr Lucius, MBBS

General Practice

Ludwig Maximilians University Munich, Germany

Dr. Aygul Z. Ibatova

Department of Natural Sciences

Tyumen Industrial University, Scopus Author ID: 57191110632 <http://orcid.org/0000-0003-0565-8533>, Russia

Dr Ahmad Faisal Ismail

Kulliyyah of Dentistry

International Islamic University Malaysia, Kuantan Campus, 25200 Kuantan, Pahang,

Scopus Author ID: 35388596700 , Malaysia

Dr. Huiliang ZHAO , Ph.D

Guizhou Minzu University, Huaxi District, Guiyang, China

Dr. Mohd Armi Abu Samah

International Islamic University Malaysia, (IIUM) 25200 Kuantan Pahang

Dr. Baded ramji

Sri Lanka

Dr. Chris randea

South Africa

Dr. Yingwen ZHAO

Researcher of Guizhou Rural Economic and Social Development Research Institute, China

Dr. Li Zihan, Ph.D

University of Glasgow, UK

Gabriela Cioca

Faculty of Medicine, Pharmacology Department

Lucian Blaga University of Sibiu, Romania, Lucian Blaga street, no 2A, Sibiu, Romania

Dariusz Nowak

Municipal Hospital, Mickiewicza street no 12, 42-200 Czestochowa, Poland

Aleksandra Zyska

Faculty of Medicine, Department of Physiology

Opole University, Oleska street no 48, 45-052 Opole, Poland

Katarzyna Sznajder

Faculty of Medicine, Clinical Department of Diagnostic Imaging

Opole University, Oleska street no 48, 45-052 Opole, Poland

Jacek Jędrzejak

Faculty of Medicine, Department of Family Medicine and Public Health

Opole University, Oleska street no 48, 45-052 Opole, Poland

Luciano Benedini

Universidad Nacional del Sur (National University of South-UNS), Bahía Blanca 8000, Argentina

Paula Messina

Departamento de Biología

Universidad Nacional del Sur (National University of South-UNS), Bioquímica y

Farmacia, Bahía Blanca 8000, Argentina

Michael Walsh

Washington State University, College of Pharmacy and Pharmaceutical Sciences (CPPS), USA

Prof. Dr. Kittisak Jermsittiparsert

Henan University, China

Amel Dawod Kamel Gudia, PhD

Faculty of nursing

Cairo University, Egypt

Arif Nur Muhammad Ansori

Airlangga University, Scopus Author ID: 57195995342, <https://orcid.org/0000-0002-1279-3904>, Indonesia

Mohammed Nader Shalaby

Suez Canal University, Associate Professor of Biological Sciences and Sports Health, Egypt

Dr. Faten Abo-Aziza Mohamed, PhD

Associate Professor, Clinical Pathology and Stem Cell Research

National Research Centre, Manager of Veterinary Division Central Lab (605), 33 El-Beheos St, Dokki, Cairo, Egypt

Professor Asim Ahmed Elnour Ahmed

College of Pharmacy

Al-Ain University of Science and Technology, UAE

S. Parasuraman, M.Pharm., Ph.D

AIMST University, Malaysia

Ebenezer Wiafe, PhD

Pharmacy

University of Kwazulu-Natal, South Africa

Editor-in-Chief

Dr. Ayad F. Alkaim

University of Babylon, College of Science for Women, Babylon, Scopus Author ID: 55255310600, Iraq

Research Article

Evaluation the Effect of Pulmicort Inhalation on Children with Acute Asthma Attack

👤 *Ahmad Bahrami, Shabahang Jafarnejad, Hamidreza khoshnezhad Ebrahimi, Seyedeh Mahsa Mahmoudinezhad Dezfouli, Rozhin Pahlevani.*

SRP. 2020; 11(9): 905 - 912

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.132

Research Article

Elevated serum levels of Interleukin-13 and Interleukin-17A in Pediatric Asthma

👤 *Sawsan M. Jabbar AL-Hasnawi, Abeer Thaher Naji AL-Hasnawi.*

SRP. 2020; 11(9): 229 - 223

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.37

Research Article

Protein Isolation from Sponge Niphates sp. as an Antibacterial and Antioxidant

👤 *Warsidah, Masrianih, Mega Sari Juane Sofiana, Ikha Safitri, Ajuk Sapar, Anthoni B. Aritonang, Yuges Saputri Muttalib, Dzul Fadly.*

SRP. 2020; 11(9): 518 - 521

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.76

Review Article

Matrix Metalloproteinase-1 (MMP-1) Expression and Density of Collagen Fibers following Application of Haruan Fish (*Channa striata*) Extract in Inflamed Pulp of Wistar Rat

👤 *Juni Jekti Nugroho, Andi Sumidarti, Mufliha Siri, Muhammad Husni Cangara, Nurhayaty Natsir, Maria Tanumihardja, Noor Hikmah, Asrianti.*

SRP. 2020; 11(9): 6 - 9

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.02

Research Article

Did Servant, Digital and Green Leadership Influence Market Performance? Evidence from Indonesian Pharmaceutical Industry

👤 *Khaerul Fahmi, Temmy Kurniawan, Yoyok Cahyono, Afen Sena, Suhadarliyah, Popong Suryani, Agus Sugianto, Dahlia Amelia, Musnaini, Shofia Amin, Husni Hasbullah, M. Jihadi, Hadion Wijoyo, Agus Purwanto.*

SRP. 2020; 11(9): 642 - 653

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.95

Research Article

Juvenile Delinquency Measurement in Indonesian High Schools

👤 *Syariful, Akif Khilmiyah, Siswanto Masruri.*

SRP. 2020; 11(9): 522 - 527

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.77

Research Article

Prevention and Treatment Approaches in Children with the Coronavirus

👤 *Shaqayeq Khosravi, Seyedeh Mahsa Mahmoudinezhad Dezfouli.*

SRP. 2020; 11(9): 913 - 919

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.133

Research Article

Comparative Study for Complications of Otoplasty between Patients under Ten Years and above Ten Years Old

👤 *Ahmed Miri saadoon, Ali Abd-Almer Jwad and Riyadh K. Madloun.*

SRP. 2020; 11(9): 234 - 238

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.38

Research Article

Extract Standardization in Ethyl Acetate Fraction from Sargassum Hystrix as Inhibitor of α -Amylase and α -Glucosidase

👤 *Sovia Indah Nurkhanifah, Siti Ari Budhiyanti, Amir Husni.*

SRP. 2020; 11(9): 528 - 534

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.78

Review Article

A Review of the Presence of Antibiotic Resistance Problems on Klebsiella Pneumoniae Acquired from Pigs: Public Health Importance

👤 *Eka Dian Sofiana, Junianto Wika Adi Pratama, Mustofa Helmi Effendi, Hani Plumeriastuti, Freshindy Marissa Wibisono, Erwan Budi Hartadi, Akvyan Rafi Hidayatullah.*

SRP. 2020; 11(9): 535 - 543

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.79

Research Article

Synergistic Effect between Zingiber Officinale Volatile Oil and Meropenem against Acinetobacter Baumannii Producing-Carbapenemase Isolated from Neurosurgery in Iraq


 Safaa A.L. Al Meani, Mohammed M. Ahmed, Ali H. Abdulkareem.

SRP. 2020; 11(9): 920 - 925

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.134

Review Article

Distinctive Therapeutic Strategies against Corona Virus-19 (COVID-19): A Pharmacological Review


 Yousra A. Nomier, Devulapalli S. Rao, Ahmed H. Suhaqi, Rayan A. Ahmed.

SRP. 2020; 11(9): 544 - 561

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.80

Research Article

Effect of Diabetic Ketoacidosis on Some Biochemical and Immunological Variables

 Oqbah Abdul Halim, Qasim Khlaif Abdullah, Asmaa wajah juma.

SRP. 2020; 11(9): 239 - 242

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.39

Research Article

The Effect of Benzo [A] Pyrene on Changes in the Profile of CD11B + IL1 +, CD11B + IL17 +, CD4 + CD25 + in Mice (MUS MUSCULUS, L) after Getting Paramicovirus Vaccine

 Suwoyo, Lumastari Ajeng Wijayanti, Dwi Estuning Rahayu.

SRP. 2020; 11(9): 926 - 930

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.135

Research Article

Mechanisms for Managing Medical Institutions in Times of Crisis


 Anastasia Barzylavych, Bubalo Volodymyr, Nesterenko G. Valentyna, Rogachevskiy Oleksandr, Chornyi Oleg.

SRP. 2020; 11(9): 562 - 568

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.81

Research Article

Platelets Profile Changes in Patients with COVID 19


 Safaa jawad kadhemi, Ahmed Hasan Raheem, Hassan Salim aljumaily, Ahmed Abdul Haleem Al shammari, Ameer Kadhimi Al-Humairi, Ali Baay.

SRP. 2020; 11(9): 569 - 574

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.82

Research Article

Wives' Perceptions of Husbands with Erectile Dysfunction in Indonesia: The Fulfilment Pattern of the Wife's Sexual Partner Who Experiences Erectile Dysfunction due to Diabetes Mellitus

 Abd. Nasir, Susilo Hariyanto, Nuruddin, Iswatun, Supatmi, Nuh Huda.

SRP. 2020; 11(9): 654 - 660

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.96

Research Article

The Value of Standing X-ray in Detecting Physiological Spondylolisthesis in Patients with Single Disc Prolapse with Normal Intensity MRI Findings


 Najat Adel Hashim, Raad Jawad Kadhim.

SRP. 2020; 11(9): 243 - 247

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.40

Research Article

Effect of Career, Organizational Commitment on Turnover Intention through Mediation of Organizational Culture: Evidence from Indonesian Companies

 Nico Alexander Vizano, Wiwik Utami, Sigmin Johannes, Aty Herawati, Havis Aima, Achmad H Sutawijaya, Agus Purwanto, Joko Supono, Puji Rahayu, Aris Setiyani, C Catur Widayati, Farida Elmi.

SRP. 2020; 11(9): 931 - 937

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.136

Research Article

Social Network for Drug Circulation in Sidenreng Rappang Regency, Indonesia

 Rahmat Pannyiwi, Andi Agustang, Tahir Kasnawi, Andi Tenri Pada, Ahmad Yani, Sadli Syam.

SRP. 2020; 11(9): 575 - 577

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.83

Review Article

The Mucosal Lesions on Removable Denture Wearers: A Systematic Review

 Mohammad Dharma Utama, Acing Habibie Mude, Muhammad Ikbali, Vinsensia Launardo, Adriani Dachri.

SRP. 2020; 11(9): 10 - 14

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.03

Research Article

Evaluation and Comparison of the Optimization Parameters Based on Univariate and Multivariate Techniques for Estimation Atorvastatin Calcium with Novel Reverse Indirect Spectrophotometric Method


 Marwan A. Hasan, Rebwar O. Hasan, Khalid F. Al-Rawi.

SRP. 2020; 11(9): 248 - 259

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.41

Research Article

Effect of pH, Temperature and Metal Salts in Different Storage Conditions on the Stability of Vitamin C Content of Yellow Bell Pepper Extracted in Aqueous Media

 Husni S Farah, Jehad F Alhmod, Atef Al-Othman, Khalid M Alqaisi, Ali M Atoom, Khalid Shadid, Ashok Shakya, Talal AlQaisi.

SRP. 2020; 11(9): 661 - 667

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.97

Research Article

The Influence of Organizational Culture, Job Satisfaction, and Professional Commitment on Innovative Behavior of Flight Instructors at the Civil Flight School in Indonesia

 Afen Sena, Yoyok Cahyono, Agus Purwanto.

SRP. 2020; 11(9): 938 - 952

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.137

Research Article

Potential Impact of micro RNA-146a Gene Polymorphisms in Oxidative Stress of Diabetic Mellitus Type 1


 Fulla Abd Alsatat Alriyahee, Noora M. Hameed, Israa Harjan Mohsen, Mona N. Al-Terehi.

SRP. 2020; 11(9): 260 - 263

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.42

Research Article

Testing the Role of Competence and Supervision of Job Satisfaction and Its Impact on Teacher Performance


 Danang Hidayatullah, Anis Eliyana, Hamidah, Tuty Sariwulan, Agung Dharmawan Buchdadi.

SRP. 2020; 11(9): 668 - 675

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.98

Research Article

Effectiveness of Finger Held Relaxation on the Decrease in Intensity of Pain in Patient of Post-Sectio Caesarea in RSUD Sorong Regency


 Ariani Pongoh, Adriana Egam, Rizqi Kamalah, Anwar Mallongi.

SRP. 2020; 11(9): 953 - 956

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.138

Review Article

Locator or Ball Attachment Systems for Mandibular Implant Overdentures: A Systematic Review

 Muhammad Ikbal, Acing Habibie Mude, Irfan Dammar, Vinsensia Launardo, Ian Afifah Sudarman.

SRP. 2020; 11(9): 15 - 19

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.04

Research Article

Atomic Spectroscopy Technique Employed to Detect the Heavy Metals from Iraqi Waterbodies Using Natural Bio-Filter (Eichhornia crassipes): Thera Dejla as a Case Study


 Ghalib Adrees Atiya Ali, Mohammed Nsaif Abbas.

SRP. 2020; 11(9): 264 - 271

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.43

Research Article

The Effect of Substitution of Purple Sweet Potato Flour and Tempeh on Organoleptic Quality of MP-ASI Biscuit

 Radeny Ramdany, Yulia Rachmawati, La Supu, Anwar Mallongi.

SRP. 2020; 11(9): 957 - 961

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.139

Research Article

The Effect of Transformational Leadership on Employee Job Satisfaction with the Meditation of Trust to Supervisors

 Bambang Raditya Purnomo, Anis Eliyana, Windra Alfatah Surya.

SRP. 2020; 11(9): 676 - 686

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.99

Research Article

Study the IL6 (C174G) Promoter SNP and Correlation with Physiological Growth Hormone and TNFA levels in Iraqi Subjects with Psoriasis


 Shaimaa H. Ali, Rawaa S. A. AL-Azawi, Hamzah H. Kzar.

SRP. 2020; 11(9): 272 - 276

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.44

Research Article

Effect of Organizational Citizenship Behavior, Work Satisfaction and Organizational Commitment toward Indonesian School Performance


 Budi Sulistiyo Nugroho, Minnah El Widdah, Lukman Hakim, Muh. Nashirudin, Acep Nurlaeli, Joko Hadi Purnomo, Muhammad Aziz, Hendri Hermawan Adinugraha, Mila Sartika, Muhammad Khoirul Fikri, Abdul Mufid, Agus Purwanto, Mochammad Fahlevi.

SRP. 2020; 11(9): 962 - 971

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.140

Research Article

Democratic, Authocratic, Bureaucratic and Charismatic Leadership Style: Which Influence School Teachers Performance in Education 4.0 Era?


 Wahidin, Basri, Teguh Setiawan Wibowo, Aufa Abdillah, Ahmad Kharis, Jaenudin, Agus Purwanto, Abdul Mufid, Suesthi Maharani, Alfi Qonita Badi`ati, Mochammad Fahlevi, Susila Sumartiningsih.

SRP. 2020; 11(9): 277 - 286

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.45

Research Article

Effect of Knowledge Sharing dan Leader member Exchange (LMX) and Organizational Citizenship Behavior (OCB) to Indonesian Lecturers? Performance

 Budi Sulistiyo Nugroho, Suheri, Lukman Hakim, Bambang Irawan, M. Sugeng Sholehuddin, Tatang Ibrahim, Mujib Ridlwan, Laily Hidayati, Gunawan Aji, Abdul Mufid, Nur Ihsan, Agus Purwanto, Mochammad Fahlevi.

SRP. 2020; 11(9): 972 - 981

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.141

Review Article

Prosthetic Rehabilitation of Patient with Ocular Defects using Conventional Technique: A Systematic Review


 Vinsensia Launardo, Rifaat Nurrahma, Rezki Wahyuni Syamsuddin, Acing Habibie Mude, Bashiera Ika Sari.

SRP. 2020; 11(9): 20 - 25

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.05

Review Article

A Review of Enterotoxigenic Escherichia coli Infection in Piglets: Public Health Importance


 Erwan Budi Hartadi, Mustofa Helmi Effendi, Hani Plumeriastuti, Eka Dian Sofiana, Freshindy Marissa Wibisono, Akvyan Rafi Hidayatullah.

SRP. 2020; 11(9): 687 - 698

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.100

Research Article

Effect of Compensation and Organization Commitment on Turnover Intention with Work Satisfaction as Intervening Variable in Indonesian Industries


 Nico Alexander Vizano, Wiwik Utami, Sigmin Johannes, Aty Herawati, Havis Aima, Achmad H Sutawijaya, Agus Purwanto, Joko Supono, Puji Rahayu, Aris Setiyani, C Catur Widayati.

SRP. 2020; 11(9): 287 - 298

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.46

Research Article

The Effect of Compensation Strategy Implementation on Knowledge Sharing through Affective Commitment and Psychological Contracts


 Afzil Ramadian, Anis Eliyana, Hamidah, Agung Dharmawan Buchdadi, Randa Rakawuri.

SRP. 2020; 11(9): 699 - 712

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.101

Review Article

Periodontal Status of Drug Abuser in Makassar

 Nursyamsi Djamaluddin, Bagus Setiawan.

SRP. 2020; 11(9): 26 - 30

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.06

Research Article

New Paradigm for the Life Skills Development of Children and Youth in Elementary Education Schools in the Rural Highland of Omkoi District, Chiang Mai, Thailand: Towards Achieving the Sustainable Development Goals (SDGs)

 Priyanut Wutti Chupradit, Pariwit Vitayacheeva, Rattaphol Prommas, Mujalin Prasannarong, Savitree Thummasorn, Sopida Apichai, Waranya Chingchit, Pachpilai Chaiwong, Chalanda Janton, Apiwat Leewattana, Natthanit Joompathong, Jedbordin Kumkronglek, Chanakarn Kumkun, Utumma Maghanemi, Kwanchai Rattanasthien, Natnakorn Kumfang, Thirasak Uppamaiathichai, Supat Chupradit.

SRP. 2020; 11(9): 713 - 718

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.102

Research Article

Moderating Role of IT Adoption and Mechanism of Dynamic Capabilities on Indonesian Pharmaceutical Firms Performance


 Juhriyansyah Dalle, Sandu Siyoto, Nita Dwi Astika, Danes Jaya Negara, Teddy Chandra, Khairul Anam.

SRP. 2020; 11(9): 982 - 992

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.142

Review Article

The Prevalence of Temporomandibular Joint Disorders in Young Violin Players in Two Orchestras in Indonesia


 Ike Damayanti Habar, Andi Adytha M.I.R, Mohammad Dharma Utama, Bahruddin Thalib, Acing Habibie Mude, Muhammad Ikbal, Eri Hendra Jubhari.

SRP. 2020; 11(9): 31 - 34

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.07

Review Article


mHealth Interventions for Cancer Care and Support A Systematic Literature Review

 Samar Zuhair Alshawwa, Rasha Assad Assiri.

SRP. 2020; 11(9): 725 - 744

Research Article

[Impact of Complications after Surgical Treatment of Colon Cancer on Survival](#)

 *Bekisheva Aizhan, Makishev Abai, Yoshihiro Noso.*

SRP. 2020; 11(9): 993 - 1002

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.143

Review Article

[Quality of Dental Health Service in Indonesia: A Pilot Pathfinder Survey](#)


 *Fuad Husain Akbar, Selistiani, Abd Hair Awang.*

SRP. 2020; 11(9): 35 - 42

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.08

Research Article

[Did Transformational, Transactional Leadership Style and Organizational Learning Influence Innovation Capabilities of School Teachers during Covid-19 Pandemic?](#)


 *Oding Supriadi, Zulkifli Musthan, Sa'odah, Rizki Nurjehan, Yuyun Dwi Haryanti, M. Rafid Marwal, Agus Purwanto, Abdul Mufid, Rohmad Adi Yulianto, Moh Farhan, Ahmad Asrof Fitri, Mochammad Fahlevi, Susila Sumartiningsih.*

SRP. 2020; 11(9): 299 - 311

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.47

Research Article

[The Role of Folic Acid on Some Physiological Parameters and Efficiency of Sperm in Male Rabbits](#)

 *Rashad Fadhil Ghadhban, Nawras A. Alwan.*

SRP. 2020; 11(9): 1003 - 1007

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.144

Research Article

[Tourism and Original Local Government Revenue in Indonesia Tourism Provinces: The Java Island Experience](#)

 *Yustisia Kristiana, Rudy Pramono, Theodosia C. Nathalia, Vasco Adato H. Goeltom.*

SRP. 2020; 11(9): 745 - 750

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.105

Research Article

[Cytotoxicity Test of Tithonia diversifolia Leaf Extract on Bone Marrow Mesenchymal Stem Cell \(BMSC\) of Rats Using MTT Assay Method](#)


 *Hani Plumeriastuti, Agesti Veva Kalista, Budiastuti; Mustofa Helmi Effendi.*

SRP. 2020; 11(9): 1008 - 1013

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.145

Research Article

[Boosting Organizational Commitment Through Visionary Leadership and Work Life Balance](#)


 *Heni Kesumayani, Anis Eliyana, Hamidah, Maruf Akbar, Karuniana Dianta Sebayang.*

SRP. 2020; 11(9): 312 - 322

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.48

Review Article

[IN-VITRO EVALUATION OF THE ANTICANCER ACTIVITY OF Cu\(II\)AMINA\(CYSTEINE\)DITHIOCARBAMATE](#)


 *Desy Kartina, Abdul Wahid Wahab, Ahyar Ahmad, Rizal Irfandi, Prihantono, And Indah Raya.*

SRP. 2020; 11(9): 43 - 51

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.09

Review Article

[THE ROLE OF FAMILIES CARING FOR PEOPLE WITH MENTAL DISORDERS THROUGH FAMILY RESILIENCE AT EAST JAVA, INDONESIA: STRUCTURAL EQUATION MODELING ANALYSIS](#)

 *Ah Yusuf, Sitti Sulaihah, Hanik Endang Nihayati, M. Suhran, Hari Basuki N, Mundakir, Esti Yunitasari.*

SRP. 2020; 11(9): 52 - 59

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.10

Review Article

[Participation in-Service Teacher Training- Creativity Cultivation Program](#)


 *Chen, I-Ju, Lin, Yi-Kai, Wey, Tzong-Ming, Chang, Yu-Heng, Hung, Ming-Kuo.*

SRP. 2020; 11(9): 1014 - 1018

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.146

Research Article

[Observational Learning and Word of Mouth Against Consumer Online Purchase Decision during the Pandemic COVID-19](#)


 *Juliana, Rudy Pramono, Arifin Djakasaputra, Innocentius Bernarto.*

SRP. 2020; 11(9): 751 - 758

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.106

Research Article

[The Role of Organizational Justice Dimensions: Enhancing Work Engagement and Employee Performance](#)

 *Marisi Pakpahan, Anis Eliyana, Hamidah, Agung Dharmawan Buchdadi, Titis Ratih Bayuwati.*

SRP. 2020; 11(9): 323 - 332

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.49

Review Article

HOW DOES APOPTOSIS OF OOCYTES AND GRANULOSA CELLS DUE TO CIGARETTE SMOKE EXPOSURE TO MICE BALB/C ? : EXPRESSION SMAD3, GDF9, APOPTOSIS

Eny Susanti, I Ketut Sudiana, Hendy Hendarto.

SRP. 2020; 11(9): 60 - 65

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.196

Review Article

Construction and Preliminary Validation of the COVID-19 Pandemic Anxiety Scale

V Vineeth Kumar, Geetika Tankha, Shelly, Sylvi Seth, Apeksha, Tanya S. Timple.

SRP. 2020; 11(9): 1019 - 1024

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.147

Research Article

ENHANCING EMPLOYEE PERFORMANCE WITH WORK MOTIVATION AS A MEDIATION VARIABLE

Qori Al Banin, Anis Eliyana, Eva Risalatul Latifiyah.

SRP. 2020; 11(9): 333 - 346

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.50

Research Article

Identification of The Positive and Negative Emotions that Appeared among High School Students When Selecting University at Jakarta and Surrounding Area

Hendra Achmadi, Ferdi Antonio, Rudy Pramono, Innocentius Bernarto, Agus Purwanto

SRP. 2020; 11(9): 759 - 766

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.107

Research Article

An Empirical Examination of the Effect of TQM Practices on Hospital Service Quality: An Assessment Study in UAE Hospitals

Ahmad Aburayya, Muhammad Alshurideh, Amina Al Marzouqi, Osama Al Diabat, Alanood Alfarsi, Roberto Suson, Mohammad Bash and Said A. Salloum.

SRP. 2020; 11(9): 347 - 362

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.51

Review Article

The Impact of Motivation Mediation and Its Effect on the Level of Education and Work Facilities on Employee Performance (Case Study of Education Office, West Sumatera Province)

Agussalim M, Novi Yanti, Hisar Sirait.

SRP. 2020; 11(9): 1025 - 1034

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.148

Review Article

A Review of the Opportunistic Pathogen Citrobacter Freundii in Piglets Post Weaning : Public Health Importance

Akvyon Rafi Hidayatullah, Mustofa Helmi Effendi, Hani Plumeriastuti, Freshindy Marissa Wibisono, Erwan Budi Hartadi, Eka Dian Sofiana.

SRP. 2020; 11(9): 767 - 773

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.108

Review Article

DISPARITIES OF THE USE OF HORMONAL AND NON-HORMONAL CONTRACEPTIVE DRUGS IN URBAN AND RURAL AREAS IN INDONESIA AND THE WORLD

Agustina Abuk Seran, Myrtati Dyah Antaria, Setya Haksama, Ema Setjaningrum, Agung Dwi Laksono, Anita Dewi Prahastuti Sujoso.

SRP. 2020; 11(9): 66 - 73

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.12

Research Article

Antidiabetic Activity of Papaya Leaf Extract (Carica Papaya L.) Isolated with Maceration Method in Alloxan-Induces Diabetic Mice

Tridiganita Intan Solikhah, Boedi Setiawan, Dilian Ramdana Ismukada.

SRP. 2020; 11(9): 774 - 778

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.109

Review Article

Health Care Professional Attitude and Motivation During COVID-19: A Case of Health Sector of Oman

Ismail AlAbri, Rusinah bte Siron.

SRP. 2020; 11(9): 1035 - 1040

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.149

Research Article

Develop Leadership Style Model for Indonesian Teachers Performance in Education 4.0 Era

Anissa Lestari Kadiyono, Rezki Ashriyana Sulistiobudi, Ikhfan Haris, Mohd Khaidir Abdul Wahab, Idan Ramdani, Agus Purwanto, Abdul Mufid, Muhammad Rikza Muqtada, M. Gufron, Mohamad Nuryansah, Lina Aris Ficayuma, Mochammad Fahlevi, Susila Sumartiningasih.

SRP. 2020; 11(9): 363 - 373

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.52

Review Article

EMPOWERMENT OF JUNIOR HIGH SCHOOL STUDENTS IN PREVENTION EARLY-AGE MARRIAGE IN GUNUNG KIDUL DISTRICT

Masruroh Masruroh, Soetrisno Soetrisno, Mahendra Wijaya, Sapja Anantanyu.

SRP. 2020; 11(9): 74 - 78

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.13

Research Article

The Impact of Social Capital, Entrepreneurial Competence on Business Performance: An Empirical Study of SMEs


Ahmad Yani, Anis Eliyana, Hamidah, I Ketut R. Sudiarditha, Agung Dharmawan Buchdadi.

SRP. 2020; 11(9): 779 - 787

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.110

Review Article

The Impact of Mass Media and Food Consumption

 *Abubakar Iskandar, R. Oetje Subagdja, Maria Fitriah, Sukarelawati.*

SRP. 2020; 11(9): 1041 - 1054

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.150

Review Article

More Meat, More COVID-19 Cases? Comparative Study between USA and China in Importing Mutton


 *Maslichah Mafruchati.*

SRP. 2020; 11(9): 374 - 377

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.53

Research Article

CYP24A1 and AHR Gene Expression in Iraqi Colorectal Cancer Patients


 *Wathiq Abbas Aldrghi, Alaa Makki Jabbar Shafeea, Nawal Mehdi Alkhalidi.*

SRP. 2020; 11(9): 89 - 94

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.15

Research Article

The Effect of Transformational Leadership on Employee Creative Self Efficacy with Creative Role Identity as a Mediation Variables

 *Barika, Anis Eliyana, Hamidah, Agung Dharmawan Buchdadi, Rengga Zulfiansyah Lakspakarti.*

SRP. 2020; 11(9): 788 - 797

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.111

Research Article

Cytotoxic Effect of Essential Oil from Cinnamon (*Cinnamomum burmannii*) Bark on Rat Bone Marrow Mesenchymal Stem Cells: In Vitro Study


 *Budiasuti, Niken Dwi Lestari, Mustofa Helmi Effendi, Arimbi, and Hani Plumeriastuti.*

SRP. 2020; 11(9): 378 - 383

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.54

Review Article

Privacy Preserving Data Publishing for Heterogeneous Multiple Sensitive Attributes with Personalized Privacy and Enhanced Utility

 *Jayapradha. J, Prakash. M, Yenumula Harshavardhan Reddy.*

SRP. 2020; 11(9): 1055 - 1066

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.151

Research Article

Management's Initial Thought in the Industrial Era 4.0 and Millennialization, Is It Still Relevant?


 *Rosa Rilantiana, Anis Eliyana, Djoko Suprayetno, Kresno Eka Mukti.*

SRP. 2020; 11(9): 798 - 802

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.112

Research Article

Study the Effect of Gabapentin on the Histology of Some Organs of Male rats


 *Fakhir M. ALzubaidy, Aymen A Bash, Raad Jasim.*

SRP. 2020; 11(9): 95 - 101

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.16

Research Article

Bioactivity of Amomum Compactum Soland Ex Maton (Java Cardamom) as a Natural Antibacterial


 *Tyagita Hartady, Roostita Lobo Balia, Mas Rizky Anggun Adipurna Syamsunarno, Sabri Jasni, Bambang Pontjo Priosoeryanto.*

SRP. 2020; 11(9): 384 - 387

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.55

Review Article

Improving White Box Testing Using Bi ? Directional Symbolic Analysis and Test Case Slicing

 *P. Velmurugan, S. Ganesh Kumar*

SRP. 2020; 11(9): 1067 - 1071

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.152

Research Article

Effect of Protecting Proteins from Degradation in the Rumen on Single Volatile Fatty Acid of Al Awassi Lambs


 *Dr. Ibrahim S. Jasim.*

SRP. 2020; 11(9): 388 - 397

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.56

Research Article

Improving Kernel Weight and Number in Some Maize Subspecies Crosses


 *M.M. Elshahookie, Saddam H. Cheyed A.A. Dawood.*

SRP. 2020; 11(9): 803 - 807

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.113

Review Article

Bilingual Education Learning to Engage in Academic Activities


 *Chen, I-Ju, Chang, Yu-Heng, Wey, Tzong-Ming.*

SRP. 2020; 11(9): 1072 - 1076

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.153

Review Article

Post-operative Obturator after Maxillectomy: A Systematic Review


 *Irfan Dammar, Acing Habibie Mude, Muhammad Ikbali, Yusalvi Rivai*

SRP. 2020; 11(9): 1 - 5

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.1

Research Article

[Epidemiological Study of Giardia lamblia in Tikrit city, Iraq](#)


 *Turkan Ahmad Hama Hasan, Abdul Khaleq Alwan Muhaimid, Ayhan Rashid Mahmoud.*

SRP. 2020; 11(9): 102 - 106

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.17

Review Article

[Beef, Pork, or Lamb? Comparative Study Between 3 Kinds of Red Meat Consumption in the USA toward the Number of COVID Cases](#)


 *Maslichah Mafruchati.*

SRP. 2020; 11(9): 808 - 812

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.114

Short Communication

[ANALYTIC STUDY OF ENDODONTIC WORKING LENGTH VARIATION OF MAXILLARY CANINE IN BASRAH GOVERNORATE](#)


 *Zainab Abdulkareem Maktoof, Zahraa Mazin Al-Hawwaz, Hiyam Salah Ahmed.*

SRP. 2020; 11(9): 107 - 109

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.18

Research Article

[Effect of Protecting Proteins from Degradation in the Rumen on Rumen Fermentations of Al Awassi Lambs](#)

 *Dr. Ibrahim S. Jasim.*

SRP. 2020; 11(9): 398 - 408

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.57

Review Article

[nCD64, mHLA-DR: Sensitive Diagnostic Markers of Infection in Term Infants Receiving Antibiotic Treatment](#)


 *Nguyen Thi Ngoc Tu, Le Thanh Hai, Truong Thi Mai Hong, Pham Thu Hien, Le Thi Ha, Doan Thi Mai Thanh.*

SRP. 2020; 11(9): 1077 - 1081

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.154

Research Article

[Overview of Metabiotics and Probiotic Cultures During Fermentation of Molasses](#)


 *V.S. Popov, N.V. Vorobyeva, G.A. Svazlyan, N.M. Naumov, O.A. Gryaznova.*

SRP. 2020; 11(9): 813 - 817

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.115

Research Article

[The Protective Effect of Omega3 Against Amikacin- Induced Nephrotoxicity in Rats](#)

 *Afrah Thiab Hlail, Hadeel Rashid Faraj, Wafa S. Abdulredha.*

SRP. 2020; 11(9): 110 - 117

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.19

Research Article

[Dynamics of Immune Status in Myofibrillar Myopathy with the T341P DES Mutation](#)


 *Viacheslav Yurievich Pauls.*

SRP. 2020; 11(9): 818 - 824

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.116

Research Article

[Develop Model of Transactional, Transformational, Democratic and Autocratic Leadership Style for Indonesian School Performance in Education 4.0 Era](#)


 *Irjus Indrawan, Evanirosa, Ramsah Ali, Indra, Ramadan, Muh. Hanif, Ihsan Harun, Lathifah Hanum, Agus Purwanto, Abdul Mufid, Siti Nurkayati, Mochammad Fahlevi, Susila Sumartiningsih.*

SRP. 2020; 11(9): 409 - 419

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.58

Research Article

[The Validity of CXR in the Screening & Detection of Endobronchial Lung Cancer in Iraqi Patients](#)


 *Ameer Kadhim Al-Humairi, Safaa jawad Kadhem, Ahmed Hussein jasim, Shahad hamid mekki, Zainab Alaa abd-alhussein, Ali Baay.*

SRP. 2020; 11(9): 578 - 583

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.84

Review Article

[Clinical study of Oral Lichen Planus for a selective sample in Basrah City south of Iraq between 2017-2019](#)


 *Ghaydaa Hashim Al Qudsi, Hussein Sh. Al-Essa and Sundus Abdul Wadood Aljazeera.*

SRP. 2020; 11(9): 1082 - 1090

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.155

Research Article

[Treating Groundwater Salinity using Magnetic Field Technology](#)


 *Yassien H. Owaied AL-Juboory, Aseel H. Mahdi.*

SRP. 2020; 11(9): 118 - 123

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.20

Research Article

The Effect Of Virtual Nutrition Education for The Improvement of Mother's Knowledge About Complementary Feeding: Randomized Control Trial

 *Nadimin, Aswita Amir, Sitti Rahmah, Sirajuddin.*

SRP. 2020; 11(9): 825 - 829

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.117

Research Article

Synthesis of Heterocyclic Nitrogen Compounds using Cyclohexene Derivative with Various Primary Amines


 *Hamid J. Mohammad, Israa I. Salih, Rabeah T. Mahmood.*

SRP. 2020; 11(9): 124 - 129

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.21

Research Article

The Oxidative Stress Induced by the Vapours of Electronic- Hookah on Mice Liver Tissues

 *Rasha Shaker Nima, Dhifaf Zeki Aziz.*

SRP. 2020; 11(9): 420 - 423

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.59

Review Article

The Intervention of the Pirfenidone with Pericyst Layer Building of the Hydatid?? Cyst


 *Yousif Tawfeeq, Ahmed A. Mohammed, Yassir Mustafa Kamal.*

SRP. 2020; 11(9): 1091 - 1099

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.156

Research Article

In Vitro Antiviral Activity of Morin Compound against Dengue Virus Type 1 in Vero Cells

 *Anisa Maharani, Teguh H. Sucipto, Harsasi Setyawati, Yovilianda M. Untoro, Novia F. Sholihah, Siti Churrotin, Ilham H. Amarullah, Puspa Wardhani, Aryati, Soegeng Soegijanto.*

SRP. 2020; 11(9): 830 - 833

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.118

Research Article

Effect of Stick Sweet Cherry (*Prunus aviam*) on the Reproductive System of Male Mice


 *Wasnaa H. Mohammed, Hamssa E. Abdul-Wahed, Zahraa A. Sharba.*

SRP. 2020; 11(9): 130 - 134

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.22

Research Article

Relative Indicators and Predicative Ability of Some Biological Variables on Cardiac Neural Activity for Volleyball Players


 *Mohammed Nader Shalaby, Marwa Ahmed Fadl.*

SRP. 2020; 11(9): 834 - 840

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.119

Review Article

Investigate the Strategy of Using Pharmacogenetics and Pharmacometabonomics to the Personalization of Ticagrelor Antiplatelet Therapy


 *Mohammed Ahmed Akkaif, Abubakar Sha'aban, Nur Aizati Athirah Daud, Mei Li Ng, Baharudin Ibrahim.*

SRP. 2020; 11(9): 1100 - 1107

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.157

Research Article

EEG Changes in Patients with Functional Psychosis in Babylon Province


 *Huda Abd Ali Hussien, Waleed Azeez AL-Ameedy, Farah Nabil Abass.*

SRP. 2020; 11(9): 135 - 139

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.23

Research Article

Comparison of Macro Nutritional Value, Dissolved Protein, Amino Acids and Minerals of Fresh and Crispy-Product of Anchovy (*Stolephorus Commersonii*)


 *Fronthea Swastawati, Putut Har Riyadi, Hersanti Sulistyningrum, Sepsina Resky, Slamet Suharto.*

SRP. 2020; 11(9): 424 - 430

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.60

Research Article

Defensive Effects of Breberine against Cypermethrin Induced Male Reproductive System Toxicity in Rabbits

 *Hawraa M. Murad, Shurooq Asaad Abdulameer, Dhuha Salman Asker Aljuboory, Dheyaa A. Neamah, Ali Hamza Maktouf.*

SRP. 2020; 11(9): 841 - 846

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.120

Research Article

The Concept of Illness among Ethnic Groups in Indonesia: A Meta-Ethnographic Study

 *Agung Dwi Laksono, Ratna Dwi Wulandari, Zainul Khaqiqi Nantabah, Zulfa Auliyati Agustina, Ira Ummu Aimanah, Rukmini Rukmini, Yunita Fitrianti, Yurika Fauzia Wardhani, Diyan Effendi, Suharmiati Suharmiati, Lestari Handayani, Niniek Lely Pratiwi*

SRP. 2020; 11(9): 584 - 591

Research Article

Effects of Cinnamon and Their Beneficial Content on Treatment of Oxidative Stress

Oras Khalis yaseen, Mustafa Taha Mohammed.

SRP. 2020; 11(9): 847 - 850

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.121

Research Article

Incidence of Mumps in Hilla City

Harith Fathi AL-Asady, Lateef Hussien AL-Khafaji, Safaa Sahib Naji.

SRP. 2020; 11(9): 140 - 142

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.24

Research Article

Vitamin D3 for Health and Muscle Functions of Athletes

Mohammed Nader Shalaby, Mona Mostafa Abdo Sakoury, Salman Mohammed Harthi, Faleh Mohammed Alshalawi, Marwa Mohammed Alhajji, Zahraa Hassan Alshaikh, Alhanouf Hassan Aljaber.

SRP. 2020; 11(9): 851 - 854

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.122

Research Article

Exploration of the Relationship Between Interleukin 37 and Folic Acid in Type 2 Diabetic Patients

Anwar A. Hussain, Khalid F. Al-Rawi, Aseel Khalid Hameed.

SRP. 2020; 11(9): 143 - 148

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.25

Research Article

The Correlation of Google Trends as an Alternative Information Source in the Early Stages of COVID-19 Outbreak in Indonesia

Elly Usman, Ricvan Dana Nindrea.

SRP. 2020; 11(9): 431 - 438

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.61

Review Article

The Study of Genetic Variations of Human Testis-Expressed Protein 101 (TEX 101) and Hormonal Levels of Fertile and Infertile (Oligospermia) Men

Baraa Ahmed Saeed, Rayah S. Baban, Usama Al-Nasiri.

SRP. 2020; 11(9): 1108 - 1117

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.158

Research Article

The Relationship between Vitamin D Deficiency and Interleukins 8 and 10 in Diabetes Mellitus

Sura Mustafa Qasim, Alaa Zanza Ra'ad Al-dorri, Mohanad Hasan Mahmood Al-Izzi.

SRP. 2020; 11(9): 149 - 155

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.26

Research Article

Enhancing Antimicrobial Properties of Food Packaging Sheets by Incorporating ZnO- Nanoparticles (NPs)

Ali R Mulakhudair and Zahraa Reasan Kareem Shati.

SRP. 2020; 11(9): 592 - 596

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.86

Research Article

Do Servant Leadership Influence Market Performance? Evidence from Indonesian Pharmacy Industries

Yoyok Cahyono, M. Jihadi, Zainal Arifin, Wulan Purnamasari, Musnaini, Hadion Wijoyo, Fitriaty, Riyan Sisiawan Putra, Rizki Amalia Putri, Dadah Muliandyah, Popong Suryani, Agus Purwanto.

SRP. 2020; 11(9): 439 - 451

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.62

Review Article

Effect of Xanthium Strumarium Extract on Some Virulence Factor of Proteus Mirabilis Isolated from Patients in Ramadi Hospital

Ali Abd Sharad, Omar Almuharib, Najeab Mohammed Hussein.

SRP. 2020; 11(9): 1122 - 1124

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.160

Research Article

Assessment of Some Biomarkers Related with Recurrent Miscarriages in Iraq

Yahaya M. Jabber, Alaa Jawad Hassan, Hussein N. Abdullah.

SRP. 2020; 11(9): 156 - 162

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.27

Research Article

Penicillin for Secondary Prevention of Acute Rheumatic Fever and Rheumatic Heart Disease in Acehnese Children

HERLINA DIMIATI, SOFIA SOFIA, BASRI A. GANI.

SRP. 2020; 11(9): 452 - 457

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.63

Review Article

The Effect of Microbiology Fertilization on the Nitrogen Fixation of Wheat Plant

Fawz A. Al.Saffar, Alaa Hussein Ali Al-Shalal

SRP. 2020; 11(9): 1125 - 1129

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.161

Research Article

Distance Education as an Alternative Form of Learning During a Pandemic

Nataliia Kaliuzhka, Nelia Samoilenko, Larysa Zdanevych, Olesia Kyselova, Nataliia Terentieva, Diana Koval.

SRP. 2020; 11(9): 458 - 461

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.64

Research Article

Correlation between P53 and Ki67 with Aggressiveness Factor in Recurrent Respiratory Papillomatosis


Rizka Fathoni Perdana, Sri Herawati, Muhtarum Yusuf, Irwan Kristyono, Pugh Setya Nugroho.

SRP. 2020; 11(9): 163 - 168

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.28

Review Article

Assessment the Correlation of D-dimer and Ferritin Level in Patients Infected with Covid-19 in Anbar Governorate of Iraq


 Safaa A.L. Al Meani, Ali H. Abdulkareem, Mohammed O. Ibrahim, Mohammed M. Ahmed, Mahmood Yassin Mukhlif.

SRP. 2020; 11(9): 1130 - 1133

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.162

Research Article

Coronavirus: Disrupts the Health of Social Networking Sites (SNS)


 Dahyar Daraba, Ruliando Hasea Purba, Muhammad Faisal, Selfi Ami Susanti.

SRP. 2020; 11(9): 855 - 859

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.123

Research Article

Intervention Model for Barotrauma Diseases to Improve Health and Safety Diving Behaviors in Traditional Fishermen in Small Islands in Makassar, Indonesia


 Syamsiar S. Russeng, Lalu Muhammad Saleh, Awaluddin, M. Rum Rahim, Anwar Mallongi.

SRP. 2020; 11(9): 597 - 600

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.87

Research Article

Information and Innovative Technologies in Distance Learning in Higher Education Institutions of Ukraine


 Inna Ivzhenko, Iryna Sokol, Valentyna Kochyna, Margaryta Noskova, Liliia Yeromina, Valentyna Blokhina.

SRP. 2020; 11(9): 462 - 465

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.65

Review Article

Effect of COVID-19 Virus on Biomass Index of Infected Patients


 Safaa A.L. Al Meani, Mohammed M. Ahmed, Ali H. Abdulkareem, Nihad M. Hamid, Mohammed O. Ibrahim.

SRP. 2020; 11(9): 1134 - 1136

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.163

Research Article

Effect of Adsorbent Composition Variation Quartz Sand/Andisol Soil/Zeolite/Activated Carbon Toward Cu, Pb, Coliform Total and E. coli Treatments on the Citarum River


 Muhammad Sholeh, Pranoto, Sri Budiastuti, Sutarno.

SRP. 2020; 11(9): 169 - 177

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.29

Review Article

Pre-Exposure Prophylaxis for COVID-19 Infection: Current Concepts and Strategies

 Asmaa T Uthman, Noor N Al-Rawi, Natheer Al-Rawi.

SRP. 2020; 11(9): 860 - 865

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.124

Research Article

The Effect of Treating Barley Straw with Fungus (Trichoderma Harzianum) (1): on Growth and Some Carcasses Characteristics of Awassi Lambs

 S.N. Alwaeli, W.H. Al-Samarae, M.J.H. Al-Tamemmy and Y.M. Al-Saadi.

SRP. 2020; 11(9): 601 - 605

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.88

Review Article

Investigation of the Trichomonas Hominis and Some other Parasites in Cases of Diarrhea Accompanying Children Arriving to the Obstetrics and Gynecology Hospital in Ramadi / Iraq


 Abdulkhalik Alwan Mohemeed, Thaeer Abdulqader salih, Qutaiba Ali Saleh Khalaf AL- juboori.

SRP. 2020; 11(9): 1137 - 1142

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.164

Research Article

Six Sigma Benefit for Indonesian Pharmaceutical Industries Performance: A Quantitative Methods Approach


 Hayu Kartika, Defi Norita, Novera Elisa Triana, Iwan Roswandi, Abdul Rahim, Aulia Naro, Titia Izzati, Andary Asvaroza Munita, Didi Junaedi, Wiwit Suprihatiningsih, Agus Purwanto, Candra Setia Bakti.

SRP. 2020; 11(9): 466 - 473

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.66

Review Article

A Novel Pleiotropic Effect of Beta-Blockers: Useful or Not?


 Tara Mandiricha, Maftuchah Rochmanti.

SRP. 2020; 11(9): 178 - 186

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.30

Research Article

Beta-Oxybutyrates: Biological and Pharmacological Effects


 Bokov D.O., Morozova M.A., Beniashvili A.G., Bessonov V.V..

SRP. 2020; 11(9): 866 - 871

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.125

Research Article

Behavior of Growth and Yield Bread Wheat by the Influence of Fulvic Acid and Seeding Rate


 Hanaa Khudhaier Mohammed Ali Al-Haidary and Safaa A. Al-Zubaidy.

SRP. 2020; 11(9): 606 - 612

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.89

Review Article

[Studies on microRNA in Pediatric Tuberculosis](#)


 *Ayling Sanjaya, Dwi Yuni Nur Hidayati, Susanthi Djajalaksana, HMS Chandra Kusuma, Sumarno.*

SRP. 2020; 11(9): 1143 - 1149

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.165

Research Article

[PSMA-Specific Peptide with Inhibitor Cystine Knot for Prostate Cancer Treatment](#)


 *Elena Iurova, Ivan Beloblov, Evgenii Beloborodov, Eugenia Rastorgueva, Evgenia Pogodina, Elizaveta Tazintseva, Aleksandr Fomin.*

SRP. 2020; 11(9): 187 - 194

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.31

Research Article

[Research Activity as a Technology of Activation of Cognitive Activity of Students of Higher Education Institutions](#)

 *Tetiana Alieksiienko, Yuliia Pivnenko, Hanna Apalat, Lesia Vysochan, Viktoriia Mohilevska, Iryna Androshchuk.*

SRP. 2020; 11(9): 474 - 477

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.67

Research Article

[Study the Impact of Some Factors Associated with Hookah Smoking on Blood Standards](#)

 *Amjad Adham Ahmed, Atheer Shehab Ahmed and Sara Fawzi Sahm.*

SRP. 2020; 11(9): 613 - 616

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.90

Review Article

[Molecular analysis of virulence genes of UTI causing bacteria among pregnant women in Baghdad city, Iraq](#)

 *Elaf Sameer and Rawa Abdul Redha Aziz.*

SRP. 2020; 11(9): 1150 - 1162

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.166

Research Article

[Does the Place of Residence Affect the Achievement of Exclusive Breastfeeding? A Study in Eastern Indonesia](#)

 *Ratna Dwi Wulandari, Agung Dwi Laksono.*

SRP. 2020; 11(9): 872 - 876

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.126

Research Article

[Effect of Pedagogic, Professional Competency, and Work Motivation Toward Indonesian Primary School Teachers Performance](#)

 *Jihaduddin, Nenden Suciwati Sartika, Desty Endrawati Subroto, Ratu Mauladaniyati, Eka Rosdianwinata, Rusdian Rifa'i, Asep Sujana, Zaenal Abidin, Muhamad Dadi Priadi, Eka Setiawati, Desri Yanti, Agus Purwanto.*

SRP. 2020; 11(9): 617 - 626

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.91

Research Article

[Factors Related to the Choice of Contraceptive Methods among the Poor in Indonesia](#)

 *Agung Dwi Laksono, Ratu Matahari, Ratna Dwi Wulandari.*

SRP. 2020; 11(9): 195 - 200

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.32

Research Article

[Interactive Training Tools in the Modern Educational Process](#)

 *Nataliia Malinovska, Valentyna Borova, Valentuna Benera, Vadym Shemchuk, Iryna Gogol, Ihor Androshchuk.*

SRP. 2020; 11(9): 478 - 480

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.68

Research Article

[The Role Of Women In Maintaining The Environment Through Vegetable Development In Rural Agriculture Systems](#)

 *Evi Feronika Elbaar, Beatrixia Barbara, M. Arief Fathuddien Hamdie, Yayuk Puji Lestari.*

SRP. 2020; 11(9): 1163 - 1170

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.167

Research Article

[Genotype of Potassium Inwardly Rectifying Channel, Subfamily J, Member 11 \(KCNJ 11\) Gene and Glycaemia Control in Diabetic Patients: A Narrative Review](#)

 *Dyah Aryani Perwitasari, Imaniar Noor Faridah, Haafizah Dania, Lalu Muhammad Irham, Fathia Vikri Salsabila, Rita Maliza.*

SRP. 2020; 11(9): 627 - 631

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.92

Research Article

[The Impact of Diabetes Mellitus on the Association of Endothelial Nitric Oxide Synthase Gene Polymorphisms \(4a/4b, G894T, and T786C\) with Clopidogrel Resistance in Coronary Artery Disease Patients Undergoing Percutaneous Coronary Interventions](#)

 *Ali A. R. Aldallal, Bassim I Mohammad, Ahmed N. Rgeeb, Salam Jasim mohammed, Khalid Amber.*

SRP. 2020; 11(9): 877 - 882

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.127

Review Article

[A Review of Salmonellosis on Poultry Farms: Public Health Importance](#)

 *Freshindy Marissa Wibisono, Freshinta Jellia Wibisono, Mustofa Helmi Effendi, Hani Plumeriastuti, Akvyan Rafi Hidayatullah, Erwan Budi Hartadi, Eka Dian Sofiana.*

SRP. 2020; 11(9): 481 - 486

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.69

Research Article

[Molecular Pharmacology Study of Andrographolide Extracted from Andrographis Paniculata on Atherosclerosis Preventive Effect](#)


 *Ni Kadek Warditiani, Pande Made Nova Armitha Sari, Yan Ramona, Made Agus Gelgel Wirasuta.*

SRP. 2020; 11(9): 201 - 206

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.33

Research Article

[Adverse Effects of Green Tea on Public Health the Untold whole Medical Story](#)

 *Ameera Kamal Khaleel, Ramizu Bin Shaari, Mohamad Arif Awang Nawwi, Ali Mihsen Hussein Al-yassiri.*

SRP. 2020; 11(9): 883 - 887

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.128

Review Article

[A Review of Bacterial Zoonoses and Antimicrobial Resistant \(AMR\) on Grouper fish \(Epinepholus sp.\)](#)


 *Azhar Muhammad Helmi, Akhmad Taufiq Mukti, Agoes Soegianto, Ketut Mahardika, Indah Mastuti, Mustofa Helmi Effendi and Hani Plumeriastuti.*

SRP. 2020; 11(9): 79 - 88

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.14

Research Article

[The Level of Student`s Creative Thinking Through Solving Open Ended Mathematics from Learning Style](#)


 *Dr. Ardianik, M.Kes., M.Pd, Dr. Edy Widayat, Drs., M.Si, Nailul Izzah, S.Pd., M. Kes, Dr. Kusmiyati, Dra., M. Pd.*

SRP. 2020; 11(9): 207 - 213

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.34

Research Article

[Modern Halogen-Containing Anesthetics in Anesthetic Management of Thoracic Surgical Interventions](#)


 *Dmitry G. Kabakov, Margarita A. Vyzhigina, Dmitry V. Bazarov, Svetlana G. Zhukova, Alexey A. Kavochkin, Kulagina T.Yu.*

SRP. 2020; 11(9): 487 - 493

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.70

Research Article

[Effect of Phosphorus Interferon on Some Physiological and Growth of Barley \(Hordeum Vulgare L.\)](#)


 *Warqa a Muhammed Shariff Al-Sheikh.*

SRP. 2020; 11(9): 632 - 635

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.93

Research Article

[Evaluation of the Combination of Sargassum Duplicatum, Sargassum Illicifolium, Abelmoschus Esculentus, and Garcinia Mangostana Extracts for Open Wound Healing in Diabetic Mice](#)


 *Saikhu Akhmad Husen, Muhammad Farraz Syadzha, Muhamad Frendy Setyawan, Pratiwi Pudjiastuti, Arif Nur Muhammad Ansori, Raden Joko Kuncoroningrat Susilo, Suhailah Hayaza, Dwi Winarni, Win Darmanto.*

SRP. 2020; 11(9): 888 - 892

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.129

Research Article

[Slow Released Fertilizer of Fe²⁺ and Mn²⁺ from Composite Micronutrient Chitosan-Silica](#)


 *Bertha Mangallo, Anwar Mallongi, Ishak MUSAAD, Sartji Taberima.*

SRP. 2020; 11(9): 499 - 502

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.72

Research Article

[Molecular and susceptibility Study of Antibiotic Resistance Genes in E. coli Isolated from Selected Iraqi Patients](#)

 *Wedad Salih Dawood.*

SRP. 2020; 11(9): 214 - 223

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.35

Research Article

[Performance Achievement of Nutritional Programs in Mulyorejo Public Health Center, Surabaya, Indonesia in 2018](#)


 *Shifa Fauziyah, Zukhaila Salma, Serious Miliyani Dwi Putri, Faradila Khoirun Nisa Hakim, Hamidah Retno Wardani, Budi Utomo, Adi Pranoto, Pradika Gita Baskara, Teguh Hari Sucipto.*

SRP. 2020; 11(9): 893 - 898

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.130

Research Article

[Use of Natural Peptides with a Cysteine Knot of Arthropods as a Carrier of a Peptide Tropic to Glutamate Carboxypeptidase II](#)


 *Elena Iurova, Ivan Beloblov, Evgenii Beloborodov, Eugenia Rastorgueva, Evgenia Pogodina, Elizaveta Tazintseva, Yuri Saenko, Aleksandr Fomin.*

SRP. 2020; 11(9): 503 - 509

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.73

Research Article

[Scoring System in Prediction of Stunting Risk Among Children in West Sumatera Province, Indonesia](#)


 *Masrul, Elly Usman, Amel Yanis, Ricvan Dana Nindrea.*

SRP. 2020; 11(9): 636 - 641

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.94

Research Article

[Transvaginal Ultrasound versus Saline Infusion Ultrasound for the Characterization of Intrauterine Lesions in Premenopausal Women with Abnormal Uterine Bleeding](#)

 *Rana Hatem Matrood Alkhazraji, Mohammed Habeeb Hachim and Alaq Saeed Abdulhussain.*

SRP. 2020; 11(9): 224 - 228

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.36

Research Article

[Importance and Benefit of Application of Governance Risk and Compliance Principle](#)

 *Bambang Leo Handoko, Ignatius Edward Riantono, Engelwati Gani.*

SRP. 2020; 11(9): 510 - 513

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.74

Research Article

Evaluation of the Effect of Massage by the Mother on the Pain of Term Infants after Care Measures


 *Hamidreza Khoshnezhad Ebrahimi, Soroor Sohrabi, Shabahang Jafarnejad, Saeideh Iranmanesh, Somayeh Esmaeilian.*

SRP. 2020; 11(9): 899 - 904

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.131

Research Article

Hepatoprotective Activity of Ethanolic Extract of Fresh and Fermented Clam *Meretrix meretrix* from Kalimantan, Indonesia

 *Dzul Fadly, Andi Hairil Alimuddin, Rukman Abdullah, Lili Amaliah, Rafdinal, Shifa Helena, Syarif Irwan Nurdiansyah, Warsidah.*

SRP. 2020; 11(9): 514 - 517

[» Abstract](#) [» PDF](#) DOI: 10.31838/srp.2020.9.75

A Review of Enterotoxigenic *Escherichia coli* Infection in Piglets: Public Health Importance

Erwan Budi Hartadi¹, Mustofa Helmi Effendi^{2*}, Hani Plumeriastuti³, Eka Dian Sofiana¹, Freshindy Marissa Wibisono¹, Akvyan Rafi Hidayatullah¹

¹Master Program in Animal Diseases and Veterinary Public Health, Faculty of Veterinary Medicine, Universitas Airlangga.

²Departement of Veterinary Public Health, Faculty of Veterinary Medicine, Universitas Airlangga

³Departement of Veterinary Pathology, Faculty of Veterinary Medicine, Universitas Airlangga

UNAIR C-Campus Mulyorejo, Surabaya, Indonesia, 60115.

* **Corresponding author:** Mustofa Helmi Effendi. Department of Veterinary Public Health, Faculty of Veterinary Medicine, Universitas Airlangga, Surabaya, Indonesia, Postal code: 60115.

Email: mheffendi@yahoo.com

ABSTRACT

Diarrhea in piglets can cause health problems and even death. The cause is often infection by enterotoxigenic *Escherichia coli* (ETEC). This condition can have an impact on the growth of pigs and the economy of farmers, the cause can also be transmitted to humans which has an impact on public health. Diarrhea is one of the main health problems of piglets, because it attacks the digestive tract, especially the intestines. The main virulence factors are adhesin (fimbriae) and enterotoxins, with the most frequently found being ETEC F4 (K88) and F18. Fimbriae F4 (K88) ETEC causes diarrhea in neonatal pigs, while fimbriae F18 causes diarrhea in post-weaning pigs (PWD). Meanwhile, enterotoxin is divided into two types, namely heat labile enterotoxin (LT) and heat resistant enterotoxin (ST). After attaching it to the intestinal mucosa, *E. coli* will colonize and produce enterotoxins. Neonatal diarrhea is usually observed in piglets 1-4 days of age, while post-weaning diarrhea occurs in piglets 2-3 weeks after weaning with a peak diarrhea occurring 6-8 weeks post weaning, and even at 12 weeks. The large amount of water and electrolyte secretions causes dehydration, metabolic acidosis, osmotic diarrhea and a high probability of death before 2 weeks. Currently, there are many incidents of antibiotic resistance, so an alternative use of antibiotics is needed in pig farms to prevent ETEC infection. Alternative antibiotics that can be used to prevent infection with ETEC infection in piglets are immunoprophylaxis, antimicrobial minerals (such as zinc oxide and cupri sulfate), acidifiers, blood plasma, egg yolk antibodies, probiotics, nucleotides, bacteriophages and so on. These kinds of alternatives and feed additives can improve intestinal health and prevent diarrhea in piglets. This review contains the latest research from various journals discussing how ETEC can infect piglets and the management against the disease.

Keywords: enterotoxigenic *Escherichia coli* (ETEC), diarrhea, piglets, public health

Correspondence:

Mustofa Helmi Effendi

Department of Veterinary Public Health, Faculty of Veterinary Medicine, Universitas Airlangga, Surabaya, Indonesia, Postal code: 60115.

Email: mheffendi@yahoo.com

INTRODUCTION

The digestive tract (GIT) is an important channel in the metabolism and defense system of pigs. One of the important parts of this channel is the intestine. The intestine is responsible for digesting food, absorption of nutrients, and for protecting the body from toxins or pathogens. So that knowledge is needed in maintaining the health of piglets. The most common cases of piglets are neonatal diarrhea, post-weaning diarrhea (PWD) and edema. This is caused by enterotoxigenic *Escherichia coli* (ETEC) infection. ETEC can cause health problems and even death in piglets around the world (1,2). So that the pathogenesis of this infectious agent is important to be discussed in this review. ETEC attaches to the epithelium of the small intestine of pigs, then there is an increase in the secretion of water and electrolytes in the intestinal lumen. This is due to the production of enterotoxins and subsequent changes in enterocyte function. The large amount of water and electrolyte secretions causes dehydration, metabolic acidosis, osmotic diarrhea and a high probability of death before 2 weeks (3).

Diarrhea in pigs caused by *E. coli* is classified into six pathogenic strains based on virulence factors and pathogenic characteristics. Namely enterotoxigenic *E. coli* (ETEC), enterohemorrhagic *E. coli* (EHEC) or shiga-toxicogenic *E. coli* (STEC), enteroagregative *E. coli* (EAEC), enteropathogenic *E. coli* (EPEC), enteroinvasive *E. coli*

(EIEC), and diffusely attached *E. coli*. The most common and pathogenic strain in piglets is the ETEC strain (4,5).

The incidence of diarrhea in piglets is usually associated with the virulence factors of ETEC. Another very influential factor besides enterotoxin is fimbriae. The main fimbriae in pigs are F18 fimbriae in post-weaning piglets and F4 (K88) fimbriae in newborn pigs (neonates) (6-8). The large number of *E. coli* bacteria that are resistant to certain antibiotics has prompted research on preventive and control measures, one of which is finding a substitute for antibiotics. Abraham et al. (2014) stated that in their research, *E. coli* in pigs in Australia was resistant to several antibiotics including third generation cephalosporins and fluoroquinolones (9). Another Australian study found *E. coli* resistance to colistin antibiotics, streptomycin spectinomycin, ampicillin and trimethoprim-sulfamethoxazole (10). Another study, ETEC infection in swine in Switzerland, occurred resistance to antibiotics ampicillin, gentamicin, kanamycin, sulfonamide, streptomycin, tetracycline, and trimethoprim (11). In Kupang, Indonesia, the dominant resistance of *E. coli* isolates from pigs to erythromycin and cephalotin antibiotics (12). Even the research of Rosager et al. (2017) suggested that resistance was greater in *E. coli* ETEC strains than in non-ETEC (13). This indicates that it is difficult to control *E. coli* in piglets which causes diarrhea. With the incidence of diarrhea in piglets caused by ETEC,

knowledge of preventive and control measures against this problem is required. Furthermore, this review focuses on alternative strategies for preventing ETEC infection in piglets.

Description of E. coli causing colisepticemia and pathogenesis

Enterotoxigenic *E. coli* disease (ETEC) in piglets causes huge economic losses with high morbidity, high mortality, growth retardation and high medical costs (13). Neonatal diarrhea is usually observed in piglets ages 1-4, while post-weaning diarrhea occurs in piglets 2-3 weeks after weaning with a peak diarrhea occurring 6-8 weeks post weaning, and even at 12 weeks. The period of ETEC infection to cause diarrhea is around 1 to 5 days depending on many factors, especially the success of bacterial colonization of the small intestinal mucosa (14).

Diseases caused by *E. coli* can cause diarrhea and septicemia in piglets. In addition, it can also cause diarrhea, edema during weaning, mastitis and cystitis in broodstock (15). Diarrhea in piglets often occurs as a result of a single infection or various types of *E. coli*, including ETEC, toxin-producing *E. coli* vero or shiga, necrotogenic *E. coli*, enteropathogenic *E. coli*, enterohemorrhagic *E. coli*, enteroaggregative *E. coli*, and enteroinvasive *E. coli*. Among these *E. coli* strains, ETEC is a common cause of severe and watery diarrhea in piglets (16). There are two important parts of ETEC infection in causing diarrhea, namely intestinal epithelial cells and the production of toxins from bacteria. The most well-known enterotoxin genes are the heat-labile enterotoxin LT and the heat-stable enterotoxins STa, STb. These toxins have the ability to cause diarrhea due to various changes in electrolyte balance (2,17).

Virulence Factors in Escherichia coli

The main pathotype of *E. coli* causing diarrhea in piglets is ETEC. These bacteria live and multiply in the intestinal epithelium. Diarrhea can cause health problems, death and economic decline for pig farmers. Enterotoxins produced by bacteria can also cause damage to enterocyte cell function so that they can interfere with fluid homeostasis (increasing fluidity and reducing water absorption) in the small intestine (6,7). Apart from predisposing environmental conditions and host factors, as well as high bacterial proliferation in the gut, virulence factors are very important in playing a role in the process of diarrhea. Virulence factor refers to the molecules produced by bacteria when interacting with the host (18). The main virulence factors of ETEC are adhesives with attachments such as fimbriae and enterotoxins. These fimbriae will help the bacteria attach to specific receptors. It is important for the pathogenesis process are adhesins and enterotoxins. These specific receptors make the ETEC strain host specific (10).

The first step in the pathogenic process is an interaction between adhesins and ligands on the microvilli of the small intestine, this allows bacteria to attach to the microvilli (19). The relationship between ETEC and intestinal epithelium is caused by adhesive fimbriae such as F4 (faeG) and F18 (fedA), as well as F5 (fanC), F6 (fasA), and F41 (fim41A). ETEC classification in pigs at least in *E. coli* isolates found one enterotoxin gene (elt, sta, stb), along with one gene encoding fimbriae, including F4, F5, F6, F18, and F41 (2). The main fimbriae in pigs are F18 fimbriae in post-weaning pigs and F4 (K88) fimbriae in newborn pigs (7).

Morphologically, fimbriae can be classified into 2 categories, namely pili and fibrillae (20). Fimbriae are extracellular appendages 0.5-10 µm long and 2-8 nm

wide. Fimbriae are involved in adhesion and many other functions, including interactions with macrophages, biofilm formation, gut persistence, and bacterial aggregation (21). There are two antigenic variants that have been identified, namely F18ab (previously known as F107) and F18ac (previously known as 2134P and 8813), the word a means an antigen factor and the word b, c is a specific factor (22, 23). The majority of the ETEC F18 strains were capable of producing heat-resistant enterotoxins including STa and STb, whereas the ability to produce Shigatoxin was more related to F18ab (23). F18 is coded by the fed gene of five units, namely, fed A (major subunit), fed B (usher), fed C (chaperone), fed E (minor protein) and fed F (adhesin) (24).

Fimbriae F18 are filaments 1 to 2 mm long based on the main structural protein, called fed A (15.1 kDa) (16). The main structural subunit of F18 fimbriae is fed A, but the small adhesive fed F subunit also plays a central role in binding to the host receptor and is highly conserved among the F18 strains (25,26). F18ab is usually associated with strains that produce Stx2e (STEC) or shigatoxin *E. coli*, and F18ac is associated with ETEC causing diarrhea in post-weaning piglets (PWD) (27). The ETEC F18 + strain frequently produces heat-resistant enterotoxins including STa and STb, whereas heat labile (LT) enterotoxins are rarely produced in these strains (28, 29). ETEC colonization in the small intestine is initiated by the interaction of the fimbriae receptor, namely F18 fimbriae which binds to glycoproteins on the microvilli or brush border of the small intestine (24, 30). Genetically, some piglets do not have the F18 fimbriae receptor and thus these pigs may be resistant to F18 + ETEC colonization (31,32).

Enterotoxigenic *E. coli* (ETEC) K88 expresses F4 fimbriae, which are proteinaceous filamentous adhesins consisting of repeated copies of the major fimbrial subunit fae G and several additional minor subunits (33). The ETEC strain expressing F4 fimbriae is associated with neonatal diarrhea and post-weaning diarrhea in piglets. Three variations of the F4 fimbriae antigen are F4ab, F4ac, and F4ad, with the most popular being F4ac. These antigen variants differ in amino acid composition from the main subunit, fae G, and each has a related but different receptor binding profile (34, 35).

Amino acids along the 125 - 163 subunits of FaeG are effectively essential to the binding of fimbrial F4. Amino acid residues 140-145 and 151-156 were identified as functional sites for F4ab fimbriae. Meanwhile, other amino acids, namely 148-150 and 156-158, were reported to inhibit the attachment of F4ab to the host cell. F4ac has an amino acid length of 147 to 160, this being the defining epitope that controls the fimbrial binding capacity (36). In contrast to the ab and ac variants, the F4ad FaeG subunit interacts with the minimal galactose-binding epitope via the D'-D''-α1-α2 binding domain, resulting in different structural and attachment properties (34). Recent studies have shown that oral inoculation of ETEC / VTEC / EPEC F4 ab or ac in freshly weaned piglets causes enteritis and a severe systemic inflammatory response (37). In another study, in vitro enterotoxigenic binding of F4 + *E. coli* (ETEC) to piglet enterocytes was partially blocked by dose-specific neoglycans (38). FaeG is the main fimbriae subunit and adhesion for F4 fimbriae compared to F18 fimbriae. All adhesins F4 bind to carbohydrate glycoproteins in intestinal epithelial cells and intestinal mucus. F4ad adheres more to glycolipids, whereas adhesins F4ab and F4ac tend to bind glycoproteins more (36).

Other associated fimbriae that have a lower prevalence are F5 (K99), F6 (987P), F17 (Fy / Att25) and F41, with the number of active receptors in intestinal epithelial cells decreasing as the pigs and cows age. This fimbriae is usually found in post weaning piglet diarrhea (PWD) together with F18 and / or F4, or individually (6). The results of the most recent study regarding colonization factors identified among the ETECs isolated from swine neonatal diarrhea were F4, F5 + F41, and F6 (40.5, 16.7, and 11.9%, respectively), whereas in post-piglet diarrhea, weaning (PWD) there were no positive isolates for F5, F6, and F41 (8).

Enterotoxin Characteristics

Enterotoxins are extracellular proteins or peptides secreted by bacteria, one of which is ETEC. ETEC can cause disease by colonizing the small intestine or colonization factors (CFs), the production of heat-resistant or labile toxin (LT) and / or heat-resistant or stable toxin (ST) toxins. The proportion of ETEC strains producing single LT, single ST, or both toxins (LT + ST) varies depending on geographic location and seasonality. However, overall, the majority of ETEC produced ST and LT (17,39).

LT is an 84-kDa polymer protein consisting of enzymatically active A subunits (28 kDa) which are noncovalently linked to pentameric B subunits (11.5 kDa each). Subunit A consists of two components, A1 and A2. The A1 subunit (21 kDa), the enzymatically active portion of the toxin, is noncovalently linked to pentamer B via peptide A2 (7 kDa) (40,41). STp or stable toxin produced by pigs is a short peptide, consisting of 18 or 19 amino acids, originally produced as 72-structure amino acids by bacteria (17). The STa gene encodes 72 precursors of pre-pro-peptide amino acids. Just like STa, STb is synthesized as 71 amino acid prepeptides, consisting of a signal peptide and an adult STb enterotoxin namely 48 amino acids (5.2 kDa) (42).

Labile enterotoxin (LT) is a member of the AB5 toxin family, which is similar to the cholera toxin secreted by *Vibrio cholerae*. These toxins have structural similarities and mechanisms of action. The LT structure consists of one catalytic subunit A and a pentameric ring of subunit B as a receptor binding. The subunit is encoded by genes from plasmids *eltA* and *eltB*, and then transcribed as operons (41,42,43). Subunit A contains 240 amino acids, while subunit B contains 103 amino acids (16).

Subunit A is enzymatically active, divided into A1 and A2. Domain A1 is enzymatically active, domain A2 is shorter active and five B subunits mediate binding of glycolipid and glycoprotein receptors to host cells. Pentamer GM1-binding B subunit (LTB) (11.5 kDa) interacts with A subunit (28 kDa) via noncovalent binding of the A2 domain to form the holotoxin AB5 structure. The B subunit binds primarily to the monosialotetrahexosylganglioside (GM1) receptor on the cell surface. Domain A1 is responsible for ADP-ribosylating stimulation of G protein. A1 will translocate to the endoplasmic reticulum and activate the cyclic adenylate system to increase cellular cyclic adenosine monophosphate then the intracellular cAMP concentration is uncontrolled. As a result, the ions open, then the chloride anion and then the water molecules are released. This is a characteristic feature of diarrhea caused by ETEC infection, namely increased secretion of fluids and electrolytes followed by decreased water absorption (44,45). In addition to its enterotoxicity function, LT also acts as an adhesin, which binds bacteria to GM1 in the plasma membrane of small intestinal epithelial cells. Elimination of the LT gene can reduce the

severity of diarrhea and ETEC colonization in the small intestine of pigs (46,47).

Heat resistant enterotoxin (ST) produced by ETEC is a peptide which is divided into two types, namely STa and STb. STb is more deadly in animals, especially in post-weaning piglets (PWD). Then the STa enterotoxin is more relevant for diarrhea in humans, newborn piglets and calves. These peptides are encoded by two genes, *estA* (STI) and *estB* (STII), which are located in plasmids, and can be differentiated from one another by their solubility in methanol and their protease sensitivity (42).

STa has poor resistance due to its small size (19 amino acids with 3 disulfide bonds), but STa is a very strong enterotoxin (48). Enterotoxin STa is soluble in methanol and resistant to proteolytic enzymes. According to the host species, STa is further classified into two subtypes, known as STp and STh, which were initially isolated from the ETEC strains of pigs and humans. While STb is a peptide consisting of 48 amino acids with 4 cysteine residues included in 2 disulfide bonds (42).

Serogroups and serotypes in diarrhea caused by ETEC

ETEC has many variations of the toxin coding genes, so that scientists classify them based on specific serogroups and specific serotypes. ETEC specific serogroups, namely O and H serogroups, were determined based on lipopolysaccharide and flagella. The O antigen consists of repeating subunits that extend over the surface of the bacteria. Research in China, the most O antigen found in pigs is O8, O64, O141 and O149 (49-51). This is in line with research in Vietnam, where the O8 antigen found the most (52). Other serogroups that cause diarrhea are O2, O6, O9, O, 11, O20, O26, O40, O45, O48, O54, O86, O87, O115, O101, O138, O139, O147, O152, O157 and O161. Meanwhile, serogroup O causes edema, namely O138, O139 and O141 (49,51). Specific serogroup H are determined by the flagella antigen, which also serves as an antigenic marker. This antigenic will be useful as a component of the ETEC vaccine. When compared with serogroup O, serogroup H has less association, namely O141: H4, O2: HNM, O139: H1, O26: H11 and O2: H40 antigens (8). In addition, fimbrial adhesins which also play an important role in diarrhea caused by ETEC in pigs are F4 (K88), F5, F6, F18 and F41 (53).

Pathogenesis of Enterotoxigenic E. coli (ETEC).

Adhesins and enterotoxins in the pathogenesis of ETEC play an important role as virulence factors. Adhesin in ETEC is useful for facilitating binding to specific receptors of small intestinal epithelial cells. Adhesin also plays an important role in the colonization, proliferation and development of ETEC infection. Enterotoxins are also considered to be direct virulence factors that cause disease and may also play a role in the colonization process. (54).

There are four main fimbriae in ETEC as fimbrial adhesins, namely F4 (K88), F5 (K99), F6 (987P), and F41. One particular ETEC strain usually only expresses one fimbrial type, so that each strain has a different fimbrial type. ETEC possessing fimbrial adhesins F4 which release enterotoxins is a characteristic pathogen causing diarrhea in piglets (55). The ETEC strain expresses two main types of enterotoxins as previously described, namely heat-labile (LT) enterotoxins and heat-stable (ST) enterotoxins. Enterotoxin ST is subdivided into STa and STb according to differences in protein structure and pathogenesis. Since each section targets a specific site, it is necessary to develop vaccinations against ETEC targeting fimbriae and enterotoxins.

How much bacteria colonize can determine the severity of the disease. Fimbriae attach to specific receptors for small intestinal epithelial cell membranes and non-specific on the epithelial mucous membrane of the small intestine, in this case the jejunum (56). The molecular epidemiology of diarrhea in pigs showed that the ETEC F4 receptor was expressed in the small intestine of newborn to adult pigs, whereas the ETEC F18 receptor was expressed increased in 3 weeks old pigs (57). Therefore, the F18 receptor does not cause diarrhea in newborn pigs.

Immunoglobulin G (IgG) antibodies or immunoglobulin A (IgA) piglets were obtained from the colostrum of sows that developed *E. coli* in their intestines. However, this only applies to weaning (54,58). As previously explained, piglets with ETEC usually show watery diarrhea in the first week after infection with ETEC. Some piglets died suddenly without symptoms of diarrhea, when necropsy was performed, intestinal edema occurred. The diarrhea causes significant dehydration due to impaired intestinal absorption. The pathogenetic mechanism of LT and ST enterotoxins, namely damaging the function of small intestinal epithelial cells which results in increased secretion of water and electrolytes (Na⁺ and Cl⁻), decreased fluid absorption and dehydration, and even acidosis.

The mechanism of action of LT is divided into 2 subunits, namely, the A subunit is enzymatically active and five B subunits which mediate the binding of glycolipids and glycoprotein receptors to host cells. Pentamer GM1-binding B subunit (LTB) interacts with the subunit via noncovalent binding of the A2 domain. The B subunit binds to the monosialotetrahexosylganglioside (GM1) receptor on the cell surface. Domain A1 is responsible for ADP-ribosylating stimulation of G protein. Then A1 will translocate to the endoplasmic reticulum and activate the cyclic adenylate system to increase cellular cyclic adenosine monophosphate then intracellular cAMP concentration is not controlled. Furthermore, protein kinase A is stimulated by cAMP which phosphorylates the cystic fibrosis transmembrane conductance regulator (CFTR). As a result, the ions open, then the chloride anion and then the water molecules are released. This is a characteristic feature of diarrhea caused by ETEC infection, namely increased secretion of fluids and electrolytes (Cl⁻) followed by decreased water absorption (44,45).

STa binds and activates guanylyl cyclase C (GC-C) in the brush border of the intestinal epithelium. It then induces intracellular cGMP accumulation and activates several interrelated signal transduction routes resulting in an uncontrolled osmotic flow of water to the intestinal lumen (Na⁺ and Cl⁻) (4,59). The STb transduction pathway does not involve cyclic nucleotides as secondary messengers. Research shows that STb binds to the sulfatide receptor (3-O-sulfogalactosylceramide) and is internalized into small intestinal epithelial cells. Subsequently, the protein G cascade was activated, and the intracellular calcium concentration increased. This makes a number of enzymes active. The first phase is calmodulin dependent PKII, which opens a specific chloride pathway and activates PKC. The result is phosphorylation of CFTR and inhibits absorption of Na⁺. Next is the activation of phospholipase A2 and C enzymes. The function of this enzyme is to catalyze the release of arachidonic acid from the phospholipid membrane and the formation of prostaglandins E2 and serotonin, which are known as secretory agents from enterochromaffin cells (60).

Incidence of diarrhea caused by ETEC in piglets.

There were cases of antibiotic resistance to ETEC strains in Switzerland with certain characterizations (11). In Brazil, ETEC strains were also found with the types LT, STa and STb, with the most cases being the type STb (61). In addition, there were cases of diarrhea in neonatal pigs in Spain, one of which is due to ETEC infection. The ETEC patotypes that often occur are STa and STb, with fimbriae F4 (62). In Spain, out of 122 pigs to be studied for antibiotic resistance, 94 were stricken with ETEC diarrhea (63).

Furthermore, in South Africa, the dominant STb type ETEC case appeared with high frequency in newborn and post-weaning piglets. A total of 74.4% of ETEC cases presented with diarrhea symptoms and 69.2% without diarrhea (14). A recent study in Korea from 2008 to 2016, found cases of diarrhea in piglets with a percentage of 61.3% ETEC, with various types of enterotoxins (27). Until now, there are still many cases that occur in piglets caused by ETEC. In addition, ETEC has a specific coding gene with a specific target which can be used as a reference for research related to vaccination of this disease. This encourages research to conduct research on how to prevent and control diseases caused by ETEC infection (11).

Preventive measures against diarrhea caused by ETEC

The diagnosis of diarrhea in piglets must take into account clinical signs and lesions, as well as epidemiological patterns and detection of infectious agents (64). However, it would be difficult to diagnose diarrhea caused by ETEC on the basis of clinical signs and necropsy lesions alone, which are considered non-specific. Isolation and identification of *E. coli* still does not prove the relationship of disease, because *E. coli* is a normal bacterial flora in the intestines of animals. Thus, a phenotypic or genotypic description of the isolated strains is needed to recognize bacterial fimbriae. Furthermore, it can be carried out characterization of genes encoding fimbrial proteins and enterotoxins (65).

Virulence factors such as adhesins and enterotoxins can be detected by ELISA (Enzyme-linked Immunosorbent Assay) (66, 67). More recently, DNA-based molecular detection methods for determining serotypes, such as enterotoxins and fimbrial genes, can use PCR with samples from the faecal or internal organs of the intestine. Until recently detection using PCR was more effective and simplest for diagnosis in pigs (68, 69). Another study using PCR multiplex has proven useful for the rapid, sensitive and specific detection of enteric pig pathogens (70).

Neonatal pigs can form immune reactions such as tolerance or mucosal defense against certain antigens (71). Vaccination of weaned piglets can be used to control diarrhea due to ETEC infection. Continuous supply of SIgA to piglets via milk is required for passive immunity. Piglets must have active immunity to ETEC after weaning because passive immunity cannot continuously protect against ETEC infection (72). So that targeted vaccination is needed to protect the intestinal mucosa. The vaccine must activate the immune system in the intestinal mucosa as well as immunoglobulin specific to the antigen, namely IgA and IgM.

There are several methods of applying the ETEC vaccine to pigs. The first is via intramuscular injection. Economically, injection vaccines tend to be expensive. This vaccine stimulates a systemic immune response rather than the mucosal barrier needed to prevent ETEC infection in the small intestine (73). The injection site is usually done in

the neck. After the first vaccine injection, a booster is carried out 2 weeks later (54).

Next is the oral vaccine with live attenuated vaccines. It is also possible with the live wild strain *E. coli* vaccine, which is non-enterotoxigenic, which carries the fimbrial adhesin. Attenuated live vaccines can protect pigs from the ETEC K88 + LT + STb + strains (74). Oral vaccination of piglets with recombinantly produced FaeG can induce specific mucosal and systemic immune responses (73). Several studies have shown that oral vaccination with purified F4 fimbriae is an antigen that can induce mucosal immunity in pigs (72). Oral vaccination of fimbriae F18 encapsulated into weaned pigs may not produce a significant serum antibody response, or in other words no decrease coli colonization. However, in Canada, the live vaccine F4 + ETEC has been commercialized, and has been shown to protect pigs from ETEC infection (58,73).

Other vaccines include the inactivated, multi-adhesins, intact cell ETEC bacterin mixture, or the purified ETEC fimbrial subunit vaccine (54). This purification of fimbriae F4ac is a vaccine that has strong immunogenicity (58). This purification involves many processes, one of which is chemical conjugation which is long and complicated, especially when the toxoid STa or STa is to be purified from wild strains. Basically, the latest research has been able to clone wild-strain STa, making the purification process easier (74, 75). The orally purified fimbriae are introduced into the small intestine in a pellet form with an enteric coating. Although the interaction of the purified fimbriae with the coating polymer reduces the biological activity of the purified fimbriae, this is not a problem. However, this requires further research to find an effective way for purified fimbriae to target the small intestine without losing its biological activity (76).

Recent studies suggest that the addition of zinc oxide (ZnO) at a level of 3100 mg / kg in feed resulted in a decrease in the number of ETEC isolated from pig faeces. This addition was associated with small intestinal morphology, increased the number of goblet cell villi and resulted in favorable changes in the ratio of lactic acid bacteria to coliforms (77,78). Another study, namely the addition of zinc oxide (ZnO) to post-weaning pig feed as much as 2,000 to 3,000 ppm can reduce diarrhea and increase intestinal morphological growth and performance (79). So that the presence of free zinc ions continuously in the luminal compartment is very important for intestinal protection, decreasing the inflammatory response and reducing the small intestinal morphological damage to ETEC K88 infection (80,81). Zinc (Zn) is a mineral that is important as a micronutrient for pigs. Zinc deficiency can lead to growth retardation and reduced overall enzyme activity in tissues (82).

Another mineral that has a pharmaceutical effect to inhibit bacterial development is cupric sulfate (CuSO₄). Cupric sulfate is actually a mineral to stimulate growth, but also has antimicrobial properties. A concentration of 175 mg / kg in pig feed is required. It is also based on the Cu inclusion rates currently allowed in EU countries. This dose can also affect the level of bacterial development in the digestive tract, in this case the fecal coliform bacteria and *E. coli* (83,84). *E. coli* is damaged and even killed due to oxidation of the membrane, which causes loss of membrane integrity. This bactericidal effect occurs due to the fusion of cupri alloy with cupric sulfate (CuSO₄) (85). Several feed additives that can function as antimicrobials, one of which is an acidifier. Acidifier-based feed when given to pigs with diarrhea, has a significant effect. In recent studies, the use of fatty acids (medium chain fatty

acids) in pigs induced enterotoxigenic β -hemolytic *E. coli* (ETEC), serotype O149: K91: K88, has antibacterial effects (86). It has also been recognized in recent studies that volatile fatty acids (VFAs), such as acetic, propionic, butyric, valeric and lactic acids, have antibacterial activity. Propionic and butyric acid are very important metabolites because they have a specific inhibitory effect against enteric bacteria, such as *E. coli* in pigs (87). Hydrochloric acid secreted from the stomach can also act as an antibacterial. After weaning piglets, solid feed can increase the pH of the digestive tract. So that feeding with organic acid supplementation can be an effective way to control the pH of the gastrointestinal tract, in order to control the growth of bacteria in the stomach and intestines.

Diets containing blood plasma have been shown to inhibit the development of ETEC in pigs. Recent studies have shown that natural IgG purified directly from pig plasma and given in the form of a feed additive can be used to increase pig production. This is because IgG has a positive effect on reducing the colonization of ETEC bacteria and can be an alternative use of antibiotics (88). This product can be used given 5 days before weaning and 10 days after weaning.

Recently, chicken egg yolk antibody called immunoglobulin Y (IgY) from chickens that were immunized against a specific pathogen was effective in preventing and controlling disease. Specific IgY acts to effectively inhibit various intestinal pathogens including Salmonella, coronavirus, rotavirus, viral gastroenteritis and ETEC (89). Oral administration of specific IgY has great potential to control diarrheal diseases and increase pig growth. This can be an alternative to antibiotics (90,91). There is research that egg yolk antibodies may be ineffective in pigs 3 to 4 weeks of age. This is because gastric pH and digestive enzymes can break down the antibodies in GIT thereby reducing the amount of egg antibodies available to protect pigs from *E. coli* infection (92). Antibodies must also remain in the intestines continuously. A total of 1.5 g per day per piglet is sufficient to prevent diarrhea caused by infection with 1010 ETEC. The addition of 0.2% egg yolk antibody to feed can prevent diarrhea in commercial pig farms (91). However, research on how many doses are needed for the effectiveness of egg yolk antibodies is still being done to date.

Probiotics or Direct fed microbials (DFM) are live microorganisms which, when given in sufficient quantities, provide health benefits to the host. These microbes are categorized into 3 main groups, including lactic acid-producing bacteria, yeast, and Bacillus (93). Probiotics can work against various pathogenesis processes. The main thing is to inhibit the invasion of pathogens to target cells. Blockade of this process is important, because it is the first step in the pathogenesis process of ETEC. Furthermore, it prevents the colonization of bacteria in the intestinal mucosa. It has also been proven related to the inhibition of enterotoxin production from ETEC. Moreover, it reduces the inflammatory process in the intestine due to ETEC infection (94). However, these results can be effective at the end of the probiotic administration. This may be due to decreased appetite, dehydration and a lack of cytokine response in the pig's body (95).

A recent study, when pigs were induced by ETEC F18, then treated with DFM1, it seemed that no change had occurred. But with DFM2 therapy can provide effectiveness by decreasing colonization of ETEC in the intestine. In addition to colonization, ETEC induction also results in impaired intestinal barrier integrity, disruption of OCLN

and ZO-1 junction proteins, decreased intestinal mucosal sIgA, and activation of the immune response, namely increased local and systemic IL-8 production. DFM1 contains 3 strains of *Bacillus amyloliquefaciens*, while DFM2 contains 2 strains of *Bacillus amyloliquefaciens* (96).

Other probiotics such as *Lactobacillus* also provide antimicrobial benefits. One of them is *L. plantarum* ZLP001. This probiotic can prevent the growth of ETEC by producing certain antimicrobial substances which are then combined to produce a relatively acidic environment. *L. plantarum* ZLP001 adheres to IPEC-J2 cells and inhibits ETEC adhesion primarily through exclusion and induces HDP expression and secretion in intestinal epithelial cells (97,98). The *Bacillus subtilis* DSM25841 strain also has an antimicrobial effect against ETEC F4ac infection in weaned pigs. *B. subtilis* can improve intestinal health of pigs by reducing the abundance of Enterobacteriaceae. It also increases the regulation of genes related to immunity, increases metabolism and utilization of amino acids (99). Overall, given the good potential in the use of probiotics to treat diarrheal disease in pigs, it can be said that probiotics are an alternative as a substitute for antibiotics and can avoid bacterial resistance to antibiotics.

Plant extracts, also known as phytobiotics, have been widely researched and have many benefits as a nutritional enhancer for animal feed, as an antimicrobial, anti-inflammatory, antioxidant, and anti-parasitic. Some studies consider that plant extracts at minimum inhibitory concentrations (MICs) of 100 - 1000 µg / ml in in vitro bacterial susceptibility tests have antibacterial activity. Until now, there are several kinds of phytobiotics, such as phenolics / polyphenols, terpenoids / essential oils, alkaloids and lectins / polypeptides. There are many variations in the composition of phytobiotics based on several influencing factors, namely biological factors (type of plant, location of growth and harvest conditions), manufacturing (extraction, distillation and stabilization), and storage conditions (light, temperature, oxygen tension, and time) . These phytobiotics have different antimicrobial activities (100,101). Previous research, tannic acid can inhibit the growth of bacteria in the intestine, one of which is *E. coli*. Alkaloids can inhibit DNA synthesis by killing the topoisomerase enzyme. In addition, saponins can be antimicrobial by forming sterol complexes and damaging the bacterial membrane. Usually these phytobiotics become feed additives (102).

Phytobiotics have now become a trend as a substitute for the growth promoter antibiotic (AGP), whose use has been banned. Like the Labiatae family plants, namely thyme, oregano and sage can reduce the number of *E. coli* bacteria in the small intestine of animals (103). *Macleaya cordata* extract can increase pig palatability, body weight and amino acid concentration. In addition, it has the effect of increasing immunity by regulating phagocytes, haptoglobin and amyloid A. Another effect is that it is an important barrier to breast milk with the action of the ZO-1 and claudin-1 proteins (104). The effectiveness of phytobiotics and any plants that can be antimicrobial needs to be studied further, because until now there are so many plants that can be used as antimicrobials.

Nucleotide feed supplements have a role as bioactive molecules in the functions of metabolism and the immune system. Recent studies suggest that giving pig feed supplements containing nucleotides has shown positive effects. Namely the increase in growth, by increasing the effectiveness of intestinal absorption, controlling the concentration of bacteria in the intestine, reducing the

severity of diarrhea, increasing the performance of enzymes in the ileum and immune stimulation (105,106). Feeding supplements to pigs containing 0.2 to 1 gram / kilogram of feed, can have a positive effect in pigs (107). There are still many studies related to how nucleotides can be used as feed additives for the prevention of diarrhea in piglets.

Bacteriophage is a kind of virus that has the effect of inhibiting growth and even killing bacteria. Virulent bacteriophages can be isolated from sources such as pig manure, wastewater and soil indicating that these phages are widely distributed in the environmental areas of pigs. Bacteriophage therapy has good potential for control of infections in pigs, such as diarrhea caused by ETEC (108). Pork feed containing bacteriophages can inhibit the development of ETEC F4 + infection. It is characterized by decreased bacterial adhesion in the ileum and cecum. It can also improve villi morphology (109). There is still much that needs to be deepened regarding how bacteriophages can become feed supplements and antimicrobial substitutes.

Preventive methods were used to avoid improper use of antibiotics. In the field of veterinary medicine, there have problems related with antimicrobial resistance such as in livestock (110-117), pets (118- 122), poultry (123-128) and in fisheries (129-132). The concept of antimicrobial replacement treatment is needed, not only to overcome the problem of diarrhea in piglets caused by ETEC, but also to prevent transmission to humans. So that public health is maintained properly.

CONCLUSION

The intestines are responsible for digestion, absorption of nutrients and protection of the body from toxins or pathogens. The incidence of diarrhea in piglets that has been rife recently has resulted in health problems and even death. The diarrhea is caused by *E. coli* enterotoxigenic infection (ETEC). An understanding of the disease features, virulence factors, ETEC characteristics and pathogenesis of the disease is required. Antibiotics are expected to be an effective way to prevent and manage infections. However, the more recent continuous use of antibiotics has resulted in *E. coli* resistance to some antibiotics. Preventive action and control strategies are needed against this disease, one of which is the use of alternative antibiotic substitutes. Alternative antibiotics that can be used to prevent infection with ETEC infection in piglets are immunoprophylaxis (vaccines), antimicrobial minerals (such as zinc oxide and cupri sulfate), acidifiers, blood plasma, egg yolk antibodies, probiotics, nucleotides, bacteriophages and so on. These kinds of alternatives and feed additives can improve intestinal health and prevent diarrhea in piglets. This review contains the latest research from various journals discussing the pathogenesis of ETEC in infecting piglets and the management of disease, which also benefits to public health.

REFERENCES

1. Rampoldi A, Jacobsen MJ, Bertschinger HU, Joller D, Bürgi E, Vögeli P, Andersson L, Archibald AL, Fredholm M, Jørgensen CB, Neuenschwander S. The receptor locus for *Escherichia coli* F4ab/F4ac in the pig maps distal to the MUC4-LMLN region. *Mammalian Genome*. 2011;22(1-2):122-129.
2. Renzhammer R, Loncaric I, Roch FF, Pinior B, Käsbohrer A, Spargser J, Ladinig A, Unterwieser C. Prevalence of Virulence Genes and Antimicrobial

- Resistances in *E. coli* Associated with Neonatal Diarrhea, Postweaning Diarrhea, and Edema Disease in Pigs from Austria. *Antibiotics*. 2020;9(4):208.
3. Rhouma M, Fairbrother JM, Thériault W, Beaudry F, Bergeron N, Laurent-Lewandowski S, Letellier A. The fecal presence of enterotoxin and F4 genes as an indicator of efficacy of treatment with colistin sulfate in pigs. *BMC microbiology*. 2017;17(1):1-7.
 4. Mohlatlole RP, Madoroba E, Muchadeyi FC, Chimonyo M, Kanengoni AT, Dzomba EF. Virulence profiles of enterotoxigenic, shiga toxin and enteroaggregative *Escherichia coli* in South African pigs. *Tropical animal health and production*. 2013; 45(6):1399-1405.
 5. Ji X, Liang B, Sun Y, Zhu L, Zhou B, Guo X, Liu J. An Extended-Spectrum Beta-Lactamase-Producing Hybrid Shiga-Toxigenic and Enterotoxigenic *Escherichia coli* Strain Isolated from a Piglet with Diarrheal Disease in Northeast China. *Foodborne Pathogens and Disease*. 2020;17(6):382-387.
 6. Luppi A, Gibellini M, Gin T, Vangroenweghe F, Vandembroucke V, Bauerfeind R, Bonilauri P, Labarque G, Hidalgo Á. Prevalence of virulence factors in enterotoxigenic *Escherichia coli* isolated from pigs with post-weaning diarrhoea in Europe. *Porcine Health Management*. 2016 Dec;2(1):1-6.
 7. Wang W, Zijlstra RT, Gänzle MG. Identification and quantification of virulence factors of enterotoxigenic *Escherichia coli* by high-resolution melting curve quantitative PCR. *BMC microbiology*. 2017;17(1):114.
 8. García-Meniño I, García V, Mora A, Díaz-Jiménez D, Flament-Simon SC, Alonso MP, Blanco JE, Blanco M, Blanco J. Swine enteric colibacillosis in Spain: pathogenic potential of mcr-1 ST10 and ST131 *E. coli* isolates. *Frontiers in Microbiology*. 2018; 9:2659.
 9. Abraham S, Trott DJ, Jordan D, Gordon DM, Groves MD, Fairbrother JM, Smith MG, Zhang R, Chapman TA. Phylogenetic and molecular insights into the evolution of multidrug-resistant porcine enterotoxigenic *Escherichia coli* in Australia. *International journal of antimicrobial agents*. 2014;44(2):105-11.
 10. Luppi A. Swine enteric colibacillosis: diagnosis, therapy and antimicrobial resistance. *Porcine health management*. 2017;3(1):16.
 11. Brillhante M, Perreten V, Donà V. Multidrug resistance and multivirulence plasmids in enterotoxigenic and hybrid Shiga toxin-producing/enterotoxigenic *Escherichia coli* isolated from diarrheic pigs in Switzerland. *The Veterinary Journal*. 2019; 244:60-68.
 12. Kallau NH, Wibawan IW, Lukman DW, Sudarwanto MB. Detection of multi-drug resistant (MDR) *Escherichia coli* and tet gene prevalence at a pig farm in Kupang, Indonesia. *Journal of Advanced Veterinary and Animal Research*. 2018;5(4):388.
 13. Rosager WN, Peter NJ, Lind JS, Svend H, Matthew D, Steen PK. Comparison of antimicrobial resistance in *E. coli* isolated from rectal and floor samples in pens with diarrhoeic nursery pigs in Denmark. *Preventive veterinary medicine*. 2017; 147:42-49.
 14. O Gundare ST, Fasanmi OG, Fasina FO. Risk factors for prevalence of Enterotoxigenic *Escherichia coli* (ETEC) in diarrheic and non-diarrheic neonatal and weaner pigs, South Africa. *Biomedical and environmental sciences*. 2018;31(2):149-154.
 15. Kidsley AK, Abraham S, Bell JM, O'Dea M, Laird TJ, Jordan D, Mitchell P, McDevitt CA, Trott DJ. Antimicrobial susceptibility of *Escherichia coli* and *Salmonella* spp. isolates from healthy pigs in Australia: results of a pilot national survey. *Frontiers in microbiology*. 2018; 9:1207.
 16. Sun Y, Kim SW. Intestinal challenge with enterotoxigenic *Escherichia coli* in pigs, and nutritional intervention to prevent postweaning diarrhoea. *Animal Nutrition*. 2017;3(4):322-330.
 17. Read LT, Hahn RW, Thompson CC, Bauer DL, Norton EB, Clements JD. Simultaneous exposure to *Escherichia coli* heat-labile and heat-stable enterotoxins increases fluid secretion and alters cyclic nucleotide and cytokine production by intestinal epithelial cells. *Infection and immunity*. 2014;82(12):5308-53016.
 18. Sahl JW, Steinsland H, Redman JC, Angiuoli SV, Nataro JP, Sommerfelt H, Rasko DA. A comparative genomic analysis of diverse clonal types of enterotoxigenic *Escherichia coli* reveals pathovar-specific conservation. *Infection and immunity*. 2011;79(2):950-960.
 19. Von Mentzer A, Zalem D, Chrienova Z, Teneberg S. Colonization factor CS30 from enterotoxigenic *Escherichia coli* binds to sulfatide in human and porcine small intestine. *Virulence*. 2020;11(1):381-390.
 20. Li Y, Wang H, Ren J, Chen L, Zhuge X, Hu L, Li D, Tang F, Dai J. The Yfco fimbriae gene enhances adherence and colonization abilities of avian pathogenic *Escherichia coli* in vivo and in vitro. *Microbial pathogenesis*. 2016; 100:56-61.
 21. Rehman T, Yin L, Latif MB, Chen J, Wang K, Geng Y, Huang X, Abaidullah M, Guo H, Ouyang P. Adhesive mechanism of different *Salmonella* fimbrial adhesins. *Microbial pathogenesis*. 2019 Dec 1; 137:103748.
 22. Barth S, Schwanitz A, Bauerfeind R. Polymerase chain reaction-based method for the typing of F18 fimbriae and distribution of F18 fimbrial subtypes among porcine Shiga toxin-encoding *Escherichia coli* in Germany. *Journal of Veterinary Diagnostic Investigation*. 2011;23(3):454-464.
 23. Luise D, Lauridsen C, Bosi P, Trevisi P. Methodology and application of *Escherichia coli* F4 and F18 encoding infection models in post-weaning pigs. *Journal of animal science and biotechnology*. 2019;10(1):53.
 24. Sinha R, Sahoo NR, Shrivastava K, Kumar P, Qureshi S, De UK, Kumar A, Ravi GV, Bhushan B. Resistance to ETEC F4/F18-mediated piglet diarrhoea: opening the gene black box. *Tropical animal health and production*. 2019;24:1-4
 25. Won G, John Hwa L. Potent immune responses induced by a *Salmonella* ghost delivery system that expresses the recombinant Stx2eB, FedF, and FedA proteins of the *Escherichia coli*-producing F18 and Shiga toxin in a murine model and evaluation of its protective effect as a porcine vaccine candidate. *Veterinary Quarterly*. 2017;37(1):81-90.
 26. Lu T, Seo H, Moxley RA, Zhang W. Mapping the neutralizing epitopes of F18 fimbrial adhesin subunit FedF of enterotoxigenic *Escherichia coli* (ETEC). *Veterinary microbiology*. 2019; 230:171-177.

27. Do KH, Byun JW, Lee WK. Prevalence of O-serogroups, virulence genes, and F18 antigenic variants in *Escherichia coli* isolated from weaned piglets with diarrhea in Korea during 2008–2016. *Journal of Veterinary Science*. 2019;20(1):43-50.
28. You J, Xu Y, He M, McAllister TA, Thacker PA, Li X, Wang T, Jin L. Protection of mice against enterotoxigenic *E. coli* by immunization with a polyvalent enterotoxin comprising a combination of LTb, STa, and STb. *Applied microbiology and biotechnology*. 2011;89(6):1885-1893.
29. Vidotto MC, Florian EC, Ono MA. Prevalence of the paa gene (porcine attaching and effacing associated) in porcine enteropathogenic *Escherichia coli* (PEPEC) associated with postweaning diarrhea in south Brazil. *Brazilian Journal of Microbiology*. 2013;44(2):515-517.
30. Huang G, Li X, Lu D, Liu S, Suo X, Li Q, Li N. Lysozyme improves gut performance and protects against enterotoxigenic *Escherichia coli* infection in neonatal piglets. *Veterinary research*. 2018;49(1):1-11.
31. Zhao Q, Liu Y, Dong W, Zhu S, Huo Y, Wu S, Bao W. Genetic variations of TAP1 gene exon 3 affects gene expression and *Escherichia coli* F18 resistance in piglets. *International journal of molecular sciences*. 2014;15(6):11161-11171.
32. Wu Z, Feng H, Cao Y, Huang Y, Dai C, Wu S, Bao W. New insight into the molecular mechanism of the FUT2 regulating *Escherichia coli* F18 resistance in weaned piglets. *International journal of molecular sciences*. 2018;19(11):3301.
33. Hermes RG, Manzanilla EG, Martín-Orúe SM, Pérez JF, Klasing KC. Influence of dietary ingredients on in vitro inflammatory response of intestinal porcine epithelial cells challenged by an enterotoxigenic *Escherichia coli* (K88). *Comparative immunology, microbiology and infectious diseases*. 2011;34(6):479-488.
34. Moonens K, Van den Broeck I, De Kerpel M, Deboeck F, Raymaekers H, Remaut H, De Greve H. Structural and functional insight into the carbohydrate receptor binding of F4 fimbriae-producing enterotoxigenic *Escherichia coli*. *Journal of Biological Chemistry*. 2015;290(13):8409-8419.
35. Hu D, Rampoldi A, Bratus-Neuenschwander A, Hofer A, Bertschinger HU, Vögeli P, Neuenschwander S. Effective genetic markers for identifying the *Escherichia coli* F4ac receptor status of pigs. *Animal genetics*. 2019;50(2):136-142.
36. Xia P, Zou Y, Wang Y, Song Y, Liu W, Francis DH, Zhu G. Receptor for the F4 fimbriae of enterotoxigenic *Escherichia coli* (ETEC). *Applied microbiology and biotechnology*. 2015;99(12):4953-9.
37. Zhou D, Zhu YH, Zhang W, Wang ML, Fan WY, Song D, Yang GY, Jensen BB, Wang JF. Oral administration of a select mixture of *Bacillus* probiotics generates Tr1 cells in weaned F4ab/acR- pigs challenged with an F4+ ETEC/VTEC/EPEC strain. *Veterinary research*. 2015;46(1):1-5.
38. Sarabia-Sainz HM, Mata-Haro V, Sarabia-Sainz JA, Vázquez-Moreno L, Montfort GR. Maillard neoglycans as inhibitors for in vitro adhesion of F4+ of enterotoxigenic *Escherichia coli* to piglet intestinal cells. *Acta Biochimica Polonica*. 2017;64(4):679-686.
39. Isidean SD, Riddle MS, Savarino SJ, Porter CK. A systematic review of ETEC epidemiology focusing on colonization factor and toxin expression. *Vaccine*. 2011;29(37):6167-6178.
40. Norton EB, Lawson LB, Freytag LC, Clements JD. Characterization of a mutant *Escherichia coli* heat-labile toxin, LT (R192G/L211A), as a safe and effective oral adjuvant. *Clinical and Vaccine Immunology*. 2011;18(4):546-551.
41. Norton EB, Lawson LB, Mahdi Z, Freytag LC, Clements JD. The A subunit of *Escherichia coli* heat-labile enterotoxin functions as a mucosal adjuvant and promotes IgG2a, IgA, and Th17 responses to vaccine antigens. *Infection and immunity*. 2012;80(7):2426-2435.
42. Wang H, Zhong Z, Luo Y, Cox E, Devriendt B. Heat-stable enterotoxins of enterotoxigenic *Escherichia coli* and their impact on host immunity. *Toxins*. 2019;11(1):24.
43. Joffré E, von Mentzer A, Abd El Ghany M, Oezguen N, Savidge T, Dougan G, Svennerholm AM, Sjöling Å. Allele variants of enterotoxigenic *Escherichia coli* heat-labile toxin are globally transmitted and associated with colonization factors. *Journal of bacteriology*. 2015;197(2):392-403.
44. Rodrigues JF, Mathias-Santos C, Sbrógio-Almeida ME, Amorim JH, Cabrera-Crespo J, Balan A, Ferreira LC. Functional diversity of heat-labile toxins (LT) produced by enterotoxigenic *Escherichia coli* differential enzymatic and immunological activities of LT1 (hLT) AND LT4 (pLT). *Journal of Biological Chemistry*. 2011;286(7):5222-33.
45. Huang J, Duan Q, Zhang W. Significance of enterotoxigenic *Escherichia coli* (ETEC) heat-labile toxin (LT) enzymatic subunit epitopes in LT enterotoxicity and immunogenicity. *Applied and environmental microbiology*. 2018;84(15).
46. Fekete PZ, Mateo KS, Zhang W, Moxley RA, Kaushik RS, Francis DH. Both enzymatic and non-enzymatic properties of heat-labile enterotoxin are responsible for LT-enhanced adherence of enterotoxigenic *Escherichia coli* to porcine IPEC-J2 cells. *Veterinary microbiology*. 2013;164(3-4):330-5.
47. Verhelst R, Schroyen M, Buys N, Niewold TA. *E. coli* heat labile toxin (LT) inactivation by specific polyphenols is aggregation dependent. *Veterinary microbiology*. 2013;163(3-4):319-324.
48. Ruan X, Sack DA, Zhang W. Genetic fusions of a CFA/I/II/IV MEFA (multi-epitope fusion antigen) and a toxoid fusion of heat-stable toxin (STa) and heat-labile toxin (LT) of enterotoxigenic *Escherichia coli* (ETEC) retain broad anti-CFA and antitoxin antigenicity. *PloS one*. 2015;10(3):e0121623.
49. Wang XM, Liao XP, Liu SG, Zhang WJ, Jiang HX, Zhang MJ, Zhu HQ, Sun J, Sun J, Li AX, Liu YH. Serotypes, virulence genes, and antimicrobial susceptibility of *Escherichia coli* isolates from pigs. *Foodborne pathogens and disease*. 2011;8(6):687-692.
50. Abraham S, Chin J, Brouwers HJ, Zhang R, Chapman TA. Molecular serogrouping of porcine enterotoxigenic *Escherichia coli* from Australia. *Journal of microbiological methods*. 2012;88(1):73-76.
51. Tan C, Tang X, Zhang X, Ding Y, Zhao Z, Wu B, Cai X, Liu Z, He Q, Chen H. Serotypes and virulence genes

- of extraintestinal pathogenic *Escherichia coli* isolates from diseased pigs in China. *The Veterinary Journal*. 2012;192(3):483-488.
52. Hoa NX, Kalhoro DH, Lu C. Distribution of serogroups and virulence genes of *E. coli* strains isolated from porcine post weaning diarrhea in Thua Thien Hue province Vietnam. *Tạp chí Công ngh Sinh học*. 2013; 11:665-72.
 53. Wyrsh E, Chowdhury PR, Abraham S, Santos J, Darling AE, Charles IG, Chapman TA, Djordjevic SP. Comparative genomic analysis of a multiple antimicrobial resistant enterotoxigenic *E. coli* O157 lineage from Australian pigs. *BMC genomics*. 2015;16(1):165.
 54. Zhang H, Xu Y, Zhang Z, You J, Yang Y, Li X. Protective immunity of a Multivalent Vaccine Candidate against piglet diarrhea caused by enterotoxigenic *Escherichia coli* (ETEC) in a pig model. *Vaccine*. 2018;36(5):723-728.
 55. Nandre RM, Ruan X, Duan Q, Sack DA, Zhang W. Antibodies derived from an enterotoxigenic *Escherichia coli* (ETEC) adhesin tip MEFA (multiepitope fusion antigen) against adherence of nine ETEC adhesins: CFA/I, CS1, CS2, CS3, CS4, CS5, CS6, CS21 and EtpA. *Vaccine*. 2016;34(31):3620-3625.
 56. Verhelst R, Schroyen M, Buys N, Niewold T. Dietary polyphenols reduce diarrhea in enterotoxigenic *Escherichia coli* (ETEC) infected post-weaning piglets. *Livestock Science*. 2014; 160:138-140.
 57. Bao WB, Ye L, Zi C, Liu L, Zhu J, Pan ZY, Zhu GQ, Huang XG, Wu SL. Relationship between the expression level of SLA-DQA and *Escherichia coli* F18 infection in piglets. *Gene*. 2012;494(1):140-4.
 58. Melkebeek V, Goddeeris BM, Cox E. ETEC vaccination in pigs. *Veterinary immunology and immunopathology*. 2013;152(1-2):37-42.
 59. Loos, M., Hellemans, A. and Cox, E., 2013. Optimization of a small intestinal segment perfusion model for heat-stable enterotoxin A induced secretion in pigs. *Veterinary immunology and immunopathology*, 152(1-2):82-86.
 60. Girard M, Bee G. Invited review: Tannins as a potential alternative to antibiotics to prevent coliform diarrhea in weaned pigs. *Animal*. 2020;14(1):95-107.
 61. Ruiz VL, Bersano JG, Carvalho AF, Catroxo MH, Chiebao DP, Gregori F, Miyashiro S, Nassar AF, Oliveira TM, Ogata RA, Scarcelli EP. Case-control study of pathogens involved in piglet diarrhea. *BMC research notes*. 2016;9(1):1-7.
 62. Mesonero-Escuredo S, Strutzberg-Minder K, Casanovas C, Segalés J. Viral and bacterial investigations on the aetiology of recurrent pig neonatal diarrhoea cases in Spain. *Porcine health management*. 2018;4(1):5.
 63. Vidal A, Aguirre L, Seminati C, Tello M, Redondo N, Martín M, Darwich L. Antimicrobial Resistance Profiles and Characterization of *Escherichia coli* Strains from Cases of Neonatal Diarrhea in Spanish Pig Farms. *Veterinary Sciences*. 2020;7(2):48.
 64. Vidal A, Martín-Valls GE, Tello M, Mateu E, Martín M, Darwich L. Prevalence of enteric pathogens in diarrheic and non-diarrheic samples from pig farms with neonatal diarrhea in the north east of Spain. *Veterinary microbiology*. 2019; 237:108419.
 65. Pereira DA, Vidotto MC, Nascimento KA, Santos AC, Mechler ML, Oliveira LG. Virulence factors of *Escherichia coli* in relation to the importance of vaccination in pigs. *Ciência Rural*. 2016;46(8):1430-1437.
 66. Neog BK, Barman NN, Bora DP, Dey SC, Chakraborty A. Experimental infection of pigs with group A rotavirus and enterotoxigenic *Escherichia coli* in India: gross, histopathological and immunopathological study. *Vet Ital*. 2011;47(2):117-128.
 67. Rausch D, Ruan X, Nandre R, Duan Q, Hashish E, Casey TA, Zhang W. Antibodies derived from a toxoid MEFA (multiepitope fusion antigen) show neutralizing activities against heat-labile toxin (LT), heat-stable toxins (STa, STb), and Shiga toxin 2e (Stx2e) of porcine enterotoxigenic *Escherichia coli* (ETEC). *Veterinary Microbiology*. 2017; 202:79-89.
 68. Moredo FA, Pineyro PE, Márquez GC, Sanz M, Colello R, Etcheverria A, Padola NL, Quiroga MA, Perfumo CJ, Galli L, Leotta GA. Enterotoxigenic *Escherichia coli* subclinical infection in pigs: bacteriological and genotypic characterization and antimicrobial resistance profiles. *Foodborne pathogens and disease*. 2015;12(8):704-711.
 69. Weber NR, Nielsen JP, Hjulsgager CK, Jorsal SE, Haugegaard S, Hansen CF, Pedersen KS. Comparison of bacterial culture and qPCR testing of rectal and pen floor samples as diagnostic approaches to detect enterotoxic *Escherichia coli* in nursery pigs. *Preventive veterinary medicine*. 2017; 143:61-67.
 70. Kang S, Sharma N, Kang HS, Moon GY, Oh SK, Park SY, Lee JY, Jeong DK. Establishment of diagnostic test for enteric diarrhea in pigs using efficient multiplex polymerase chain reaction. *Indian Journal of Animal Sciences*. 2014;84(11):1157-62.
 71. Maradiaga N, Aldridge B, Zeineldin M, Lowe J. Gastrointestinal microbiota and mucosal immune gene expression in neonatal pigs reared in a cross-fostering model. *Microbial pathogenesis*. 2018; 121:27-39.
 72. Takeyama N, Yuki Y, Tokuhara D, Oroku K, Mejima M, Kurokawa S, Kuroda M, Kodama T, Nagai S, Ueda S, Kiyono H. Oral rice-based vaccine induces passive and active immunity against enterotoxigenic *E. coli*-mediated diarrhea in pigs. *Vaccine*. 2015;33(39):5204-5211.
 73. Kolotilin I, Kaldis A, Devriendt B, Joensuu J, Cox E, Menassa R. Production of a subunit vaccine candidate against porcine post-weaning diarrhea in high biomass transplastomic tobacco. *PLoS One*. 2012;7(8): e42405.
 74. Ruan X, Zhang W. Oral immunization of a live attenuated *Escherichia coli* strain expressing a holotoxin-structured adhesin-toxoid fusion (1FaeG-FedF-LTA2: 5LTB) protected young pigs against enterotoxigenic *E. coli* (ETEC) infection. *Vaccine*. 2013;31(11):1458-1463.
 75. Seo H, Lu T, Nandre RM, Duan Q, Zhang W. Immunogenicity characterization of genetically fused or chemically conjugated heat-stable toxin toxoids of enterotoxigenic *Escherichia coli* in mice and pigs. *FEMS microbiology letters*. 2019;366(4): fnz037.
 76. Srivastava A, Gowda DV, V Madhunapantula S. Development and efficacy assessment of an enteric coated porous tablet loaded with F4 fimbriae for oral vaccination of piglets against F4+ *Escherichia coli*

- coli infections. *Current Drug Delivery*. 2016;13(1):121-130.
77. Sargeant HR, Miller HM, Shaw MA. Inflammatory response of porcine epithelial IPEC J2 cells to enterotoxigenic *E. coli* infection is modulated by zinc supplementation. *Molecular immunology*. 2011;48(15-16):2113-21.
 78. Slade RD, Kyriazakis I, Carroll SM, Reynolds FH, Wellock IJ, Broom LJ, Miller HM. Effect of rearing environment and dietary zinc oxide on the response of group-housed weaned pigs to enterotoxigenic *Escherichia coli* O149 challenge. *Animal: an international journal of animal bioscience*. 2011;5(8):1170.
 79. Jae Kim S, Kwon CH, Park BC, Lee CY, Han JH. Effects of a lipid-encapsulated zinc oxide dietary supplement, on growth parameters and intestinal morphology in weanling pigs artificially infected with enterotoxigenic *Escherichia coli*. *Journal of animal science and technology*. 2015;57(1):4.
 80. Bücken R, Zakrzewski SS, Wiegand S, Pieper R, Fromm A, Fromm M, Günzel D, Schulzke JD. Zinc prevents intestinal epithelial barrier dysfunction induced by alpha-hemolysin-producing *Escherichia coli* 536 infection in porcine colon. *Veterinary Microbiology*. 2020;108632.
 81. Lei XJ, Kim IH. Evaluation of coated zinc oxide in young pigs challenged with enterotoxigenic *Escherichia coli* K88. *Animal Feed Science and Technology*. 2020; 10:114399.
 82. Heo JM, Opapeju FO, Pluske JR, Kim JC, Hampson DJ, Nyachoti CM. Gastrointestinal health and function in weaned pigs: a review of feeding strategies to control post-weaning diarrhoea without using in-feed antimicrobial compounds. *Journal of animal physiology and animal nutrition*. 2013;97(2):207-37.
 83. Trevisi P, Corrent E, Mazzoni M, Messori S, Priori D, Gherpelli Y, Simongiovanni A, Bosi P. Effect of added dietary threonine on growth performance, health, immunity and gastrointestinal function of weaning pigs with differing genetic susceptibility to *Escherichia coli* infection and challenged with *E. coli* K88ac. *Journal of animal physiology and animal nutrition*. 2015;99(3):511-520.
 84. Debski B. Supplementation of pig's diet with zinc and copper as alternative to conventional antimicrobials. *Polish Journal of Veterinary Sciences*. 2016;19(4).
 85. Hong R, Kang TY, Michels CA, Gadura N. Membrane lipid peroxidation in copper alloy-mediated contact killing of *Escherichia coli*. *Applied and environmental microbiology*. 2012;78(6):1776-1784.
 86. Cochrane RA, Pluske JR, Mansfield JP, Dritz SS, Woodworth JC, Tokach MD, Niederwerder MC, Paulk CB, Jones CK. Evaluating medium chain fatty acids as an alternative to chlortetracycline in nursery pig diets. *Kansas Agricultural Experiment Station Research Reports*. 2018;4(9):11.
 87. Longpré J, Fairbrother JM, Fravallo P, Arsenaault J, LeBel P, Laplante B, Surprenant C, Massé D, Letellier A. Impact of mash feeding versus pellets on propionic/butyric acid levels and on total *Escherichia coli* load in the gastrointestinal tract of growing pigs. *Journal of Animal Science*. 2016;94(3):1053-63.
 88. Hedegaard CJ, Strube ML, Hansen MB, Lindved BK, Lihme A, Boye M, Heegaard PM. Natural pig plasma immunoglobulins have anti-bacterial effects: potential for use as feed supplement for treatment of intestinal infections in pigs. *PLoS One*. 2016;11(1): e0147373.
 89. Han S, Yu H, Yang F, Qiao S, He P. Effect of dietary supplementation with hyperimmunized hen egg yolk powder on diarrhoea incidence and intestinal health of weaned pigs. *Food and Agricultural Immunology*. 2019;30(1):333-348.
 90. Zhang ZF, Kim IH. Effects of egg yolk immunoglobulin on growth performance, diarrhea score, diarrhea incidence and serum antibody titer in pre-and post-weaned pigs. *Wayamba J Anim Sci X*. 2013; 578:590-597.
 91. Li X, Wang L, Zhen Y, Li S, Xu Y. Chicken egg yolk antibodies (IgY) as non-antibiotic production enhancers for use in swine production: a review. *Journal of animal science and biotechnology*. 2015;6(1):40.
 92. Aluko K, Velayudhan DE, Khafipour E, Fang L, Nyachoti M. Effect of chicken egg anti-F4 antibodies on performance and diarrhea incidences in enterotoxigenic *Escherichia coli* K88+-challenged piglets. *Animal Nutrition*. 2017;3(4):353-358.
 93. Kim K, He Y, Xiong X, Ehrlich A, Li X, Raybould H, Atwill ER, Maga EA, Jørgensen J, Liu Y. Dietary supplementation of *Bacillus subtilis* influenced intestinal health of weaned pigs experimentally infected with a pathogenic *E. coli*. *Journal of Animal Science and Biotechnology*. 2019;10(1):52.
 94. Dubreuil JD. Enterotoxigenic *Escherichia coli* and probiotics in swine: what the bleep do we know? *Bioscience of microbiota, food and health*. 2017:16-030.
 95. Becker S. Investigation of an ETEC challenge and supplementation of direct fed microbials in weaned pigs. Graduate Theses and Dissertations. 17644. 2019. Iowa State University.
 96. Becker SL, Li Q, Burrough ER, Kenne D, Sahin O, Gould SA, Patience JF. Effects of an F18 enterotoxigenic *Escherichia coli* challenge on growth performance, immunological status, and gastrointestinal structure of weaned pigs and the potential protective effect of direct-fed microbial blends. *Journal of Animal Science*. 2020;98(5):113.
 97. Pan L, Zhao PF, Ma XK, Shang QH, Xu YT, Long SF, Wu Y, Yuan FM, Piao XS. Probiotic supplementation protects weaned pigs against enterotoxigenic *Escherichia coli* K88 challenge and improves performance similar to antibiotics. *Journal of animal science*. 2017;95(6):2627-2639.
 98. Wang J, Zeng Y, Wang S, Liu H, Zhang D, Zhang W, Wang Y, Ji H. Swine-derived probiotic *Lactobacillus plantarum* inhibits growth and adhesion of Enterotoxigenic *Escherichia coli* and mediates host defense. *Frontiers in microbiology*. 2018; 9:1364.
 99. Luise D, Bertocchi M, Motta V, Salvarani C, Bosi P, Luppi A, Fanelli F, Mazzoni M, Archetti I, Maiorano G, Nielsen BK. *Bacillus* sp. probiotic supplementation diminish the *Escherichia coli* F4ac infection in susceptible weaned pigs by influencing the intestinal immune response, intestinal microbiota and blood metabolomics. *Journal of animal science and biotechnology*. 2019;10(1):74.

100. Cheng G, Hao H, Xie S, Wang X, Dai M, Huang L, Yuan Z. Antibiotic alternatives: the substitution of antibiotics in animal husbandry? *Frontiers in microbiology*. 2014; 5:217.
101. Kiczorowska B, Samolińska W, Al-Yasiry AR, Kiczorowski P, Winiarska-Mieczan A. The natural feed additives as immunostimulants in monogastric animal nutrition—a review. *Annals of animal science*. 2017;17(3):605-25.
102. Hashemi SR, Davoodi H. Herbal plants and their derivatives as growth and health promoters in animal nutrition. *Veterinary research communications*. 2011;35(3):169-180.
103. Mohammadi Gheisar M, Kim IH. Phytobiotics in poultry and swine nutrition—a review. *Italian Journal of Animal Science*. 2018;17(1):92-99.
104. Ni H, Martínez Y, Guan G, Rodríguez R, Más D, Peng H, Valdivié Navarro M, Liu G. Analysis of the impact of isoquinoline alkaloids, derived from *Macleaya cordata* extract, on the development and innate immune response in swine and poultry. *BioMed research international*. 2016; ID 1352146.
105. Sauer N, Eklund M, Roth S, Rink F, Jezierny D, Bauer E, Mosenthin R. Short-term effect of dietary yeast nucleotide supplementation on small intestinal enzyme activities, bacterial populations and metabolites and ileal nutrient digestibilities in newly weaned pigs. *Journal of animal physiology and animal nutrition*. 2012;96(4):700-708.
106. Superchi P, Saleri R, Borghetti P, De Angelis E, Ferrari L, Cavalli V, Amicucci P, Ossiprandi MC, Sabbioni A. Effects of dietary nucleotide supplementation on growth performance and hormonal and immune responses of piglets. *Animal: an international journal of animal bioscience*. 2012;6(6):902.
107. Weaver AC, Kim SW. Supplemental nucleotides high in inosine 5'-monophosphate to improve the growth and health of nursery pigs. *Journal of Animal Science*. 2014;92(2):645-651.
108. Zhang J, Li Z, Cao Z, Wang L, Li X, Li S, Xu Y. Bacteriophages as antimicrobial agents against major pathogens in swine: a review. *Journal of animal science and biotechnology*. 2015;6(1):1-7.
109. Lee CY, Kim SJ, Park BC, Han JH. Effects of dietary supplementation of bacteriophages against enterotoxigenic *Escherichia coli* (EPEC) K88 on clinical symptoms of post-weaning pigs challenged with the EPEC pathogen. *Journal of animal physiology and animal nutrition*. 2017;101(1):88-95.
110. Effendi, M.H., Oktavianto, A and Hastutiek, P. Tetracycline Resistance Gene in *Streptococcus Agalactiae* Isolated from Bovine Subclinical Mastitis in Surabaya, Indonesia. *Philipp. Journal of Veterinary Medicine*. 2018; 55 (SI): 115-120.
111. Effendi M.H, Harijani N, Budiarto, Triningtya N.P, Tyasningsih W. and Plumeriastuti H. Prevalence of Pathogenic *Escherichia Coli* Isolated from Subclinical Mastitis in East Java Province, Indonesia. *Indian Vet. J.* 2019; 96 (03): 22 – 25.
112. Tyasningsih, W., Effendi, M. H., Budiarto, B., Syahputra, I. R. Antibiotic Resistance to *Staphylococcus aureus* and Methicillin Resistant *Staphylococcus aureus* (MRSA) Isolated from Dairy Farms in Surabaya, Indonesia. *Indian Vet. J.* 2019; 96(11), 27-31.
113. Putra, A.R. Effendi, M.H. Koesdarto, S. Suwarno, S. Tyasningsih, W. and Estoepongastie, A.T. Detection of the extended spectrum β -lactamase produced by *Escherichia coli* from dairy cows by using the Vitek-2 method in Tulungagung regency, Indonesia. *Iraqi Journal of Veterinary Sciences*, 2020; 34 (1): 203-207.
114. Putra ARS, Effendi MH, Koesdarto S, and Tyasningsih W. Molecular Identification of Extended Spectrum Beta-Lactamase (ESBL) Producing *Escherichia coli* Isolated from Dairy Cows in East Java Province, Indonesia. *Indian Vet. J.* 2019; 96 (10): 26 – 30.
115. Ramandinianto, S.C., Khairullah, A.R., Effendi, M.H., Tyasningsih, W. and Rahmahani, J. Detection of Enterotoxin type B gene on Methicillin Resistant *Staphylococcus aureus* (MRSA) isolated from raw milk in East Java, Indonesia. *Sys Rev Pharm*, 2020;11(7):290-298.
116. Ramandinianto, S.C., Khairullah, A.R., Effendi, M.H. *MecA* gene and methicillin-resistant *Staphylococcus aureus* (MRSA) isolated from dairy farms in East Java, Indonesia. *Biodiversitas*, 2020; 21(8): 3562-3568.
117. Sofiana, E.D., Pratama, J.W.A., Effendi, M.H., Plumeriastuti, H., Wibisono, F.M., Hartadi, E.B., Hidayatullah, A.R. A Review of the Presence of Antibiotic Resistance Problems on *Klebsiella Pneumoniae* Acquired from Pigs: Public Health Importance. *Sys Rev Pharm* 2020;11(9):535-543.
118. Riwu KHP, Effendi MH, Rantam FA. A review of extended-spectrum β -Lactamase (ESBL) producing *Klebsiella pneumoniae* and Multidrug-Resistant (MDR) on companion animals. *Syst Rev Pharm*, 2020; 11 (7): 270-277.
119. Rahmaniar, R. P., Yunita, M. N., Effendi, M. H., Yanestria, S. M. Encoding Gene for Methicillin Resistant *Staphylococcus aureus* (MRSA) Isolated from Nasal Swab of Dogs. *Indian Vet. J.* 2020; 97(02), 37-40.
120. Kristianingtyas L, Effendi, MH, Tyasningsih W, Kurniawan F. Genetic Identification of *bla*CTX-M Gene and *bla*TEM Gene on Extended Spectrum Beta Lactamase (ESBL) Producing *Escherichia Coli* from Dogs. *Indian Vet. J.* 2020; 97 (01): 17 – 21.
121. Decline, V., Effendi, M. H., Rahmaniar, R. P., Yanestria, S. M., Harijani, N. Profile of antibiotic-resistant and presence of methicillin-resistant *Staphylococcus aureus* from nasal swab of dogs from several animal clinics in Surabaya, Indonesia. *Intl J One Health*, 2020; 6(1), 90-94.
122. Yunita, M. N., Effendi, M. H., Rahmaniar, R. P., Arifah, S., Yanestria, S. M. Identification Of *Spa* Gene For Strain Typing Of Methicillin Resistant *Staphylococcus aureus* (MRSA) Isolated From Nasal Swab Of Dogs. *Biochem. Cell. Arch.* 2020; 20 (1), 2999-3004.
123. Wibisono FJ, Sumiarto B, Untari T, Effendi MH, Permatasari DA, Witaningrum AM. The Presence of Extended Spectrum Beta-Lactamase (ESBL) Producing *Escherichia coli* On Layer Chicken Farms In Blitar Area, Indonesia. *Biodiversitas*. 2020; 21 (6): 2667-2671.
124. Rahmahani J, Salamah, Mufasirin, Tyasningsih W, and Effendi MH. Antimicrobial Resistance Profile of *Escherichia coli* From Cloacal Swab of Domestic Chicken in Surabaya Traditional Market. *Biochem. Cell. Arch.* 2020; 20 (1): 2993-2997.

125. Wibisono, F.J., Sumiarto, B., Untari, T., Effendi, M.H., Permatasari, D.A., Witaningrum, A.M. CTX Gene of Extended Spectrum Beta-Lactamase (ESBL) Producing *Escherichia coli* on Broilers in Blitar, Indonesia. *Sys Rev Pharm* 2020;11(7): 396-403.
126. Permatasari, D.A., Witaningrum, A.M., Wibisono, F.J., Effendi, M.H. Detection and prevalence of multidrug-resistant *Klebsiella pneumoniae* strains isolated from poultry farms in Blitar, Indonesia. *Biodiversitas*, 2020; 21 (10): 4642-4647.
127. Wibisono, F.J., Sumiarto, B., Untari, T., Effendi, M.H., Permatasari, D.A., Witaningrum, A.M. Short Communication: Pattern of antibiotic resistance on extended-spectrum beta-lactamases genes producing *Escherichia coli* on laying hens in Blitar, Indonesia. *Biodiversitas*, 2020; 21 (10): 4631-4635.
128. Wibisono, F.M., Wibisono, F.J., Effendi, M.H., Plumeriastuti, H., Hidayatullah, A.R., Hartadi, E.B., Sofiana, E.D. A Review of Salmonellosis on Poultry Farms: Public Health Importance. *Sys Rev Pharm* 2020;11(9):481-486
129. Helmi, AM, Mukti, AT, Soegianto, A and Effendi, MH. A Review of Vibriosis in Fisheries: Public Health Importance. *Sys Rev Pharm*, 2020;11(8):51-58.
130. Helmi, AM., Mukti, AT., Soegianto, A., Mahardika, K., Mastuti, I., Effendi, MH., Plumeriastuti, H. A Review of Bacterial Zoonoses and Antimicrobial Resistant (AMR) on Grouper fish (*Epinephelus sp.*). *Sys Rev Pharm* 2020;11(9):79-88.
131. Effendi MH, Bintari IG, Aksono EB, Hermawan IP. Detection of *bla*TEM Gene of *Klebsiella pneumoniae* Isolated from Swab of Food Producing Animals in East Java. *Tropical Animal Science Journal*. 2018;41(3):174-178.
132. Yanestria, S.M., Rahmaniar, R.P., Wibisono, F.J., Effendi, M.H. Detection of *invA* gene of *Salmonella* from milkfish (*Chanos chanos*) at Sidoarjo wet fish market, Indonesia, using polymerase chain reaction technique, *Veterinary World*, 2019; 12(1): 170-175.