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Journal of Health Law, Ethics and Regulation



Healthcare in Low-resource Settings

HEALTHCARE IN LOW-RESOURCE SE...

Editor-in-Chief: Luigi Barberini, Italy | eISSN 2281-7824

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About the Journal

Focus, Scope and Objectives

Healthcare in Low-resource Settings is an Open Access, peer-reviewed journal which aims to publish high quality, outcome-based research conducted in or applicable to low-resource settings. Potential topics of interest are also: comparison of different medical procedures in terms of their effects on healthcare resources; education of health professionals in rural areas; strategies to formulate effective health policies in those areas, and guidelines targeted specifically to them; advances in healthcare resource management. **Healthcare in Low-resource Settings** publishes *Research Articles*, *Reviews* (narrative, systematic and meta-analysis), *Case Reports*, *Debate Articles*, *Short Reports*, *Letters to the Editor*, and *Study Protocols*. The Journal also publishes thematic issues focusing on a single topic within the scope of the journal. Contextually relevant announcements, book reviews and abstracts from scientific meetings may also be hosted. Every article published in the Journal will be peer-reviewed by experts in the field and decided on by members of the editorial board.

Peer review

Introduction

COOKIE SETTINGS applied to all research articles and the majority of

other article types published in **Healthcare in Low-resource Settings**. This entails at least two independent, expert peer reviewers. *Letters to the Editor* may be subject to peer review at the Editor's discretion.

Policy

All submissions to *Healthcare in Low-resource Settings* are first checked for completeness (criteria for *desk reject* are available in the [Guide for Authors](#)) before being sent to an Editor, who decides whether they are suitable for peer review. If an Editor is on the author list or has a competing interest in a particular manuscript, another member of the Editorial Board will be assigned to oversee peer review. When making a decision, Editors will consider the peer-reviewed reports, but they will not be bound by the opinions or recommendations contained in them. A single peer reviewer's or the Editor's concern may result in the manuscript being rejected. Peer review reports are sent to authors along with the editorial decision on their manuscript.

At *Healthcare in Low-resource Settings* papers undergo a single-blind review process - meaning that the reviewers' identity is not shared with the authors.

Selection

Peer reviewer selection is critical to the publication process. A variety of factors influence it, including expertise, reputation, specific recommendations, conflicts of interest, and previous performance. All of these qualities are highly desirable: speed, thoroughness, sound reasoning, and collegiality.

Before accepting an invitation to review a manuscript, potential peer reviewers should notify the Editor of any potential conflicts of interest. Editors' and peer reviewers' communications contain confidential information that should not be shared with third parties.

The *Healthcare in Low-resource Settings* board is committed to making editorial decisions and publishing them as soon as

possible, and we believe that an efficient editorial process benefits both our authors and the research community as a whole. As a result, we ask reviewers to respond within the agreed-upon time frame. If reviewers anticipate a delay, we ask that they notify us so that we can keep the authors updated and, if necessary, find alternative solutions.

Diversity and equity

Healthcare in Low-resource Settings is committed to diversity, equity, and inclusion, and strives for demographic diversity among peer reviewers. When inviting peer reviewers, editors are encouraged to consider geographical regions, gender identities, racial/ethnic groups, and other groups.

Misconduct

False or misleading information, such as identity theft and suggesting fake peer-reviewers, will result in the manuscript being rejected, further investigation in accordance with the Publisher's misconduct policy (https://www.pagepress.org/site/plagiarism_misconduct), and notification to the authors' institutions/employers. The Publisher follows the Committee on Publication Ethics (COPE) [guidance](#) about peer reviewer fraud/falsification.

Guidance

The primary goal of peer review is to provide the Editor with the information needed to make a fair, evidence-based decision that adheres to the journal's editorial criteria. Review reports should also assist authors in revising their paper so that it can be accepted for publication. Reports that include a recommendation to reject the paper should explain the major flaws in the research; this will help the authors prepare their manuscript for possible re-submission (if allowed by the Editor) or submission to a different journal.

A quick guide to reviewing is available [here](#)

Before submitting a report, reviewers should ask themselves the following questions:

- How would you react if you received this report?
- Do you find the tone offensive?
- Is it polite and professional?
- Do the authors or their competitors receive any unnecessary personal or antagonistic remarks?

Please keep in mind that any offensive language in your report may be removed by the Editor.

Publication Frequency

All papers are published as soon as they have been accepted, by adding them to the "current" volume's *Table of Contents*.

Open Access Policy

Healthcare in Low-resource Settings is fully compliant with open access mandates and provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge.

Archiving

This journal utilizes the [PKP Preservation Network](#), the [Global LOCKSS Network](#) and [Portico](#) to create a distributed archiving system among participating libraries and permits those libraries to create permanent archives of the journal for purposes of preservation and restoration.

HEALTHCARE IN LOW-RESOURCE SE...

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Chemistry at the Faculty of Sciences of the University of Cagliari, Department of Chemical and Geological Sciences, since 1990. She obtained a PhD Chemistry from the University of Cagliari 1992 with a thesis titled *Synthesis of polyfunctionalized benzenes by means of lithiation reactions*. Her research interests include the metallation reactions of aromatic derivatives leading to one-pot synthesis of benzocondensed sulfurated heterocycles; metabolomic analysis of biological fluids using GC-MS in medicine; mechanochemical organic synthesis. During her career she taught several different courses, such as "Chemistry of natural organic substances" for 6 years; "Applied organic chemistry" for 11 years; "Laboratory of Organic Chemistry II" 2002-present and Laboratory of Organic Chemistry I" for 3 years, all in the Chemistry Bachelor's Degree. She has been a supervisor for Bachelor, Master, and PhD students (Chemistry). Prof. Fattuoni is a member of the board for the PhD Course in Chemical Sciences and Technologies (University of Sassari/ University of Cagliari), and she is the author of 68 scientific articles in international journals as well as a reviewer for several journals in the chemical and biomedical field.

Cesar Ivan Aviles Gonzalez

Universidad Popular del Cesar, Colombia

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Cesar Ivan Aviles Gonzalez is a Senior Researcher at the Universidad Popular del Cesar, Colombia, with extensive experience in public health, mental health, and nursing. He holds a Ph.D. in Nursing and Health Sciences from the Universitat Rovira i Virgili in Spain. Dr. Aviles Gonzalez's research focuses on enhancing healthcare delivery in low-resource settings, with a strong emphasis on evidence-based practices and the application of nursing theories, such as Jean Watson's Caring Science. His work is dedicated to addressing the unique challenges faced by healthcare systems in resource-limited environments, particularly in Latin America. He is actively involved in academic mentoring and various research projects that aim to improve patient care and health outcomes. Dr. Aviles

Gonzalez's interdisciplinary approach to health challenges, including substance abuse and chronic disease management, underscores his commitment to advancing nursing practice and education in low-resource settings.

Massimo Migani

All Souls Mission, Mutoko, Zimbabwe

E-mail: mmigani@lgmissiohosp.org | [ORCID](#)

Born in Rimini on the 11/05/1977; Master's degree in Dentistry and Dental Prosthetics (cum laude) (University of Bologna - Italy, 2003) with final thesis in Periodontology under the mentorship of Prof. G. Zucchelli. Has special interest in Periodontology and Oral Surgery, Restorative and Endodontics. Attended post graduate courses in Periodontology (Prof. G Zucchelli), Implantology (Prof. M. Merli), Restorative (Dr Spreafico) and Endodontics (Prof. Mareschi/Dr Gesi). Between 2003 and 2008, worked as collaborator of Prof. G. Zucchelli and Prof. M. Merli in the private sector mainly in the fields of Periodontology, Restorative and Endodontics. Participated to scientific publications with Prof. Merli during this time. After 2 years between Italy and Zimbabwe where he coordinated the installation of the dental department at Luisa Guidotti Hospital (All Souls Mission – Mutoko), permanently relocated in Zimbabwe in 2010. Currently, Medical Superintendent of Luisa Guidotti hospital since 2014, his main field of clinical practice are: Oral surgery and Periodontology, Restorative, Endodontics. He is currently the focal person for the Oral Health Programme for the Mashonaland East Province. As a health sector manager, he has passion for public health and to contribute towards strengthening public health systems with One-Health oriented approaches. He has been Chairperson of the management Board of the national association of Church related hospitals in Zimbabwe (ZACH) and currently is a member of the management Board of the Medical and Dental Practitioners Council of Zimbabwe.

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Federica Sancassiani is an Associate Professor of Health Sciences and Applied Medical Technologies at the Department of Medical Sciences and Public Health at the University of Cagliari, Italy. She is a Health Psychologist-Psychotherapist with a Ph.D. in Biomedical, Nutritional, and Metabolic Sciences. Her research is focused on preventing psychosocial disabilities and chronic diseases, with a strong emphasis on physical activity and innovative technologies. She also explores psychosomatics, organizational health, service quality, and the promotion of human rights in mental health. Prof. Sancassiani is actively engaged in teaching and has published numerous peer-reviewed articles. Since 2010, she has been involved in leading research projects for several national and international research teams and has also been a keynote speaker at various conferences, seminars, and webinars.

Salvatore Sardo

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Dr. Salvatore Sardo is an Assistant Professor, Researcher and Consultant in Anaesthesia, Intensive Care, and Pain Medicine at the University of Cagliari, Italy. He trained as a resident at the University of Cagliari, integrating his education with traineeships in Milan, Rome, and Bologna and a Clinical Fellowship in Intensive Care Medicine at King's College Hospital (Denmark Hill). His research efforts focus on advancing the understanding of pain phenotypes and targeted management, metabolomics, non-oncologic chronic pain, and chemotherapy-induced neuropathic pain, as well as conducting systematic reviews and meta-analyses in the field of Anaesthesia, Intensive Care, and Pain Medicine. Dr. Salvatore Sardo has a keen interest in evidence synthesis methodology, especially mixed-methods meta-analysis, Bayesian generalized linear models, and R

language statistical programming. In recent years, he has worked as a literature search specialist for the Italian Society of Anaesthesia Analgesia Reanimation and Intensive Care (SIAARTI). He is also one of the founding members of SIAARTI's special interest group, the Systematic Review Group, directed by Dr. Prof. Cortegiani. His clinical interests include total intravenous anaesthesia with targeted controlled infusion protocols, EEG-based monitoring, haemodynamic optimisation and mechanical ventilation, and mechanism-based pain management. Dr. Sardo's unwavering commitment to advancing the knowledge and practice of Anaesthesia, Intensive Care, and Pain Medicine is evident in his continuous efforts to make meaningful contributions to the field through his research and clinical expertise.

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These are newly published articles but not yet assigned to an issue. The **Early Access** service lets users access peer-reviewed articles well before publication in a regular issue. These articles are

4TH INTERNATIONAL NURSING AND HEALTH SCIENCES SYMPOSIUM

Development of food for special dietary uses of diabetes based on oyster mushroom and brown rice

Inggita Kusumastuty, Etik Sulistyowati, Dian Handayani, Fajar Ari Nugroho, Anggun Rindang Cempaka, Agustin Rustiani, Alfina Putri Rakhmadiyah, Muhamad Zulkifli, Hana Raniza Jasmine, Gemma Karnika Prakasita, Firza Zahra Amanda, Ajeng Rifana Putri

<https://doi.org/10.4081/hls.2024.13039>



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The effectiveness of hyperoxygenation in preventing oxygen desaturation in intubated infants treated with endotracheal suctioning

Sholihatul Amaliya, Yeni Rustina, Defi Efendi

<https://doi.org/10.4081/hls.2024.13045>

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Correlation between self-efficacy and health status of Type 2 Diabetes Mellitus patients in primary health care

Setyoadi Setyoadi, Ferry Efendi, Joni Haryanto, Dina Dewi Sartika Lestari Ismail, Niko Dima Kristianingrum, Yati Sri Hayati, Annisa Wuri Kartika

 <https://doi.org/10.4081/hls.2024.13058>

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The effect of family-supportive therapy on the burden of caregivers and Activities of Daily Living among stroke patients

Nikmatul Fadilah, Loetfia Dwi Rahariyani, Hilmi Yumni, Dinarwiyata Dinarwiyata

 <https://doi.org/10.4081/hls.2024.13066>

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Spiritual coping “tri hita karana” and depression prevention behavior among the elderly during the Covid-19 pandemic

I. Wayan Suardana, Ah Yusuf, Rachmat

Hargono, I. Gede Juanamasta, Ketut Sudiantara, I. Ketut Gama, I. Wayan Mustika

 <https://doi.org/10.4081/hls.2024.13025>

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Analysis of diarrhea incidence based on demographic characteristics and hygiene behavior of adults in Indonesia and Taiwan

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The comparison of carbohydrate, fiber, and immunoglobulin-A levels in feces against stunting children in Tuban Regency

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 <https://doi.org/10.4081/hls.2024.13042>

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Improving Cardiopulmonary Resuscitation skills for layperson in cases of heart attack: a scoping review

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 <https://doi.org/10.4081/hls.2024.13049>

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Hypertensive patients' experience of care: a qualitative study

Nikmatul Fadilah, Dyah Wijayanti, Siti Nur
Kholifah, Dinarwiyata Dinarwiyata

 <https://doi.org/10.4081/hls.2024.13064>

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The effects of brown rice as functional food on Lee Index, adipose tissues and PRDM16 levels in obesity model *Rattus norvegicus*

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Sasiarini, Achmad Rudijanto, Dian
Handayani

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Examining the onset and cessation patterns of active smoking among college students: an interpretative analysis

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<https://doi.org/10.4081/hls.2024.13023>

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Culture-based Gorontalo community support for short-term pregnancy women to prevent stunting in neonates

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<https://doi.org/10.4081/hls.2024.13033>

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What factors influence clinical nurses' self-efficacy after wound care training? A scoping review

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The analysis of adolescents' behaviors through demographic characteristics and basic health knowledge in Taiwan

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The effect of psychoeducation with health coaching method on HbA1c levels Among Type 2 Diabetes Mellitus

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Correlation between personal characteristics and intention to perform bystander Cardiopulmonary Resuscitation

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Sartika Lestari Ismail, Ayut Merdikawati

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Preventive effect of yacon leaves capsule in reducing symptoms of Exercise-Induced Muscle Damage

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Effect of peer education on improving parental knowledge about nutrition in children

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Roles and challenges of health cadres in handling stunting: a qualitative study

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Insulin injection rotation and Diabetes Mellitus nutritional management education

Indah Rosdiana Narahaubun, Dian Handayani, Heri Kristianto

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An integrative literature review on clinical decision-making of novice nurses for disaster management in

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Factors associated with maternal stress while caring for premature infants at home

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Importance of self-management interventions in hypertension patients: a scoping review

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The role of peer social support on family psychological resilience in caring for Chronic Kidney Disease patients receiving hemodialysis

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A model of nursing intervention on the psychological needs of a group of neighborhood children in a shelter place in Surabaya

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Development of the "Mother Give

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Septa Katmawanti, Farah Paramita, Agung Kurniawan, Siti Khuzaimah A. Sharoni, Rosuzeita Fauzi, Dea Aflah Samah, Yassinda Thasia Audina, Muhammad Irfan Syahputra, Reza Pahlevi, Intan Gumilang Pratiwi

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The role of family support in managing death anxiety among the elderly

Niko Dima Kristianingrum, Yati Sri Hayati, Annisa Wuri Kartika, Fransiska Imavike Fevriasanty, Selsa Rifziqka Heltha Novian Haryono, Ayut Merdikawati

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Understanding river culture to approach health promotion in river management in Banjarmasin, South Kalimantan, Indonesia

Herawati Herawati, Anggi Setyowati, Lolla Ilona Elfani Kausar, Soedjadi Keman, Shrimarti R. Devy

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TRANSFORMING HEALTHCARE IN LOW- RESOURCE SETTINGS

The effectiveness of HIV/AIDS
education models for adolescents
with speech disabilities

Dedes Fitria, Sri Wahyuni, Elin Supliyani,
Fauzia Djamilus, Ari Kurniarum, Sri
Sumarni

<https://doi.org/10.4081/hls.2024.11973>

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E-counseling development model:
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Ima Nadatien, Abdul Muhith, Rizqi Putri
Nourma Budiarti, Mursyidul Ibad

<https://doi.org/10.4081/hls.2024.11990>

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Exploring the relationship between

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Arum Dwi Ningsih, Endang Yuswatiningsih, Dwi Prasetyaningati

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The effect of light massage and Spiritual Emotional Freedom Technique interventions on blood pressure among hypertension patients in Indonesia

Arsyawina Arsyawina, Rivan Firdaus, Diah Setiani, Raisyah Chairunnisya

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Analysis of determinants of infertility among women at *in vitro* fertilization clinic in Surabaya

Yati Isnaini Safitri, Esty Puji Rahayu , Lailatul Khusnul Rizki , Siska Nurul Abidah, Ima Nadatien

 <https://doi.org/10.4081/hls.2024.11985>

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Enhancing self-care in elderly patients: the impact of WhatsApp reminder messages at the Heart and Vascular Center

Hidayatus Sya'diyah, Dewi Purnama Sarira, Diyan Mutyah, Ayu Citra Mayasari, Sukma Ayu Candra Kirana

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Monitoring medication adherence using smart digital technology in patients with pulmonary tuberculosis

Eppy Setiyowati, Firdaus Firdaus, Erika Martining Wardani, Mulyadi Mulyadi

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Examining the relationship between health literacy and quality of life in patients with coronary heart disease: a quantitative study at a cardiology clinic

Lita Lita, Nadila Khairiyah, Agnita Utami, Silvia Nora Anggreini, Faridah Mohd. Said

 <https://doi.org/10.4081/hls.2024.11851>

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Enhancing the knowledge and skills of health cadres and mothers to prevent developmental disorders through stimulation interventions

Ningsih Jaya, Ambo Dalle, Sri Anggriani

<https://doi.org/10.4081/hls.2024.11966>

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Determinants of birth weight and length: an analysis of the 2020 mothers' cohort register data

Gurid Pramintarto Eko Mulyo, Denira Kusuma Putri, Aryani Sudja , Yenny Moviana , Mulus Gumilar, Umi Mahmudah, Nitta Isdiany

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Original Article

The comparison of carbohydrates, fibers, and immunoglobulin-A levels in feces against stunting children in Tuban Regency

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Key words: carbohydrates; feces; fibers; immunoglobulin-A; stunting

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Significance for health: Stunting events tend to have a negative impact on children development. Various risks of health and intellectual disorders can also cause a decline in the quality of human resources in a country. Decreased digestive tract function is one of the factors contributing to immune system disorders in stunted children, which can trigger the emergence of diseases and decreased absorption and metabolism from the GI Tract. This study seeks to analyze and compare the levels of carbohydrates, fibre, and immunoglobulin-A in the faeces of stunted children, aiming to provide valuable insights into potential dietary and immune factors contributing to stunting.

Abstract

Stunting in children under five years old is a major health problem in Indonesia. A compromised immune system in stunted children increases the risk of infection which has an impact on morbidity and mortality. Moreover, food intake is one of the causes of decreased immunity, where carbohydrate, fiber, and immunoglobulin-A levels in the intestine are related to the immunity of children under five years old. The assessment of feces content can provide an overview of carbohydrates, fiber, and immunoglobulin-A levels in the intestine. Therefore, this study aimed to determine the comparison of carbohydrate, fiber, and immunoglobulin-A levels in feces for stunted children.

An observational method with a case-control design was used, and it was conducted in Tuban Regency from May to July 2023. Forty stool samples were obtained from 20 stunted children and 20 non-stunted children who were tested for carbohydrates, fiber, and immunoglobulin-A. Subsequently, the data were analyzed with a comparison test to determine the differences between the two groups.

The results showed that carbohydrate and immunoglobulin-A levels were higher, while fiber levels in feces were lower in stunted children ($p \geq 0.05$).

It was concluded that there were differences in levels of carbohydrates, fiber, and immunoglobulin-A in the intestines of stunted children.

Introduction

The problem of malnutrition in children under five years old is a global health concern, with developing countries recording over 50% of death cases. Malnutrition in this age group can be prevented through treatment and intervention strategies.¹ Even though there has been a reduction in the prevalence of malnutrition, the decline has not been significant. In low-income communities, the risk of mortality before the age of 20 is doubled, similar to the risk of stunting children due to chronic malnutrition.² Stunting is a chronic nutritional problem attributed to inadequate nutrient intake over a long period, resulting in impaired growth in children. Globally, the prevalence of stunting among children under five is 21.3%.³ with Africa recording a prevalence of 30.9% in 2015. More than 155 million children under five suffer from stunting globally, with over 1 million deaths and a third experiencing Disability Adjusted Life Years (DALYS).⁴ Asian regions recorded 83.6 million cases, with the highest proportion originating from South Asia (58.7%), and Indonesia (27.67%) in 2019.⁵

Stunting is an indicator for determining the well-being of children, reflecting environmental and social inequalities. Various risk factors contribute to stunting, including parental (physical condition and nutritional status of the mother during pregnancy, parental education level, and socio-economic status), child (genetic, anthropometric, infection, food intake during infancy, gender, and age), environment (hygiene, sanitation, drinking water sources, culture, and beliefs) among others.⁶ Stunting process often begins during pregnancy, influenced by the mother's dietary history during gestation.⁷ The impacts of disease on stunted children include inflammation, disruption of the leptin hormone, and increased glucocorticoids. These factors can trigger neurological development disorders, neurogenesis, and apoptosis, affecting brain areas related to cognition and memory in children.⁸ Others may include digestive tract disorders in the form of intestinal inflammation. These lead to hampered nutrients absorption, further worsening the condition of stunted children. Intestinal disorders can also compromise the immune system, facilitating microbial invasion, diseases, and systemic inflammation.⁹

Intestinal inflammation can impact children nutritional status through impaired absorption of carbohydrates and proteins. It also disrupts the intestinal mucosa and microbial metabolic activity, which is essential for preventing the entry of pathogens.¹⁰ Microbiota in the food tract plays a significant role in children health, such as increasing metabolism and immunology. This condition is influenced

by various factors, including food intake, particularly fiber. Fiber, a type of polymeric carbohydrate found in food, cannot be absorbed and undergoes fermentation, thereby affecting the bacterial community and microbial metabolic activity.¹¹ Immunoglobulin A (Ig A), secreted by the mucous membrane lining the gastrointestinal tract plays a role in protecting or providing immunity in the digestive tract. Adequate IgA production enhances gut-associated lymphoid tissue (GALT) and functions as a mechanical barrier in the digestive tract.¹²

Stunting in children can lead to various vulnerabilities in the body, increasing the risk of mortality. Genetic, racial, and ethnic differences, as well as the provision of food, also tend to influence the risk of stunting.¹³ Different interventions, including nutritional support and education, are required for each stunted child in various regions. Therefore, assessing the levels of carbohydrates, fiber, and immunoglobulin-A in feces of stunted children in Tuban Regency is necessary to determine differences between the groups.

Materials and Methods

This study used an observational with a case-control method and was conducted in Tuban Regency from May to July 2023. Research approval was issued by Tuban Regency One-Stop Investment and Integrated Services Service (No.070/298/1.S/414.111.3/2023). Furthermore, a non-random purposive sampling method was used. Respondents were 20 stunting and 20 non-stunting children residing in Tuban Regency, East Java, who met the inclusion criteria (aged 2-5 years, free from autoimmune or congenital diseases related to GI Tract, and not suffering from diseases affecting digestion during the study period such as gastroenteritis, hepatobiliary, parasites, or worms) and exclusion criteria (fecal samples showing abnormal characteristics such as changes in color, texture, and odor).

Children who agreed to participate were accompanied by village cadres to receive further information about the study and to sign informed consent. Height/body length measurements were taken before fecal collection, and mothers were educated on the proper collection procedure, including separation from urine by urinating first. Fecal samples were collected in plastic wrap and transferred to clean, dry, and tightly closed pots using a stick or spoon. Each pot was labeled, stored in an ice box at

temperatures of 4-8°C, and transported to the nutrition laboratory of the Faculty of Public Health, Airlangga University for analysis. Carbohydrate levels were examined using the Luff School test, fiber levels through gravimetric test, and Immunoglobulin-A levels using enzyme-linked immunosorbent assay (ELISA) method.

The obtained data were analyzed using a comparison test. Normality test was first carried out to assess data distribution, respectively followed by homogeneity, and Independent T-test for comparison. Mann-Whitney test can be carried out when data are not normally distributed or heterogeneous.

Result and Discussion

Characteristics of respondents included gender, history of exclusive breastfeeding, history of diarrhea frequency each year, and type of additional food intake. Respondents were 20 stunting and 20 non-stunting children residing in Tuban Regency, East Java. Based on Table 1, the majority were female, namely stunting (60%) and non-stunting (65%) children. Furthermore, there were 85% exclusive breastfeeding non-stunting children. Both groups demonstrated a similar history of diarrhea frequency of once per year (40%), with porridge being the most common food intake.

Stunted children were affected by various factors such as socio-economics, environmental conditions, and behavior. Gender differences in the risk of stunting varied significantly between regions, with several studies showing no effect due to wrong parenting patterns.¹⁴ A mother's behavior in complying with exclusive breastfeeding had been proven to be associated with an increased risk of stunting. Examples of poor food intake for children include micronutrient content, low food diversity, and wrong feeding patterns in terms of timing, consistency, and quantity. Infant nutrition is crucial for the health and development of children.¹⁵ Optimal breastfeeding and provision of healthy and appropriate complementary foods to babies until 2 years can increase immunity factors.¹⁶ Diarrhea is known to be a complication of stunting and environmental conditions, affecting approximately 13.5%. Sampling from a single population tends to have similarities in terms of environmental conditions and sanitation hygiene.¹⁷ A significant relationship was found between children who received complementary foods and the risk of stunting. However, the additional food in question was not solely

based on the quantity or type of food provided, but also on diversity, balance of macronutrients and micronutrients, as well as intake of vitamins and minerals. The most important period of a children growth is up to the age of 60 months when any slowdown can cause disruption.¹⁸

The results of fecal examination are presented in Table 2. The average carbohydrate content was \pm SD-value of 11.39 ± 1.18 mg in feces of stunted children and 6.45 ± 1.17 mg for non-stunted. The average fiber content was \pm SD-value of $5.28 \pm 0.78\%$ for stunted and $2.98 \pm 0.73\%$ for non-stunted. The average immunoglobulin-A level was \pm SD-value of 31.47 ± 4.08 ng/mL for stunted and 12.94 ± 1.38 ng/mL for non-stunted.

The absorption of carbohydrate macronutrients is influenced by starch, lactose, and sucrose consumed. Foods containing cellulose cannot be digested by the small intestine, while monosaccharides are absorbed more rapidly by the body. Digestion of carbohydrates initiates in the mouth through the action of amylase enzyme, and continues further in the microvillus membrane. However, monosaccharides can be directly absorbed, and unabsorbed carbohydrates, such as cellulose, are fermented by bacteria in the large intestine and used for energy conversion. Excessive carbohydrate fermentation in malabsorption disorders can lead to bloating.¹⁹ Absorption disorders in stunted children are related to adaptation mechanisms to chronic calorie, protein, and environmental deficiencies, as well as the extent of malnutrition.²⁰ Malnutrition contributes to a decrease in the secretion of pancreatic enzymes (lipase, trypsin, chymotrypsin, and amylase), atrophy of the villi in the intestine, changes in blood flow, and increased intestinal permeability. This can result to a decrease in digestive enzymes and absorption function in the large intestine.²¹ Changes in the microbiota of the digestive tract, thinning of the mucosal layer and intestinal wall, atrophy of the microvilli (brush border), and changes in mucosal cells lead to increased intestinal mucosal permeability, more than threefold, in stunted children.²² Consequently, this affects carbohydrate absorption, resulting in higher carbohydrate levels in feces of stunted children compared to non-stunted.

Based on Table 3, data on carbohydrate, fiber, and immunoglobulin-A levels showed a normal distribution ($p > 0.05$). In the homogeneity test, the homogeneous variables were carbohydrates and fiber ($p > 0.05$), while Immunoglobulin-A was heterogeneous ($p < 0.05$). Independent t-test was conducted to compare carbohydrate and fiber variables, which showed significant differences between the two

groups ($p > 0.05$). Furthermore, immunoglobulin variable was assessed using Mann Whitney test, showing significant differences ($p > 0.05$).

The microbiota in humans comprises bacteria, fungi, archaea, protozoa, and viruses found in the digestive tract. It plays a crucial role in processing dietary fiber to release antioxidant or anti-inflammatory components. The breakdown of fiber by colonic microbiota can prevent various diseases, including digestive (colitis and infections) and metabolic disorders (diabetes, cardiovascular disease, and obesity).²³ Gut microbiota is related to digestion, absorption, and intestinal function. Stunted children experience changes in the composition of gut microbiota, leading to an imbalance or dysbiosis.²⁴ This dysbiosis can be related to malnutrition and a decrease in essential amino acid levels in plasma. Furthermore, gut microbiota is essential in regulating body weight, particularly Short Chain Fatty Acid (SCFA) production. Changes in gut microbiota are also related to the pathophysiology of stunting and can be detected before growth retardation occurs.²⁵ Consumption of dietary fiber influences the microbial composition in the human gut and microbiome function, potentially leading to the development of chronic inflammatory diseases.²⁶ The increase in fecal fiber levels in stunted children is attributed to the absence of microbiota in the digestive tract.

Immunoglobulin (Ig) A contributed to host bacterial homeostasis in the intestine, which showed nutritional deficiency was associated with changes in the interaction between IgA and gut microbiota.²⁷ Chronic nutritional deficiency tends to alter IgA recognition of the microbiota. Microbes bound to IgA in feces are significantly higher in stunted children. Stunting is associated with an increase in antibodies, leading to intestinal dysbiosis and inflammation.²⁸ IgA also functions as a mucosal antibody in the intestine. A substantial increase of IgA in stunted and non-stunted children should be considered due to the potential as a pathogen.²⁹ The chronic inflammatory process directly induces body inflammation and cell damage.³⁰ Therefore, increased Ig A levels are often observed in stunted children with infections and associated with a high risk of death.

Conclusions

In conclusion, carbohydrate and immunoglobulin-A levels were higher in feces of stunted children due to digestive disorders and inflammatory processes, while fiber levels were lower ($p \leq 0.05$).

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Table 1. Distribution of Respondents' Characteristics

Characteristics		Stunting		Non-Stunting	
		Frequency	%	Frequency	%
Gender	Male	8	40	7	35
	Female	12	60	13	65
Exclusive breastfeeding	Yes	5	25	17	85
	No	15	75	3	15
History of frequency of diarrhoea	1x/year	8	40	8	40
	2x/year	10	50	7	35
	3x/year	1	5	4	20
	Every drinking milk	1	5	1	5
Types of additional food intake	Fine Porridge	14	70	15	75
	Packaged Porridge	2	10	0	0
	Family Food	4	20	5	25

Table 2. Results of Children Feces Examination

Variable		Average \pm SD	Maximum	Minimum
Carbohydrate (mg)	Stunting	11.39 \pm 1.18	13.02	8.99
	Non-stunting	6.45 \pm 1.17	8.12	4.18
Fiber (%)	Stunting	5.28 \pm 0.78	6.58	3.64
	Non-stunting	2.98 \pm 0.73	4.13	1.49
Immunoglobulin-A (ng/mL)	Stunting	31.47 \pm 4.08	39.90	25.92
	Non-stunting	12.94 \pm 1.38	15.02	11.04

Table 3. Difference Test Results in Children Feces

Variable		Normality Test	Homogeneity Test	P-Value
Carbohydrate (mg)	Stunting	0.252	0.798	< 0.001
	Non-stunting	0.359		
Fiber (%)	Stunting	0.525	0.645	< 0.001
	Non-stunting	0.631		
Immunoglobulin-A (ng/mL)	Stunting	0.124	< 0.001	< 0.001
	Non-stunting	0.053		

The comparison of carbohydrates, fibers, and immunoglobulin-A levels in feces against stunting children in Tuban Regency

by Rivan Virlando Suryadinata

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Original Article

The comparison of carbohydrates, fibers, and immunoglobulin-A levels in feces against stunting children in Tuban Regency

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Running title: The comparison of carbohydrate, fiber, and immunoglobulin-A levels

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Significance for health: Stunting events tend to have a negative impact on children development. Various risks of health and intellectual disorders can also cause a decline in the quality of human resources in a country. Decreased digestive tract function is one of the factors contributing to immune system disorders in stunted children, which can trigger the emergence of diseases and decreased absorption and metabolism from the GI Tract. This study seeks to analyze and compare the levels of carbohydrates, fibre, and immunoglobulin-A in the faeces of stunted children, aiming to provide valuable insights into potential dietary and immune factors contributing to stunting.

5

Abstract

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Children who agreed to participate were accompanied by village cadres to receive further information about the study and to sign informed consent. Height/body length measurements were taken before fecal collection, and mothers were educated on the proper collection procedure, including separation from urine by urinating first. Fecal samples were collected in plastic wrap and transferred to clean, dry, and tightly closed pots using a stick or spoon. Each pot was labeled, stored in an ice box at

temperatures of 4-8°C, and transported ² to the nutrition laboratory of the Faculty of Public Health, Airlangga University for analysis. Carbohydrate levels were examined using the Luff School test, fiber levels through gravimetric test, and Immunoglobulin-A levels using enzyme-linked immunosorbent assay (ELISA) method.

The obtained data were analyzed using a comparison test. Normality ⁴ test was first carried out to assess data distribution, respectively followed by homogeneity, and Independent T-test for comparison. Mann-Whitney test can be carried out when data are not normally distributed or heterogeneous.

Result and Discussion

Characteristics of respondents included gender, history of exclusive breastfeeding, history of diarrhea frequency each year, and type of additional food intake. Respondents were 20 stunting and 20 non-stunting children residing in Tuban Regency, East Java. Based on Table 1, the majority were female, namely stunting (60%) and non-stunting (65%) children. Furthermore, there were 85% exclusive breastfeeding non-stunting children. Both groups demonstrated a similar history of diarrhea frequency of once per year (40%), with porridge being the most common food intake.

Stunted children were affected by various factors such as socio-economics, environmental conditions, and behavior. Gender differences in the risk of stunting varied significantly between regions, with several studies showing no effect due to wrong parenting patterns.¹⁴ A mother's behavior in complying with exclusive breastfeeding had been proven to ⁸ be associated with an increased risk of stunting. Examples of poor food intake for children include micronutrient content, low food diversity, and wrong feeding patterns in terms of timing, consistency, and quantity. Infant nutrition is crucial for the health and development of children.¹⁵ Optimal breastfeeding and provision of healthy and appropriate complementary foods to babies until 2 years can increase immunity factors.¹⁶ Diarrhea is known to be a complication of stunting and environmental conditions, affecting approximately 13.5%. Sampling from a single population tends to have similarities in terms of environmental conditions and sanitation hygiene.¹⁷ A significant relationship was found between children who received complementary foods and the risk of stunting. However, the additional food in question was not solely

based on the quantity or type of food provided, but also on diversity, balance of macronutrients and micronutrients, as well as intake of vitamins and minerals. The most important period of a children growth is up to the age of 60 months when any slowdown can cause disruption.¹⁸

The results of fecal examination are presented in Table 2. The average carbohydrate content was \pm SD-value of 11.39 ± 1.18 mg in feces of stunted children and 6.45 ± 1.17 mg for non-stunted. The average fiber content was \pm SD-value of $5.28 \pm 0.78\%$ for stunted and $2.98 \pm 0.73\%$ for non-stunted. The average immunoglobulin-A level was \pm SD-value of 31.47 ± 4.08 ng/mL for stunted and 12.94 ± 1.38 ng/mL for non-stunted.

The absorption of carbohydrate macronutrients is influenced by starch, lactose, and sucrose consumed. Foods containing cellulose cannot be digested by the small intestine, while monosaccharides are absorbed more rapidly by the body. Digestion of carbohydrates initiates in the mouth through the action of amylase enzyme, and continues further in the microvillus membrane. However, monosaccharides can be directly absorbed, and unabsorbed carbohydrates, such as cellulose, are fermented by bacteria in the large intestine and used for energy conversion. Excessive carbohydrate fermentation in malabsorption disorders can lead to bloating.¹⁹ Absorption disorders in stunted children are related to ¹⁷ adaptation mechanisms to chronic calorie, protein, and environmental deficiencies, as well as the extent of malnutrition.²⁰ Malnutrition contributes to a decrease in the secretion of pancreatic enzymes (lipase, trypsin, chymotrypsin, and amylase), atrophy of the villi in the intestine, changes in blood flow, and increased intestinal permeability. This can result to a decrease in digestive enzymes and absorption function in the large intestine.²¹ Changes in the microbiota of the digestive tract, thinning of the mucosal layer and intestinal wall, atrophy of the microvilli (brush border), and changes in mucosal cells lead to increased intestinal mucosal permeability, more than threefold, in stunted children.²² Consequently, this affects carbohydrate absorption, resulting in higher carbohydrate levels in feces of stunted children compared to non-stunted.

Based on Table 3, data on carbohydrate, fiber, and immunoglobulin-A levels showed a ²⁴ normal distribution ($p>0.05$). In the homogeneity test, the homogeneous variables were carbohydrates and fiber ($p>0.05$), while Immunoglobulin-A was heterogeneous ($p<0.05$). Independent t-test was conducted to ¹² compare carbohydrate and fiber variables, which ¹⁴ showed significant differences between the two

groups ($p > 0.05$). Furthermore, immunoglobulin variable was assessed using Mann Whitney test, showing significant differences ($p > 0.05$).

The microbiota in humans comprises bacteria, fungi, archaea, protozoa, and viruses found in the digestive tract. It plays a crucial role in processing dietary fiber to release antioxidant or anti-inflammatory components. The breakdown of fiber by colonic microbiota can prevent various diseases, including digestive (colitis and infections) and metabolic disorders (diabetes, cardiovascular disease, and obesity).²³ Gut microbiota is related to digestion, absorption, and intestinal function. Stunted children experience changes in the composition of gut microbiota, leading to an imbalance or dysbiosis.²⁴ This dysbiosis can be related to malnutrition and a decrease in essential amino acid levels in plasma. Furthermore, gut microbiota is essential in regulating body weight, particularly Short Chain Fatty Acid (SCFA) production. Changes in gut microbiota are also related to the pathophysiology of stunting and can be detected before growth retardation occurs.²⁵ Consumption of dietary fiber influences the microbial composition in the human gut and microbiome function, potentially leading to the development of chronic inflammatory diseases.²⁶ The increase in fecal fiber levels in stunted children is attributed to the absence of microbiota in the digestive tract.

Immunoglobulin (Ig) A contributed to host bacterial homeostasis in the intestine, which showed nutritional deficiency was associated with changes in the interaction between IgA and gut microbiota.²⁷ Chronic nutritional deficiency tends to alter IgA recognition of the microbiota. Microbes bound to IgA in feces are significantly higher in stunted children. Stunting is associated with an increase in antibodies, leading to intestinal dysbiosis and inflammation.²⁸ IgA also functions as a mucosal antibody in the intestine. A substantial increase of IgA in stunted and non-stunted children should be considered due to the potential as a pathogen.²⁹ The chronic inflammatory process directly induces body inflammation and cell damage.³⁰ Therefore, increased Ig A levels are often observed in stunted children with infections and associated with a high risk of death.

Conclusions

In conclusion, carbohydrate and immunoglobulin-A levels were higher in feces of stunted children due to digestive disorders and inflammatory processes, while fiber levels were lower ($p \leq 0.05$).

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Table 1. Distribution of Respondents' Characteristics

Characteristics		Stunting		Non-Stunting	
		Frequency	%	Frequency	%
Gender	Male	8	40	7	35
	Female	12	60	13	65
Exclusive breastfeeding	Yes	5	25	17	85
	No	15	75	3	15
History of frequency of diarrhoea	1x/year	8	40	8	40
	2x/year	10	50	7	35
	3x/year	1	5	4	20
	Every drinking milk	1	5	1	5
Types of additional food intake	Fine Porridge	14	70	15	75
	Packaged Porridge	2	10	0	0
	Family Food	4	20	5	25

Table 2. Results of Children Feces Examination

Variable	Average ± SD	Maximum	Minimum	
Carbohydrate (mg)	Stunting	11.39 ± 1.18	13.02	8.99
	Non-stunting	6.45 ± 1.17	8.12	4.18
Fiber (%)	Stunting	5.28 ± 0.78	6.58	3.64
	Non-stunting	2.98 ± 0.73	4.13	1.49
Immunoglobulin-A (ng/mL)	Stunting	31.47 ± 4.08	39.90	25.92
	Non-stunting	12.94 ± 1.38	15.02	11.04

Table 3. Difference Test Results in Children Feces

Variable	Normality Test	Homogeneity Test	P-Value	
Carbohydrate (mg)	Stunting	0.252	0.798	< 0.001
	Non-stunting	0.359		
Fiber (%)	Stunting	0.525	0.645	< 0.001
	Non-stunting	0.631		
Immunoglobulin-A (ng/mL)	Stunting	0.124	< 0.001	< 0.001
	Non-stunting	0.053		