

Edson Silva
(Organizador)

Atena
Editora
Ano 2022

Serviços e cuidados
NAS CIÊNCIAS DA SAÚDE 2



Edson Silva
(Organizador)

Atena
Editora
Ano 2022

Serviços e cuidados

NAS CIÊNCIAS DA SAÚDE 2



Editora chefe

Profª Drª Antonella Carvalho de Oliveira

Editora executiva

Natalia Oliveira

Assistente editorial

Flávia Roberta Barão

Bibliotecária

Janaina Ramos

Projeto gráfico

Bruno Oliveira

Camila Alves de Cremo

Daphynny Pamplona

Luiza Alves Batista

Natália Sandrini de Azevedo

Imagens da capa

iStock

Edição de arte

Luiza Alves Batista

2022 by Atena Editora

Copyright © Atena Editora

Copyright do texto © 2022 Os autores

Copyright da edição © 2022 Atena Editora

Direitos para esta edição cedidos à Atena Editora pelos autores.

Open access publication by Atena Editora



Todo o conteúdo deste livro está licenciado sob uma Licença de Atribuição Creative Commons. Atribuição-Não-Comercial-NãoDerivativos 4.0 Internacional (CC BY-NC-ND 4.0).

O conteúdo dos artigos e seus dados em sua forma, correção e confiabilidade são de responsabilidade exclusiva dos autores, inclusive não representam necessariamente a posição oficial da Atena Editora. Permitido o *download* da obra e o compartilhamento desde que sejam atribuídos créditos aos autores, mas sem a possibilidade de alterá-la de nenhuma forma ou utilizá-la para fins comerciais.

Todos os manuscritos foram previamente submetidos à avaliação cega pelos pares, membros do Conselho Editorial desta Editora, tendo sido aprovados para a publicação com base em critérios de neutralidade e imparcialidade acadêmica.

A Atena Editora é comprometida em garantir a integridade editorial em todas as etapas do processo de publicação, evitando plágio, dados ou resultados fraudulentos e impedindo que interesses financeiros comprometam os padrões éticos da publicação. Situações suspeitas de má conduta científica serão investigadas sob o mais alto padrão de rigor acadêmico e ético.

Conselho Editorial**Ciências Biológicas e da Saúde**

Profª Drª Aline Silva da Fonte Santa Rosa de Oliveira – Hospital Federal de Bonsucesso

Profª Drª Ana Beatriz Duarte Vieira – Universidade de Brasília

Profª Drª Ana Paula Peron – Universidade Tecnológica Federal do Paraná

Prof. Dr. André Ribeiro da Silva – Universidade de Brasília

Profª Drª Anelise Levay Murari – Universidade Federal de Pelotas

Prof. Dr. Benedito Rodrigues da Silva Neto – Universidade Federal de Goiás



Prof. Dr. Cirênio de Almeida Barbosa – Universidade Federal de Ouro Preto
Prof^o Dr^a Daniela Reis Joaquim de Freitas – Universidade Federal do Piauí
Prof^o Dr^a Débora Luana Ribeiro Pessoa – Universidade Federal do Maranhão
Prof. Dr. Douglas Siqueira de Almeida Chaves – Universidade Federal Rural do Rio de Janeiro
Prof. Dr. Edson da Silva – Universidade Federal dos Vales do Jequitinhonha e Mucuri
Prof^o Dr^a Elizabeth Cordeiro Fernandes – Faculdade Integrada Medicina
Prof^o Dr^a Eleuza Rodrigues Machado – Faculdade Anhanguera de Brasília
Prof^o Dr^a Elane Schwinden Prudêncio – Universidade Federal de Santa Catarina
Prof^o Dr^a Eysler Gonçalves Maia Brasil – Universidade da Integração Internacional da Lusofonia Afro-Brasileira
Prof. Dr. Ferlando Lima Santos – Universidade Federal do Recôncavo da Bahia
Prof^o Dr^a Fernanda Miguel de Andrade – Universidade Federal de Pernambuco
Prof. Dr. Fernando Mendes – Instituto Politécnico de Coimbra – Escola Superior de Saúde de Coimbra
Prof^o Dr^a Gabriela Vieira do Amaral – Universidade de Vassouras
Prof. Dr. Gianfábio Pimentel Franco – Universidade Federal de Santa Maria
Prof. Dr. Helio Franklin Rodrigues de Almeida – Universidade Federal de Rondônia
Prof^o Dr^a Iara Lúcia Tescarollo – Universidade São Francisco
Prof. Dr. Igor Luiz Vieira de Lima Santos – Universidade Federal de Campina Grande
Prof. Dr. Jefferson Thiago Souza – Universidade Estadual do Ceará
Prof. Dr. Jesus Rodrigues Lemos – Universidade Federal do Piauí
Prof. Dr. Jônatas de França Barros – Universidade Federal do Rio Grande do Norte
Prof. Dr. José Aderval Aragão – Universidade Federal de Sergipe
Prof. Dr. José Max Barbosa de Oliveira Junior – Universidade Federal do Oeste do Pará
Prof^o Dr^a Juliana Santana de Curcio – Universidade Federal de Goiás
Prof^o Dr^a Lívia do Carmo Silva – Universidade Federal de Goiás
Prof. Dr. Luís Paulo Souza e Souza – Universidade Federal do Amazonas
Prof^o Dr^a Magnólia de Araújo Campos – Universidade Federal de Campina Grande
Prof. Dr. Marcus Fernando da Silva Praxedes – Universidade Federal do Recôncavo da Bahia
Prof^o Dr^a Maria Tatiane Gonçalves Sá – Universidade do Estado do Pará
Prof. Dr. Maurilio Antonio Varavallo – Universidade Federal do Tocantins
Prof^o Dr^a Mylena Andréa Oliveira Torres – Universidade Ceuma
Prof^o Dr^a Natiéli Piovesan – Instituto Federaci do Rio Grande do Norte
Prof. Dr. Paulo Inada – Universidade Estadual de Maringá
Prof. Dr. Rafael Henrique Silva – Hospital Universitário da Universidade Federal da Grande Dourados
Prof^o Dr^a Regiane Luz Carvalho – Centro Universitário das Faculdades Associadas de Ensino
Prof^o Dr^a Renata Mendes de Freitas – Universidade Federal de Juiz de Fora
Prof^o Dr^a Sheyla Mara Silva de Oliveira – Universidade do Estado do Pará
Prof^o Dr^a Suely Lopes de Azevedo – Universidade Federal Fluminense
Prof^o Dr^a Vanessa da Fontoura Custódio Monteiro – Universidade do Vale do Sapucaí
Prof^o Dr^a Vanessa Lima Gonçalves – Universidade Estadual de Ponta Grossa
Prof^o Dr^a Vanessa Bordin Viera – Universidade Federal de Campina Grande
Prof^o Dr^a Welma Emídio da Silva – Universidade Federal Rural de Pernambuco



Serviços e cuidados nas ciências da saúde 2

Diagramação: Camila Alves de Cremo
Correção: Yaidy Paola Martinez
Indexação: Amanda Kelly da Costa Veiga
Revisão: Os autores
Organizador: Edson da Silva

Dados Internacionais de Catalogação na Publicação (CIP)

S491 Serviços e cuidados nas ciências da saúde 2 / Organizador Edson da Silva. – Ponta Grossa - PR: Atena, 2022.

Formato: PDF

Requisitos de sistema: Adobe Acrobat Reader

Modo de acesso: World Wide Web

Inclui bibliografia

ISBN 978-65-258-0169-8

DOI: <https://doi.org/10.22533/at.ed.698220305>

1. Saúde. I. Silva, Edson da (Organizador). II. Título.

CDD 613

Elaborado por Bibliotecária Janaina Ramos – CRB-8/9166

Atena Editora
Ponta Grossa – Paraná – Brasil
Telefone: +55 (42) 3323-5493
www.atenaeditora.com.br
contato@atenaeditora.com.br



DECLARAÇÃO DOS AUTORES

Os autores desta obra: 1. Atestam não possuir qualquer interesse comercial que constitua um conflito de interesses em relação ao artigo científico publicado; 2. Declaram que participaram ativamente da construção dos respectivos manuscritos, preferencialmente na: a) Concepção do estudo, e/ou aquisição de dados, e/ou análise e interpretação de dados; b) Elaboração do artigo ou revisão com vistas a tornar o material intelectualmente relevante; c) Aprovação final do manuscrito para submissão.; 3. Certificam que os artigos científicos publicados estão completamente isentos de dados e/ou resultados fraudulentos; 4. Confirmam a citação e a referência correta de todos os dados e de interpretações de dados de outras pesquisas; 5. Reconhecem terem informado todas as fontes de financiamento recebidas para a consecução da pesquisa; 6. Autorizam a edição da obra, que incluem os registros de ficha catalográfica, ISBN, DOI e demais indexadores, projeto visual e criação de capa, diagramação de miolo, assim como lançamento e divulgação da mesma conforme critérios da Atena Editora.



DECLARAÇÃO DA EDITORA

A Atena Editora declara, para os devidos fins de direito, que: 1. A presente publicação constitui apenas transferência temporária dos direitos autorais, direito sobre a publicação, inclusive não constitui responsabilidade solidária na criação dos manuscritos publicados, nos termos previstos na Lei sobre direitos autorais (Lei 9610/98), no art. 184 do Código Penal e no art. 927 do Código Civil; 2. Autoriza e incentiva os autores a assinarem contratos com repositórios institucionais, com fins exclusivos de divulgação da obra, desde que com o devido reconhecimento de autoria e edição e sem qualquer finalidade comercial; 3. Todos os e-book são *open access*, *desta forma* não os comercializa em seu site, sites parceiros, plataformas de *e-commerce*, ou qualquer outro meio virtual ou físico, portanto, está isenta de repasses de direitos autorais aos autores; 4. Todos os membros do conselho editorial são doutores e vinculados a instituições de ensino superior públicas, conforme recomendação da CAPES para obtenção do Qualis livro; 5. Não cede, comercializa ou autoriza a utilização dos nomes e e-mails dos autores, bem como nenhum outro dado dos mesmos, para qualquer finalidade que não o escopo da divulgação desta obra.



APRESENTAÇÃO

A coletânea '*Serviços e cuidados nas ciências da saúde*' é uma obra composta por 50 capítulos, organizados em dois volumes. O volume 1 foi constituído por 26 capítulos e o volume 2, por 24.

O foco da coletânea é a discussão científica por intermédio de trabalhos multiprofissionais desenvolvidos por autores brasileiros e estrangeiros.

Temas atuais foram investigados pelos autores e compartilhados com a proposta de fortalecer o conhecimento de estudantes, de profissionais e de todos aqueles que, de alguma forma, estão envolvidos na estrutura do cuidado mediado pelas ciências da saúde. Além disso, conhecer as inovações e as estratégias desses atores é essencial para a formação e a atualização profissional em saúde.

Dedico essa obra aos estudantes, professores, profissionais e às instituições envolvidas com os estudos relatados ao longo dos capítulos. Gratidão aos autores que tornaram essa coletânea uma realidade ao partilhar suas vivências.

A você...desejo uma ótima leitura!

Edson da Silva

SUMÁRIO

CAPÍTULO 1..... 1


PERFIL EPIDEMIOLÓGICO DE INTERNAÇÕES POR DENGUE DE PACIENTES PEDIÁTRICOS NO ESTADO DO TOCANTINS ENTRE OS ANOS DE 2016 A 2021

Livia Moreira da Silva

Fernanda Carriço Lemes

Letícia Lelles David Gomes Melo

Michelle de Jesus Pantoja Filgueira

 <https://doi.org/10.22533/at.ed.6982203051>

CAPÍTULO 2..... 11

CONSIDERAÇÕES SOBRE A CIRURGIA BARIÁTRICA E OBESIDADE EM ADOLESCENTES: INDICAÇÕES, TÉCNICAS, TRATAMENTO E PÓS- OPERATÓRIO

Sandy Vanessa César Cadengue

Brunna Pinheiro Milazzo Mesquita

Camille Walkyria Bugar Costa

Eduarda Regina Pelizza

Isadora Campos de Oliveira


Laura Gomes Martucci

Maria Fernanda Neto Vieira

Natacha da Silva Estevão Cáceres Marques

Nayara Bruna Pauferro de Souza Pacheco

Yngre Campagnaro Nogueira

 <https://doi.org/10.22533/at.ed.6982203052>

CAPÍTULO 3..... 22

ASSISTÊNCIA DE ENFERMAGEM AO RECÉM-NASCIDO PRÉ-TERMO COM ICTERÍCIA FISIOLÓGICA EM UNIDADES DE TERAPIA INTENSIVA NEONATAL

Helena Raquel Severino

Joanderson Nunes Cardoso

Maria Sabrina da Silva Alencar

Jhane Lopes de Carvalho

Shady Maria Furtado Moreira

Davi Pedro Soares Macêdo


Uilna Natércia Soares Feitosa

Izadora Soares Pedro Macêdo

Edglê Pedro de Sousa Filho

Kely Gomes Pereira

Prycilla Karen Sousa da Silva


 <https://doi.org/10.22533/at.ed.6982203053>

CAPÍTULO 4..... 31

PRAZER E SOFRIMENTO NA EMERGÊNCIA PEDIÁTRICA

Janice Schimelfenig

Grasiele Fatima Busnello

 <https://doi.org/10.22533/at.ed.6982203054>

CAPÍTULO 5..... 43

PREVALENCIA DE DEPRESIÓN EN EL ADULTO MAYOR DEL POBLADO DE AQUILES SERDÁN, CHAMPOTÓN, CAMPECHE


Betty Sarabia-Alcocer
Baldemar Aké-Canché
Rafael Manuel de Jesús Mex-Álvarez
Eduardo Jahir Gutiérrez Alcántara
Román Pérez-Balan
Marvel del Carmen Valencia Gutiérrez
Pedro Gerbacio Canul Rodríguez
María Eugenia López-Caamal
María Concepción Ruíz de Chávez-Figueroa
Carmen Cecilia Lara-Gamboa
Patricia Margarita Garma-Quen
Judith Ruíz Hernández.

 <https://doi.org/10.22533/at.ed.6982203055>

CAPÍTULO 6..... 54

ALEITAMENTO MATERNO NA PREMATURIDADE


Carina Galvan
Rosane Maria Sordi
Liege Segabinazzi Lunardi
Terezinha de Fátima Gorreis
Flávia Giendruczak da Silva
Andreia Tanara de Carvalho
Adelita Noro
Paula de Cezaro
Rozemy Magda Vieira Gonçalves
Ana Paula Narcizo Carcuchinski

 <https://doi.org/10.22533/at.ed.6982203056>

CAPÍTULO 7..... 62

EUTANÁSIA NO BRASIL: DILEMAS MÉDICO-LEGAIS & BIOÉTICOS FRENTE A TERMINALIDADE

Maria Eduarda Kobayashi Teixeira
Giovanna Almeida da Silva de Sá Oliveira
Janaína Dourado Ramos Rôde
Catharina Oliveira Vianna Dias da Silva
Almir Ramos Carneiro Neto
Raul Coelho Barreto Filho


 <https://doi.org/10.22533/at.ed.6982203057>

CAPÍTULO 8..... 74

PROCESSOS ÉTICOS EM ENFERMAGEM

Danielly da Costa Rocha
Ana Beatriz Oliveira Costa
Jhully Sales Pena de Sousa


Luini Aiesca, Senna de Luna
Stefane Ferreira de Souza
Thalia Kelly Caetano de Sousa
Tarcia Millene de A. C. Barreto

 <https://doi.org/10.22533/at.ed.6982203058>

CAPÍTULO 9..... 88

TREINAMENTO DE UMA REMADORA FINALISTA DOS JOGOS PARALÍMPICOS RIO 2016


José Paulo Sabadini de Lima
Thiago Oliveira Borges

 <https://doi.org/10.22533/at.ed.6982203059>

CAPÍTULO 10..... 95

GRUPO DE ATIVIDADE FÍSICA NO TERRITÓRIO: DISPOSITIVO TERAPÊUTICO A USUÁRIOS E FAMILIARES


Sdnei Gomes dos Santos

 <https://doi.org/10.22533/at.ed.69822030510>

CAPÍTULO 11 103

AVALIAÇÃO DO NÍVEL DE CONHECIMENTO E PRÁTICAS DE HIDRATAÇÃO DE ATLETAS PROFISSIONAIS DE BASQUETE DE FORTALEZA-CE

Shelda Guimarães Santos
Marie Pereira de Sousa
Arlene Machado de Freitas
Cícero Matheus Lima Amaral
Abelardo Barbosa Moreira Lima Neto
Luís Sérgio Fonteles Duarte
Derlange Belizário Diniz

 <https://doi.org/10.22533/at.ed.69822030511>

CAPÍTULO 12..... 110

IMPACTO DA TELECARDIOLOGIA NO RECONHECIMENTO DE DIAGNÓSTICOS CARDIOLÓGICOS EM SERVIÇOS DE URGÊNCIA E EMERGÊNCIA DO SISTEMA DE SAÚDE HAPVIDA


Vinícius Batista Carlesso
José Luciano Monteiro Cunha
Marcelo Sampaio Moreira
Alexandre Giandoni Wolkoff
Henrique José Bonaldi
Carlos Funes Prada
Flávio Luís Gambi Cavallari
Juliano Cesar dos Santos
Luís Fernando Soares Medeiros
Silvia Nunes Szente Fonseca

 <https://doi.org/10.22533/at.ed.69822030512>

CAPÍTULO 13..... 114

EXERCÍCIO FÍSICO NA SÍNDROME CARDIORRENAL


Danieli de Cristo
Maiara Vanusa Guedes Ribeiro
Matheus Ribeiro Bizuti
Thabata Caroline de Oliveira Santos
Rafael Luiz Pereira
Débora Tavares de Resende e Silva

 <https://doi.org/10.22533/at.ed.69822030513>

CAPÍTULO 14..... 123

EXTENSÃO MULTIDISCIPLINAR DE DIABETES E HIPERTENSÃO: UM RELATO DE EXPERIÊNCIA


Lucas Pontes Coutinho
Catarina Joelma Magalhães Braga

 <https://doi.org/10.22533/at.ed.69822030514>

CAPÍTULO 15..... 128

EXTENSÃO UNIVERSITÁRIA E EDUCAÇÃO EM SAÚDE NO CONTEXTO DA PANDEMIA DA COVID-19: UM RELATO DE EXPERIÊNCIA

Larissa Batista Bessa
Lailton Arruda Barreto Filho
Eddie William de Pinho Santana

 <https://doi.org/10.22533/at.ed.69822030515>

CAPÍTULO 16..... 134

USO DE PLATAFORMA DIGITAL PARA EDUCAÇÃO ALIMENTAR E NUTRICIONAL NA PANDEMIA COVID-19: RELATO DE EXPERIÊNCIA

Francilene da Silva Chabí
Fernanda Sousa Barros
Emilly Nunes Salustiano de Sousa
Kelly Bessa da Silva
Gabrielly Sobral Neiva
Lais Santos da Silva
Bruna de Araújo Cavalcante
Tatiane Rocha da Silva Santos


 <https://doi.org/10.22533/at.ed.69822030516>

CAPÍTULO 17..... 142

O INSTAGRAM COMO FERRAMENTA DE EDUCAÇÃO NUTRICIONAL: RELATO DE EXPERIÊNCIA DO PROGRAMA DE ATIVIDADES INTEGRADAS EM NUTRIÇÃO (PAIN)

Ana Lídia de Lacerda Abreu
Alessandra da Silva Rocha
Victor Vincent Morais de Lima
Taynah Lemos Gomes
Ana Bárbara Muniz Araújo
Antônia Gislayne Abreu da Silva


Vitória Régia Soares Gomes
Beatriz Melo de Carvalho
Bruno de Sousa Almeida
Amanda Maria Serra Pinto
Keciany Alves de Oliveira
Maria Luisa Pereira de Melo

 <https://doi.org/10.22533/at.ed.69822030517>

CAPÍTULO 18..... 150

PRESENÇA E NÍVEL DE ESTRESSE EM MÉDICOS E ENFERMEIROS QUE TRABALHAM EM UNIDADES DE TERAPIA INTENSIVA DO MUNICÍPIO DE SÃO LUÍS-MA

Joacy Gonçalves de Oliveira Filho
Sílvia Cristianne Nava Lopes
Aline Silva Andrade Costa
Érica Celestino Cordeiro
Júlio César Costa dos Santos
Pâmela Cirqueira Nunes
Rafayelle Maria Campos Balby
William Vieira Ferreira

 <https://doi.org/10.22533/at.ed.69822030518>

CAPÍTULO 19..... 167

ANÁLISE ERGONÔMICA DO TRABALHO EM PROL DA SAÚDE OCUPACIONAL: UMA VISÃO INTERPROFISSIONAL


Emillie Bianca Silva do Carmo
Grazielle Maria da Silveira
Maiki José Gomes Nascimento
Cinthia Rodrigues de Vasconcelos

 <https://doi.org/10.22533/at.ed.69822030519>

CAPÍTULO 20..... 185

AVALIAÇÃO MICROBIOLÓGICA DAS MÃOS E AMBIENTES E/EM HOSPITALARES, UMA REVISÃO BIBLIOGRÁFICA

Thabata Vitória da Costa Alves
Daniele Decanine


 <https://doi.org/10.22533/at.ed.69822030520>

CAPÍTULO 21..... 191

A ETIOLOGIA DA ESPOROTRICOSE E SUA ASSOCIAÇÃO COM O CONTEXTO EPIDÊMICO NO BRASIL

Thayná Marcondes Morato Mateus
Ana Virginia Xavier da Silveira Godoy
Brenda Lauanny Ribeiro Da Silva
Brenda Vieira Silva
Caroline Sardelari
Dallet Amorim Paes Almeida
Emanuely Victória Rodrigues de Andrade

Giovana Boletti Perim
Guilherme Gomes Morgan Taveira
Maria Eduarda Veraldo Ramos
Micaela Lucena Cordeiro
Natalia Cruz Ferrara
Nathalia Helena Patricio Carvalho

 <https://doi.org/10.22533/at.ed.69822030521>

CAPÍTULO 22..... 202

A RESISTÊNCIA MICROBIOLÓGICA DE *Klebsiella pneumoniae carbapenemase* (KPC)
EM UNIDADES HOSPITALARES BRASILEIRAS


Graciete de Oliveira Rocha
Fernanda dos Santos Zenaide

 <https://doi.org/10.22533/at.ed.69822030522>

CAPÍTULO 23..... 213

USING PERIPHYTON TO MONITOR MICROBIOLOGICAL CONTAMINATION OF
AQUATIC ENVIRONMENTS


Monyque Palagano da Rocha
Renata Pires de Araujo
Heberth Juliano Vieira
Kelly Mari Pires de Oliveira

 <https://doi.org/10.22533/at.ed.69822030523>

CAPÍTULO 24..... 227

IMPORTÂNCIA DA FITOTERAPIA NO CONTROLE DAS DOENÇAS PARASITÁRIAS:
UMA REVISÃO

Kevyn Danuway Oliveira Alves
Ana Carolyn Diógenes Bezerra
José Francisco do Vale Nascimento
Rita de Cassia Aquino
Ismael Vinicius de Oliveira
Jael Soares Batista
Ana Carla Diógenes Suassuna Bezerra

 <https://doi.org/10.22533/at.ed.69822030524>

SOBRE O ORGANIZADOR..... 236

ÍNDICE REMISSIVO..... 237

CAPÍTULO 23

USING PERIPHYTON TO MONITOR MICROBIOLOGICAL CONTAMINATION OF AQUATIC ENVIRONMENTS

Data de aceite: 01/04/2022

Monyque Palagano da Rocha

Faculty of Exact Sciences and Technology –
FACET, Federal University of Grande Dourados
- UFGD
Dourados, Mato Grosso do Sul, Brazil

Renata Pires de Araujo

Faculty of Exact Sciences and Technology –
FACET, Federal University of Grande Dourados
- UFGD
Dourados, Mato Grosso do Sul, Brazil

Heberth Juliano Vieira

Faculty of Exact Sciences and Technology –
FACET, Federal University of Grande Dourados
- UFGD
Dourados, Mato Grosso do Sul, Brazil

Kelly Mari Pires de Oliveira

Faculty of Biological and Environmental
Sciences – FCBA, Federal University of Grande
Dourados - UFGD
Dourados, Mato Grosso do Sul, Brazil

ABSTRACT: Periphyton developed on artificial substrates (polyethylene terephthalate (PET), polyvinyl chloride (PVC) and glass) has been used in fish farming as an alternative to improve the water quality of cultivation systems due to their ability to cycle nutrients from the aquatic environment. However, the periphytic biofilm composition has not been investigated in detail; thus, the objective of this study was to perform microbiological biomonitoring of fish farming

through the periphytic community developed on artificial PET substrates. PET strips were installed at sampling points and removed after 30 days to collect the periphyton. Water samples were also collected for microbiological analyses (*E. coli*, *Aeromonas* spp., *Pseudomonas* spp., and *Salmonella* spp.), and the chemical and physical data of the water from each collection point were obtained. *Escherichia coli* was isolated from all water and periphyton samples. In two collections, *Salmonella* spp. and *Aeromonas* spp. were isolated only from the periphyton sample. The fish farming environment is dynamic, with water entering and leaving the tanks; thus, water collection for microbiological biomonitoring may only represent its quality on the collection day and not the general cultivation conditions. In contrast, the formation of periphyton on PET strips allows biomonitoring of the environment over a 30-day period. The use of periphyton for the continuous biomonitoring of tanks should thus be considered a general practice for fish farming management, as it allows identification of possible pathogens in the aquatic environment and facilitates adequate management to prevent disease spread, thus avoiding mortality and consequent financial losses.

KEYWORDS: Periphyton, Fish farming, Biomonitoring, Pathogenic bacteria.

USANDO O PERIFÍTON PARA MONITORAR A CONTAMINAÇÃO MICROBIOLÓGICA DE AMBIENTES AQUÁTICOS

RESUMO: O perifíton desenvolvido em

substratos artificiais (polietileno tereftalato (PET), policloreto de vinila (PVC) e vidro) tem sido utilizado na piscicultura como alternativa para melhorar a qualidade da água dos sistemas de cultivo devido à sua capacidade de ciclar nutrientes do ambiente aquático. No entanto, a composição do biofilme perifítico não foi investigada em detalhes; assim, o objetivo deste estudo foi realizar o biomonitoramento microbiológico da piscicultura através da comunidade perifítica desenvolvida em substratos artificiais de PET. Tiras de PET foram instaladas nos pontos de amostragem e retiradas após 30 dias para a coleta do perifíton. Amostras de água também foram coletadas para as análises microbiológicas (*E. coli*, *Aeromonas* spp., *Pseudomonas* spp. e *Salmonella* spp.), e foram obtidos os dados químicos e físicos da água de cada ponto de coleta. *Escherichia coli* foi isolada em todas as amostras de água e do perifíton. Em duas coletas, *Salmonella* spp. e *Aeromonas* spp. foram isolados apenas da amostra de perifíton. O ambiente da piscicultura é dinâmico, com entrada e saída de água dos tanques; assim, a coleta de água para biomonitoramento microbiológico pode representar apenas sua qualidade no dia da coleta e não as condições gerais de cultivo. Em contraste, a formação de perifíton em tiras de PET permite o biomonitoramento do ambiente por um período de 30 dias. A utilização do perifíton para o biomonitoramento contínuo dos tanques deve, portanto, ser considerada uma prática geral para o manejo da piscicultura, pois permite a identificação de possíveis patógenos no ambiente aquático e facilita o manejo adequado para evitar a disseminação de doenças, evitando assim mortalidade e consequentes perdas financeiras.

PALAVRAS-CHAVE: Perifíton, Piscicultura, Biomonitoramento, Bactérias patogênicas.

1 | INTRODUCTION

Periphyton refers to the viscous material adhering to natural substrates (stones, branches, and plants) in the layers of water bodies (Haddadchi et al., 2020). It is a complex community of micro and meso-organisms, comprising microalgae, protozoa, fungi, bacteria, zooplankton, phytoplankton, animals, inorganic debris, and organic matter that unite in complex microbial consortia (Silva et al., 2016b; Martini, et al., 2019; Tammam, et al., 2020).

Considering its richness in bioproducts such as lipids, carbohydrates, proteins, pigments, and antioxidants (Martini et al., 2019; Tammam, et al., 2020), periphyton developed on artificial substrates such as bamboo, glass, acrylic, polyvinyl chloride (PVC), and polyethylene terephthalate (PET) have been used as alternatives to increase the availability of biomass present in the environment and serve as a complement to fish feeding (Alves et al., 2020; Sahu et al., 2021; Shahar and Guttman, 2021).

Periphyton developed on artificial substrates in aquatic environments creates an assemblage capable of directly influencing microorganisms, increasing the selection, adaptation, and growth of specific bacterial communities in aquatic microbiota (Silva et al., 2016b). These bacterial group benefit aquaculture systems with numerous functions such as nutrient cycling and reducing the amount of toxic nitrogen compounds (Kataki et al., 2021). These factors thus favor the fixation of biofilm bacteria in this community.

Microorganisms that can compromise fish health can also benefit from this ecosystem

(Silva et al., 2016a); however, the presence of pathogenic microorganisms in the aquatic environment can result in the disease development thus affecting production, resulting in high mortality, and, consequently, economic losses in fish farming (Silva et al., 2016b).

Aeromonas spp. is one of the pathogenic microorganisms that compromise the cultivation system and fish health, as it causes a lethal disease called motile *Aeromonas* septicemia (MAS) (Pessoa et al., 2020; Zhang et al., 2020). *Pseudomonas* sp. is part of the aquatic ecosystem, but is considered a contaminant or invader because it infects a wide variety of debilitated aquatic species, and is associated with a disease called fin rot, which corrodes the affected area and causes high mortality in fish (Gasparotto et al., 2020). In many species, contamination with *Pseudomonas* spp. causes loss of appetite, hemorrhagic lesions in the skin and at the base of the fins, petechial hemorrhages in the gills and liver, and accumulation of ascetic fluid in the peritoneal cavity, which causes hemorrhagic septicemia and subsequent death (Fernandes et al., 2020).

In recent years, *Salmonella* spp. have been isolated in fish farms, with studies reporting the adherence of *Salmonella* to fish carcasses, and the problems that this contamination can cause to humans (diarrhea, typhoid fever) (Santos et al., 2019; Samanta and Bandyopadhyay, 2020). Thus, monitoring the microbiological quality of fish farms is essential for proper handling to prevent the spread of fish diseases and avoid economic losses.

The microbiological quality of the cultivation system can be used to as a tool used to monitor contamination of the aquatic environment, and most published studies have reported the use of water sampling for this purpose (Silva et al., 2016b, Santos et al., 2019, Zhang et al., 2020). However, this sample only represents the water quality on the day of collection, what is not suitable for fish farming, since fish farming water remains in constant movement, from tank inflow to the cultivation system outflow.

Currently, no reported method allows verification of water quality in a tank over a specified period. Therefore, periphyton developed on artificial substrates is necessary for microbiological biomonitoring, as the time for which the substrate will be submerged in the aquatic environment can be controlled, thus allowing evaluation of contamination in the environment within a specified period (static effect). Therefore, the objective of this study was to evaluate the efficiency of periphyton developed on an artificial substrate (PET) as a tool for microbiological biomonitoring in fish farming.

2 | MATERIALS AND METHODS

2.1 Study sites

This study was conducted in two fish farms located in the Brilhante River watershed belonging to the Grande Dourados region, both in Mato Grosso do Sul, Brazil (Fig. 1). Table 1 shows the fish farming cultivation system.

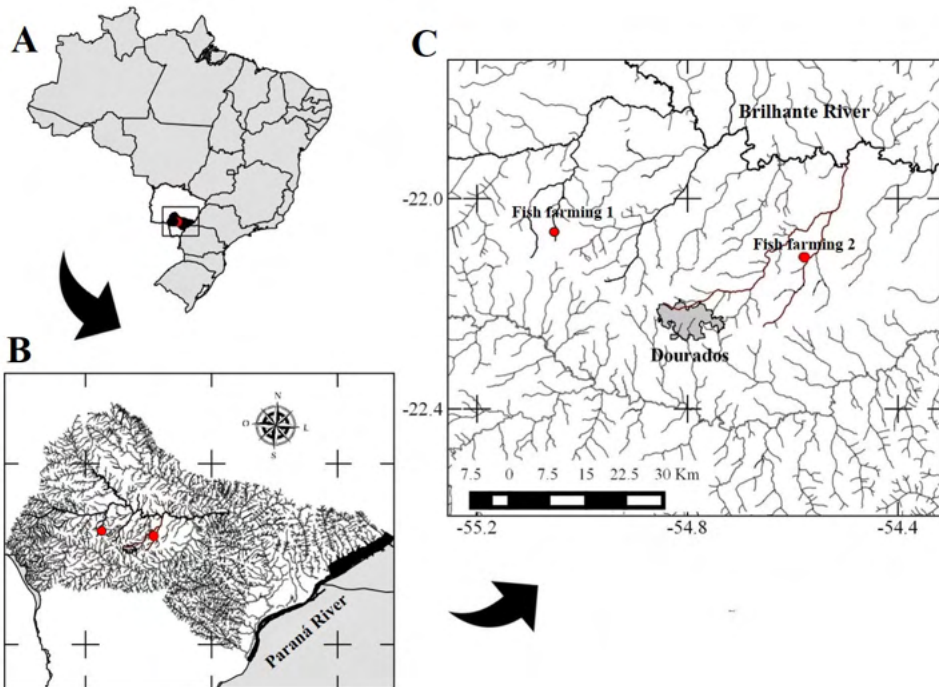


Fig. 1. Fish farm site in the hydrographic microbasin of Brillhante River.

A: Map of Brazil showing the state of Mato Grosso do Sul and the Ivinhema River watershed, **B** – Ivinhema River hydrographic basin highlighting the Brillhante River microbasin, **C** – Fish farms location in the microbasin of Brillhante River.

Author: FERREIRA, F. S., 2021.

Characteristics of the fish farms

Collection sites	Cultivation type	Cultivated species	Food	Canvas protection at bottom of tanks	Aeration	Use of fertilization in the tanks before the beginning of cultivation	Objective
Fish farm 1	Fattening	<i>Astyanax</i> (<i>Astyanax lacustris</i>)	Commercial feed	No	No	No	Commercial
Fish farm 2	Fattening	Tambaqui (<i>Colossoma macropomum</i>), Pacu (<i>Piaractus mesopotamicus</i>), Dourado (<i>Salminus brasiliensis</i>) and Patinga - Pacu (<i>Piaractus mesopotamicus</i>) crossing with Pirapitinga (<i>Piaractus brachipomus</i>)	Commercial feed	No	No	No	Subsistence

Table 1 Description of fish farming cultivation practices used in this study.

Three collections were carried out in each fish farm, being the months of June, August and October in Fish Farm 1, and July, September and November in Fish Farm 2. Chemical and physical data as well as water and periphyton samples were collected at the following points:

- Point 1 (P1) – located at the spring that distributes water to fish farming, i.e., water inflow.
- Point 2 (P2) – located in the cultivation tank inside the fish farming area.
- Point 3 (P3) – located in the channel that discharges effluents from fish farming to the stream, i.e., water outflow.

2.2 Water collection

Water samples for microbiological analyses were collected in sterile 500 mL glass bottles, submerged at a 20 cm depth, and were transported in a refrigerated box, complying with the requirement of a maximum of 8 hours between water collection and the beginning of microbiological examination (APHA, 2005).

2.3 Collection, storage, and extraction of periphyton

PET strips (5 cm × 20 cm) were used as artificial substrates for growing the periphytic community, as they provided low-cost and easily handled chemically inert supports. Five strips were installed at each collection point, at a 20 cm depth, 30 days before each collection a period considered favorable for the formation of a mature periphytic community (Fig. 2) (Fernandes, et al., 2020; Sahu et al., 2020; Tammam, et al., 2020).



Fig. 2: Prepared PET strips before and after 30 days submerged at the fish farming collection points.

Source: Rocha, M. P., 2017.

The collected periphyton strips were stored in labelled sterile plastic bags and transported under refrigeration to the Laboratory of Microbiological Assays (LMA) at the Federal University of Grande Dourados.

The periphyton adhered to the PET strips was scraped and collected using stainless steel blades into 200 mL of sterile distilled water. The procedure was performed in a laminar flow chamber; the samples were placed in sealed sterile glass bottles and vortexed for homogenization.

2.4 Physical and chemical analyses

The physical and chemical conditions of water were measured using the YSI Professional Plus multiparameter probe as follows: DO (% and mg/L), dissolved oxygen in percentage and in milligrams per liter; ORP (mV), oxidation reduction potential; pH, potential of hydrogen; Temp (°C), temperature in degrees Celsius; SPC ($\mu\text{S}/\text{cm}$), specific conductance in microSiemens per centimeter; TSD (mg/L), total solids dissolved in milligrams per liter.

2.5 Microbiological analyses

2.5.1 Total coliforms and *Escherichia coli*

Total coliforms and *E. coli* were determined by the presence and absence of chromogenic and fluorogenic substrates of Colilert® (IDEXX Laboratories, Inc. 2012). In total, 100 mL of water and periphyton samples were stored in analysis bottles, the substrate was added, and the samples were then incubated at $35 \pm 0.5^\circ\text{C}$ for 24 ± 2 hours. According to the Colilert® interpretation criteria, the yellow color of the medium indicated the presence of total coliforms, and fluorescence under 360 nm ultraviolet light indicated the presence of *E. coli*.

For *E. coli* isolation, 1 mL of the Colilert “positive” analysis reagent was added to 9 mL of EC broth (HIMEDIA) and incubated at $42 \pm 0.5^\circ\text{C}$ for 24 ± 2 hours. After this period, the sample was striated in duplicate by depletion on EMB agar (HIMEDIA). According to the manufacturer’s recommendations, colonies that presented a metallic green color were considered as *E. coli* because these are selective and specific media.

2.5.2 *Aeromonas spp.* and *Pseudomonas spp.* analysis

For sample enrichment, 1 mL of the collected water and periphyton sample was added to 9 mL of buffered peptone water (HIMEDIA) and incubated at 30°C for 24 h. Next, aliquots of the cultures were seeded in duplicate in *Aeromonas* medium base (ryan) (OXOID). The strips were then placed in an incubator at 32°C for 24 h (APHA, 2005; Silva, et al., 2017). Colonies that were dark green, opaque with darker centers, and 0.5-1.5 mm in diameter, were identified as *Aeromonas spp.*, and colonies with translucent blue/gray color, a point diameter up to 0.25 mm, were identified as *Pseudomonas spp.*, according to the

manufacturer's specifications.

2.5.3 *Salmonella* spp. analysis

Water and periphyton sample pre-enrichment was performed in buffered peptone water (HIMEDIA), followed by selective enrichment in selenite cystine broth (SCB) (ISOFAR) and Rappaport Vassiliadis Broth (RVB) (ISOFAR). Hektoen enteric agar (ISOFAR) was used to isolate microorganisms (APHA, 2005; SILVA et al., 2017). Colonies that presented a transparent halo and central black spots were selected and sorted using Triple Sugar Iron Agar (TSI) and Motility Indole Ornithine (MIO) biochemical methods, and urea was used to confirm the species (APHA, 2005; Silva, et al., 2017).

3 | RESULTS

3.1 Physical and chemical data

According to the Brazilian Resolution n° 357 of 2005 by the National Council of the Environment (*Conselho Nacional do Meio Ambiente – CONAMA*), water intended for aquaculture and fish farming activities is classified as Class 2 water. Table 2 shows the physical and chemical conditions of the fish farming water in this study and the standards established by the legislation.

Some measured values for DO were below the values recommended by the legislation, especially in the third collection from fish farm 1.

Locations/ collections	Points	Measured elements					
		DO (% and mg/L)	ORP (mV)	pH	Temp (°C)	SPC (US/ cm)	TSD (mg/L)
Fish farm 1	1	73.65 / 6.66	-28.63	6.92	20.2	45.0	29.25
1st collect	2	73.4 / 6.46	-7.35	6.55	21.7	126.0	81.9
	3	73.8 / 6.5	-4.2	6.71	21.6	126.0	81.9
2nd collect	1	37.25 / 3.32	-35.7	6.92	21.0	44.0	28.6
	2	85.45 / 7.39	-33.0	7.47	22.6	80.0	52.0
	3	52.0 / 4.54	-27.4	7.53	22.1	79.0	51.52
3rd collect	1	19.05 / 1.72	-11.9	7.05	20.2	43.0	27.95
	2	42.7 / 3.75	-11.5	7.11	21.7	60.0	39.0
	3	32.75 / 2.89	-7.8	7.22	21.3	64.0	41.6
Fish farm 2	1	78.15 / 6.83	-9.4	6.41	22.0	61.0	39.8
1st collect	2	90.0 / 7.74	-45.95	6.54	22.8	55.0	35.75
	3	80.4 / 6.88	-17.7	6.12	23.1	57.0	37.05

2nd collect	1	48.0 / 4.16	-17.85	8.23	22.5	64.0	41.6
	2	83.3 / 6.96	-41.0	8.56	24.4	54.0	35.1
	3	59.5 / 4.97	-25.35	8.34	24.4	51.0	33.15
3rd collect	1	63.55 / 5.42	-18.1	6.66	23.3	63.0	40.95
	2	71.95 / 5.94	-25.1	6.66	25.0	58.0	37.7
	3	67.65 / 5.60	-18.05	6.72	24.9	52.0	33.8
CONAMA 357/2005		Not less than 5.0 mg/L	*	6.0 to 9.0	*	*	Maximum value 500 mg/L

Note: DO (% and mg/L): dissolved oxygen in percentage and milligrams per liter, ORP (mV): oxidation reduction potential in millivolts, pH: potential of hydrogen, Temp (°C): temperature in degrees Celsius, SPC ($\mu\text{S}/\text{cm}$): specific conductance in microSiemens per centimeter, TSD (mg/L): total solids dissolved in milligrams per liter. All relative standard deviations were less than 5% of the mean value of the parameter.

(*) not specified by CONAMA Resolution n° 357 of 2005.

Table 2 Water physical and chemical data of sampling points at the fish farms

The ORP values were negative in all the collections, indicating the presence of dissolved electrons in the water. Therefore, both fish farms had reducing conditions.

The lowest temperature values were observed at point 1, located at the springs in both fish farms. The points that showed the highest values for SPC also showed the highest values for TSD.

3.2 Microbiological analysis

Isolation of bacteria adhered to the periphytic community has not been reported in literature; therefore, standardized techniques were been used to develop the laboratory analyses. We still emphasize that the techniques used in microbiological analyzes identify the presence and absence of the microorganism in the collected sample, and does not quantify the concentration of microorganism in the sample. Table 3 shows the results of water and periphyton microbiological analyses.

E. coli was isolated from all the collections and points studied, both in water and periphyton samples. This bacterium is often used as an indicator of fecal contamination in aquatic environment studies.

The periphyton sample contained more isolated *Aeromonas* spp. In the first collection of fish farm 2, *Aeromonas* were found only in the periphyton sample.

Pseudomonas was absent in both samples (water and periphyton) only in the first collection of fish farm 2, at point 3 (exit).

In *Salmonella* analysis, most isolates were obtained from periphyton samples. Further, in the first collection from fish farm 1, *Salmonella* was isolated only in the periphyton sample, and was absent in the water sample.

4 | DISCUSSION

Continuous monitoring of the physical and chemical parameters of the fish farm (DO, ORP, pH, temperature, SPC, and TSD) allows fish farmers to control changes in the environment and avoid production losses. Fore et al. (2018) reported the importance of knowing the physical and chemical data of the local environment, as many of these factors affect fish growth, development, and well-being, and monitoring these conditions during production can facilitate decision making in fish management.

Locations/ collections	Points	Microorganisms isolated from water				Locations/ collections	Points	Microorganisms isolated from periphyton			
		<i>E. coli</i>	<i>Aeromonas</i> spp.	<i>Pseudomonas</i> spp.	<i>Salmonella</i> spp.			<i>E. coli</i>	<i>Aeromonas</i> spp.	<i>Pseudomonas</i> spp.	<i>Salmonella</i> spp.
Fish farm 1 1st collect	1	x	x	x	-	Fish farm 1 1st collect	1	x	x	x	x
	2	x	x	x	-		2	x	x	x	x
	3	x	x	x	-		3	x	-	x	x
2nd collect	1	x	-	x	-	2nd collect	1	x	x	x	x
	2	x	x	x	x		2	x	x	x	x
	3	x	x	x	x		3	x	x	x	x
3rd collect	1	x	x	x	x	3rd collect	1	x	x	x	-
	2	x	x	x	x		2	x	x	x	-
	3	x	x	x	x		3	x	x	x	x
Fish farm 2 1st collect	1	x	-	x	x	Fish farm 2 1st collect	1	x	x	x	x
	2	x	-	x	-		2	x	-	x	-
	3	x	-	-	x		3	x	x	-	x
2nd collect	1	x	x	x	x	2nd collect	1	x	x	x	-
	2	x	-	x	-		2	x	-	x	x
	3	x	x	x	x		3	x	x	x	x
3rd collect	1	x	x	x	-	3rd collect	1	x	x	x	x
	2	x	x	x	x		2	x	x	x	x
	3	x	x	x	-		3	x	x	x	x

Note: (x) presence, (-) absence of the microorganism.

Table 3 Microorganisms isolated from water and the periphytic community in the fish farm.

The measured values of SPC and TSD in this study were within the limits allowed by the Brazilian legislation. SPC is measured by the concentration of dissolved salts and

other inorganic materials in water; thus, if the total dissolved solids increase (total weight of mineral components present in water per unit volume), the TSD increases. The levels of organic residues in fish farms are related to animal excrement and unconsumed food. These residues may cause damage to the environment due to the high sedimentation load of total dissolved solids and the presence of nutrients such as nitrogen and phosphorus (Cacho et al., 2020).

ORP measures indicate the reduction and oxidation activities in water. This method is used to test the decomposition process of organic materials because ORP measures the potential of electricity contained in the environment and can indicate whether the decomposition process of organic matter in water occurs in a state of reduction (negative) or oxidation (positive) (Hariyadi et al., 2020). Fish farms in this study presented reduced environments because all ORP values were negative.

This study highlights the efficiency of using periphyton for the microbiological biomonitoring of aquatic environments. As periphyton is commonly used for fish feeding supplementation and for water treatment in tanks, it can easily provide fish farmers with a third advantage, for biomonitoring the environment.

The use of periphyton sampling in the microbiological biomonitoring of fish farms proved to be effective, as we could isolate all groups of bacteria studied in all samples obtained from both fish farms. Godinho-Orlandi and Barbieri (1983) reported that during periphyton formation, microorganisms are the first colonizing organisms, with colonization times varying from a few hours to a few days.

Our determined period of 30 days for periphyton colonization was effective as adherence of the periphytic community was observed on the PET strips in all collected samples. According to existing literature, the periphytic community reaches a climax, or a phase with a mature community, over a period of 28 to 30 days (Fernandes, et al., 2020; Sahu et al., 2020; Tammam, et al., 2020).

Silva et al. (2016a) studied the microbial composition in the periphyton developed on artificial substrates (PVC) installed in fish farming tanks with Nile tilapia (*Oreochromis niloticus*), but they did not identify the genera of the isolated microorganisms performed only the total count. In the present study, microorganisms of both economic and sanitary interest in fish farming were isolated directly from the periphyton and were identified.

E. coli are commonly found in aquatic environments (Rocha et al., 2018; Ibrahim et al., 2019; Mathai et al., 2019). Here, breeding of animals like horses and cattle, which drink water from a source near the fish farm, may have contributed to the isolation of *E. coli* from the sources (collection point 1) of both fish farms studied.

Aeromonas spp. were isolated from the water and periphyton in both fish farms. According to Leira et al. (2017) and Kim et al. (2018), *Aeromonas* spp. are the main causes of fish disease, with clinical signs ranging from superficial to deep skin lesions that can progress to ulcers and typical septicemia. The fish farms in this study were supplied by

springs and the water flowed from one tank to the next, in a rustic system, allowing cross contamination, because there was no control on the quality of the water flowing into these fish farms. The presence of *Pseudomonas* in the water and in the periphyton in all collections from both fish farms is a worrying fact, as infection of fish by *Pseudomonas* spp. can cause mortality and consequently, significant economic losses to the fish farmer (Carvalho et al., 2015).

Salmonella spp. were isolated in ten water samples and in 14 periphyton samples, indicating that periphyton is better for evaluating the presence of this microorganism. The source of *Salmonella* contamination in fish farms has been little explored, except when studies are focused on fish meat, relating its contamination to the quality of water and the living environment (Costa et al., 2016). However, *Salmonella* spp. are the main microorganisms linked to food-borne diseases and are associated with the production chain of birds and pigs, but are increasingly present in the fish production chain.

As expected, the results obtained in our microbiological analyses did not show any distinction by the collection points, as point 1 was located in the spring and point 3 was in the effluent of the fish farm. The management practices used in fish farming may interfere with the health of the environment, because all groups of microorganisms found in this study can be pathogenic to fish. Early diagnosis and accurate treatment of bacterial infections in fish farming are key to success, as they can prevent the spread of fish diseases.

Further, the use of periphytic biofilms for microbiological biomonitoring of aquatic environments indicates the actual contamination in the environment over a certain period (static effect). In contrast, water in the fish farms is subject to movement (dynamic effect), which does not allow determination of the actual contamination present in the aquatic environment over a period, but only allows evaluation of contamination on the day of collection.

The data obtained in some collections, where isolates of the studied microorganism were obtained only in the periphytic biofilm, are justified by the premise that most microorganisms in natural environments are fixed to substrates and are not dispersed particles in suspension (Costerton et al., 1978), and that microorganisms are grouped together in biofilms to protect planktonic cells and for survival in hostile environments (Donlan and Costerton, 2002).

5 | CONCLUSION

Microorganisms were isolated from the periphytic community adhered to the artificial PET substrate in all groups of pathogenic bacteria (*E. coli*, *Aeromonas* spp., *Pseudomonas* spp., and *Salmonella* spp.). The periphyton proved an efficient tool for the microbiological biomonitoring of fish farms, microorganism isolation indicated that the bacterium was present in the cultivation system during the estimated time of 30 days. Thus, microbiological

evaluation of the periphyton can be used as a suitable management tool for fish farming, because identification of pathogenic bacterial groups in the environment can facilitate their proper management and prevent the spread of fish diseases. As management of environmental conditions can support fish health, the presented approach can prevent fish death and consequent financial losses. The results exposed in this study will serve as a basis to guide future research focused at the microbiological biomonitoring of fish farms and aquatic environments, and will complement the data published in the literature on the composition of the bacterial community adhered to the periphytic biofilm.

ACKNOWLEDGMENTS

The authors thank the Foundation for Support for the Development of Teaching, Science and Technology of the State of Mato Grosso do Sul (*Fundação de Apoio ao Desenvolvimento do Ensino, Ciência e Tecnologia do Estado de Mato Grosso do Sul* – FUNDECT) and the National Council for Scientific and Technological Development (*Conselho Nacional de Desenvolvimento Científico e Tecnológico* – CNPq).

REFERENCES

- Alves, G., Rizzetti, T. M., Wilges, H. G., Szarblewski, M.S., Benitez, L.B., Sanchez-Barrios, A., Hoeltz, M., & Schneider, R.C.S. (2020). Avaliação de formação de biofilme perifítico e identificação de microalgas em um sistema piloto algal turf scrubber. *Revista Jovens Pesquisadores* 10(1), 13.
- APHA, American Public Health Association. (2005). *Standard Methods for the Examination of Water and Wastewater*. 21st ed. Washington, D.C: APHA, AWWA, & WEF, p. 1368.
- Cacho, J. C. S., Moura, R. S. T., & Henry-Silva, G. G. (2020). Influence of Nile tilapia (*Oreochromis niloticus*) fish farming in net cages on the nutrient and particulate matter sedimentation rates in Umari reservoir, Brazilian semi-arid. *Aquaculture Reports* 17, 100358.
- Carvalho, E., Belém-Costa, A., & Porto, J. I. R. (2015). Identificação bioquímica de bactérias patogênicas isoladas de peixes ornamentais no estado do Amazonas. *Rev. Bras. Saúde Prod. Anim.* 16 (1), 170-178.
- CONAMA – Conselho Nacional do Meio Ambiente. (2005). Resolução nº357, de 17 de março de 2005, dispõe sobre a classificação dos corpos de água e diretrizes ambientais para o seu enquadramento, bem como estabelece as condições e padrões de lançamento de efluentes, e dá outras providências. *Diário Oficial da União*, 58-63.
- Costa, T. D., Costa, R. D., Vaz, A. C. N., & Vidal, A. M. C. (2016). Qualidade microbiológica de tilápias obtidas de pesqueiros no interior do estado de São Paulo, Brasil. *Ciência & Tecnologia: FATEC-JB, Jaboticabal (SP)* 8.
- Costerton, J. W., Geesey, G. G., & Cheng, K. J. (1978). How Bacteria Stick. *Scientific American* 238(1), 86–95.
- Donlan, R. M., & Costerton, J. W. (2002). Biofilms: survival mechanisms of clinically relevant microorganisms biofilms. *Clinical Microbiology Reviews* 15(2), 167-193.

Fernandes, U.L., Casas, G., Lopes, T.M., Palheta, L., Rodrigues, L. & (2020). Eating at the edges: the feeding mode and the individual-resource networks of a characid fish in the periphyton. *Acta Limnologica Brasiliensia* 32(e303), 1-17.

Fore, M., Frank, K., Norton, T., Svendsen, E., Alfredsen, J. A., Dempster, T., Eguiraun, H., Watson, W., Stahl, A., Sunde, L. M., Schellewald, C., Skoien, K. R., Alvera, M. O., & Berckmans, D. (2018). Precision fish farming: A new framework to improve production in aquaculture. *Biosystems Engineering* 173, 176-193.

Gasparotto, P.H.G., Freitas, H.T., Dantas Filho, J.V., Cavali, J., Pontuschka, R.B., Francisco, R.S., & Daudt, C. (2020). Detection of *Pseudomonas* sp. in pirarucu (*Arapaima gigas*): a case report in the Western Amazon. *Acta Veterinaria Brasilica* December 14, 209-214.

Godinho-Orlandi, M. J. L., & Barbieri, S. M. (1983). Observação de microrganismos perifíticos (bactérias, protozoários e algas) na região marginal de um ecossistema aquático. *An. Sem. Reg. Ecol.* 3, 135- 155.

Haddadchi, A., Kuczynski, A., Hoyle, J. T., Kilroy, C., Booker, D. J., & Hicks, M. (2020). Periphyton removal flows determined by sediment entrainment thresholds. *Ecological Modelling* 434, 1-16.

Hariyadi, H., Prasetyo, D., & Kurniawati, Y. D. (2020). The relationship of redox potential to crustacea abundance at Bama beach of Baluran National Park, Situbondo, Indonesia. *IJOTA* 3(2), 95-108.

Ibrahim, E. M. E., El-Liethy, M. A., Abia, A. L. K., Hemdan, B. A., & Shaheen, M. N. (2019). Survival of *E. coli* O157: H7, Salmonella Typhimurium, HAdV2 and MNV-1 in river water under dark conditions and varying storage temperatures. *Science of the total environment* 648, 1297-1304.

Kataki, S., Chatterjee, S., Vairale, M. G., Dwivedi, S. K., & Gupta, D. K. (2021). Constructed wetland, an eco-technology for wastewater treatment: A review on types of wastewater treated and components of the technology (macrophyte, biofilm and substrate). *Journal of Environmental Management* 283, 111986.

Kim, F. J. P., Silva, A. E. M., Silva, R. V. S., Kim, P. C. P., Acosta, A. C., Silva, S. M. B. C., Sena, M. J., & Mota, R. A. (2018). Detecção de *Aeromonas* spp. e do gene de virulência aerolisina em tilápias do Nilo (*Oreochromis niloticus*) com a técnica de mPCR. *Pesq. Vet. Bras.* 38 (9), 1731-1735.

Leira, M. H., Reghim, L. S., Ciacci, L. S., Cunha, L. T., Botelho, H A., Braz, M. S., Dias, N. P., & Melo, C. C. V. (2017). Problemas sanitários das pisciculturas brasileiras. *PUBVET* 11(6), 538-544.

Martini, F. A., Rubert, A., Souza, M. P., Kist, L. T., Hoeltz, M., Benitez, L. B., Rizzetti, T. M., Gressler, P. D., & Schneider, R. C. S. (2019). Periphytic biomass composition and exploitation from algae turf scrubber system. *SN Applied Sciences* 765, 1-9.

Mathai, P. P., Dunn, H. M., Magnone, P., Zhang, Q., Ishii, S., Chun, C. L., & Sadowsky, M. J. (2019). Association between submerged aquatic vegetation and elevated levels of *Escherichia coli* and potential bacterial pathogens in freshwater lakes. *Science of The Total Environment* 657, 319-324.

Pessoa, R. B. G., Marques, D. S. C., Lima, R. O. H. A., Oliveira, M. B. M., Lima, G. M. S., Maciel de Carvalho, E. V. M., & Coelho, L. C. B. B. (2020). Molecular characterization and evaluation of virulence traits of *Aeromonas* spp. isolated from the tambaqui fish (*Colossoma macropomum*). *Microbial Pathogenesis* 147, 1-7.

Rocha, M. P., Vaini, J. O., Amaral, B. C., Oliveira, L. S., Oliveira, K. M. P., & Grisolia, A. B. (2018). Identification of microbiological contamination and mutagenic potential of surface waters of the municipality of Dourados, MS. *Ciência e Natura* 40(38), 1-8.

Sahu, P. K., Jena, J., & Das, P. C. (2020). Periphyton based grow-out farming of Indian major carps with *Labeo calbasu* (Hamilton) and *Puntius gonionotus* (Bleeker) for better water quality and enhanced fish production. *Aquaculture* 533, 1-8.

Samanta, I., & Bandyopadhyay, S. (2020). Chapter 13 - Characteristics of antimicrobial resistance among microorganisms of concern to animal, fish and human health: *Salmonella*. *Antimicrobial Resistance in Agriculture: Perspective, Policy and Mitigation*, 135-151.

Santos, R. R., Xavier, R. G. C., Oliveira, T. F., Leite, R. C., Figueiredo, H. C. P., & Leal, C. A. G. (2019). Occurrence, genetic diversity, and control of *Salmonella enterica* in native Brazilian farmed fish. *Aquaculture* 501, 304-312.

Shahar, B., & Guttman, L. (2021). Integrated biofilters with *Ulva* and periphyton to improve nitrogen removal from mariculture effluent. *Aquaculture* 532, 736011.

Silva, J. L. S., Cavalcante, D. H., Carvalho, F. C. T., Vieira, R. H. S. F., Carmo, M. V. S., & Sousa, O. V. (2016b). Aquatic microbiota diversity in the culture of Nile tilapia (*Oreochromis niloticus*) using bioflocs or periphyton: virulence factors and biofilm formation. *Acta Scientiarum* 38(3), 233-241.

Silva, J. L. S., Carvalho, R. M. M., Carvalho, F. C. T., Vieira, R. H. S. F., & Sousa, O. V. (2016a). Composição da microbiota presente no biofilme perifítico durante cultivo de tilápia do nilo (*oreochromis niloticus*). *Encontros Universitários da UFC* 1, 2039.

Silva, N., Junqueira, V. C. A., Silveira, N. F. A., Taniwaki, M. H., Gomes, R. A. R., & Okazaki, M. M. (2017). *Manual de Métodos de Análise Microbiológica de Alimentos e Água*. São Paulo: Blucher 5ª ed., 560.

Tammam, M., Wassef, E. A., Toutou, M. M., & El-Sayed, A. F. M. (2020). Combined effects of surface area of periphyton substrates and stocking density on growth performance, health status, and immune response of Nile tilapia (*Oreochromis niloticus*) produced in cages. *Journal of Applied Phycology* 32, 3419–3428.

Zhang, D., Xu, D. H., Shoemaker, C. A., & Beck, B. H. (2020). The severity of motile *Aeromonas* septicemia caused by virulent *Aeromonas hydrophila* in channel catfish is influenced by nutrients and microbes in water. *Aquaculture* 519, 1-6.

ÍNDICE REMISSIVO

A

Aleitamento materno 54, 55, 56, 57, 58, 59, 60, 61, 137

Amamentação 27, 28, 54, 55, 56, 57, 58, 59, 60, 61

Ambiente nosocomial 202, 204

Atendimento médico 110

B

Basquetebol 103, 108

Bioética 20, 62, 65, 66, 69, 71, 72, 73

Biomonitoramento 214

C

CAPS 95, 96, 97, 98, 99, 101, 102

Carga de treinamento 88, 93

Ciências da nutrição 103, 236

Cirurgia bariátrica 11, 12, 13, 14, 16, 17, 18, 19, 20, 21

Código de ética 68, 74, 77, 81, 85

COVID-19 9, 112, 125, 127, 128, 129, 130, 133, 134, 135, 136, 140, 141, 143, 146, 149, 173, 182, 183

Criança hospitalizada 1

Cuidados de enfermagem 23, 29, 30

D

Dengue 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Desempenho motor 88, 90, 92

Desidratação 25, 103, 104, 105, 106, 107, 108

Desinstitucionalização 95, 97

Desnutrición infantil 44, 45, 52

Doença renal 14, 114, 115, 117, 120, 121

Doenças crônicas não transmissíveis 101, 114, 115, 117, 144, 149

E

Educação alimentar e nutricional 134, 137, 139, 140, 143, 144, 145, 148, 149

Educação em saúde 36, 102, 123, 124, 126, 127, 128, 129, 130, 132, 141, 152, 236

Emergência 31, 32, 33, 36, 37, 38, 40, 41, 42, 84, 110, 111, 112, 124, 157, 158, 163, 164,

203

Epidemiologia 1, 9, 53, 117, 191, 192, 193, 195, 234

Equipe de enfermagem 24, 25, 27, 28, 29, 35, 38, 39, 40, 41, 55, 58, 74, 75, 76, 77, 78, 81, 83, 84, 86, 160

Ergonomia 168, 169, 171, 172, 176, 182, 183

Esporotricose 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201

Estresse 16, 18, 38, 55, 59, 60, 89, 102, 104, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 175, 181

Ética em enfermagem 74, 77, 81

Eutanásia 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 199

Exercício físico 104, 114, 116, 119, 120, 121, 153

F

Felinos 191, 192, 194, 198, 199, 200

Fitoterápicos 227, 228, 229, 230, 231, 232, 233

Fototerapia 23, 24, 25, 27, 28, 29, 30

I

Icterícia neonatal 22, 23, 26, 27, 28, 29, 30

Infecção urinaria 44, 45, 46, 47, 48, 49, 51, 52, 53

K

Klebsiella pneumoniae carbapenemase 202, 207

M

Medicina legal 62

Microbiologia 185, 186, 208, 212

P

Pediatria 10, 31, 141

Perifíton 213, 214

Piscicultura 214

Pós-operatório 12, 13, 17, 18, 19, 20, 21

Prazer 31, 33, 34, 35, 36, 37, 38, 39, 40, 41

Prematuridade 26, 54, 55, 56, 57, 58, 59, 60, 61

Promoção em saúde 123

R

Rede pública de saúde 150, 156, 157

Redes sociais online 143

Relações comunidade-instituição 128

S

Saúde do adolescente 11, 12

Saúde ocupacional 167, 168, 169, 183, 184

Síndrome cardiorenal 114, 116, 117, 118, 119, 121

Sofrimento 24, 28, 31, 33, 34, 35, 36, 37, 38, 39, 40, 41, 59, 63, 64, 66, 67, 68, 69, 70, 71, 96, 97, 98, 102, 124, 155

T

Telecardiologia 110, 111, 113

Telemedicina 110, 111

Tratamento alternativo 228, 230, 231

U

Unidades de terapia intensiva 22, 23, 24, 61, 150, 151, 161, 162, 163, 164, 165, 205

Z

Zoonose 191, 192

Serviços e cuidados
NAS CIÊNCIAS DA SAÚDE 2



Serviços e cuidados

NAS CIÊNCIAS DA SAÚDE 2

