Original Article
Food Science and Technology
ISSN 0101-2061 (Print)
ISSN 1678-457X (Online)
DOI: https://doi.org/10.5327/fst.131022

Ten years of research on bioactive peptides in Brazil: a scientometric analysis

Edson Flávio Teixeira da SILVA[1], Maria Alane Pereira BARBOSA[2], Thayná Alícia de Figueirêdo MARINHO[2], Gleidson Costa LIMA[2], Wellington Leal dos SANTOS[1], Maria Tamires Alves ESPINDOLA[1], Larice Bruna Ferreira SOARES[1], José Erick Galindo GOMES[2], Keila Aparecida MOREIRA[2]*

Abstract

Peptides are biomolecules composed of amino acids linked through peptide bonds present in proteins. These peptides may have biological activities associated with their secondary structure, especially when released from the original protein sequence. The prospect of these biomolecules is the subject of study and research in various sectors, including the food and pharmaceutical industries. This is due to the possibility of using them as substitutes for traditionally marketed drugs, especially those with restrictive legislation on their use, or losing their effectiveness. A scientometric analysis of studies published from 2011 to 2021 by Brazilian researchers demonstrated the growing interest in basic research involving bioactive peptides from numerous protein sources, including food-based and agro-industrial residues. The antioxidant activity, followed by the antimicrobial potential, has been the most studied property of these biomolecules. Several other activities such as anxiolytic, anti-adipogenic, anticoagulant, anticonvulsant, antisclerotic, and cytoregulatory actions have been reported in a limited number of studies, highlighting the potential application of these biomolecules in the development of new products.

Keywords: bioactivity; biopeptide; Brazilian researchers; prospection; proteins.

1. Introduction

Bioactive peptides are a group of molecules derived from proteins with 2–50 amino acid residues connected by peptide bonds (Bhandari et al., 2019). These molecules have diverse compositions and arrangements of amino acids along the peptide chain, which define their unimodal or multimodal regulatory actions and lead to health benefits in the organisms consuming them (Akbarian et al., 2022; Liao et al., 2018).

The first study related to the bioactive properties of a peptide was published in 1950 when the receptor-activation ability for umami taste was reported (Chakrabarti et al., 2014). Numerous studies have since been conducted to explore new activities in various bioactive peptides, such as antioxidant, antimicrobial, immunomodulatory, antihypertensive, anticancer, cholesterolemic, and antidiabetic activities (Alberto-Silva et al., 2021; Nascimento et al., 2021b; Santos et al., 2021; Silva et al., 2021).

From a therapeutic point of view, bioactive peptides have shown more benefits than traditionally marketed drugs as they are derived from natural organic macromolecules and tend to have target-tissue-directed activity with little or no toxicity. Moreover, they can exert their biological activity at low concentrations and do not have a cumulative effect on the organisms (Akbarian et al., 2022).

These new revelations and the constant search of consumers for products of natural origin have raised the interest of researchers and industrial sectors to search for bioactive peptides in food sources and agro-industrial residues with high protein content (Acquah et al., 2019; Toldrá & Mora, 2021; Tu et al., 2018a). Therefore, several peptide prospection studies have focused on low-cost proteins, such as milk (Arruda et al., 2012; Silva et al., 2019b), collagen (Hexsel et al., 2017), animal viscera (Aguilar et al., 2020), legumes (Marques et al., 2015), algae (Silva et al., 2021), and yams (Nascimento et al., 2021a).

Peptides are inactive when encrypted in the protein chain; however, they are activated after the degradation of the protein chain (Toldrá & Mora, 2021). The cleavage process occurs *in vivo* through chemical-enzymatic digestion within the gastrointestinal tract, *in vitro* through food maturation, direct action of enzymes, microbial metabolism, or controlled chemical hydrolysis (Akbarian et al., 2022).

Controlled enzymatic hydrolysis is the most commonly used method in bioprocesses because of the possibility of controlling the physicochemical parameters (Liu et al., 2020). This method allows the optimization of the protein cleavage process and the consequent increase in the final yield of the hydrolyzed material. Moreover, standardization of the steps involving protein cleavage facilitates the reproducibility of the

Received: 23 Jan., 2023
Accepted: 4 Apr., 2023
[1]*Universidade Federal Rural de Pernambuco, Department of Animal Morphology and Physiology, Recife, Pernambuco, Brazil.*
[2]*Universidade Federal do Agreste de Pernambuco, Laboratory of Microbiology, Enzymatic Technology and Bioproducts, Garanhuns, Pernambuco, Brazil.*
*Corresponding author: keila.moreira@ufape.edu.br

process (Cruz-Casas et al., 2021; Mohanty et al., 2016; Nascimento et al., 2021b).

The scientific literature reports the great possibility of methods and techniques for prospection, purification, recovery, and discovery of numerous activities associated with bioactive peptides (Campos et al., 2022). Therefore, evaluating the quantitative aspects of scientific production and the current state of study trends in the prospection of these substances is crucial, as it will facilitate the identification of relevant fields that require further scientific exploration (Parra et al., 2019).

Therefore, we conducted a scientometric analysis to identify trends in the scientific literature on the source and therapeutic purpose of bioactive peptides studied by Brazilian researchers during 2011–2021.

2. Material and methods

The data were obtained through a bibliographic survey involving research and analysis of the documents from September to December 2021. Two multidisciplinary scientific databases, Web of Science (www.webofknowledge.com) and Scopus (www.scopus.com), were used for this purpose. The keywords used were "Bioactive" and "Peptide".

In this search, documents published from 2011 to 2021 with Brazilian researchers as authors were considered. Bibliographic review articles were excluded from the search criteria, and only articles of an experimental nature were considered, including full articles, brief communications, and scientific notes. Only the first 200 results found for each argument studied ("bioactive" and "peptide") in each multidisciplinary scientific basis ("Web of Science" and "Scopus") were considered, totaling 800 articles. Duplicate articles or articles that did not match the analysis criteria were discarded as they were characterized as search tools and not evaluation criteria.

The documents suitable for the purpose of this scientometric article were analyzed individually, and the data were systematized through Bardin's content analysis (Bardin, 2006), where data are grouped by the frequency distribution method. In view of this, the following criteria were developed for data systematization: total number and publications related to the search criteria; the number of scientific publications distributed in the evaluated years; Brazilian regions and states; the number of publications in journals according to the factor range of impact, i.e., Journal Citation Reports (JCR); prospect source used; and biological activities tested. The results were exported to an Excel spreadsheet.

Among the evaluated articles, 31 therapeutic purposes were reported; thereafter, the data were grouped into 31 categories according to their functional similarity to facilitate the interpretation of the results (Table 1).

Table 1. Biological activities of bioactive peptides categorized as obtained by the scientometrically analyzing the data published by Brazilian researchers during 2011–2021.

Categories	Test Objective	Author
Antiadipogenic	Reduce or inhibit adipocyte formation and fat deposition	Grancieri et al. (2019)
Antiangiogenic	Inhibit the formation of new blood vessels	Silva et al. (2017a)
Antibacterial	Bactericidal and/or bacteriostatic action	Anaya et al. (2020); Baptista et al. (2018); Baptista et al. (2020a); Baptista et al. (2020b); Bassan et al. (2016); Brand et al. (2012); Brand et al. (2018); Brandelli et al. (2015); Castro and Sato (2016); Chaparro and Silva Junior (2016); Coelho et al. (2018); Conceição et al. (2020); Corrêa et al. (2011); Cruz et al. (2020); Dornelles et al. (2018); Fagundes et al. (2011); Ferreira et al. (2015); Fontenele et al. (2017); Galli et al. (2019); Games et al. (2016); Lima et al. (2018); Luz et al. (2017); Machado et al. (2012); Machado et al. (2016); Mandal et al. (2014); Meira et al. (2012); Migliolo et al. (2016); Nascimento et al. (2021b); Oliveira et al. (2019c); Sanches et al. (2021); Santana et al. (2020); Santos et al. (2021); Silva et al. (2019a); Torres-Rêgo et al. (2019); Zanutto-Elgui et al. (2019); Plácido et al. (2020); Oliveira Filho et al. (2021)
Anticancer	Inhibition of cancer cell proliferation	Arruda et al. (2017); Assis et al. (2016); Brand et al. (2019); Crusca Jr. et al. (2018); Daroit et al. (2012); Dematei et al. (2021); Figueiredo et al. (2015); Fontenele et al. (2017); Galli et al. (2019); Gomes et al. (2020); Lima et al. (2015); Lima et al. (2020); Magalhães et al. (2013); Martins et al. (2019); Massaoka et al. (2014); Matsuo et al. (2011); Mello et al. (2015); Mello et al. (2020); Montalvo et al. (2019); Nascimento et al. (2011); Quadros et al. (2019); Ramada et al. (2017); Silva et al. (2012); Silva-Stenico et al. (2011); Torres et al. (2018); Yekta et al. (2020)
Anticoagulant	Inhibition of blood clotting	Bezerra et al. (2019)
Anticonvulsant	Control and inhibition of seizures	Silva et al. (2020)
Antidepressant	Controlling levels of neurotransmitters associated with depression	Cruz et al. (2017)
Antidiabetic	Control of blood glucose levels (hyperglycemia and hypoglycemia)	Baptista et al. (2020b); Barati et al. (2020); Brandelli et al. (2015); Callegaro et al. (2018); Henaux et al. (2021); Landim et al. (2021); Martins-Santos et al. (2011); Ohara et al. (2020); Rocha et al. (2015); Vogel et al. (2021)
Antigenicity	Interaction with previously sensitized T and B lymphocytes	Landim et al. (2021)

Continue...

Table 1. Continuation.

Categories	Test Objective	Author
Antihistamine	Control of histamine release	Rádis-Baptista et al. (2020)
Antihypertensive	Blood pressure control	Aguilar et al. (2020); Alberto-Silva et al. (2020); Amorim et al. (2018); Amorim et al. (2019); Baptista et al. (2018); Baptista et al. (2020a); Baptista et al. (2020b); Barati et al. (2020); Bassan et al. (2016); Bezerra et al. (2019); Brandelli et al. (2015); Callegaro et al. (2018); Campeiro et al. (2015); Cavalheiro et al. (2020); Corrêa et al. (2011); Corrêa et al. (2014); Coutinho-Neto et al. (2013); Da Silva et al. (2011); De Oliveira et al. (2020); De Oliveira et al. (2021); Fontenele et al. (2017); Freitas et al. (2020); Fucase et al. (2017); Galli et al. (2019); Latorres et al. (2021); Meira et al. (2012); Mezzomo et al. (2021); Michelon et al. (2021); Miltenburg et al. (2021); Nascimento et al. (2021b); Oliveira Filho et al. (2021); Piotrowicz et al. (2020); Pucca et al. (2016); Ribeiro et al. (2021); Silva et al. (2019a); Vanzolini et al. (2018); Yesmine et al. (2017)
Anti-inflammatory	Inhibition of pro-inflammatory substances and cells	Brand et al. (2019); Grancieri et al. (2019); Henaux et al. (2021); Lima et al. (2019); Michelon et al. (2021); Rosa et al. (2012); Vernaza et al. (2012)
Antinociceptive/ antalgic	Inhibition of sensitivity to painful stimuli	Galli et al. (2019); Oliveira et al. (2019a); Ribeiro et al. (2013)
Antioxidant	Reduction of free radical oxidation and lipid peroxidation	Aguilar et al. (2020); Barati et al. (2020); Barbosa et al. (2018); Bassan et al. (2016); Bertolini et al. (2021); Bezerra et al. (2013); Bezerra et al. (2020); Brandelli et al. (2015); Callegaro et al. (2018); Corrêa et al. (2011); Corrêa et al. (2014); Corrêa et al. (2019); Cruz et al. (2020); Daroit et al. (2012); Delgado-García et al. (2019); Duarte Neto et al. (2017); Fontenele et al. (2017); Fontoura et al. (2019); Graziani et al. (2021); Latorres et al. (2018); Latorres et al. (2021); Lima et al. (2015); Lima et al. (2018); Mandal et al. (2014); Marson et al. (2020); Matos et al. (2021); Meira et al. (2012); Michelon et al. (2021); Montalvo et al. (2019); Moura et al. (2016); Nascimento et al. (2021a); Nascimento et al. (2021b); Hamin Neto et al. (2019); Ohara et al. (2020); Oliveira Filho et al. (2021); Oliveira et al. (2017); Oliveira et al. (2019b); Pazinatto et al. (2013); Pereira et al. (2019); Piotrowicz et al. (2020); Plácido et al. (2020); Quadros et al. (2019); Ribeiro et al. (2021); Romani et al. (2020); Sbroggio et al. (2016); Silva et al. (2012); Silva et al. (2019a); Silva et al. (2019b); Silva et al. (2021); Sousa et al. (2020); Venancio et al. (2013); Vernaza et al. (2012); Vogel et al. (2021); Yekta et al. (2020); Zanutto-Elgui et al. (2019)
Antiparasitic	Broad-spectrum endo- and ectoparasiticide	Boelter et al. (2020); Mendes et al. (2019); Mongui et al. (2015); Rádis-Baptista et al. (2020); Traoré et al. (2013)
Antiproliferative	Inhibition of proliferation of non-cancerous cells and benign prostatic hyperplasia	Santana et al. (2020)
Antisclerotic	Inhibition of loss of arterial compliance	Alves et al. (2016)
Antithrombotic	Control of the formation and eradication of intravenous thrombi	Bassan et al. (2016); Michelon et al. (2021)
Anxiolytic	Reduce anxiety and tension	Cruz et al. (2019)
Characterization of the peptide profile	Characterization of the structural chain at the amino acid composition level	Fialho et al. (2018); Mariano et al. (2021); Santos et al. (2012); Sanz et al. (2015)
Cholesterolemic	Control of blood cholesterol and lipoprotein levels	Bassan et al. (2016); Câmara et al. (2020); Coelho et al. (2018); Lima et al. (2019); Marques et al. (2015); Silva et al. (2018); Soares et al. (2015)
Cytoregulatory	Regulation of mitotic and meiotic processes	Cruz et al. (2019)
Cytotoxicity	Test for the evaluation of the cytotoxicity of peptides	Cancelarich et al. (2020); Corrales-Ureña et al. (2020); Martins et al. (2020); Naman et al. (2017); Pinto et al. (2016)
Hemolytic	Control and regulation of intravascular and extravascular hemolytic processes	Michelon et al. (2021); Rádis-Baptista et al. (2020)
Immunomodulator	Migration of leukocytes and/or macrophages in immune processes and increased immunoglobulin synthesis	Baptista et al. (2020b); Barati et al. (2020); Carvalho et al. (2014); Fontenele et al. (2017); Galli et al. (2019); Michelon et al. (2021); Monte et al. (2017); Moura et al. (2017)
Metal chelator	Chelation of metal ions	Montalvo et al. (2019)
Neuroprotective	Elevation of brain tolerance to ischemia, inhibition of cholinesterase, and reduction of deleterious effects of toxic substances	Alberto-Silva et al. (2021); Campeiro et al. (2015); Sousa et al. (2020)
Protease activator	Activation of proteases	Michelon et al. (2021)
Protection from DNA damage	Protection against DNA strand structure damage and consequent mutagenic errors	Nascimento et al. (2021a)
Protein inhibitor	Inhibition of specific proteins	Michelon et al. (2021)
Proteolytic	Assessment of proteolytic activity associated with peptide chains	Kuniyoshi et al. (2017); Michelon et al. (2021)

3. Results and discussion

According to the search criteria used, only 174 out of 800 publications were analyzed. A total of 594 studies were repeated, and 32 did not fit the research objective; therefore, they were disregarded from the analysis. Figure 1 shows the distribution of scientific publications on bioactive peptides studied by researchers from the Brazilian States during 2011–2021.

Figure 1 shows the authorization of publications based on the study of bioactive peptides during 2011–2021 in Brazil. With time, the data demonstrated an increasing trend in the relevant studies, as evidenced by a gradual rise in the annual publication numbers, with the highest number of researcher engagements and published articles in 2020.

The general trend of promoting research on the prospection of bioactive peptides can be justified by a change in the lifestyle of consumers, who prefer to include new natural-origin products in their diet (Toldrá et al., 2018). Therefore, research institutions and industrial sectors have intensified their studies to obtain novel potential bioactive compounds with beneficial biological activities *in vivo* and *in vitro* (Khedri et al., 2021; Mohanty et al., 2016; Toldrá & Mora, 2021).

However, the results indicated a decline in the total number of publications related to the topic in 2021, with only 22 articles (a reduction of 40.55%) compared to the year 2020 with 37 articles; this was in stark contrast to the upward trend observed during previous years. In 2020, the SARS-CoV-2 pandemic began, which affected the world population in terms of public health and negatively impacted the industrial, scientific, and technology-based sectors, especially in developing countries such as Brazil and in underdeveloped countries (Candido et al., 2021).

While analyzing the data from each suitable publication, Brazilian researchers from five regions were verified to have contributed to the research related to the prospection and evaluation of the biological activities of peptides during 2011–2021.

The data demonstrate that the Southeast region led the publication ranking, followed by the South, Northeast, and Midwest regions,

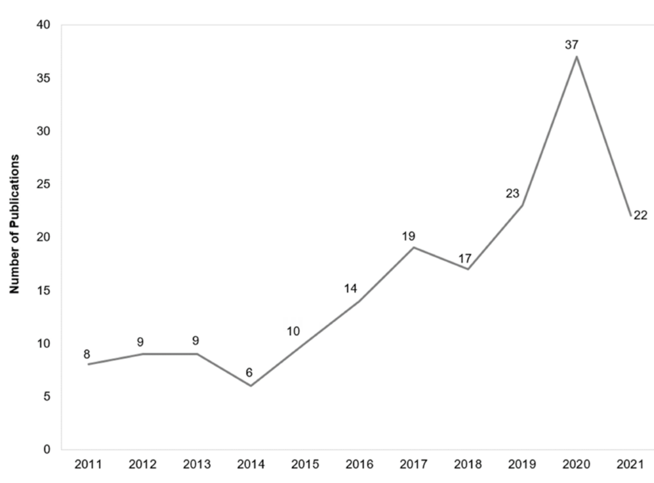

Figure 1. Number of publications on bioactive peptides studied by researchers from the Brazilian during 2011–2021.

with 98, 35, 21, 19, and 1 scientific publications about bioactive peptides, respectively. In fact, studies about this theme have gained significant prominence in the number of publications over time. This is primarily due to increased investments in basic research and partnerships and collaborations with good scientific institutions, such as those located in the Southeast region (Sidone et al., 2016).

The southeast region of Brazil accounted for approximately 54% of the total bioactive peptide studies published by Brazilian researchers. Additionally, this region also ranks the highest for the most diverse scientific and technological topics owing to the high level of financial investment (Oliveira, 2016). The interaction between universities, research institutes, and the private sector occurs in a punctual and concentrated manner in some regions of the country. This helps meet the demand for interests aligned with specific regional economic activity segments (Camargo et al., 2021).

Although the distribution map elucidated increased research on bioactive peptides in Brazil, the focus on specific regions shows a significant gap in the investments and interests of Brazilian researchers in terms of scientific studies aimed at prospecting peptides across different states and countries. Notably, only one work was reported from the North region, corresponding to 0.57% of the total scientific publications. The primary factor contributing to the slow evolution of scientific and technological development in this region is the delayed implementation of the industrialization process (Spíndola et al., 2015).

While analyzing the data from each suitable publication, Brazilian researchers from 17 states and the Federal District were verified to have contributed to the research related to the prospection and evaluation of the biological activities of peptides during 2011–2021, according to the data shown in Figure 2.

Researchers affiliated with the institutions in São Paulo State had the most publications, with 72 publications during the study period. In general, the growth trend of Brazilian scientific outcomes is closely correlated with public sector investments, which in turn are directed toward the education of human capital and the improvement of the infrastructure of universities and research institutes (Helene & Ribeiro, 2011; Souza et al., 2020).

The Universidade Estadual de Campinas and the Universidade de São Paulo, located in the State of São Paulo, had the highest number of publications nationwide, with 23 (13.21%) and 19 (10.91%), respectively. The leading institutions are located in the Southeast and South regions, followed by the Northeast region (Universidade Federal de Pernambuco) and the Center-West region (Universidade de Goiás) of Brazil.

Regarding the periodicals used for publications, a total of 95 journals were used for collecting data on bioactive peptides studied by Brazilian researchers during 2011–2021. The lowest value of the JCR impact factor was 0.579 for the "Brazilian Archives of Biology and Technology". The highest was 9.642 for "Bioresource Technology", each journal having only one published article. Figure 3 shows an overview of the 174 scientific publications on bioactive peptides published by Brazilian researchers according to the JCR impact factor intervals for the journals.

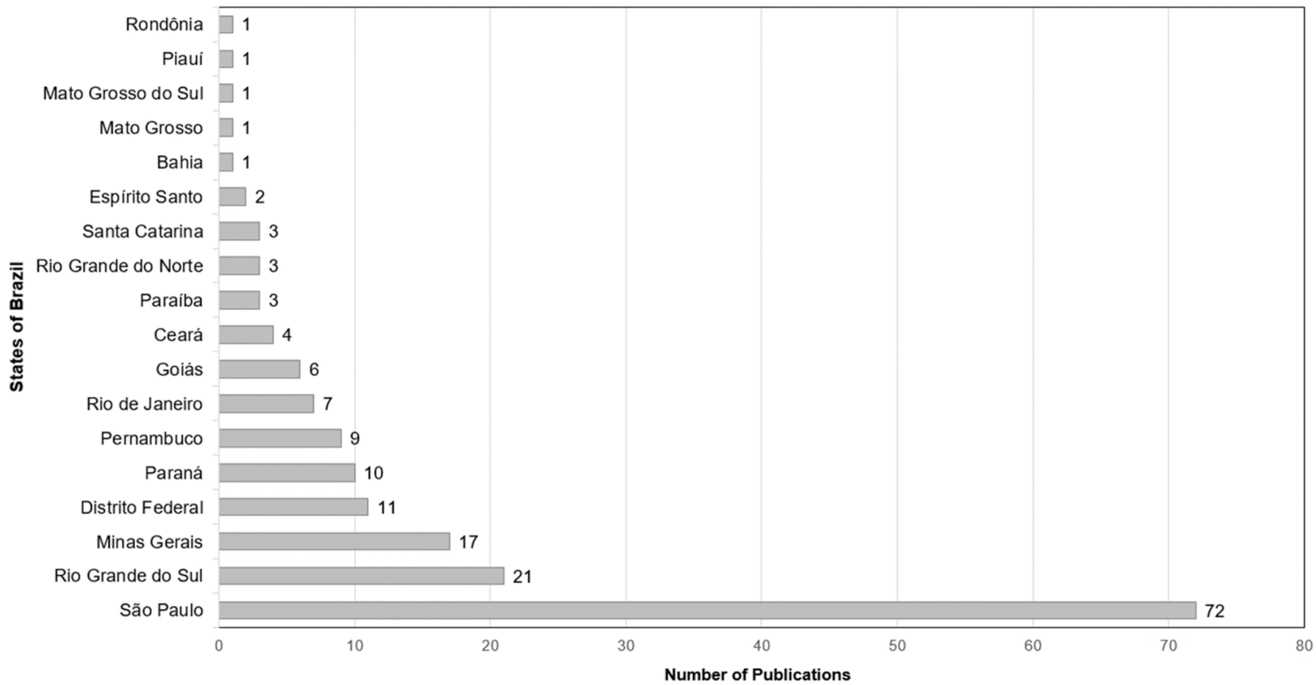

Figure 2. Number of publications on bioactive peptides studied by researchers affiliated from Brazilian States during 2011–2021.

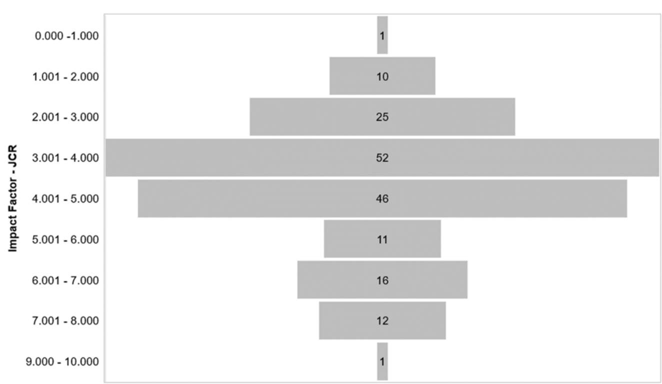

Figure 3. Frequency distribution of scientific articles published by Brazilian researchers on bioactive peptides during 2011–2021 according to JCR impact factor intervals.

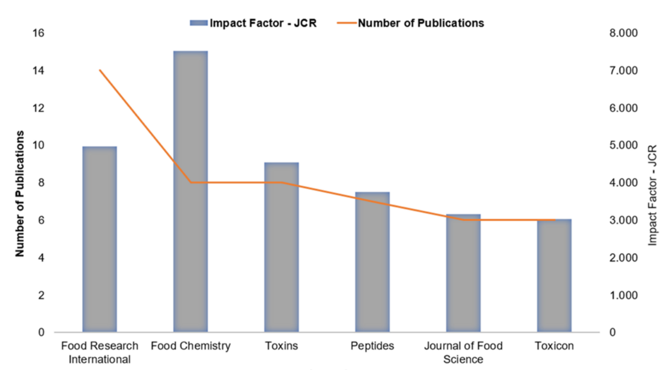

Figure 4. Frequency distribution of scientific articles published by Brazilian researchers on bioactive peptides in seven leading journals with their respective JCR impact factors during 2011–2021.

A total of 52 and 46 articles on the topic studied were published in journals with a JCR value between 3.001–4.000 and 4.001–5.000, respectively. These results suggest that the studies conducted by Brazilian researchers on bioactive peptides over the last 10 years have been gaining strength and recognition in the scientific environment. Among the 95 journals included in the present study, seven with the highest number of publications were selected (Figure 4), along with their respective JCR scientific impact factors.

Our results demonstrated that the "Food Research International" journal published 14 articles with the highest publication rate and currently has an impact factor of 4.972. The impact factor is a bibliometric indicator commonly used to assess the relative quality of a journal within its field of study and measure the frequency with which a journal article was cited in each period (Sharma et al., 2014).

The prospecting sources studied in the 174 scientific articles evaluated in the present study are shown in Figure 5.

Our observations based on 108 (62.06%) publications suggested that Brazilian researchers used animal products as the primary source of bioactive peptides. In contrast, protein matrices of plant, microbial, and synthetic origin were discussed in 35 (20.11%), 18 (10.35%), and 13 (7.48%) publications, respectively.

Over the years, different animal protein sources have been investigated for bioactive peptide production owing to their high concentration of essential amino acids and bioavailability

(Wen et al., 2019). These animal sources include bovine milk (Silva et al., 2019b), goat milk (Nascimento et al., 2021b), whey (Amorim et al., 2018), buffalo cheese (Moura et al., 2016), collagen (Hexsel et al., 2017), snake venom (Alberto-Silva et al., 2021), shrimp (Proksch et al., 2014), fish (Quadros et al., 2019), and industrial waste (Bassan et al., 2016).

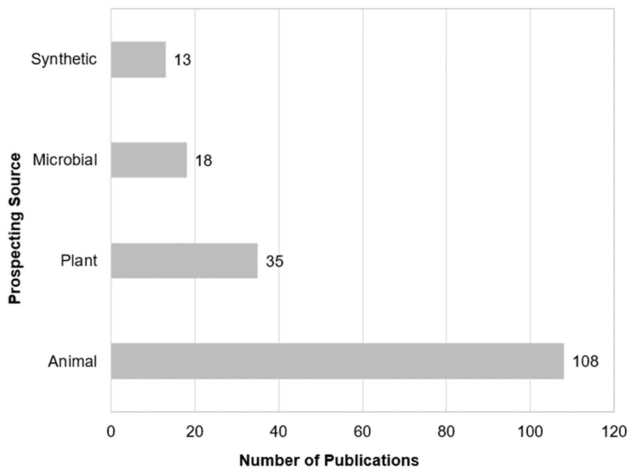

Figure 5. Number of scientific publications based on the bioactive peptides prospected by Brazilian researchers and grouped according to the prospecting source.

Among plant sources, protein matrices from yams (Nascimento et al., 2021a), beans (Rocha et al., 2015), wheat flour (Lima et al., 2019), pepper (Silva et al., 2017b), chia seeds (Grancieri et al., 2019), and quinoa seeds (Yekta et al., 2020) have been studied.

Bioactive peptides exhibit bioactivity (unimodal or multimodal) based on the length and arrangement of amino acids in their chain (Bezerra et al., 2020; Cruz et al., 2020; Silva et al., 2021). Figure 6 shows the number of published studies according to the underlying therapeutic purpose.

The data analysis revealed that some scientific articles reported more than one activity for the prospected peptide, thereby characterizing the multimodal activity of these peptides. The analysis of specific activities revealed that antimicrobial and antioxidant activities were most frequently reported, with 55 (35.05%) publications reporting them.

The least studied biological activities included anti-adipogenic (Grancieri et al., 2019), antiangiogenic (Silva et al., 2017a), anticoagulant (Silva et al., 2011), anticonvulsant (Silva et al., 2020), antidepressant (Cruz et al., 2017), antigenicity (Landim et al., 2021), antihistamine (Rádis-Baptista et al., 2020), antiproliferative (Santana et al., 2020), antisclerotic (Alves et al., 2016), anxiolytic (Cruz et al., 2019), cytoregulatory (Proksch et al., 2014), metal chelators (Montalvo et al., 2019), protease

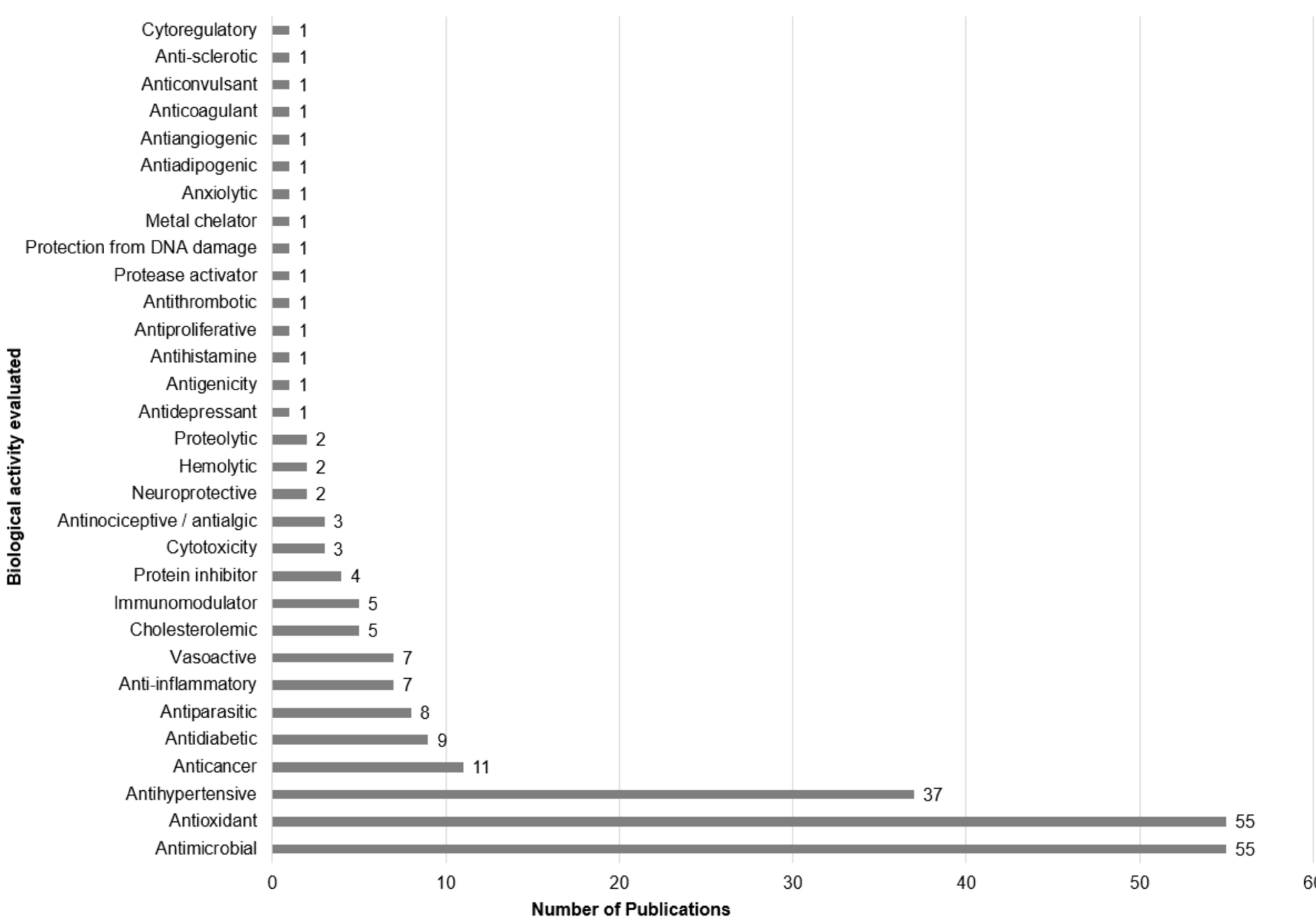

Figure 6. Number of Publications by Brazilian researchers on bioactive peptides and grouped according to the therapeutic purpose.

activator (Michelon et al., 2021), protection from DNA damage (Nascimento et al., 2021a), and protein inhibitor (Michelon et al., 2021) actions, each of which was tested and reported in only one publication.

Several studies related to testing the antioxidant properties of peptides could be justified by the existence of specific legislation that limits the use of synthetic substances, particularly in the preservation of foods and medicines. Therefore, the development of potentially safe natural-origin products, such as bioactive peptides with antioxidant activity, is always desirable (Marques et al., 2015).

Since conventional antimicrobial drugs are losing their effectiveness owing to indiscriminate usage and increasing multidrug resistance in the microbial population, interest in exploring peptides with antimicrobial activity has grown over the years (Jia et al., 2019). Peptides with antimicrobial action effectively control pathogens owing to their valuable characteristics. These substances have broad-spectrum microbicidal activity associated with high specificity for microbial cells. Moreover, the rare induction of microbial resistance and the ability to act synergistically with commonly marketed antibiotics make them a promising choice for antimicrobials (Kobbi et al., 2018; Osman et al., 2021).

Studies related to other observed biological activities are expanding, demonstrating a high potential for their application in future therapeutic studies. In view of the data analysis, only five of the 174 articles included cytotoxicity studies. Despite a lower rate of peptide-associated toxicity, biomolecules can possibly generate toxic substances, such as lysinoalanine, D-amino acids, and biogenic amines, capable of causing deleterious effects in organisms. Therefore, extensive toxicity studies must be performed (Liu et al., 2020).

The *in vitro* cytotoxicity, hemolytic activity, and genotoxicity tests of bioactive peptides must be assessed before their development for human consumption. Additional *in vivo*, animal, acute oral toxicity, chronic, and repeated-dose toxicity assessments must be performed (Shivanna & Nataraj, 2020). Major limitations include the complexity and cost of assays to determine toxicity and/or allergenicity *in vitro* and *in vivo*, particularly with several peptides under evaluation (Lin et al., 2018).

However, *in silico* methods are considered a practical alternative to predict toxicity, allergenicity, and peptide bioactivity (Lin et al., 2018; Tu et al., 2018b). Although such analysis is unsuitable for reliable comparison between *in vitro* and preclinical toxicity testing, bioinformatics tools can help researchers screen and select peptides with potential pharmacological applications (Tu et al., 2018a).

Given these data, the increasing development of bioactive substances, especially bioactive peptides, is evident. The prospection of novel natural-origin products can generate health benefits; therefore, they can serve as alternatives to increase the nutritional scope since these substances are primarily dietary constituents (Romani et al., 2020).

4. Conclusion

The results of the analyzed publications based on the prospection of bioactive peptides and evaluation of their biological activities over the last 10 years (2011–2021) in Brazil demonstrate the increasing number of publications and their respective impact on contributing to the scientific and technological development of the country. The Brazilian region that has the largest number of researchers who carry out studies related to the prospection of bioactive peptides is the Southeast region; however, it has been possible to observe the rise of scientific development over the last few years in the South, Northeast, and Midwest regions. Among the numerous sources of prospecting for bioactive peptides, food proteins of animal origin are the most used, and studies published by Brazilian researchers demonstrate the potential for multimodal application of bioactive peptides, as several biological activities are reported. Antioxidant, broad-spectrum antimicrobial, and antihypertensive activities were the most researched in the evaluated period; however, it was possible to identify other activities that demonstrate the potential for the development of new bioactive formulations based on peptides.

Acknowledgments

The study was funded by the Fundação de Amparo à Ciência e Tecnologia de Pernambuco (FACEPE), through the IBPG process (1806-5.05/19), and the infrastructure of the Universidade Federal do Agreste de Pernambuco (UFAPE) and the Laboratory Center for Research Support of the Academic Unit of Garanhuns (CENLAG).

References

Acquah, C., Chan, Y. W., Pan, S., Agyei, D., & Udenigwe, C. C. (2019). Structure-informed separation of bioactive peptides. *Journal of Food Biochemistry*, *43*(1), e12765. https://doi.org/10.1111/jfbc.12765

Aguilar, J. G. S., Souza, A. K. S., & Castro, R. J. S. (2020). Enzymatic Hydrolysis of Chicken Viscera to Obtain Added-Value Protein Hydrolysates with Antioxidant and Antihypertensive Properties. *International Journal of Peptide Research and Therapeutics*, *26*, 717-725. https://doi.org/10.1007/s10989-019-09879-3

Akbarian, M., Khani, A., Eghbalpour, S., & Uversky, V. N. (2022). Bioactive Peptides: Synthesis, Sources, Applications, and Proposed Mechanisms of Action. *International Journal of Molecular Sciences*, *23*(3), 1445-1475. https://doi.org/10.3390/ijms23031445

Alberto-Silva, C., Franzin, C. S., Gilio, J. M., Bonfim, R. S., & Querobino, S. M. H. (2020). Toxicological effects of bioactive peptide fractions obtained from *Bothrops jararaca* snake venom on the structure and function of mouse seminiferous epithelium. *Journal of Venomous Animals and Toxins Including Tropical Diseases*, *26*, e20200007. https://doi.org/10.1590/1678-9199-JVATITD-2020-0007

Alberto-Silva, C., Portaro, F. C. V., Kodama, R. T., Pantaleão, H. Q., Rangel, M., Nihei, K. I., & Konno, K. (2021). Novel neuroprotective peptides in the venom of the solitary scoliid wasp Scolia decorata ventralis. *Journal of Venomous Animals and Toxins Including Tropical Diseases*, *27*, 1-14. https://doi.org/10.1590/1678-9199-jvatitd-2020-0171

Alves, N. E. G., Vasconcelos, C. M., Bassinello, P. Z., Mejia, E. G., & Martino, H. S. D. (2016). Digestion protein isolate from fresh and stored Carioca beans reduced markers of atherosclerosis in oxidized LDL-induced THP-1 macrophages. *Journal of Functional Foods*, *24*, 97-111. https://doi.org/10.1016/j.jff.2016.03.027

Amorim, F. G., Coitinho, L. B., Dias, A. T., Friques, A. G. F., Monteiro, B. L., Rezende, L. C. D., Pereira, T. M. C., Campagnaro, B. P., Pauw, E., Vasquez, E. C., & Quinton, L. (2019). Identification of new bioactive peptides from Kefir milk through proteopeptidomics: Bioprospection of antihypertensive molecules. *Food Chemistry*, *282*, 109-119. https://doi.org/10.1016/j.foodchem.2019.01.010

Amorim, M., Pereira, J. O., Silva, L. B., Ormenese, R. C. S. C., Pacheco, M. T. B., & Pintado, M. (2018). Use of whey peptide fraction in coated cashew nut as functional ingredient and salt replacer. *LWT – Food Science and Technology*, *92*, 204-211. https://doi.org/10.1016/j.lwt.2017.12.075

Anaya, K., Podszun, M., Franco, O. L., Gadelha, C. A. A., & Frank, J. (2020). The coconut water antimicrobial peptide CnAMP1 is taken up to intestinal cells but does not alter Pglycoprotein expression and activity. *Plant Foods for Human Nutrition*, *75*, 396-403. https://doi.org/10.1007/s11130-020-00826-y

Arruda, D. C., Oliceira, T. D., Cursino, P. H. F., Maia, V. S. C., Berzaghi, R., Travassos, L. R., & Tada, D. B. (2017). Inhibition of melanoma metastasis by dual-peptide PLGA NPS. *Wiley Peptide Science*, *108*(5), e23029. https://doi.org/10.1002/bip.23029

Arruda, M. S., Silva, F. O., Egito, A. S., Silva, T. M. S., Lima-Filho, J. L., Porto, A. L. F., & Moreira, KA. (2012). New peptides obtained by hydrolysis of caseins from bovine milk by protease extracted from the latex *Jacaratia corumbensis*. *LWT - Food Science and Technology*, *49*(1), 73-79. https://doi.org/10.1016/j.lwt.2012.04.001

Assis, A. B., Santos, C., Dutra, F. P., Motta, A. O., Costa, F. S., Navas, C. A., Magalhães, B. S., & Barreto, C. C. (2016). Assessing antibacterial potential of components of *Phyllomedusa distincta* skin and its associated dermal microbiota. *Journal of Chemical Ecology*, *42*, 139-148. https://doi.org/10.1007/s10886-016-0665-3

Baptista, D. P., Galli, B. D., Cavalheiro, F. G., Negrão, F., Eberlin, M. N., & Gigante, M. L. (2018). *Lactobacillus helveticus* LH-B02 favours the release of bioactive peptide during Prato cheese ripening. *International Dairy Journal*, *87*, 75-83. https://doi.org/10.1016/j.idairyj.2018.08.001

Baptista, D. P., Negrão, F., Eberlin, M. N., & Gigante, M. L. (2020a). Peptide profile and angiotensin-converting enzyme inhibitory activity of Prato cheese with salt reduction and *Lactobacillus helveticus* as an adjunct culture. *Food Research International*, *133*, 109190. https://doi.org/10.1016/j.foodres.2020.109190

Baptista, D. P., Salgaço, M. K., Sivieri, K., & Gigante, M. N. (2020b). Use of static and dynamic models to simulate Prato cheese gastrointestinal digestion: effect of *Lactobacillus helvitucus* LH-B02 addition on peptides bioaccessibility. *LWT - Food Science and Technology*, *134*, 110229. https://doi.org/10.1016/j.lwt.2020.110229

Barati, M., Javanmardi, F., Jabbari, M., Mokari-Yamchi, A., Farahmand, F., Eş, I., Farhadnejad, H., Davoodi, S. H., & Khaneghah, A. M. (2020). An *in silico* model to predict and estimate digestion-resistant and bioactive peptide content of dairy products: A primarily study of a time-saving and affordable method for practical research purposes. *LWT - Food Science and Technology*, *130*, 109616. https://doi.org/10.1016/j.lwt.2020.109616

Barbosa, E. A., Oliveira, A., Plácido, A., Socodato, R., Portugal, C. C., Mafud, A. C., Ombredane, A. S., Moreira, D. C., Vale, N., Bessa, L. J., Joanitti, G. A., Alves, C., Gomes, P., Delerue-Matos, C., Mascarenhas, Y. P., Marani, M. M., Relvas, J. B., Pintado, M., & Leite, J. R. S. A. (2018). Structure and function of a novel antioxidant peptide from the skin of tropical frogs. *Free Radical Biology and Medicine*, *115*, 68-79. https://doi.org/10.1016/j.freeradbiomed.2017.11.001

Bardin, L. (Ed.). (2006). *Análise de conteúdo*. Edição 70.

Bassan, J. C., Bezerra, T. M. S., Peixoto, G., Cruz, C. Z. P., Galán, J. P. M., Vaz, A. B. S., Garrido, S. S., Filice, M., & Monti, R. (2016). Immobilization of trypsin in lignocellulosic waste material to produce peptides with bioactive potential from whey protein. *Materials*, *9*(5), 357-377. https://doi.org/10.3390/ma9050357

Bertolini, D., Jiménez, M. E. P., Santos, C., Corrêa, A. P. F., & Brandelli, A. (2021). Microbial bioconversion of feathers into antioxidant peptides and pigments and their liposome encapsulation. *Biotechnology Letters*, *43*, 835-844. https://doi.org/10.1007/s10529-020-03067-w

Bezerra, T. K. A., Estévez, M., Lacerda, J. T., Dias, M., Juliano, M., Mendes, M. A., Morgano, M., Pacheco, M. T., & Madruga, M. (2020). Chicken combs and wattles as sources of bioactive peptides: Optimization of hydrolysis, identification by LC-ESI-MS2 and bioactivity assessment. *Molecules*, *25*(7), 1698. https://doi.org/10.3390/molecules25071698

Bezerra, T. K. A., Lacerda, J. T. J. G., Salu, B. R., Oliva, M. L. V., Juliano, M. A., Pacheco, M. T. B., & Madruga, M. S. (2019). Identification of Angiotensin I-Converting Enzyme-Inhibitory and Anticoagulant Peptides from Enzymatic Hydrolysates of Chicken Combs and Wattles. *Journal of Medicinal Food*, *22*(12), 1294-1300. https://doi.org/10.1089/jmf.2019.0066

Bezerra, V. S., Campos, J. F., Silva, R. A., Porto, T. S., Lima Filho, J. L., & Porto, A. L. F. (2013). Biotechnological richness of the northeastern semi-arid region: Antioxidant activity of casein hydrolysates from Moxotó goat milk (*Capra hircus Linnaeus*, 1758) obtained by papain action. *Food Science and Technology*, *33*(3), 513-520. https://doi.org/10.1590/S0101-20612013005000074

Bhandari, D., Rafiq, S., Gat, Y., Gat, P., Waghmare, R., & Kumar, V. (2019). A review on bioactive peptides: Physiological functions, bioavailability and safety. *International Journal of Peptide Research and Therapeutics*, *26*, 139-150. https://doi.org/10.1007/s10989-019-09823-5

Boelter, J. F., Brandelli, A., Meira, S. M. M., Göethel, G., & Garcia, S. C. (2020). Toxicology study of nanoclays adsorbed with the antimicrobial peptide nisin on *Caenorhabditis elegans*. *Applied Clay Science*, *188*, 105490. https://doi.org/10.1016/j.clay.2020.105490

Brand, G. D., Magalhães, M. T. Q., Tinoco, M. L. P., Aragão, F. J. L., Nicoli, J., Kelly, S. M., Cooper, A., & Bloch Jr., C. (2012). Probing protein sequences as sources for encrypted antimicrobial peptides. *Plos One*, *7*(9), e45848. https://doi.org/10.1371/journal.pone.0045848

Brand, G. D., Ramada, M. H. S., Genaro-Mattos, T. C., & Bloch Jr., C. (2018). Towards an experimental classification system for membrane active peptides. *Scientific Reports*, *8*, 1194. https://doi.org/10.1038/s41598-018-19566-w

Brand, G. D., Ramada, M. H. S., Manickchand, J. R., Correa, F., Ribeiro, D. J. S., Santos, M. A., Vasconcelos, A. G., Abrão, F. Y., Prates, M. V., Murad, A. M., Fh, J. L. C., Leite, J. R. S. A., Magalhães, K. G., Oliveira, A. L., & Bloch Jr., C. (2019). Intragenic antimicrobial peptides (IAPs) from human proteins with potent antimicrobial and anti-inflammatory activity. *Plos One*, *14*(8), e0220656. https://doi.org/10.1371/journal.pone.0220656

Brandelli, A., Daroit, A. J., & Corrêa, A. P. F. (2015). Whey as a source of peptides with remarkable biological activities. *Food Research International*, *73*, 149-161. https://doi.org/10.1016/j.foodres.2015.01.016

Callegaro, K., Welter, N., & Daroit, D. J. (2018). Feathers as bioresource: Microbial conversion into bioactive protein hydrolysates. *Process Biochemistry*, *75*, 1-9. https://doi.org/10.1016/j.procbio.2018.09.002

Câmara, G. A., Nishiyama, M. Y., Kitano, E. S., Oliveira, U. C., Silva Jr., P. I., Junqueira-de-Azevedo, I. L., & Tashima, A. K. (2020). A Multiomics approach unravels new toxins with possible in silico antimicrobial, antiviral, and antitumoral activities in the venom of *Acanthoscurria rondoniae*. *Frontiers in Pharmacology*, *11*, e1075. https://doi.org/10.3389/fphar.2020.01075

Camargo, R. B., Batisti, D. L. S., Souza, V. K. G., Neumann, M., & Moritz, C. M. F. (2021). Reflexões sobre a importância do aporte financeiro para a pesquisa científica brasileira com produtos naturais. *Research, Society and Development*, *10*(5), e43110515001. https://doi.org/10.33448/rsd-v10i5.15001

Campeiro, J. D. A., Neshich, I. P., Sant'Anna, O. A., Lopes, R., Ianzer, D., Assakura, M. T., Neshich, G., & Hayashi, M. A. F. (2015). Identification of snake bradykinin-potentiating peptides (BPPs)-simile sequences in rat brain - Potential BPP-like precursor protein? *Biochemical Pharmacology*, *96*(3), 202-215. https://doi.org/10.1016/j.bcp.2015.05.012

Campos, M. I. F., Lima, A. K. S., Lopes Neto, J. H. P., Oliveira, J. M. C, & Gadelha, T. S. (2022). Artigo de revisão: Propriedades biológicas das proteínas e peptídeos do soro do leite caprino. *Research, Society and Development*, *11*(1), e6611124340. https://doi.org/10.33448/rsd-v11i1.24340

Cancelarich, N. L., Wilke, N., Fanini, M. L., Moreira, D. C., Pérez, L. O., Barbosa, E. A., Plácido, A., Socodato, R., Portugal, C. C., Relvas, J. B., Torre, B. G. L., Albericio, F., Basso, N. G., Leite, J. R., & Marani, M. M. (2020). Somuncurins: bioactive peptides from skin of the endangered endemic Patagonian frog *Pleurodema somuncurense*. *Journal of Natural Products*, *83*(4), 972-984. https://doi.org/10.1021/acs.jnatprod.9b00906

Candido, M. R., Marques, D., Oliveira, V. E, & Biroli, F. (2021). As ciências sociais na pandemia da Covid-19: rotinas de trabalho e desigualdades. *Sociologia & Antropologia*, *11*(Spe.), 31-65. https://doi.org/10.1590/2238-38752021v11esp2

Carvalho, D. C., Kuniyoshi, A. K., Kodama, R. T., Oliveira, A. K., Serrano, S. M. T., Tambourgi, D. V., & Portaro, F. V. (2014). Neuropeptide Y family-degrading metallopeptidases in the *Tityus serrulatus* venom partially blocked by commercial antivenoms. *Toxicological Sciences*, *142*(2), 418-426. https://doi.org/10.1093/toxsci/kfu193

Castro, R. J. S., & Sato, H. H. (2016). Simultaneous hydrolysis of proteins from different sources to enhance their antibacterial properties through the synergistic action of bioactive peptides. *Biocatalysis and Agricultural Biotechnology*, *8*, 209-212. https://doi.org/10.1016/j.bcab.2016.09.014

Cavalheiro, F. G., Baptista, D. P., Galli, B. D., Negrão, F., Eberlin, M. N., & Gigante, M. L. (2020). High protein yogurt with addition of Lactobacillus helveticus: Peptide profile and angiotensin-converting enzyme ACE-inhibitory activity. *Food Chemistry*, *333*, 127482. https://doi.org/10.1016/j.foodchem.2020.127482

Chakrabarti, S., Jahandideh, F., & Wu, J. (2014). Food-derived bioactive peptides on inflammation and oxidative stress. *BioMed Research International*, *2014*, 608979. https://doi.org/10.1155/2014/608979

Chaparro, E., & Silva Junior, P. I. (2016). Lacrain: the first antimicrobial peptide from the body extract of the Brazilian centipede *Scolopendra viridicornis*. *International Journal of Antimicrobial Agents*, *48*(3), 277-285. https://doi.org/10.1016/j.ijantimicag.2016.05.015

Coelho, M. S., Soares-Freitas, R. A. M., Arêas, J. A. G., Gandra, E. A., & Salas-Mellado, M. I. M. (2018). Peptides from chia present antibacterial activity and inhibit colesterol synthesis. *Plant Foods for Human Nutrition*, *73*, 101-107. https://doi.org/10.1007/s11130-018-0668-z

Conceição, K., Cena, G. L., Silva, V. A., Neto, X. A. O., Andrade, V, M., Tada, D. B., Richardson, M., Andrade, S. A., Dias, S. A., Castanho, M. A. R. B., & Lopes-Ferreira, M. (2020). Design of bioactive peptides derived from CART sequence isolated from the toadfish *Thalassophryne nattereri*. *3 Biotech*, *10*, 162. https://doi.org/10.1007/s13205-020-2151-4

Corrales-Ureña, Y. R., Souza-Schiaber, Z., Lisboa-Filho, P. N., Marquenet, F., Noeske, P. M., Gätjen, L., & Rischka, K. (2020). Functionalization of hydrophobic surfaces with antimicrobial peptides immobilized on a biointerfactant layer. *Royal Society of Chemistry*, *10*(1), 376-386. https://doi.org/10.1039/c9ra07380a

Corrêa, A. P. F., Bertolini, D., Lopes, N. A., Veras, F. F., Gregory, G., & Brandelli, A. (2019). Characterization of nanoliposomes containing bioactive peptides obtained from sheep whey hydrolysates. *LWT - Food Science and Technology*, *101*, 107-112. https://doi.org/10.1016/j.lwt.2018.11.036

Corrêa, A. P. F., Daroit, D. J., Coelho, J., Meira, S. M. M., Lopes, F. C., Segalin, J., Risso, P. H., & Brandelli, A. (2011). Antioxidant, antihypertensive and antimicrobial properties of ovine milk caseinate hydrolyzed with a microbial protease. *Journal of the Science of Food and Agriculture*, *91*(12), 2247-2254. https://doi.org/10.1002/jsfa.4446

Corrêa, A. P. F., Daroit, D. J., Fontoura, R., Meira, S. M. M., Segalin, J., & Brandelli, A. (2014). Hydrolysates of sheep cheese whey as a source of bioactive peptides with antioxidant and angiotensin-converting enzyme inhibitory activities. *Peptides*, *61*, 48-55. https://doi.org/10.1016/j.peptides.2014.09.001

Coutinho-Neto, A., Caldeira, C. A. S., Souza, G. H. M. F., Zaqueo, K. D., Kayano, A. M., Silva, R. S., Zuliani, J. P., Soares, A. M., Stábeli, R. G., & Calderon, L. A. (2013). ESI-MS/MS identification of a bradykinin-potentiating peptide from Amazon *Bothrops atrox* Snake Venom using a hybrid Qq-oaTOF mass spectrometer. *Toxins*, *5*(2), 327-335. https://doi.org/10.3390/toxins5020327

Crusca Jr., E. C., Basso, L. G. M., Altei, W. F., Marchetto, R. (2018). Biophysical characterization and antitumor activity of synthetic Pantinin peptides from scorpion's venom. *Biomembranes*, *1860*(11), 2155-2165. https://doi.org/10.1016/j.bbamem.2018.08.012

Cruz, C. Z. P., Mendonça, R. J., Guimaraes, L. H. S., Santos Ramos, M. A., Garrido, S. S., Paula, A. V., Monti, R., & Massolini, G. (2020). Assessment of the bioactive potential of cheese whey protein hydrolysates using immobilized alcalase. *Food and Bioprocess Technology*, *13*(12), 2120-2130. https://doi.org/10.1007/s11947-020-02552-4

Cruz, K. R., Ianzer, D., Turones, L. C., Reis, L. L., Camargo-Silva, G., Mendonça, M. M., Silva, E. S., Pedrino, G. R., Castro, C. H., Costa, E. E., & Xavier, C. H. (2019). Behavioral effects evocked by the beta globin-derived nanopeptide LVV_H6. *Peptides*, *115*, 59-68. https://doi.org/10.1016/j.peptides.2019.03.002

Cruz, K. R., Turones, L. C., Camargo-Silva, G., Gomes, K. P., Mendonça, M. M., Galdino, P., Rodrigues-Silva, C., Santos, R. A. S., Costa, E. A., Ghedini, P. C., Ianzer, D., & Xavier, C. H. (2017). The haemoglobin derived peptide LVV- hemorphin-7 evokes behavioural effects mediated by oxytocin receptors. *Neuropeptides*, *66*, 59-68. http://doi.org/10.1016/j.npep.2017.09.002

Cruz-Casas, D. E., Aguilar, C. N., Ascacio-Valdés, J. A., Rodríguez-Herrera, R., Chávez-González, M. L., & Flores-Gallegos, A. C. (2021). Enzymatic hydrolysis and microbial fermentation: The most favourable biotechnological methods for the release of bioactive peptides. *Food Chemistry: Molecular Sciences*, *3*, 100047. https://doi.org/10.1016/j.fochms.2021.100047

Da Silva, S. L., Almeida, J. R., Resende, L. M., Martins, W., Henriques, F. A. F. A., Baldasso, P. A., Soares, A. M., Taranto, A. G., Resende, R. R., Marangoni, S., & Dias-Junior, C. A. (2011). Isolation and characterization of a natriuretic peptide from *Crotalus oreganus abyssus* (grand canyon rattlesnake) and its effects on systemic blood pressure and nitrite levels. *International Journal of Peptide Research and Therapeutics*, *17*, 165-173. https://doi.org/10.1007/s10989-011-9254-z

Daroit, D. J., Corrêa, A. P. F., Canales, M. M., Coelho, J. G., Hidalgo, M. E., Tichota, D. M., Risso, P. H., & Brandelli, A. (2012). Physicochemical properties and biological activities of ovine caseinate hydrolysates. *Dairy Science and Technology*, *92*, 335-351. https://doi.org/10.1007/s13594-012-0068-3

De Oliveira, T. V., Guimarães, A. P., Bressan, G. C., Maia, E. R., Coimbra, J. S. R., Polêto, M. D., & De Oliveira, E. B. (2021). Structural and molecular bases of angiotensin-converting enzyme inhibition by bovine casein-derived peptides: an in silico molecular dynamics approach. *Journal of Biomolecular Structure and Dynamics*, *39*(4), 1386-1403. https://doi.org/10.1080/07391102.2020.1730243

De Oliveira, T. V., Polêto, M. D., De Oliveira, M. R., Silva, T. J., Barros, E., Guimarães, V. M., Baracat-Pereira, M. C., Eller, M. R., Coimbra, J. S. R., & De Oliveira, E. B. (2020). Casein-Derived Peptides with Antihypertensive Potential: Production, Identification and Assessment of Complex Formation with Angiotensin I-Converting Enzyme (ACE) through Molecular Docking Studies. *Food Biophysics*, *15*, 162-172. https://doi.org/10.1007/s11483-019-09616-9

Delgado-García, M., Flores-Gallegos, A. C., Kirchmayr, M., Rodríguez, J. A., Mateos-Díaz, J. C., Aguilar, C. N., Muller, M., & Camacho-Ruíz, R. M. (2019). Bioprospection of proteases from *Halobacillus andaensis* for bioactive peptide production from fish muscle protein. *Electronic Journal of Biotechnology*, *39*, 52-60. https://doi.org/10.1016/j.ejbt.2019.03.001

Dematei, A., Nunes, J. B., Moreira, D. C., Jesus, J. A., Laurenti, M. D., Mengarda, A. C. A., Vieira, m. S., Amaral, C. P., Domingues, M. M., Moraes, J., Passero, L. F. D., Brand, G., Bessa, L. J., Wimmer, R., Kuckelhaus, S. A. S., Tomás, A. M., Santos, N. C., Plácido, A., Eaton, P., & Leite, J. R. S. A. (2021). Mechanistic insights into the leishmanicidal and bactericidal activities of batroxicidin, a cathelicidin-related peptide from a south american viper (*Bothrops atrox*). *Journal of Natural Products*, *84*(6), 1787-1798. https://doi.org/10.1021/acs.jnatprod.1c00153

Dornelles, L. P., Souza, M. F. D., Silva, P. M., Procópio, T. F., Filho, R. S. R., Lima, T. A., Oliveira, A. P. S., Zingali, R. B., Paiva, P. M. G., Pontual, E. V., & Napoleão, T. H. (2018). Purification and characterization of a protease from the visceral mass of *Mytella charruana* and its evaluation to obtain antimicrobial peptides. *Food Chemistry*, *245*, 1169-1175. https://doi.org/10.1016/j.foodchem.2017.11.044

Duarte Neto, J. M. W., Maciel, J. C., Campos, J. F., Carvalho Junior, L. B., Marques, D. A. V., Lima, C. A., & Porto, A. L. F. (2017). Optimization of *Penicillium aurantiogriseum* protease immobilization on magnetic nanoparticles for antioxidant peptides' obtainment. *Preparative Biochemistry and Biotechnology*, *47*(7), 644-654. https://doi.org/10.1080/10826068.2017.1292286

Fagundes, P. C., Ceotto, H., Potter, A., Brito, M. A. V. P., Brede, D., Nes, I. F., & Bastos, M. C. F. (2011). Hyicin 3682, a bioactive peptide produced by *Staphylococcus hyicus* 3862 with potential applications for food preservation. *Research in Microbiology*, *162*(10), 1052-1059. https://doi.org/10.1016/j.resmic.2011.10.002

Ferreira, S. Z., Carneiro, H. C., Lara, H. A., Alves, R. B., Resende, J. M., Oliveiram H. M., Silva, L. M., Santos, D. A., & Freitas, R. P. (2015). Synthesis of a new peptide–coumarin conjugate: a potential agent against Cryptococcosis. *ACS Medicinal Chemistry Letters*, *6*(3), 271-275. https://doi.org/10.1021/ml500393q

Fialho, T. L., Carrijo, L. C., Júnior, M. J. M., Baract-Pereira, M. C., Piccoli, R. H., & Abreu, L. R. (2018). Extraction and identification of antimicrobial peptides from the Canastra artisanal minas cheese. *Food Research International*, *107*, 406-413. https://doi.org/10.1016/j.foodres.2018.02.009

Figueiredo, C. R., Matsuo, A. L., Azevedo, R. A., Massaoka, M. H., Girola, N., Polonelli, L., & Travassos, L. R. (2015). A novel microtubule de-stabilizing complementarity-determining region C36L1 peptide displays antitumor activity against melanoma *in vitro* and *in vivo*. *Scientific Reports*, *5*, e14310. https://doi.org/10.1038/srep14310

Fontenele, M. A., Bastos, M. S. R., Santos, K. M. O., Bemquerer, M. P., & Egito, A. S. (2017). Peptide profile of coalho cheese: a contribution for protected designation of origin (PDO). *Food Chemistry*, *219*, 382-390. https://doi.org/10.1016/j.foodchem.2016.09.171

Fontoura, R., Daroit, D. J., Corrêa, A. P. F., Moresco, K. S., Santi, L., Beys-da-Silva, W. O., Yates, J. R., Moreira, J. C. F., & Brandelli, A. (2019). Characterization of a novel antioxidant peptide from feather keratin hydrolysates. *New Biotechnology*, *49*, 71-76. https://doi.org/10.1016/j.nbt.2018.09.003

Freitas, M. A. G., Amaral, N. O., Álvares, A. C. M., Oliveira, S. A., Mehdad, A., Honda, D. E., Bessa, A. S. M., Ramada, M. H. S., Naves, L. M., Pontes, C. N. R., Castro, C. H., Pedrino, G. R., & de Freitas, S. M. (2020). Blood pressure-lowering effects of a Bowman-Birk inhibitor and its derived peptides in normotensive and hypertensive rats. *Scientific Reports*, *10*, 11680. https://doi.org/10.1038/s41598-020-66624-3

Fucase, T. M., Sciani, J. M., Cavalcante, I., Viala, V. L., Chagas, B. B., Pimenta, D. C., & Spencer, P. J. (2017). Isolation and biochemical characterization of bradykinin-potentiating peptides from *Bitis gabonica rhinoceros*. *Journal of Venomous Animals and Toxins Including Tropical Diseases*, *23*, 33. https://doi.org/10.1186/s40409-017-0124-9

Galli, B. D., Baptista, D. P., Cavalheiro, F. G., Negrão, F., Eberlin, M. N., & Gigante, M. L. (2019). Peptide profile of Camembert-type chesse: effect of heat treatment and adjunct culture *Lactobacillus rhamnosus* GG. *Food Research International*, *123*, 393-402. https://doi.org/10.1016/j.foodres.2019.05.009

Games, P. D., Silva, E. Q. G., Barbosa, M. O., Almeida-Souza, H. O., Fontes, P. P., Magalhães-Jr., M. J., Pereira, O. R. G., Prates, M. V., Franco, G. R., Faria-Campos, A., Campos, S. V. A., & Baracat-Pereira, M. C. (2016). Computer aided identification of a heveinlike antimicrobial peptide of bell pepper leaves for biotechnological use. *BMC Genomics*, *17*(12), 999. https://doi.org/10.1186/s12864-016-3332-8

Gomes, M. J. C., Lima, S. L. S., Alves, N. E. G., Assis, A., Moreira, M. E. C., Toledo, R. C. L., Rosa, C. O. B., Teixeira. O. R., Bassinello, P. Z., Mejía, E. G., & Martino, H. S. D. (2020). Common bean protein hydrolysate modulates lipid metabolism and prevents endothelial dysfunction in BALB/c mice fed an atherogenic diet. *Nutrition, Metabolism & Cardiovascular Diseases*, *30*(1), 141-150. https://doi.org/10.1016/j.numecd.2019.07.020

Grancieri, M., Martino, H. S. D., & Mejia, E. G. (2019). Chia (*Salvia hispanica* L.) seed total protein and protein fractions digests reduce biomarkers of inflammation and atherosclerosis in macrophages *in vitro*. *Molecular Nutrition and Food Research*, *63*(19), 1900021. https://doi.org/10.1002/mnfr.201900021

Graziani, D., Ribeiro, J. V. V., Cruz, V. S., Gomes, R. M., Araújo, E. G., Santos Júnior, A. C. M., Tomaz, H. C. M., Castro, C. H., Fontes, W., Batista, K. A., Fernandes, K. F., & Xavier, C. H. (2021). Oxidonitrergic and antioxidant effects of a low molecular weight peptide fraction from hardened bean (*Phaseolus vulgaris*) on endothelium. *Brazilian Journal of Medical and Biological Research*, *54*(6), e10423. https://doi.org/10.1590/1414-431x202010423

Hamin Neto, Y. A. A. H., Rosa, J. C., & Cabral, H. (2019). Peptides with antioxidant properties identified from casein, whey, and egg albumin hydrolysates generated by two novel fungal proteases. *Preparative Biochemistry and Biotechnology*, *49*(7), 639-648. https://doi.org/10.1080/10826068.2019.1566147

Helene, A. F., & Ribeiro, P. L. (2011). Brazilian scientific production, financial support, established investigators and doctoral graduates. *Scientometrics*, *89*(2), 677-686. https://doi.org/10.1007/s11192-011-0470-2

Henaux, L., Pereira, K. D., Thibodeau, J., Pilon, G., Gill, Tom., Marette, A., & Bazinet, L. (2021). Glucoregulatory and anti-inflammatory activities of peptide fractions separated by electrodialysis with ultrafiltration membranes from salmon protein hydrolysate and identification of four novel glucoregulatory peptides. *Membranes*, *11*(7), 528. https://doi.org/10.3390/membranes11070528

Hexsel, D., Zague, V., Schunck, M., Siega, C., Camozzato, F. O., & Oesser, S. (2017). Oral supplementation with specific bioactive collagen peptides improves nail growth and reduces symptoms of brittle nails. *Journal of Cosmetic Dermatology*, *16*(4), 520-526. https://doi.org/10.1111/jocd.12393

Jia, F., Zhang, Y., Wang, J., Peng, J., Zhao, P., Zhang, L., Yao, H., Ni, J., & Wang, K. (2019). The effect of halogenation on the antimicrobial activity, antibiofilm activity, cytotoxicity and proteolytic stability of the antimicrobial peptide Jelleine-I. *Peptides*, *112*, 56-66. https://doi.org/10.1016/j.peptides.2018.11.006

Khedri, S., Sadeghi, E., Rouhi, M., Delshadian, Z., Mortazavian, A. M., Guimarães, J. T., Fallah, M., & Mohammadi, R. (2021). Bioactive edible films: Development and characterization of gelatin edible films incorporated with casein phosphopeptides. *LWT – Food Science and Technology*, *138*, 110649. https://doi.org/10.1016/j.lwt.2020.110649

Kobbi, S., Nedjar, N., Chihib, N., Balti, R., Chevalier, M., Silvain, A., Chaabouni, S., Dhulster, P., & Bougatef, A. (2018). Synthesis and antibacterial activity of new peptides from Alfalfa RuBisCO protein hydrolysates and mode of action via a membrane damage mechanism against *Listeria innocua*. *Microbial Pathogenesis*, *115*, 41-49. https://doi.org/10.1016/j.micpath.2017.12.009

Kuniyoshi, A. K., Kodama, R. T., Moraes, L. H. F., Duzzi, B., Iwai, L. K., Lima, I. F., Cajado-Carvalho, D., & Portaro, F. V. (2017). *In vitro* cleavage of bioactive peptides by peptidases from *Bothrops jararaca* venom and its neutralization by bothropic antivenom produced by Butantan Institute: Major contribution of serine peptidases. *Toxicon*, *137*, 114-119. https://doi.org/10.1016/j.toxicon.2017.07.020

Landim, A. P. M., Matsubara, N. K., Silva-Santos, J. E., Mellinger-Silva, C., & Rosenthal. A. (2021). Application of preliminary high-pressure processing for improving bioactive characteristics and reducing antigenicity of whey protein hydrolysates. *Food Science and Technology International*, *28*(6), 489-501. https://doi.org/10.1177/10820132211022106

Latorres, J. M., Aquino, S., da Rocha, M., Wasielesky, W., Martins, V. G., & Prentice, C. (2021). Nanoencapsulation of white shrimp peptides in liposomes: Characterization, stability, and influence on bioactive properties. *Journal of Food Processing and Preservation*, *45*(7), e15591. https://doi.org/10.1111/jfpp.15591

Latorres, J. M., Rios, D. G., Saggiomo, G., Wasielesky, W., & Prentice-Hernandez, C. (2018). Functional and antioxidant properties of protein hydrolysates obtained from white shrimp (*Litopenaeus vannamei*). *Journal of Food Science and Technology*, *55*, 721-729. https://doi.org/10.1007/s13197-017-2983-z

Liao, W., Jahandideh, F., Fan, H., Son, M., & Wu, J. (2018). Egg protein-derived bioactive peptides: preparation, efficacy, and absorption. *Advances in Food and Nutrition Research*, *85*, 1-58. https://doi.org/10.1016/bs.afnr.2018.02.001

Lima, C. A., Campos, J. F., Filho, J. L. L., Converti, A., Cunha, M. G. C., & Porto, A. L. (2015). Antimicrobial and radical scavenging properties of bovine collagen hydrolysates produced by *Penicillium aurantiogriseum* URM 4622 collagenase. *Journal of Food Science and Technology*, *52*(7), 4459-4466. https://doi.org/10.1007/s13197-014-1463-y

Lima, H. V. D., Cavalcante, C. S. P., & Rádis-Baptista, G. (2020). Antimicrobial activity of synthetic Dq-3162, a 28-residue ponericin G-like dinoponeratoxin from the giant ant *Dinoponera quadriceps* venom, against carbapenem-resistant bacteria. *Toxicon*, *187*, 19-28. https://doi.org/10.1016/j.toxicon.2020.08.015

Lima, M. S. F., Silva, R. A., Silva, M. F., Silva, P. A. B., Costa, R. M. P. B., Teixeira, J. A. C., Porto, A. L. F., & Cavalcanti, M. T. H. (2018). Brazilian kefir-fermented Sheep's milk, a source of antimicrobial and antioxidant peptides. *Probiotics and Antimicrobial Proteins*, *10*, 446-455. https://doi.org/10.1007/s12602-017-9365-8

Lima, S. L. S., Gomes, M. J. C., Silva, B. P., Alves, N. E. G., Toledo, R. C. L., Theodoro, J. M. V., Moreira, M. E. C., Bento, J. A. C., Bassinello, P. Z., Matta, S. L. P., Mejía, E. G., & Martino, H. S. D. (2019). Whole flour and protein hydrolysate from common beans reduce the inflammation in BALB/c mice fed with high fat high cholesterol diet. *Food Research International*, *122*, 330-339. https://doi.org/10.1016/j.foodres.2019.04.013

Lin, K., Zhang, L., Han, X., Xin, L., Meng, Z., Gong, P, & Cheng, D. (2018). Yak milk casein as potential precursor of angiotensin I-converting enzyme inhibitory peptides based on in silico proteolysis. *Food Chemistry*, *254*, 340-347. https://doi.org/10.1016/j.foodchem.2018.02.051

Liu, L., Li, S., Zheng, J., Bu, T., He, G., & Wu, J. (2020). Safety considerations on food protein-derived bioactive peptides. *Trends in Food Science and Technology*, *96*, 199-207. https://doi.org/10.1016/j.tifs.2019.12.022

Luz, C., Saladino, F., Luciano, F. B., Mañes, J., & Meca, G. (2017). In vitro antifungal activity of bioactive peptides produced by Lactobacillus plantarum against *Aspergillus* parasiticus and *Penicillium expansum*. *LWT – Food Science and Technology*, *81*, 128-135. https://doi.org/10.1016/j.lwt.2017.03.053

Machado, A., Fázio, M. A., Miranda, A., Daffre, S., & Machini, T. (2012). Synthesis and properties of cyclic. *Journal of Peptide Science*, *18*(9), 588-598. https://doi.org/10.1002/psc.2439

Machado, R. J. A., Estrela, A. B., Nascimento, A. K. L., Melo, M. M. A., Torres-Rêgo, M., Lima, E. O., Rocha, H. A. O., Carvalho, E., Silva-Junior, A. A., & Fernandes-Pedrosa, M. F. (2016). Characterization of TistH, a multifunctional peptide from the scorpion *Tityus stigmurus*: Structure, cytotoxicity and antimicrobial activity. *Toxicon*, *119*, 362-370. https://doi.org/10.1016/j.toxicon.2016.06.002

Magalhães, M. T. Q., Barbosa, E. A., Prates, M. V., Verly, R. M., Munhoz, V. H. O., Araújo, I. E., & Bloch Jr., C. (2013). Conformational and Functional Effects Induced by Dand L-Amino Acid Epimerization on a Single Gene Encoded Peptide from the Skin Secretion of *Hypsiboas punctatus*. *Plos One*, *8*(4), e59255. https://doi.org/10.1371/journal.pone.0059255

Mandal, S. M., Bharti, R., Porto, W. F., Gauri, S. S., Mandal, M. M., Franco, O. L., & Ghosh, A. K. (2014). Identification of multifunctional peptides from human milk. *Peptides*, *56*, 84-93. https://doi.org/10.1016/j.peptides.2014.03.017

Mariano, D. O., Sciani, J. M., Antoniazzi, M. M., Jared, C., & Conceição, K. (2021). Quantity – but not diversity – of secreted peptides and proteins increases with age in the tree frog *Pithecopus nordestinus*. *Journal of Venomous Animals and Toxins including Tropical Diseases*, *27*, e20200105. https://doi.org/10.1590/1678-9199-JVATITD-2020-0105

Marques, M. R., Fontanari, G. G., Pimenta, D. C., Soares-Freitas, R. M., & Arêas, J. A.G. (2015). Proteolytic hydrolysis of cowpea proteins is able to release peptides with hypocholesterolemic activity. *Food Research International*, *77*(Part 1), 43-48. https://doi.org/10.1016/j.foodres.2015.04.020

Marson, G. V., Castro, R. J. S., Machado, M. T. C., Zandonadi, F. S., Barros, H. D. F. Q., Maróstica Júnior, M. R., Sussulini, A., & Hubinger, M. D. (2020). Proteolytic enzymes positively modulated the physicochemical and antioxidant properties of spent yeast protein hydrolysates. *Process Biochemistry*, 91, 34-45. https://doi.org/10.1016/j.procbio.2019.11.030

Martins, D. B., Pacca, C. C., Silva, A. M. B., Souza, B. M., Almeida, M. T. G., Palma, M. S., Arcisio-Miranda, M., & Cabrera, M. P. S. (2020). Comparing activity, toxicity and model membrane interactions of Jelleine-I and Trp/Arg analogs: analysis of peptide aggregation. *Amino Acids*, *52*, 725-741. https://doi.org/10.1007/s00726-020-02847-y

Martins, L. A., Malossi, C. D., Galletti, M., Ribeiro, J. M., Fujita, A., Esteves, E., Costa, F. B., Labruna, M. B., Daffre, S., & Fogaça, A. C. (2019). The transcriptome of the salivary glands of *Amblyomma aureolatum* reveals the antimicrobial peptide microplusin as an important factor for the tick protection against *rickettsia rickettsii* infection. *Frontiers in Physiology*, *10*, e529. https://doi.org/10.3389/fphys.2019.00529

Martins-Santos, M. E. S., Resende, R. R., Pinto, F. C. H., Soares, A. M., Marangoni, S., Oliveira, E., Albericio, F., & Silva, S. L. (2011). Effect of a Pool of Peptides Isolated from *Crotalus durissus terrificus* (South American Rattlesnake) Venom on Glucose Levels of Mice Fed on a High-Fat Diet. *International Journal of Peptides Research and Therapeutics*, *17*, 225-230. https://doi.org/10.1007/s10989-011-9261-0

Massaoka, M. H., Matsuo, A. L., Figueiredo, C. R., Girola, N., Farias, C. F., Pasqualoto, K., & Travassos, L. R. (2014). A subtraction tolerization method of immunization allowed for Wilms' tumor protein-1 (WT1) identification in melanoma and discovery of an antitumor peptide sequence. *Journal of Immunological Methods*, *414*, 11-19. https://doi.org/10.1016/j.jim.2014.08.003

Matos, F. M., Novelli, P. K., & Castro, R. J. S. (2021). Enzymatic hydrolysis of black cricket (*Gryllus assimilis*) proteins positively affects their antioxidant properties. *Journal of Food Science*, *86*(2), 571-578. https://doi.org/10.1111/1750-3841.15576

Matsuo, A. L., Juliano, M. A., Figueiredo, C. R., Batista, W. L., Tanaka, A. S., & Travassos, L. R. (2011). A new phage-display tumor-homing peptide fused to antiangiogenic peptide generates a novel bioactive molecule with antimelanoma activity. *Angiogenesis, Metastasis, and Cellular Microenvironment*, *9*(11), 1471-1478. https://doi.org/10.1158/1541-7786.MCR-10-0501

Meira, S. M. M., Daroit, D. J., Helfer, V. E., Corrêa, A. P. F., Segalin, J., Carro, S., & Brandelli, A. (2012). Bioactive peptides in water-soluble extracts of ovine cheeses from Southern Brazil and Uruguay. *Food Research International*, *48*(1), 322-329. https://doi.org/10.1016/j.foodres.2012.05.009

Mello, L. R., Aguiar, R. B., Yamada, R. Y., Moraes, J. Z., Hamley, I. W., Alves, W. A., Reza, M., Ruokolainem, J., & Silva, E. R. (2020). Amphipathic design dictates self-assembly, cytotoxicity and cell uptake of arginine-rich surfactant-like peptides. *Journal of Materials Chemistry B*, *8*(12), 2495-2507. https://doi.org/10.1039/c9tb02219h

Mello, M. B., Malheiros, P. S., Brandelli, A., Silveira, N. P., Jantzen, M. M., & Motta, A. S. (2015). Characterization and antilisterial effect of phosphatidylcholine nanovesicles containing the antimicrobial peptide pediocin. *Probiotics and Antimicrobial Proteins*, 5, 43-50. https://doi.org/10.1007/s12602-013-9125-3

Mendes, B., Almeida, J. R., Vale, N., Gomes, P., Gadelha, F. R., Da Silva, S. L., & Miguel, D. C. (2019). Potential use of 13-mer peptides based on phospholipase and oligoarginine as leishmanicidal agentes. *Comparative Biochemistry and Physiology, Part C*, *226*, e108612. https://doi.org/10.1016/j.cbpc.2019.108612

Mezzomo, T. R., Martins, C. A. F., Marcondes, D. B. S., Mischiatti, K. L., & Weffort-Santos, A. M. (2021). Assessment of the Functional Activities of Casein Phosphopeptides on Circulating Blood Leukocytes. *International Journal of Peptide Research and Therapeutics*, *27*, 1265-1280. https://doi.org/10.1007/s10989-021-10166-3

Michelon, W., Silva, M. L. B., Matthiensen, A., Andrade, C. J., Andrade, L. M., & Soares, H. M. (2021). Amino acids, fatty acids, and peptides in microalgae biomass harvested from phycoremediation of swine wastewaters. *Biomass Conversion and Biorefinery*, *12*, 869-880. https://doi.org/10.1007/s13399-020-01263-2

Migliolo, L., Felício, M. R., Cardoso, M. H., Silva, O. N., Xavier, M. E., Nolasco, D. O., Oliveira, A. S., Roca-Subira, I., Estape, J. V., Teixeira, L. D., Freitas, S. M., Otero-Gonzalez, A. J. O., Gonçalves, S., Santos, N. C., & Franco, O. L. (2016). Structural and functional evaluation of the palindromic alanine-rich antimicrobial peptide *Pa*-MAP2. *Biochimica et Biophysica Acta*, *1858*(7 Part A), 1488-1498. https://doi.org/10.1016/j.bbamem.2016.04.003

Miltenburg, T. Z., Silva, M. U., Bosch, G., & Vasconcellos, R. S. (2021). Effects of enzymatically hydrolysed poultry byproduct meal in extruded diets on serum angiotensin-converting enzyme activity and aldosterone in cats. *Archives of Animal Nutrition*, *75*(1), 64-77. https://doi.org/10.1080/1745039X.2020.1849899

Mohanty, D. P., Mohapatra, S., Misra, S., & Sahu, P. S. (2016). Milk derived bioactive peptides and their impact on human health – A review. *Saudi Journal of Biological Sciences*, *23*(5), 577-583. https://doi.org/10.1016/j.sjbs.2015.06.005

Mongui, A., Pérez-Lianos, F. J., Yamamoto, M. M., Lozano, M., Zambrano, M. M., Portillo, P. D., Fernández-Becerra, C., Restrepo, S., Portillo H. A. D., & Junca, H. (2015). Development of a genetic tool for functional screening of anti-malarial bioactive extracts in metagenomic libraries. *Malaria Journal*, *14*, 233. https://doi.org/10.1186/s12936-015-0748-6

Montalvo, G. E. B., Thomz-Soccol, V., Vandenberghe, L. P. S., Carvalho, J. C., Faulds, C. B., Bertrand, E., Prado, M. R. M., Bonatto, S. J. R., & Soccol, C. R. (2019). *Arthrospira maxima* OF15 biomass cultivation at laboratory and pilot scale from sugarcane vinasse for potential biological new peptides production. *Bioresource Technology*, *273*, 103-113. https://doi.org/10.1016/j.biortech.2018.10.081

Monte, E. R. C., Rossato, C., Llanos, R. P., Russo, L. C., Castro, L. M., Gozzo, E. S., Araujo, C. B., Peron, J. P. S., Sant'Anna, O. A., Ferro, E. S., & Riolli, V. (2017). Interferon-gamma activity is potentiated by an intracellular peptide derived from the human 19S ATPase regulatory subunit 4 of the proteasome. *Journal of Proteomics*, *151*, 74-82. https://doi.org/10.1016/j.jprot.2016.08.003

Moura, C. S., Lollo, P. C. B., Morato, P. N., Risso, E. M., & Amaya-Farfan, J. (2016). Functional effects of milk bioactive peptides on skeletal muscle of rats. *Food Research International*, *84*, 18-25. https://doi.org/10.1016/j.foodres.2016.03.001

Moura, C. S., Lollo, P. C. B., Morato, P. N., Risso, E. M., & Amaya-Farfan, J. (2017). Bioactivity of food peptides: biological response of rats to bovine milk whey peptides following acute exercise. *Food & Nutrition Research*, *61*(1), e1290740. https://doi.org/10.1080/16546628.2017.1290740

Naman, C. B., Rattan, R., Nikoulina, S. E., Lee, J., Miller, B. W., Moss, N. A., Armstrong, L., Boudreau, P. D., Debonsi, H. M., Valeriote, F. A., Dorrestein, P. C., & Gerwick, W. H. (2017). Integrating molecular networking and biological assays to target the isolation of a cytotoxic cyclic octapeptide, samoamide a, from an american samoan marine cyanobacterium. *Journal of Natural Products*, *80*(3), 625-633. https://doi.org/10.1021/acs.jnatprod.6b00907

Nascimento, C. F., Siqueira, A. S., Pinheiro, J. J. V., Freitas, V. M., & Jaeger, R. G. (2011). Laminin-111 derived peptides AG73 and C16 regulate invadopodia activity of a human adenoid cystic carcinoma cell line. *Experimental Cell Research*, *317*(18), 2562-2575. https://doi.org/10.1016/j.yexcr.2011.08.022

Nascimento, E. S., Anaya, K., Oliveira, J. M. C., Lacerda, J. T. J. G., Miller, M. E., Dias, M., Mendes, M. A., Pallone, J. A. L., Arns, C. W., Juliano, M. A., Gadelha, T. S., Pacheco, M. T. B., & Gadelha, C. A. A. (2021a). Identification of bioactive peptides released from in vitro gastrointestinal digestion of yam proteins (*Dioscorea cayennensis*). *Food Research International*, *143*, 110286. https://doi.org/10.1016/j.foodres.2021.110286

Nascimento, T. C. E. S., Molino, J. V. D., Donado, P. R. S., Montalvo, G. S. A., Santos, W. L., Gomes, J. E. G., Santos, J. H. P. M., Silva, R., Sette, L. D., Junior. A. P., & Moreira, K. A. (2021b). Antarctic fungus proteases generate bioactive peptides from caseinate. *Food Research International*, *139*, 109944. https://doi.org/10.1016/j.foodres.2020.109944

Ohara, A., Cason, V. G., Nishide, T. G., Matos, F. M., & Castro, R. J. S. (2020). Improving the antioxidant and antidiabetic properties of common bean proteins by enzymatic hydrolysis using a blend of proteases. *Biocatalysis and Biotransformation*, *39*(2), 100-108. https://doi.org/10.1080/10242422.2020.1789114

Oliveira, C. F. B., Alves, D. P., Emerich, B. L., Figueiredo, S. G., Cordeiro, M. N., Borges, M. H., Richardson, M., Pimenta, A. M. C., Duarte, I. D. G., & Lima, M. E. (2019a). Antinociceptive effect of PnTx4(5-5), a peptide from *Phoneutria nigriventer* spider venom, in rat models and the involvement of glutamatergic system. *Journal of Venomous Animals and Toxins including Tropical Deseases*, *25*, e20190022. https://doi.org/10.1590/1678-9199-JVATITD-2019-0022

Oliveira, D., Bernardi, D., Drummond, F., Dieterich, F., Boscolo, W., Leivas, C., Kiatkoski, E., & Waszczynskyj, N. (2017). Potential use of tuna (*Thunnus albacares*) by-product: Production of antioxidant peptides and recovery of unsaturated fatty acids from tuna head. *International Journal of Food Engineering*, *13*(7), 20150365. https://doi.org/10.1515/ijfe-2015-0365

Oliveira, G. V., Volino-Souza, M., Cordeiro, E. M., Conte-Junior, C. A., & Alvares, T. S. (2019b). Effects of fish protein hydrolysate ingestion on endothelial function compared to whey protein hydrolysate in humans. *International Journal of Food Sciences and Nutrition*, *71*(2), 242-248. https://doi.org/10.1080/09637486.2019.1635090

Oliveira, J. J. (2016). Ciência, tecnologia e inovação no Brasil: Poder, política e burocracia na arena decisória. *Revista de Sociologia e Política*, *24*(59), 129-147. https://doi.org/10.1590/1678-987316245907

Oliveira, T. J., Oliveira, U. C., & Silva Junior, P. I. (2019c). Serrulin: a glycine-rich bioactive peptide from hemolymph of the yellow *Tityus serulatus* Scorpion. *Toxicon*, *11*(9), 517. https://doi.org/10.3390/toxins11090517

Oliveira Filho, J. G., Rodrigues, J. M., Valadares, A. C. F., Almeida, A. B., Valencia-Mejia, E., Fernandes, K. F., Lemes, A. C., Alves, C. C. F., Sousa, H. A. F., Silva, E. R., Egea, M. B., & Dyszy, F. H. (2021). Bioactive properties of protein hydrolysate of cottonseed byproduct: antioxidant, antimicrobial, and angiotensin-converting enzyme (ace) inhibitory activities. *Wast and Biomass Valorization*, *12*, 1395-1404. https://doi.org/10.1007/s12649-020-01066-6

Osman, A., Enan, G., Al-Mohammadi, A. R., Abdel-Shafi, S., Abdel-Hameid, S., Sitohy, M. Z., & El-Gazzar, N. (2021). Antibacterial peptides produced by alcalase from cowpea seed proteins. *Antibiotics*, *10*(7), 870. https://doi.org/10.3390/antibiotics10070870

Parra, M. R., Coutinho, R. X., & Pessano, E. F. C. (2019). Um breve olhar sobre a cienciometria: origem, evolução, tendências e sua contribuição para o ensino de ciências. *Revista Contexto & Educação*, *34*(107), 126-141. https://doi.org/10.21527/2179-1309.2019.107.126-141

Pazinatto, C., Malta, L. G., Pastore, G. M., & Maria Netto, F. (2013). Antioxidant capacity of amaranth products: Effects of thermal and enzymatic treatments. *Food Science and Technology*, *33*(3), 485-493. https://doi.org/10.1590/S0101-20612013005000076

Pereira, A. M., Lisboa, C. R., Santos, T. D., & Costa, J. A. V. (2019). Bioactive stability of microalgal protein hydrolysates under food processing and storage conditions. *Journal of Food Science and Technology*, *56*, 4543-4551. https://doi.org/10.1007/s13197-019-03915-2

Pinto, M. F. S., Silva, O. N., Viana, J. C., Porto, W. F., Migliolo, L., Cunha, N. B., Gomes Jr., N., Fensterseifer, J. C. M., Colgrave, M. L., Craik, D, J., Dias, S. C., & Franco, O. L. (2016). Characterization of a bioactive acyclotide from *Palicourea rigida*. *Journal of Natural Products*, *79*(11), 2767-2773. https://doi.org/10.1021/acs.jnatprod.6b00270

Piotrowicz, I. B. B., Garcés-Rimon, M., Moreno-Fernández, S., Aleixandre, A., Salas-Mellado, M., & Miguel-Castro, M. (2020). Antioxidant, angiotensin-converting enzyme inhibitory properties and blood-pressure-lowering effect of rice bran protein hydrolysates. *Foods*, *9*(6), 812. https://doi.org/10.3390/foods9060812

Plácido, A., Bueno, J., Barbosa, E. A., Moreira, D. C., Dias, J. N., Cabral, W. F., Albuquerque, P., Bessa. L. J., Freitas, J., Kucklhaus, S. A. S., Lima, F. C. D. A., Batagin-Neto, A., Brand, G. D., Relvas, J. B., Leite, J. R. S. A., & Eaton, P. (2020). The antioxidante peptide salamandrin-I: First bioactive peptide identified from skin secretion of Salamandra Genus (*Salamandra salamandra*). *Biomolecules*, *10*(4), 512. https://doi.org/10.3390/biom10040512

Proksch, E., Schunck, M., Zague, V., Segger, D., Degwert, J., & Oesser, S. (2014). Oral intake of specific bioactive collagen peptides reduces skin wrinkles and increases dermal matrix synthesis. *Skin Pharmacology and Physiology*, *27*(3), 113-119. https://doi.org/10.1159/000355523

Pucca, M. B., Cerni, F. A., Pinheiro-Junior, E. L., Zoccal, K. F., Bordon, K. D. C. F., Amorim, F. G., Peigneur, S., Vriens, K., Thevissen, K., Cammue, B. P. A., Júnior, R. B. M., Arruda, E., Faccioli, L. H., Tytgat, J., & Arantes, E. C. (2016). Non-disulfide-bridged peptides from *Tityus serrulatus* venom: Evidence for proline-free ACE-inhibitors. *Peptides*, *82*, 44-51. https://doi.org/10.1016/j.peptides.2016.05.008

Quadros, C. C., Lima, K. O., Bueno, C. H. L., Fogaça, F. H. S., Rocha, M., & Prentice, C. (2019). Evaluation of the antioxidant and antimicrobial activity of protein hydrolysates and peptide fractions derived from *Colossoma macropomum* and their effect on ground beef lipid oxidation. *Journal of Aquatic Food Product Technology*, *28*(6), 677-688. https://doi.org/10.1080/10498850.2019.1628152

Rádis-Baptista, G., Dodou, H. V., Prieto-da-Silva, Á. R. B., Zaharenko, A. J., Kazuma, K., Nihei, K., Inagaki, H., Mori-Yasumoto, K., & Konno, K. (2020). Comprehensive analysis of peptides and low molecular weight components of the giant ant *Dinoponera quadriceps* venom. *Biological* Chemistry, *401*(8), 945-954. https://doi.org/10.1515/hsz-2019-0397

Ramada, M. H. S., Brand, G. D., Abrão, F. Y., Oliveira, M., Filho, J. L. C., Galbieri, R., Gramacho, K. P., Prates, M. V., Bloch Jr., C. (2017). Encrypted antimicrobial peptides from plant proteins. *Scientific Reports*, *7*, 13263. https://doi.org/10.1038/s41598-017-13685-6

Ribeiro, E., Rocha, T. de S., & Prudencio, S. H. (2021). Potential of green and roasted coffee beans and spent coffee grounds to provide bioactive peptides. *Food Chemistry*, *348*, 129061. https://doi.org/10.1016/j.foodchem.2021.129061

Ribeiro, N. M., Toniolo, E. F., Castro, L. M., Russo, L. C., Riolli, V., Ferro, E. S., & Dale, C. S. (2013). AGH is a new hemoglobin alpha-chain fragment with antinociceptive activity. *Peptides*, *48*, 10-20. https://doi.org/10.1016/j.peptides.2013.07.011

Rocha, T. S., Hernandez, L. M. R., Mojica, L., Johnson, M. H., Chang, Y. K., & Mejía, E. G. (2015). Germination of *Phaseolus vulgaris* and alcalase hydrolysis of its proteins produced bioactive peptides capable of improving markers related to type-2 diabetes *in vitro*. *Food Research International*, *76*(Part 1), 150-159. https://doi.org/10.1016/j.foodres.2015.04.041

Romani, V. P., Martins, V. G., & Goddard, J. M. (2020). Radical scavenging polyethylene films as antioxidant active packaging materials. *Food Control*, *109*, 106946. https://doi.org/10.1016/j.foodcont.2019.106946

Rosa, F. T., Zulet, M. A., Marchini, J. S., & Martínez, J. A. (2012). Bioactive compounds with effects on inflammation markers in humans. *International Journal of Food Science and Nutrition*, *63*(6), 749-765. https://doi.org/10.3109/09637486.2011.649250

Sanches, B. C. P., Rocha, C. A., Bedoya, J. G. M., Silva, P. B., Fusco-Almeida, A. M., Chorilli, M., Contiero, J., Crusca, E., & Marchetto, R. (2021). Rhamnolipid-based liposomes promising nano-carriers for enhancing the antibacterial activity of peptides derived from bacterial toxin-antitoxin systems. *International Journal of Nanomedicine*, *2021*, 925-939. https://doi.org/10.2147/IJN.S283400

Santana, C. J. C., Magalhães. A. C. M., Santos Júnior, A. C. M., Ricart, C. A. O., Lima, B. D., Álvares, A. C. M., Freitas, S. M., Pires Júnior, O. R., Fontes, W., & Castro, M. S. (2020). Figainin 1, a novel amphibian skin peptide with antimicrobial and antiproliferative properties. *Antibiotics*, *9*(9), 625. https://doi.org/10.3390/antibiotics9090625

Santos, B. P. O., Alves, E. S. F., Ferreira, C. S., Ferreira-Silva, A., Góes-Neto, A., Verly, R. M., Lião, L. M., Oliveira, S. C., & Magalhães, M. T. Q. (2021). Schistocins: Novel antimicrobial peptides encrypted in the *Schistosoma mansoni* Kunitz inhibitor SmKI-1. *Biochimica et Biophysica Acta - General Subjects*, *1865*(11), 129989. https://doi.org/10.1016/j.bbagen.2021.129989

Santos, L. S. N., Sonoda, M. T., Gomes, R. A. S., & Abrahão Jr., O. (2012). Molecular modeling of bioactive neuropeptides: substrates of angiotensin I-converting enzyme. *International Journal of Quantum Chemistry*, *112*(20), 3414-3420. https://doi.org/10.1002/qua.24276

Sanz, M., Andreote, A. P. D., Fiore, M. F., Dörr, F. A., & Pinto, E. (2015). Structural characterization of new peptide variants produced by cyanobacteria from the Brazilian Atlantic coastal forest using liquid chromatography coupled to quadrupole time-of-flight tandem mass spectrometry. *Marine Drugs*, *13*(6), 3892-3919. https://doi.org/10.3390/md13063892

Sbroggio, M. F., Montilha, M. S., Figueiredo, V. R. G., Georgetti, S. R., & Kurozawa, L. E. (2016). Influence of the degree of hydrolysis and type of enzyme on antioxidant activity of okara protein hydrolysates. *Food Science and Technology*, *36*(2), 375-381. https://doi.org/10.1590/1678-457X.000216

Sharma, M., Sarin, A., Gupta, P., Sachdeva, S., & Desai, A. (2014). Journal impact factor: its use, significance and limitations. *World Journal of Nuclear Medicine*, *13*(2), 146. https://doi.org/10.4103/1450-1147.139151

Shivanna, S. K., & Nataraj, B. H. (2020). Revisiting therapeutic and toxicological fingerprints of milk-derived bioactive peptides: An overview. *Food Bioscience*, *38*, 100771. https://doi.org/10.1016/j.fbio.2020.100771

Sidone, O. J. G., Haddad, E. A., & Mena-Chalco, J. P. (2016). A ciência nas regiões brasileiras: evolução da produção e das redes de colaboração científica. *Transinformação*, *28*(1), 15-31. https://doi.org/10.1590/2318-08892016002800002

Silva, A. C., Queiroz, A. E. S. F., Oliveira, J. T. C., Medeiros, E. V., Souza-Motta, C. M., & Moreira, K. A. (2019a). Antioxidant activities of chicken egg white hydrolysates obtained by new purified protease of *Aspergillus avenaceus* URM 6706. *Brazilian Archives of Biology and Technology*, *62*, e19180062. https://doi.org/10.1590/1678-4324-2019180062

Silva, C. C. F., Menezes, M. C., Palomino, M., Oliveira, A. K., Iwai, L. K., Faria, M., & Portaro, F. V. (2017a). Peptides derived from plasma proteins released by bothropasin a metalloprotease present in the *Bothrops jararaca* venom. *Toxicon*, *137*, 65-72. https://doi.org/10.1016/j.toxicon.2017.07.009

Silva, D. D., Lima, M. S. F., Silva, M. F., Silva, G. R., Campos, J. F., Albuquerque, W. W. C., Cavalcanti, M. T. H., & Porto, A. L. F. (2019b). Bioactive water-soluble peptides from fresh buffalo cheese may be used as product markers. *LWT - Food Science and Technology*, *108*, 97-105. https://doi.org/10.1016/j.lwt.2019.03.035

Silva, J. C., Couto, L. L., Amaral, H. O., Gomes, F. M. M., Campos, G. A. A., Silva, L. P., & Mortari, M. R. (2020). Neuropolybin: a new antiseizure peptide obtained from wasp venom. *Biochemical Pharmacology*, *181*, 114119. https://doi.org/10.1016/j.bcp.2020.114119

Silva, M. B. C., Souza, C. A. C., Philadelpho, B. O., Cunha, M. M. N., Batista, F. P. R., Silva, J. R., Druzian, J. I., Castilho, M. S., Cilli, E. M., & Ferreira, E. S. (2018). *In vitro* and *in silico* studies of 3-hydroxy-3-methyl-glutaryl coenzyme A reductase inhibitory activity of the cowpea Gln-Asp-Phe peptide. *Food Chemistry*, *259*, 270-277. https://doi.org/10.1016/j.foodchem.2018.03.132

Silva, M. S., Ribeiro, S. F. F., Taveira, G. B., Rodrigues, R., Fernandes, K. V. S., Carvalho, A. O., Vasconcelos, I. M., Mello, E. O., & Gomes, V. M. (2017b). Application and bioactive properties of CaTI, a trypsin inhibitor from *Capsicum annuum* seeds: membrane permeabilization, oxidative stress and intracellular target in phytopathogenic fungi cells. *Journal of the Science of Food and Agriculture*, *97*(11), 3790-3801. https://doi.org/10.1002/jsfa.8243

Silva, P. C, Toledo, T., Brião, V., Bertolin, T. E., & Costa, J. A. V. (2021). Development of extruded snacks enriched by bioactive peptides from microalga *Spirulina* sp. LEB 18. *Food Bioscience*, *42*, 101031. https://doi.org/10.1016/j.fbio.2021.101031

Silva, R. A., Lima, M. S. F., Viana, J. B. M., Bezerra, V. S., Pimentel, M. C. B., Porto, A. L. F., Cavalcanti, M. T. H., & Lima Filho, J. L. (2012). Can artesanal "Coalho" cheese from Northeastern Brazil be used as a functional food? *Food Chemistry*, *135*(3), 1533-1538. https://doi.org/10.1016/j.foodchem.2012.06.058

Silva, S. L., Almeida, J. R., Resende, L. M., Martins, W., Henriques, F. A. F. A., Baldasso, P. A., Soares, A. M., Taranto, A. G., Resende, R. R., Marangoni, S., & Dias-Junior, C. A. (2011). Isolation and characterization of a nutriuretic peptide fro *Crotalus oregans abyssus* (Grand Cabyon Rattlesnake) and its effects on systemic blood pressure and nitrite levels. *International Journal of Peptide Research and Therapeutics*, *17*(3), 165-173. https://doi.org/10.1007/s10989-011-9254-z

Silva-Stenico, M. E., Silva, C. S. P., Lorenzi, A. S., Shishido, T. K., Etchegaray, A., Lira, S. P., Moraes, L. A. B., & Fiore, M. F. (2011). Non-ribosomal peptides produced by brazilian cyanobacterial isolates with antimicrobial activity. *Microbial Research*, *166*(3), 161-175. https://doi.org/10.1016/j.micres.2010.04.002

Soares, R. A. M., Mendonça, S., Castro, L. I. A., Menezes, A. C. C. C. C., & Arêas, J. A. G. (2015). Major peptides from Amaranth (*Amaranthus cruentus*) protein inhibit HMG-CoA reductase activity. *International Journal of Molecular Sciences*, *16*(2), 4150-4160. https://doi.org/10.3390/ijms16024150

Sousa, N. A., Oliveira, G. A. L., Oliveira, A. P., Lopes, A. L. F., Iles, B., Nogueira, K. M., Araújo, T. S. L., Souza, L. K. M., Araújo, A. R., Ramos-Jesus, J., Plácido, A., Amaral, C., Campelo, Y. D. M., Barbosa, E. A., Portugal, C. C., Socodato, R., Lobo, A., Relvas, J., Bemquerer, M., Eaton, P., Leite, J. R. S. A., & Medeiros, J. V. R. (2020). Novel Ocellatin Peptides Mitigate LPS-induced ROS Formation and NF-kB Activation in Microglia and Hippocampal Neurons. *Scientific Reports*, *10*, 2696. https://doi.org/10.1038/s41598-020-59665-1

Souza, D. L., Zambalde, A. L., Mesquita, D. L., Souza, T. A., & Silva, N. L. C. (2020). The perspective of researchers on the challenges of research in Brazil. *Educação e Pesquisa*, *46*, e221628. https://doi.org/10.1590/S1678-4634202046221628

Spíndola, F. D., Lima, J. P. R., & Fernandes, A. C. (2015). Interação Universidade-Empresa: o caso do setor sucroalcooleiro de Pernambuco. *Economia e Sociedade*, *24*(1), 121-149. https://doi.org/10.1590/1982-3533.2015v24n1art5

Toldrá, F., & Mora, L. (2021). Proteins and bioactive peptides in high protein content foods. *Foods*, *10*(6), 1186. https://doi.org/10.3390/foods10061186

Toldrá, F., Reig, M., Aristoy, M. C., & Mora, L. (2018). Generation of bioactive peptides during food processing. *Food Chemistry*, *267*, 395-404. https://doi.org/10.1016/j.foodchem.2017.06.119

Torres, M. D. T., Andrade, G. P., Sato, R. H., Pedron, C. N., Manieri, T. M., Cerchiaro, G., Ribeiro, A. O., Fuente-Nunez. C. L., & Jr., V. X. O. (2018). Natural and redesigned wasp venom peptides with selective antitumoral activity. *Beilstein Journal of Organic Chemistry*, *14*, 1693-1703. https://doi.org/10.3762/bjoc.14.144

Torres-Rêgo, M., Gláucia-Silva, F., Soares, K. S. R., Souza, L. B. F. C., Damasceno, I. Z., Santos-Silva, E., Lacerda, A. F., Chaves, G. M., Silva-Júnior, A. A., & Fernandes-Pedrosa, M. F. F. (2019). Biodegradable cross-linked chitosan nanoparticles improve anti-Candida and anti-biofilm activity of TistH, a peptide identified in the venom gland of the *Tityus stigmurus* scorpion. *Materials Science & Engineering C*, *103*, 109830. https://doi.org/10.1016/j.msec.2019.109830

Traoré, M., Mietton, F., Maubon, D., Peuchmar, M., Hilário, F. F., Freitas, R. P., Bougdour, A., Curt, A., Maynadier, M., Vial, H., Pelloux, H., Hakimi, M., & Wong, Y. (2013). Flexible synthesis and evaluation of diverse anti-apicomplexa cyclic peptides. *Journal of Organic Chemistry*, *78*(8), 3655-3675. https://doi.org/10.1021/jo4001492

Tu, M., Cheng, S., Lu, W., & Du, M. (2018a). Advancement and prospects of bioinformatics analysis for studying bioactive peptides from food-derived protein: Sequence, structure, and functions. *TrAC Trends in Analytical Chemistry*, *105*, 7-17. https://doi.org/10.1016/j.trac.2018.04.005

Tu, M., Liu, H., Zhang, R., Chen, H., Fan, F., Shi, P., Xu, X., Lu, W., & Du, M. (2018b). Bioactive hydrolysates from casein: generation, identification, and *in silico* toxicity and allergenicity prediction of peptides. *Journal of the Science of Food and Agriculture*, *98*(9), 3416-3426. https://doi.org/10.1002/jsfa.8854

Vanzolini, K. L., Ainsworth, S., Bruyneel, B., Herzig, V., Seraus, M. G. L., Somsen, G. W., Casewell, N. R., Cass, Q. B., & Kool, J. (2018). Rapid ligand fishing for identification of acetylcholinesterase-binding peptides in snake venom reveals new properties of dendrotoxins. *Toxicon*, 152, 1-8. https://doi.org/10.1016/j.toxicon.2018.06.080

Venancio, E. J., Portaro, F. C. V., Kuniyoshi, A. K., Carvalho, D. C., Pidde-Queiroz, G., & Tambourgi, D. V. (2013). Enzymatic properties of venoms from Brazilian scorpions of *Tityus* genus and the neutralisation potential of therapeutical antivenoms. *Toxicon*, *69*, 180-190. https://doi.org/10.1016/j.toxicon.2013.02.012

Vernaza, M. G., Dia, V. P., Mejia, E. G., & Chang, Y. K. (2012). Antioxidant and antiinflammatory properties of germinated and hydrolysed Brazilian soybean flours. *Food Chemistry*, *134*(4), 2217-2225. https://doi.org/10.1016/j.foodchem.2012.04.037

Vogel, C., Paglia, E. B., Moroni, L. S., Demiate, I. M., Prestes, R. C., & Kempka, A. P. (2021). Swine plasma peptides obtained using pepsin: In silico and in vitro properties and biological activities. *Biocatalysis and Biotransformation*, *41*(2), 108-122. https://doi.org/10.1080/10242422.2021.1981880

Wen, C., Zhang, J., Yao, H., Zhou, J., Duan, Y., Zhang, H., & Ma, H. (2019). Advances in renewable plant-derived protein source: The structure, physicochemical properties affected by ultrasonication. *Ultrasonics Sonochemistry*, *53*, 83-98. https://doi.org/10.1016/j.ultsonch.2018.12.036

Yekta, M. M., Rezaei, M., Nouri, L., Azizi, M. H., Jabbari, M., Eş, I., & Khaneghah, A. M. (2020). Antimicrobial and antioxidant properties of burgers with quinoa peptide-loaded nanoliposomes. *Journal of Food Safety*, *40*(2), e12753. https://doi.org/10.1111/jfs.12753

Yesmine, B. H., Antoine, B., Leocádia, N. G. S. O., Rogério, B. W., Ingrid, A., Nicolas, B., Thierry, M., Piot, J. M., Frédéric, S., & Stéphanie, B. J. (2017). Identification of ace inhibitory cryptides in Tilapia protein hydrolysate by UPLC–MS/MS coupled to database analysis. *Journal of Chromatography B: Analytical Technologies in the Biomedical and Life Sciences*, *1052*, 43-50. https://doi.org/10.1016/j.jchromb.2017.02.015

Zanutto-Elgui, M. R., Vieira, J. C. S., Prado, D, Z., Buzalaf, M. A R., Padilha, P. M., Oliveira, D. E., & Fleuri, L. F. (2019). Production of milk peptides with antimicrobial and antioxidant properties through fungal proteases. *Food Chemistry*, *278*, 823-831. https://doi.org/10.1016/j.foodchem.2018.11.119