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85 years of professional nutritionist pratice in Brazil

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New nutritionists' fields of activity in Brazil: the emergence of digital technological innovations, including artificial intelligence

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ABSTRACT

Objective
To reflect on new nutritionists' practice fields in Brazil, focusing on the application of digital technological innovations, including artificial intelligence.

Methods
Literature and documentary review of resolutions and statistics regarding the number of nutritionists in this country based on the Federal Nutrition Council data.

Results
Among the 34 specialties in Nutrition acknowledged by the Federal Nutrition Council, Precision Nutrition stands out, both in Brazil and in other countries, as a new scientific paradigm aimed at elucidating the complex and multicausal nutritional issue. The literature review showed that both Precision Nutrition and digital technologies, including artificial intelligence, have been applied in the nutritionists' professional practice in different fields of knowledge and practice, such as: development of functional foods; development of instruments and equipment used in the diagnosis and treatment of nutritional problems and in nutritional therapy and counseling for a wide range of diseases, disorders and health conditions (obesity, diabetes mellitus, dyslipidemia, high blood pressure, metabolic syndrome, malignancies, eating disorders, etc.).

Conclusion
The expansion of the activity areas and specialties in Nutrition seems to be in line with the demands defined by: expansion of the number of professionals, the job market, search for identification with other professions in the health sector; and technological scientific innovations, in the global context. The work of Brazilian nutritionists specializing in Precision Nutrition and in the application of digital technologies, including artificial intelligence, shows that these new and promising fields are still quite incipiently explored.

Keywords: Areas of expertise. Artificial intelligence. Nutrigenomics. Nutritionists. Precision nutrition. Specialization.

INTRODUCTION

In recent decades, with the intensive development of communication and information technology, genetics and theories on the ecological sustainability of the

planet, important paradigmatic changes have occurred in the field of Nutrition both in Brazil and in other countries. Among the *new scientific paradigms* (from the philosophical perspective of Thomas Khun) [1] that began to involve Nutrition science (from Pierre Bourdieu's sociological perspective) [2], the paradigms considered dominant or hegemonic stand out (*hegemony* from Antonio Gramsci's political perspective) [3], which are centered on technological and genetic innovations (Precision Nutrition, Nutrigenomics, Nutrigenetics) [4-11] and the so-called alternative or competing paradigms, such as the paradigm of sustainability, sovereignty and food security [12-15]. Thus, evidence found in the scientific literature indicates the occurrence of an internationalization process of these new scientific paradigms in the field of Nutrition; this trend occurred both in the group of the most economically developed countries (G7) – the United States of America [16], Japan [17], Germany [18], United Kingdom [19], France [20], Italy [21] and Canada [22], as well as in part of the group of the largest emerging economies (BRICS), such as Brazil [23], Russia [24], India [25], China [26] and South Africa [27].

Therefore, the current scenario of the nutritionists' work, both in Brazil and in other countries, taking into account the studies reviewed that originated from the G7 and BRICS countries [16-27], reveals that, in recent decades, the analog procedures of diagnosis, counseling and nutritional therapy that characterized the professional practice throughout its history [28-34] have increasingly been replaced by new digital technologies, including the use of Artificial Intelligence (AI) [8-11].

In Brazil, advances in Nutrition science have led to the emergence of new areas for nutritionists to work in. Based on the changes that occurred in these fields of activity, the *Conselho Federal de Nutrição* (CFN, Federal Nutrition Council), the current name for this entity, has sought to update the set of regulations that guide, regulate and monitor the practice of the nutrition professional in this country. Among such regulations the following stand out: (i) CFN Resolution No. 600/2018, which defines the nutritionists' areas of activity and their attributions [35]; (ii) CFN Resolution No. 679/2021, which regulates the integrative and complementary nutritionists' health practices (ICHP) [36]; (iii) Resolution No. 680/2021, which regulates the nutritionists' Phytotherapy practice [37]; (iv) CFN resolution No. 689/2021, which regulates the recognition of specialties in Nutrition [38]; (v) CFN resolution No. 705/2021, which establishes the nutritionists' code of ethical-disciplinary processing [39]; (vi) CFN resolution No. 731/2022, which provides guidelines for nutritionists' prescription of food supplements [40]; and (vii) CFN Resolution No. 760/2023, which defines and regulates telenutrition as a form of care and/or provision of services [41]. It is worth noting that the resolution that regulates telenutrition [41] emerged as a standardization of a practice that was disseminated, in the global context and in Brazil, due to the physical distancing measures adopted during the Coronavirus Disease 2019 (COVID-19) pandemic [42-44]. Among the considerations of the CFN [41], the need to adapt to Law No. 14,510/2022 stands out; this federal law allows and regulates the practice of telenutrition for the health professionals in Brazil [45].

In summary, the set of regulations established by the CFN between the years 2018 and 2023 [35-41], all of them in connection with the specific areas of activity, specialties and ethical, technical-scientific and methodological aspects of the nutritionists' professional practice, seems to be a trend to update or adapt CFN to the complex and multidimensional epidemiological and nutritional profile of the Brazilian population [28-30]. It also targets the nutritionist's profile when entering professional activities and the job market in this country [46]. On the other hand, it seems to express, in a much clearer way, a trend to approach the new paradigms of the science and the profession globalization process, particularly those paradigms focusing the use of digital technologies [8-11].

In the last five years, studies carried out by nutritionists in Brazil on areas of activity, specialties and the use of digital technologies, including AI, have been scarce or non-existent, justifying the relevance, timeliness and pertinence of this paper.

Our objective is to cause a reflection on the nutritionists' new fields of activity in Brazil, with emphasis on the application of digital technological innovations, including AI.

METHODS

The study used two separate methodological procedures: 1) CFN resolutions documentary and statistics review of the areas of activity, specialties and ethical, technical-scientific and methodological aspects of the nutritionists' professional practice in Brazil; and 2) Exploratory bibliographic review of Precision Nutrition and the use of digital technologies, including AI, in the G7 and BRICS countries.

The article is structured in three sections. The first section reports the results of the documentary review, whose objective was to outline a descriptive profile, overview or contextualization of the areas of the nutritionists' practice in Brazil, based on the analysis of CFN regulations and data. A descriptive analysis of CFN Resolution No. 600/2018 [35] was carried out, complemented by a statistical table of all nutritionists [47], presentation of a brief excerpt from the survey of nutritionists initiating professional activities and entering the job market in Brazil [46]. In addition we sought to describe and reflect on CFN resolution no. 689/2021 [38], which defines the specialties in Nutrition. The second section reports the results of the literature review on Precision Nutrition which is considered a nutritionist specialty in Brazil. Finally, in the third section we report the use of digital technologies, including AI devices, in the different areas of the nutritionists' practice, in Brazil and in global context.

The bibliographic survey was carried out in the electronic databases PubMed (MEDLINE), Scientific Electronic Library Online (SciELO) and Google Scholar, using specific search strategies for each database, according to each subject investigated.

In the search for articles on the topics of *Precision Nutrition and the use of digital technologies*, including AI, in the context of the G7 and BRICS countries, the search was carried out exclusively in the PubMed database. In this database, the search was carried out separately for each of these two subjects, using advanced strategies with associated keywords: *nutritionists* AND *personalized nutrition;* and *nutritionists* AND *artificial intelligence* AND the name of the country in English, without a publication date filter, in an attempt to identify the year in which publications on the topic were first issued (first article).

To capture articles published by Brazilian researchers, searches were conducted for specific topics in each of the three databases investigated. For example, in the PubMed® database, for the topic *Precision Nutrition*, an advanced search strategy was used with the keyword *Precision Nutrition* associated (AND) with the keyword Brazil and filters for the publication date of the articles. In the SciELO database, the advanced search strategy was used with the keyword *Precision Nutrition* associated with the keyword Brazil without the use of filters. It is worth noting that analogous strategies were used to search for the keywords *Personalized Nutrition* and *Nutrigenomics*, considered as equivalent terms or synonyms of *Precision Nutrition* by the literature in this area of knowledge. Search strategies were similarly conducted for the topic Use of digital technologies including AI.

The process of selecting and, if the case be, excluding the studies of both themes reviewed was based on reading the titles, keywords and abstracts of the articles retrieved. The search was not exhaustive, nor did we analyze the methodological quality and results of the studies. For each

theme investigated, we only sought to identify the quantitative existence and the year of publication, and to select some examples of articles published, preferably in the last five years. Therefore, in the review of the theme *Precision Nutrition*, 14 studies were intentionally included of which ten were literature review papers and four were original articles. In turn, in the review of the theme Use of digital technologies, including AI, 20 articles were included, of which 12 were original articles each one issued in one of the G7 and BRICS countries (South Africa, Germany, Brazil, Canada, China, United States of America, France, India, Italy, Japan, United Kingdom and Russia), four were literature review articles and four were original articles issued by Brazilian researchers.

Nutritionists' areas of activity and specialities in Brazil

According to the CFN Resolution No. 600/2018, six major areas of activity for nutritionists are acknowledged in Brazil: 1) Nutrition in Collective Feeding; 2) Clinical Nutrition; 3) Nutrition in Sports and Physical Exercises; 4) Public Health Nutrition; 5) Nutrition in the Production Chain, in the Industry and in the Food Trade; and 6) Nutrition in Teaching, Research and Extension [35].

Considering the year 2018, the recognition by the CFN of these six major areas of nutritionist practice appears to have been based both on scientific evidence about the complex and multidimensional epidemiological and nutritional profile of the Brazilian population [28-30], and on the research regarding the boundaries of the professional insertion area and job market of nutritionists in this country, carried out in 2016-2017 [46]. In fact, it seems to us that one of the innovative aspects of this regulation, in relation to previous ones, was the attempt to resignify the terminologies used to define these six major areas of practice. In other words, the terminologies of the six areas begin with the broadest term that characterizes the scientific or professional field (Nutrition) followed by the terms that designate the specific area or subfield of practice (or knowledge). Another important change in relation to the previous regulation (CFN Resolution No. 380/2005) was the reduction from seven to six areas of activity, excluding the area "Marketing in the area of Food and Nutrition" [35]. This configuration in six major areas seeks to remain aligned with the historical aspects of the 85 years of nutritionist activity in Brazil, portrayed in previous studies [28-29]; it also seeks to incorporate aspects related to advances in scientific and technological knowledge in the field of Nutrition within the global framework [16-27]. It is worth noting that, except for the specificities of terminology, this configuration also maintains similarities with the configurations adopted in other countries, such as those that are part of the "International Confederation of Dietetic Associations" [31]. As described by Shen et al. [31], the International Confederation of Dietetic Associations is an entity created in 1952, bringing together Nutrition and Dietetics associations from countries in Europe, North America, Asia, Africa and Latin America [including Brazil, represented by the *Associação Brasileira de Nutrição* (ASBRAN, Brazilian Nutrition Association)], with the aim of establishing international standards for the training and practice of nutritionists. In other words, the study by Shen et al. [31] seeks to report the experience of implementing, in 2017, the registration system for nutritionists (dietitians, as they were called) in China, comparing it with the standards that regulate the profession in other countries, such as the United States of America, Japan and the United Kingdom.

Throughout the 85-year history of nutritionists in Brazil, particularly in the last two decades, there has been a growing number of professionals and, simultaneously, an expansion of areas and subareas of activity, as reported in previous studies [28,29,32]. According to the CFN statistics [47], as of March 31, 2024, there was a universe of 214,293 nutritionists in Brazil, with the ten largest

concentrations registered in the states of São Paulo (*n*=52,123; 24.3%), Rio de Janeiro (*n*=25,911; 12.1%), Minas Gerais (*n*=18,565; 8.7%), Bahia (*n*=12,779; 6.0%); Rio Grande do Sul (*n*=11,633; 5.4%), Paraná (*n*=11,132; 5.2%), Pernambuco (*n*=9,361; 4.4%), Santa Catarina (*n*=8,562; 4.0%), Ceará (*n*=7,537; 3.5%) and Federal District (*n*=6,318; 2.9%).

How is this total of 214,293 nutritionists distributed across the six major areas of activity? In the absence of information for the year 2024, the data of the research carried out in 2016-2017 were taken as a parameter, based on a random and stratified sample of 1,104 nutritionists working in the different CRNs; an estimated 95% confidence level and an error margin of 3 percentage points were set [46]. Figure 1 shows the results of the CFN survey [46] regarding Brazilian nutritionists rate of distribution by areas of activity. The following frequency set in decreasing order, was observed: Nutrition in Collective Feeding (30.8%), Clinical Nutrition (30.4%), Public Health Nutrition (17.7%), Nutrition in Teaching, Research and Extension (Teaching) (11.4), Nutrition in the Production Chain, in the Food Industry and Trade (2.6%) and Sports Nutrition (2.5%). The survey revealed that the two most traditional areas of activity of the Brazilian nutritionist (Nutrition in Collective Feeding and Clinical Nutrition) concentrated 61.2% of the universe of nutrition professionals. Comparing to the data from previous surveys, it was observed that between 2005 and 2017, there were significant increases in the rate of nutritionists active in the areas of Public Health Nutrition and Nutrition in Education, Research and Extension (Teaching), which can be explained by the relevant increase in social policies in the fields of Nutrition and Health, as well as by the growing expansion in the number of undergraduate courses in Nutrition which were opened during that period [29,32-34].

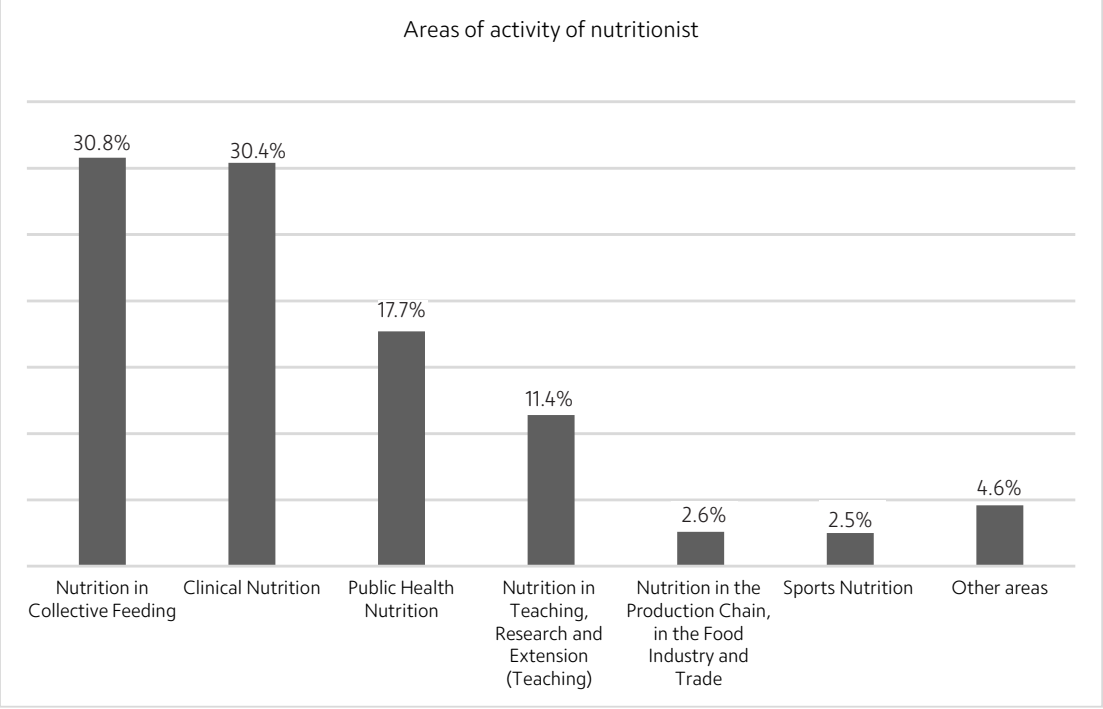

Figure 1 – Rate of Brazilian nutritionists by areas of professional activity, according to data from the *Conselho Federal de Nutrição* (CFN, Federal Nutrition Council), Brazil, 2017.

Source: Prepared from data from CFN [46].

On the other hand, considering the historical trajectory of nutritionists' work in Brazil, at the same time that the number of professionals and their areas of activity increased, there was also an expansion of the specialties recognized by the nutrition regulatory entities [29,32-34]. According to CFN resolution no. 689/2021, 34 specialties in Nutrition are acknowledged for academic and/or professional purposes [38]. Chart 1 reports the list of these Nutrition specialties; they denote the entity's effort to seek alignment and updating, with the advances in the scientific and technological development of Nutrition and the job market [4-34,46,47]. The expansion of specialties in Nutrition set up by the CFN, also seeks alignment with other professional categories in the health area, such as Medicine [48,49] and Nursing [50], professions in which relevant levels of specialization are observed.

In Chart 1 we observe that in the set of Nutrition specialties, at least 13 (38.2%) constitute subareas of *Clinical Nutrition*, historically considered the core area of science and of the profession in the global framework [28,29]. We can also see that the actual naming of each specialty was based on a close resemblance with the Medicine specialization fields [49], a procedure that is justified by the greater proximity that this area of nutritionist practice has historically maintained with the paradigms of the biomedical field [29].

In addition Chart 1 shows that the specialties that constitute subareas of *Public Health Nutrition*, which is the third nutritionists' area of activity in Brazil [28,29], include at least nine (26.5%) of the total categories. We see that the titles of these specialties maintain somehow an identification with the terminologies used in the area of Public Health, a field of scientific knowledge of a multidisciplinary epistemological nature and close to the Human and Social Sciences [29,30].

The specialties reported in Chart 1 that represent specific subareas of *Nutrition in Collective Feeding*, considered the second area of activity of nutritionists in Brazil [28,29] that includes a total of at least five modalities. It is believed that the number of specialties in *Nutrition in Collective Feeding* was underestimated in the CFN Resolution No. 689 [38], perhaps because certain subareas did not meet the established criteria. In fact, according to the 2016 CFN survey results [46], the area of Nutrition in Collective Feeding was the area with the highest rate of operational nutritionists, and was also the one that contemplated a wide distribution of subareas and segments of activity, according to CFN Resolution No. 600/2018 [35], such as nutritionists' management activities in the *Programa de Alimentação do Trabalhador* (PAT, Worker Food Program) and in the *Unidades de Alimentação e Nutrição* (UAN, Food and Nutrition Units) of industries and hotels, among other segments.

Among the specialties in Nutrition recognized by the CFN [38] (Chart 1), some stand out for constituting the core of knowledge, skills and technical-scientific competence of a transversal nature, that is, they should cross all areas, such as Food and Nutrition Education. Others, due to their epidemiological and social relevance, complexity and accumulation of specific knowledge, have gained the status of professional area of activity in recent years, such as *Precision Nutrition, Nutrition and Functional Foods, Nutrition and Phytotherapy, Nutrition in Aesthetics, Nutrition in Marketing, Nutrition in Eating Disorders*, and *Nutrition in Vegetarianism*. It is also worth noting that the area of *Nutrition in Education, Research and Extension* (Teaching) is not recognized as a specialty in Nutrition. In this sense, it is worth highlighting that taking as parameters of comparison the regulations of Medicine [49] and Nursing [50], very different behaviors are observed in relation to the issue of Teaching (Teaching, Research and Extension) between these professions. In the Resolution of the Federal Council of Medicine, Teaching is not recognized either as an area of activity, nor as a specialty [49] whereas in the Resolution of the Federal Council of Nursing, Teaching is recognized both as an area of activity and as a specialty [50]. In Nursing, eight specialties are recognized in the area of Teaching (or Teaching and Research, according to the terminology used by the specific standard of this profession), namely: (i) Bioethics; (ii) Education in Nursing (Higher

Education Methodology; Scientific Research Methodology; Higher Education Teaching; Nursing Assistance Projects; Teaching for Professional Education; and Teaching in Health Sciences); (iii) Permanent and Continuing Education in Health; (iv) Nursing; (v) Nursing in Clinical Research; (vi) Ethics; (vii) Epistemological and Philosophical Bases of Nursing; and viii) The History of Nursing [50]. Therefore, the example of Nursing could be taken as a basis for consideration by the CFN for future updates of its regulations.

Precision Nutrition as nutritionists' specialty in Brazil

The emergence of *Precision Nutrition* or *Personalized Nutrition* as a field of practice for nutritionists is a relatively recent phenomenon, both in Brazil and elsewhere in the world. Evidence on

Chart 1 – List of the 34 specialties of nutritionists' academic and/or professional activity, as established by the Conselho Federal de Nutrição (CFN, Federal Council of Nutrition), categorized by areas of activity. Brazil, 2024.

Areas of activity		Nutrition Specialties
Clinical Nutrition	1.	Clinical Nutrition;
	2.	Clinical Nutrition in Cardiology;
	3.	Clinical Nutrition in Palliative Care;
	4.	Clinical Nutrition in Endocrinology and Metabolism;
	5.	Clinical Nutrition in Gastroenterology;
	6.	Clinical Nutrition in Gerontology;
	7.	Clinical Nutrition in Nephrology;
	8.	Clinical Nutrition in Oncology;
	9.	Clinical Nutrition in Intensive Care;
	10.	Precision Nutrition;
	11.	Nutrition in Eating Disorders;
	12.	Maternal and Child Nutrition;[a]
	13.	Parenteral and Enteral Nutrition Therapy.
Nutrition in Collective Feeding	14.	Nutrition in Collective Feeding;
	15.	Nutrition in Collective Hospital Food;
	16.	Nutrition in the Production of Commercial Meals;
	17.	Nutrition in School Food;[b]
	18.	Food Quality and Safety.
Public Health Nutrition	19.	Public Health Nutrition;
	20.	Management of Public Policies and Programs in Food and Nutrition;
	21.	Nutrition in Primary Care and Family and Community Health;
	22.	Nutrition in Indigenous Health;
	23.	Nutrition in the Health of Traditional Peoples and Communities;
	24.	Nutrition in Women's Health;
	25.	Nutrition in Mental Health;
	26	Food and Nutrition Education;[c]
	27.	Food and Nutrition Security.
Nutrition in Sports and Physical Exercise	28.	Nutrition in Sports and Physical Exercise.
Nutrition in the Production Chain, in the Industry and in the Food Trade	29.	Nutrition in the Production Chain, in the Food Industry and Trade.
Specialties not included in the major areas of activity	30.	Nutrition and Functional Foods;
	31.	Nutrition and Phytotherapy;
	32.	Nutrition in Vegetarianism;[d]
	33.	Nutrition in Aesthetics;
	34.	Nutrition in Marketing.

Note: [a] Specialty whose terminology could be equivalent to "Nutrition in Pediatrics" and/or "Nutrition in Gynecology". It could also be linked to the area of Public Health Nutrition. [b] Specialty that may be common or shared with the area of Public Health Nutrition. [c] Specialty that in the academic training process constitutes a field or core of knowledge in the area of Public Health Nutrition, but that in professional practice should be shared by all areas. [d] Terminology changed by the CFN as of June 2024.

Source: Prepared based on CNF regulations [38].

the dissemination of the concept of *Personalized Nutrition indicates* that the first scientific publications occurred in the first decade of the 21st century [4-6,51-55]. The use of the term *Personalized Nutrition* has its origins associated with the terms *Nutritional Genomics* (or *Nutrigenomics* or *Nutrigenetics*) [4]. According to the literature examined, it was from the sequencing of the human genome and the subsequent advancement of knowledge about the variability of human genetics that the field of *Personalized Nutrition* emerged [6].

Precision Nutrition is based on the principle of the complex and multidimensional interaction of the metabolic heterogeneity of individuals in relation to their needs and responses to food and nutrient intake, which involves biological, psychosocial, and environmental factors and, mainly, variations in genetics, epigenetics, and microbiota. *Precision Nutrition* is based on the premise that considering the analysis of the individuals' genomes, we can distinguish those who respond from those who do not respond to dietary interventions and treatments, thus enabling the development of more precise and effective nutritional therapy and dietary counseling plans [6,52].

According to the literature review Precision Nutrition has been used in different fields based on omics technologies, in the development of functional foods and in clinical practice aimed at nutritional therapy and advice for a wide range of diseases, disorders, and health conditions, such as obesity, diabetes mellitus, dyslipidemia, arterial hypertension, malignancies, metabolic syndrome, eating disorders, etc. [6,52-57]. In the previous section of this article, we pointed out that, according to CFN Resolution No. 689/2021 [38], Precision Nutrition constitutes a specialty characteristic of the Clinical Nutrition area of activity (Chart 1). However, according to the literature review we performed, it was observed that the foundations of Precision Nutrition support other areas of the nutritionists' professional practice. Table 1 presents the results of exploratory searches in the PubMed database about the topic which is being investigated in this article. Table 2 shows that 1,368 articles on the topic were found in the 12 G7 and BRICS countries, with the five highest frequencies observed in the United States of America, Canada, the United Kingdom, Brazil and Italy.

Table 1 – Total number of articles retrieved and publication period for the 12 G7 and BRICS countries investigated, according to a search in the PubMed database, on May 14, 2024, using the refined advanced strategies.

Country	Nutritionists AND Personalized Nutrition AND Country		Nutritionists AND Artificial Intelligence AND Country	
	Total articles retrieved	Publication period	Total articles retrieved	Publication period
United States of America	404	1994-2024	2	2020-2024
Japan	57	1964-2024	Not retrieved	Not retrieved
Germany	37	2000-2024	1	2018
United Kingdom	196	1978-2024	2	2016-2024
France	56	1952-2024	None	None
Italy	123	1997-2024	1	2024
Canada	223	1946-2024	1	2023
Brazil	161	1953-2024	1	2014
Russia	3	1999-2024	None	None
India	37	1988-2024	None	None
China	46	1996-2024	2	2011-2024
South Africa	25	1964-2024	2	2023-2024
Total	1.368	1946-2024	12	2011-2024

Furthermore, in connection with the dissemination of the concept of Precision Nutrition, the International Society of Nutrigenetics/Nutrigenomics already in 2016 warned that this emerging scientific field should be included in the professional health practice, grounded on the use of a

solid knowledge derived from *Nutrigenetics* and *Nutrigenomics* [6]. In Brazil, in the field of *Human Nutrition*, the use of the term *Precision Nutrition* is still rare or nonexistent in the papers included in the SciELO database. Only three publications using this term were found [58-60]. In turn, using the term *Nutrigenomics*, five publications were located [29,61-64]. Therefore, it was deduced that the emergence of the concept of *Nutrigenomics* in Brazil, taking the SciELO database as a reference, occurred initially in 2008, with the publication of a pioneering study by Fialho et al. [61] and then the study by Vasconcelos [29], published in 2010, both essays of a theoretical, conceptual and historical nature.

On the other hand, in the PubMed® database, different publications by Brazilian researchers were retrieved, using the indexers *Precision Nutrition* or *Personalized Nutrition* or *Nutrigenomics*. Such articles in international journals appear to have emerged as of 2017. In Chart 2, we present the list of the 14 articles selected in the search carried out on *Precision Nutrition* and *nutritionist*, on May 5, 2023, according to author/year, country/location, objective and potential areas of application. In this section of our article, out of the 14 studies selected, nine were authored by Brazilian researchers, six of which are bibliographic review articles and three are empirical investigations (primary data) [62-70]. Of the five articles by international researchers selected to compose this section of our article, four are review articles and only one is of an empirical nature [53-57]. The nine articles authored by Brazilian researchers, linked to public institutions in different states (São Paulo, Mato Grosso do Sul, Minas Gerais, Brasília, Paraná, Rio de Janeiro and Rio Grande do Norte), address themes pertinent to the use of procedures related to Precision Nutrition, such as: bariatric surgery; fatty acids in infant formulas versus human milk; food consumption and metabolic risks; methods for determining Vitamin D; ovarian cancer; obesity; microbiota; antioxidants; ethics and bioethics.

Chart 2 – List of articles published in the last five years, selected in the search carried out on Precision Nutrition and nutritionist, on May 5, 2023, according to author/year, country/location, objective and potential areas of application.

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Author / year	Country/Local	Objective	Areas of activity (Application)
Renner et al. [53] / 2023	Germany, Konstanz	Theoretical-conceptual essay. Proposes to extend current Personalized Nutrition approaches by creating adaptive personalized nutrition advice systems (APNASs) that are tailored to the type and timing of personalized advice to individual needs, capabilities, and receptivity in real-life food environments.	Nutrition in Teaching, Research and Extension; Clinical Nutrition, among others.
Kirk et al. [54] / 2021	Netherlands, Wageningen	Systematic literature review to provide an overview of where and how machine learning has been used in Precision Nutrition from different aspects, what these machine learning models use as input features, what is the availability status of the data used in the literature, and how the models are evaluated.	Nutrition in Teaching, Research and Extension; Clinical Nutrition, among others.
Antwi [55] / 2023	USA, Prairie View	The purpose of this narrative review is to synthesize the current research and examine the state of the science regarding the effect of Precision Nutrition on improving risk factors for obesity and type 2 diabetes.	Clinical Nutrition; Nutrition in Teaching, Research and Extension, among others.
Cunha & Duarte [56] / 2022	Portugal, Viseu	This paper presents the concepts, requirements, and architecture of a solution that supports dietitians in creating and reviewing meal plans and users in following them. It does so by minimizing human-computer interaction by integrating dietitian and user systems and introducing off-the-shelf IoT devices into the system, such as temperature sensors, smartwatches, smartphones, and smart bottles.	Clinical Nutrition; Nutrition in Teaching, Research and Extension, among others.
Martínez-Garay et al. [57] / 2023	Spain, Madrid	This review aims to provide oncology researchers and clinicians with a comprehensive overview of the contemporary landscape of nutritional interventions and precision nutrition as cancer therapeutics, and to provide insight into the steps required to establish nutritional interventions as a standard of care.	Clinical Nutrition; Nutrition in Teaching, Research and Extension, among others.
Fischer et al. [62] /2020	Brazil, Curitiba (PR)	The study consisted of a quantitative map of the nutrigenomic outlook in the scientific and popular context of Brazil, and an exploratory bibliographic analysis with the objective of identifying moral agents and patients, as well as vulnerabilities to promote reflection in light of Bioethics.	Nutrition in Teaching, Research and Extension; Clinical Nutrition, among others.

Chart 2 – List of articles published in the last five years, selected in the search carried out on Precision Nutrition and nutritionist, on May 5, 2023, according to author/year, country/location, objective and potential areas of application.

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Author / year	Country/Local	Objective	Areas of activity (Application)
Teixeira & Melo [63] / 2021	Brazil, Juiz de Fora (MG)	Review and critical analysis of works researched electronically through the Pubmed database. To evaluate the relationship between intestinal microbiota and bioactive compounds in food in the modulation of genes related to obesity, highlighting the main epigenetic mechanisms.	Clinical Nutrition; Nutrition in Teaching, Research and Extension, among others.
Almeida [64] / 2023	Brazil, Rio de Janeiro (RJ)	This review aims to explore key aspects of personalized medicine for age-related diseases using pharmacogenomic and nutrigenomic data, addressing the bioethical concerns involved in the use of these data.	Clinical Nutrition; Nutrition in Teaching, Research and Extension, among others.
Nicoletti et al. [65] /2017	Brazil, Ribeirão Preto (SP)	This review provides an overview of the literature on new findings relating nutritional genomics and bariatric surgery. It also describes the importance of nutritional genomics concepts in personalized bariatric care. It includes a discussion of the potential role that bariatric surgery plays in altering the three pillars of nutritional genomics: nutrigenetics, nutrigenomics, and epigenetics.	Clinical Nutrition; Nutrition in Teaching, Research and Extension, among others.
Lopes et al. [66] / 2028	Brazil, Campo Grande (MS)	Nuclear magnetic resonance (NMR)-based metabolomics was used to compare the lipid profiles of 12 commercial infant formula samples and 10 breast milk samples. In addition, vegetable, fish and microalgae oil as raw materials in infant formulas were also investigated to understand the lipid profile of infant formulas.	Nutrition in the Production Chain, in the Food Industry and Commerce. Nutrition in Teaching, Research and Extension, among others.
Duarte et al. [67] / 2020	Brazil, Brasília (DF)	A double-blind, placebo-controlled study aimed to investigate the effect of an acute intake of Passiflora setacea juice on inflammation, metabolic parameters and gene expression in circulating immune cells in humans.	Clinical Nutrition; Nutrition in Teaching, Research and Extension; among others.
Martins et al. [68] / 2022	Brazil, São Carlos (SP)	The study reports the development of flexible, label-free immunosensor chips made with tree-like gold dendrites (AuDdrites) electrochemically formed by selective desorption of l-cysteine (L-cys) onto (111) gold planes. They can be extended for use as wearable sensors with their mechanical flexibility and possible customization for monitoring the metabololite 25-hydroxyvitamin D3.	Clinical Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in the Production Chain, in the Industry and in the Food Trade; among others.
Tecchio Borsoi et al. [69] / 2023	Brazil, Campinas (SP)	Updated review (mini review) involving the current applications of high-throughput technologies in ovarian cancer, the role of dietary polyphenols and their mechanistic effects in ovarian cancer, and the currentstatus and challenges of precision nutrition.	Clinical Nutrition; Nutrition in Teaching, Research and Extension; among others.
Duarte et al. [70] / 2024	Brazil, Natal (RN)	Narrative review of studies published in PubMed Science Direct investigates whether nutrigenetic testing can help prevent or treat obesity.	Clinical Nutrition; Nutrition in Public Health. Nutrition in Teaching, Research and Extension; among others.

In summary, in the last two decades, *Precision Nutrition* has emerged, both in Brazil and elsewhere in the world, as one of the new *scientific paradigms* [1] aimed at elucidating the complex and multi-causal nutritional issues. Above all, this new field of action for nutritionists circulates as a new nutritional paradigm, aimed at developing more precise and effective nutritional therapy and dietary counseling plans. The limitations and potential of this specialty in Nutrition have been highlighted in the overseas scientific literature [6,52-57] and in Brazil literature [60,62-64,71]. In fact, considering the theory of construction and deconstruction of paradigms [1], the theory of constitution and consolidation of scientific fields [2] and the theory of fabrication of scientific truths [72], the brief and non-exhaustive literature review on *Precision Nutrition* in Brazil shows that this is a very fertile ground, although dry and swampy, for the work of nutritionists. The almost total invisibility of reports on the performance of nutritionists in the *Precision Nutrition* specialty leads to the suggestion that potential experiences carried out in this emerging and promising field of professional activity should be submitted for publication in international and national circulation journals indexed in scientific databases.

The use of digital technologies by nutritionists: from human nutrition to "neonutrition" or "nutrition of things"

As already mentioned in the previous sections of this article, in the global context including Brazil, there has been a growing advance in the use of technological innovations, including the involvement of AI in the different areas of nutritionists' practice [16-27]. In fact, in recent decades, there has been a potential "deconstruction" of *old paradigms* (*traditional paradigms*) [1] and an incipient process of construction of new paradigms that guide the procedures for diagnosing and intervening in nutritional problems. This construction process of new paradigms seems to be focused exclusively on the adoption of the foundations of technological advances. Epistemological, philosophical, holistic or critical arguments from researchers for adherence to new paradigms of science and professional practice are rarely observed [1-3,72]. In Brazil, Nutrition in its dimensions as a *scientific field* (Science) and *professional field* (Profession) [2,72], throughout its 85-year historical trajectory, has accompanied the economic, social, political and cultural transformations endeavored by Brazilian society [28-30,32-34]. In this trajectory, the diagnostic and nutritional intervention procedures that for decades were characterized by the use of analog technologies have been increasingly replaced by new digital technologies, including AI. In this connection, we seek to explain the neologism and analogy of the subtitle of this section: From Human Nutrition to "Neonutrition" or "Nutrition of things".

The concept of AI has been associated to the use of computers that perform cognitive procedures, generally attributed to the human mind, particularly associated with learning and problem-solving, involving a broad and complex set of data or information. Therefore, the definition of AI, according to the literature we assessed, presupposes the simultaneous use of different digital technologies, such as: (a) Machine Learning - ML; (b) Deep Learning - DL; (c) Data Mining - DM; and (d) Neural Networks - NT [73-75].

In turn, in the evolution of digital technologies, around 1999, as reported by Lacerda & Lima-Marques [75], the concept of Internet of Things (IoT) was created and disseminated, attributed to Kevin Ashton from Great Britain. This explains the analogy expressed in the subtitle of the section – "Nutrition of things". Generally speaking, the term IoT refers to a network of interconnected physical objects, integrated by means of software, sensors and technologies, which exchange data with each other. Physical objects (or things) of everyday use that are transformed into an infinity of digital devices or technologies, such as watches, cell phones, computers, toys, refrigerators, televisions, houses, cars, among others [75].

According to the narrative review carried out by Miyazawa et al. [8], the application of the AI concept in the field of Nutrition was consolidated in the late 2010s. Relevant literature review studies have sought to map the history of AI in the field of Nutrition, seeking to identify the different fields of application, as well as to review their potentialities and limitations [8-11]. With the purpose of illustration, two examples of these reviews are summarized. The study by Limketkai et al. [10], which consisted of a literature review describing the use of digital devices, such as: (a) mobile applications with features for managing body weight loss; fasting timer; food tracker by barcodes; calorie, nutrient and energy expenditure monitor, among others; (b) wearable devices (accessories and clothing), such as "Smartwatches" for nutritional assessment and devices for dietary assessment with the ability to monitor food consumption, symptoms, bowel movements, exercise, stress and sleep, used to support the determination of patterns and choice of foods for the composition of the diet; and (c) digital devices that are now used by nutritional support teams in virtual, remote or non-face-to-face consultations or care, carried out through videos, cell phones, computers and telephones – the so-called *telehealth* or, in this case, *telenutrition*, a procedure standardized in Brazil by the CFN [41]. Limketkai et al. [10] concluded that such AI devices have contributed to the

improvement of the quality and safety of nutritional care. On the other hand, these authors attest to the early stage of development of AI in the field of Clinical Nutrition, pointing to a promising future in this field. Indeed AI has transformed the use of digital technologies into reality, which, a few years ago, consisted of science fiction devices. In fact, according to the exploratory search results presented in Table 2, a total of 12 studies was found for the *nutritionists* AND *artificial intelligence* strategy in the 12 G7 and BRICS countries investigated: two studies (*n*=2) in the USA, United Kingdom, China and South Africa respectively; one (*n*=1) in Germany, Italy, Canada and Brazil respectively: in the other countries (Japan, France, Russia and India) no studies were found.

A systematic literature review, published in 2024, was carried out by Theodore Armand et al. [11] with the aim of investigating the current scenario of AI in Nutrition, in order to deeply understand the potential of ML and DL, and highlighting possible challenges and future directions. Out of the total of 1,498 articles dealing with the application of AI in Nutrition, 31 studies were included in the review. These articles were assessed according to the modalities of AI use in five thematic clusters: Smart and personalized nutrition (*n*=10, 32.3%), Predictive modeling for diseases (*n*=8, 25.8%), Dietary assessment (*n*=6, 19.4%), Food recognition and tracking (*n*=4, 12.9%), and Disease diagnosis and monitoring (*n*=3, 9%). The authors also point out that with the rapid advancement of AI, its integration into Nutrition holds significant promise for improving individual nutritional outcomes and optimizing dietary recommendations.

Chart 3 shows a list of 20 articles selected for the construction of this section, according to authorship/year of publication, objectives and keywords. Among these, four are literature review studies [8-11], 12 are empirical articles retrieved in the G7 and BRICS countries' literature [16-27] and four are empirical articles written by Brazilian researchers taken as examples [76-79]. It can be observed that the 12 empirical studies of the G7 and BRICS countries deal with reports of the use of different experiences, involving digital technologies (including AI) in the professional practice of nutritionists, focused on topics such as chronic non-communicable diseases (obesity, diabetes mellitus, cardiovascular diseases), healthy eating, diet quality, food choices, among others. Although such studies adhere more to the areas of *Clinical Nutrition and Nutrition in Teaching, Research* and *Extension*, we consider that such technological innovations constitute a field of instrumental knowledge for all areas of nutritionist activity.

Chart 3 – List of articles selected in the search carried out on nutritionists and digital technologies, including the use of artificial intelligence, on May 5, 2023, according to author/year, country/location, objective and potential areas of application.

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Author / year	Country/Local	Objective	Areas of activity (Application)
Miyazawa et al. [8] / 2022	Japan, Aoba-ku, Sendai	This review aims to summarize these technological advances by systematically describing the following: the use of AI in other fields (e.g., engineering, pharmacy, and medicine); the history of AI in relation to food science and nutrition; the AI technologies currently used in the agricultural and food industries; and some of the important applications of AI in areas such as immunity-boosting foods, dietary assessment, gut microbiome profile analysis, and toxicity prediction of food ingredients.	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.
Côté & Lamarche [9] / 2021	Canada, Quebec	In this review, an overview of the main and latest applications of AI in nutrition research is provided and gaps are identified that ought to be addressed to potentialize this emerging field. AI algorithms may help better understand and predict the complex and non-linear interactions between nutrition-related data and health outcomes, particularly when large amounts of data need to be structured and integrated, such as in metabolomics. AI-based approaches, including image recognition, may also improve dietary assessment by maximizing efficiency and addressing systematic and random errors associated with self-reported measurements of dietary intakes.	Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.

Chart 3 – List of articles selected in the search carried out on nutritionists and digital technologies, including the use of artificial intelligence, on May 5, 2023, according to author/year, country/location, objective and potential areas of application.

Author / year	Country/Local	Objective	Areas of activity (Application)
Limketkai et al. [10] / 2021	USA, Los Angeles	This review discusses the implementation of such technologies for nutrition, ranging from the use of mobile apps and wearable technologies to the development of decision support tools for parenteral nutrition and use of telehealth for remote assessment of nutrition.	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercise, among others.
Theodore Armand et al. [11] / 2024	South Korea Gimhae	This study aims to comprehensively investigate the current outlook of AI in nutrition, providing a deep understanding of the potential of AI, machine learning (ML), and deep learning (DL) in nutrition sciences and highlighting eventual challenges and futuristic directions. A hybrid approach from the systematic literature review (SLR) guidelines and the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines was adopted to systematically analyze the scientific literature from a search of major databases on artificial intelligence in nutrition sciences.	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.
Burgermaster et al. [16] / 2020	USA, Austin, Texas	Examine applicability of the suggestion system approach to providing data-driven decision support in the context of personalizing nutritional recommendations for individuals with T2D (type 2 diabetes) using PGHD (patient-generated health data).	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercise, among others.
Murakami et al. [17] / 2021	Japan, Tokyo	Describe the development process and piloting among dietitians of our web-based PN (personalized nutrition) system for helping improve the quality of overall diet in the general adult population.	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.
Elfert et al. [18] / 2022	Germany, Oldenburg	A digital nutrition diary was developed that is specially adapted to the needs of geriatric patients (>=70 years), enabling them to record their consumption behavior themselves.	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercise, among others.
Chung et al. [19] / 2024	United Kingdom, Guildford	This substudy tested if machine learning could predict need to see a dietitian (NTSD) using 5 or 10 measures.	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.
Schäfer et al. [20] / 2022	France, Palaiseau	To evaluate attitudes and expectations toward digital patient-generated health data and food tracking mobile apps and understand if their choices are associated with age groups.	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.
Gnagnarella et al. [21] / 2022	Italy, Palermo	We designed the first survey to investigate the changes in RDN (Registered Dietitian Nutritionist) o practices related to telenutrition provision after the onset of the pandemic through an online survey in Italy.	Public Health Nutrition; Nutrition in Collective Feeding; Clinical Nutrition; Nutrition in Teaching, Research and Extension, among others.
Davis & MacKay [22] / 2020	Canada, Victoria, British Columbia	To confirm a functional model of an integrated shared decision-making-personal health record system (e-PHR) by young adults with T1D (type 1 diabetes) and care providers.	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.
Rodrigues et al. [23] / 2023	Brazil, Belo Horizonte (MG)	To develop a machine learning-based method to automatically identify and classify food and non-food ad videos.	Public Health Nutrition; Nutrition in Collective Feeding; Clinical Nutrition; Nutrition in Teaching, Research and Extension, among others.
Popova et al. [24] / 2023	Russia, Saint Petersburg	To clarify the effect of using DiaCompanion I on glycaemic levels and pregnancy outcomes in women with Gestational diabetes mellitus (GDM).	Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.
Erande et al. [25] / 2023	India, Kamothe, Navi Mumbai, Maharashtra	A framework for the development of a healthy heart mobile application for CVD risk stratification and risk management among Type 2 diabetes mellitus patients was finalized after consultation with diabetologists, nutritionists, and scientists.	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.
Sun et al. [26] / 2023	China, Beijing	The potential of an AI nutritionist program for patients with type 2 diabetes mellitus (T2DM) was evaluated through a multistep process. Finally, a user-friendly app was developed, integrating the capabilities of language and image recognition models to potentially improve care for patients with T2DM.	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.
Greyvensteyn et al. [27] / 2023	South Africa, Bloemfontein	To investigate the perceptions of registered dietitians (RDs) and general practitioners (GPs) in South Africa regarding nutrigenomics. A self-administered electronic survey using EvaSys Software® was completed by those that agreed to participate.	Clinical Nutrition; Public Health Nutrition; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.

Chart 3 – List of articles selected in the search carried out on nutritionists and digital technologies, including the use of artificial intelligence, on May 5, 2023, according to author/year, country/location, objective and potential areas of application.

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Author / year	Country/Local	Objective	Areas of activity (Application)
Moraes & Pereira [76] / 2010	Brazil, Santa Maria (RS)	Development of an Expert System (SISNUTRI) to assess nutritional risks in children and adolescents, as well as the use of Food Anamnesis techniques, to assist in the learning of students in the Nutrition course.	Clinical Nutrition; Public Health Nutrition; Nutrition in Collective Feeding; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.
Caivano et al. [71] / 2014	Brazil, Santos (SP)	To assess users' perception regarding the usability of the Digital Food Guide (GAD), a smartphone application with guidelines on healthy eating.	Clinical Nutrition, Public Health Nutrition, Nutrition in Collective Feeding, Nutrition in Teaching, Research and Extension, among others.
Moreira et al. [78] / 2017	Brazil, Belo Horizonte (MG)	Present and evaluate a software that uses Artificial Intelligence techniques (CARDNUTRI) to automatically and quickly prepare weekly nutritional menus for School Meals, meeting the daily nutritional needs of students and, simultaneously, minimizing the total cost of the menu.	Public Health Nutrition; Nutrition in Collective Feeding; Nutrition in Teaching, Research and Extension, among others.
Coelho et al. [79] / 2023	Brazil, São Paulo (SP)	Develop a computational tool (NutriPersona) to represent the nutritionist's expertise in preparing personalized menus using the nutrient intake assessment database from the Brazilian Food Composition Table.	Public Health Nutrition; Nutrition in Collective Feeding; Nutrition in Teaching, Research and Extension; Nutrition in Sports and Physical Exercises, among others.

In Brazil, a literature search in the SciELO, PubMed and Google Scholar databases revealed that there are still few papers of Brazilian researchers reporting their experiences in this field. The studies reported demonstrate the impacts that the "*internet of things*" has had on the practice of Brazilian nutritionists. The first records on the application of digital technologies, including AI devices, began to appear in the early 2000s. However, publications in scientific journals only began in 2010. As an example, we selected five of these studies that address the use of these technological innovations by nutritionists. The first is the study published in 2010 by Moraes and Pereira [76], who, using AI procedures, proposed the development of a tool called "SISNUTRI", an expert system to assess nutritional risks in children and adolescents, using anthropometric and dietary anamnesis data with the aim of assisting students in the learning of nutritional assessment in their Nutrition course. The second study by Caivano et al. [77] was issued in 2014; its objective was to evaluate users' perception regarding the usability of the Digital Food Guide (DFG), a smartphone application with guidelines on healthy eating. The third study, published in 2017, is the "CardNutri" tool, a software that uses AI techniques for automated planning of weekly menus for school meals, based on the regulations established by the *Programa Nacional de Alimentação Escolar* (PNAE, National School Feeding Program) [78]. The fourth study, published in 2023, is the methodological study carried out by Rodrigues et al. [23], which, with the use of AI devices, aimed to develop an algorithm model that prioritized accuracy and efficiency in the automated monitoring and classification of advertising videos for healthy and unhealthy foods, shown on Brazilian television (TV) advertisements. Finally, the fifth study, published in 2023, is "*NutriPersona*" [79], a web-based computational tool, using AI, for the automatic development of personalized menus, based on a database of Brazilian food composition, considering the nutritional recommendations and the food preferences of Brazilian healthy adults.

Finally, in the last two decades, simultaneously with the dominant paradigms, centered on technological innovations (*Precision Nutrition, Nutrigenomics*, "*Nutrition of Things*", etc.) [4-10,51,52], other competing paradigms, such as the sustainability paradigms [12-14,80] have gained prominence in the field of Nutrition. Since 2015, with the publication by the United Nations (UN) 2030 Agenda [15], composed of the 17 Sustainable Development Goals (SDGs), different papers have been issued, which,

simultaneously, have sought to reflect and propose goals and perspectives for the future of Nutrition, within its three dimensions: science, social policy and profession [31,81-84]. It is noteworthy that, since the end of the 20th century, the circulation of the nutritional transition paradigm has already been evident, whose central assumptions based on the search for explanations and strategies to resolve the complex and paradoxical nutritional epidemiological outlook, characterized by the simultaneous coexistence of nutritional diseases associated with situations of poverty and hunger of people (such as protein-calorie malnutrition, iron deficiency anemia, endemic goiter and hypovitaminosis) and nutritional diseases associated with modernity and the excess and/or imbalance in the consumption and bioavailability/utilization of calories and nutrients (such as obesity, type 2 diabetes mellitus, dyslipidemia, systemic arterial hypertension, certain types of cancer and eating disorders) [29,83]. In 2019, with the publication of the Lancet Commission on Health and Climate Change report, the paradigm of the *global syndemic of obesity, malnutrition and climate change* was added [85]. With the advent of the COVID-19 pandemic and its social, economic and nutritional impacts, especially in relation to the global expansion of poverty and hunger rates, new challenges and perspectives began to circulate in the field of Nutrition [86,87]. The UN Sustainable Development Report 2023 [86] warns about the weak and insufficient performance of all the SDGs established in the 2030 Agenda [15], particularly those related to the eradication of poverty and hunger and the fight against climate change, which have worsened throughout the COVID-19 pandemic. The report by the Food and Agriculture Organization (FAO), entitled *The State of Food Security and Nutrition in the World 2023* [87] points out that if efforts are not redoubled and better targeted, the SDG of ending hunger, food insecurity and malnutrition in all its forms by 2030 [15] will remain out of reach. This FAO report states that in 2022, between 690 and 783 million people worldwide faced hunger, which corresponded to 122 million more people than before the COVID-19 pandemic [87]. In contrast to this scenario, in its subtitle, the FAO report for 2021, quoting data from 2020, presented a very hopeful message for future global actions, namely *transforming food systems to ensure food security, better nutrition and healthy diets for all* [88]. This message brings in its statement concepts, premises and assumptions of the paradigm of sustainability, sovereignty and food security [12-14,80], a competing paradigm, perhaps, the paradigm of a new Nutrition (NeoNutrition), EcoNutrition.

CONCLUSION

Regarding the nutritionists' areas of activity and specialties in Brazil, we concluded that: (a) By recognizing 34 specialties in Nutrition, traditional and new fields of activity for Brazilian nutritionists, the CFN seems to seek to establish a direct and updated dialogue with the scientific and technological advances of Nutrition Science, within its global context; (b) The expansion of the areas of professional activity and specialties in Nutrition is in line with the contextual demands defined by the expansion in the number of professionals, by the job market, as well as by the search for identification with other professions in the health sector; (c) Of the 34 specialties, the vast majority is linked to the three traditional areas of activity of the Brazilian nutritionist: Clinical Nutrition, Nutrition in Collective Feeding and Public Health Nutrition. These three areas of activity, especially Clinical Nutrition and their respective specialties, maintain their close identification with traditional paradigms of the biomedical field, incorporating the new dominant paradigms, arising from scientific and technological advances (*Precision Nutrition, Nutrigenomics and Nutrition of Things*); (d) However, in the new specialties acknowledged by the CFN, a percentage of around 25% is potentially linked to the competing paradigms, traditionally identified with the field of Human and Social Sciences (*Nutrition in Indigenous Health, Nutrition in the Health of Traditional Peoples and Communities, Nutrition in Vegetarianism, Food and Nutritional Security*, among others).

Regarding the literature review on Precision Nutrition considered as a specialty of nutrition in Brazil, it is concluded that: (a) The analysis of the 14 selected articles shows that, both in the global context and in Brazil, Precision Nutrition emerges as one of the new scientific paradigms aimed at elucidating the complex and multicausal nutritional issues, being applied in different fields that use omics technologies, in the development of functional foods and in clinical practice aimed at nutritional therapy and counseling to control a wide range of diseases, disorders and health conditions, such as obesity, diabetes mellitus, dyslipidemia, arterial hypertension, malignancies, metabolic syndrome, eating disorders, etc.; and (b) Although Precision Nutrition is identified as one of the specialties of the *Clinical Nutrition* area of activity, its epistemological and methodological principles and procedures apply to other areas of the nutritionists' professional activity.

Regarding the literature review on the use of digital technologies by nutritionists, including AI devices, it was concluded that: (a) The analysis of the 20 studies included, originating from the G7 and BRICS countries, as well as those produced by Brazilian researchers, indicated that these are reports of the use of different experiences, involving digital technologies (including AI) in the professional practice of nutritionists, focused on topics such as chronic non-communicable diseases (obesity, diabetes mellitus, cardiovascular diseases), healthy eating, diet quality, food choices, among others; (b) Although such studies were identified as having greater adherence to the areas of Clinical Nutrition and Nutrition in Teaching, Research and Extension, it is considered that such technological innovations constitute a field of instrumental knowledge for all areas of the nutritionists' practice.

Finally, the literature review carried out reveals that, in Brazil, there is still a scarcity of studies on the work of nutritionists in the Precision Nutrition specialty and, above all, studies on the application of digital technologies, including AI devices. Therefore, it indicates that, although promising, these are fields of knowledge and professional activity that are still in their infancy.

In short, our expectation is that this growing number of Brazilian nutritionists, who are active across the 34 traditional and new fields of activity, whether or not they share the same paradigms, have as a principle of their practices the construction of a Brazilian society, where the relationships between man-nature-food are focused on ensuring the human right to adequate and healthy food for everyone, as well as the ecological sustainability of our planet.

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