


Educational training of nutritionists in Public Health Nutrition: A systematic review

Formação do nutricionista em Saúde Pública: uma revisão sistemática

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ABSTRACT

The present systematic review aimed to synthesize the findings of studies in the literature on the educational training of nutritionists in Public Health. The study was conducted by searching international databases (PubMed, Science Direct, Lilacs, PsycINFO, Scopus, and Web of Science), as well as in the gray literature. The steps of systematic search followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis. Eligibility criteria included studies on the Public Health training in Nutrition Undergraduate courses, whose subjects were students, educators, and professionals who practice in the field of Nutrition. A total of 633 articles were identified, of which, 66 were eligible for reading and analysis of the full text and 12 were included in the systematic review. Of these, five of these 12 articles used quantitative methods, 3 used mixed methods, and 4 used exclusively qualitative methods. There was high heterogeneity among the

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studies, such as different samples, subjects, and evaluation methods. The studies included were carried out from 2008 to 2017 in 28 different countries, including Brazil, Canada, Vietnam, and some European countries. In most of these articles, Public Health was one of the main areas in the formal education of nutritionists, with predominant traditional teaching approach, with a biological focus and a fragmented curricular structure. The included studies were evaluated with low risk of bias. In spite of the limitations identified in the professional training of nutritionists, there was a clear emphasis on the importance of the relationship between theory and practice, teaching-research-extension approaches, and practical activities or internships in Public Health, which can promote the development of skills and competencies that can exert an impact on their professional performance.

Keywords: Education higher. Nutrition, public health. Nutritionists. Professional training.

RESUMO

A presente revisão sistemática objetivou sintetizar os achados disponíveis na literatura sobre a formação profissional do nutricionista em Saúde Pública. A pesquisa foi realizada em bases de dados internacionais (PubMed, Science Direct, Lilacs, PsycINFO, Scopus e Web of Science), bem como uma busca adicional na literatura cinzenta. As etapas da pesquisa seguiram as recomendações do Preferred Reporting Items for Systematic Reviews and Meta-Analysis. Como critérios de elegibilidade incluiu-se os estudos sobre a formação em Saúde Pública nos cursos de Graduação em Nutrição, cujos sujeitos respondentes eram estudantes, docentes e profissionais do campo da Nutrição. Foram identificados inicialmente 633 artigos, dos quais 66 foram elegíveis para leitura completa e 12 incluídos na revisão sistemática. Destes, cinco utilizaram a abordagem quantitativa, três se serviram da metodologia mista, e quatro são estudos qualitativos. A heterogeneidade dos estudos foi alta, com amostras, público-alvo e métodos de avaliação distintos. As pesquisas incluídas foram realizadas em 28 países, entre eles Brasil, Canadá, Vietnã e países da Europa, nos anos de 2008 a 2017. Na maioria dos estudos, a Saúde Pública está entre as principais áreas na formação profissional do nutricionista, num processo de ensino que se mostrou tradicional, biologicista e com estrutura curricular fragmentada. A qualidade dos estudos indicou baixo risco de vieses. Houve um destaque para a importância da articulação teoria-prática, ensino-pesquisa-extensão e atividades práticas-estágios na formação em Saúde Pública, o que favorece o desenvolvimento de competências e habilidades que podem se refletir na atuação profissional.

Palavras-chave: Educação superior. Nutrição em saúde pública. Nutricionista. Capacitação profissional.

INTRODUCTION

Public Health (PH) is a set of measures that are proposed, organized, and implemented in the public and private spheres aiming to prevent diseases, promote health, and improve the quality of life of the population. Although this definition has been proposed by the World Health Organization (WHO) [1], there are differences in the conception of Public Health among countries. For example, the concept of Collective Health is used in Brazil, a concept that encompasses the diversity of a field aimed at going beyond the narrow approach of a health care system model based on the dichotomy between public and individual health care and on Biosciences. It is rooted in the

social determination of the health-disease-care process and the need to analyze health practices integrated with other social practices [2,3].

Thus, it can be said that the organization of the health care system has undergone numerous structural changes over the years. The epidemiological scenario, along with its socioeconomic, cultural, environmental and political factors, has demanded closer attention from health professionals, including nutritionists, to their role in using strategies for health promotion, health care provision, and handling food and nutritional problems [4,5].

Therefore, in terms of Public Health, in order to meet the *demands of contemporary* health care practice, the educational training of

nutritionists must consider the practice aspects and the challenges of professional performance, taking into account the transformations in the labor market, the social determinants of health, the epidemiological and nutritional transition, the complexity of Chronic Non-Communicable Diseases (CNCD), and Food and Nutrition Security (FNS) dimensions [6-9].

Given the critical need to change the hegemonic perspective of health care, which is based on the biomedical conception and the need to promote reflection on health care, understanding the potential and limitations of professional training processes seems to be fundamental in order to effectively meet the demands of society and contribute to an improved and influential professional performance [10].

In this perspective, due to the growth and aging of population, the need for new health service arrangements, and the search for healthier living conditions, there has been a significant increase in the number of Nutrition courses in Higher Education Institutions, and consequently in the number of professionals, in several countries [9,11-14].

Therefore, some studies have proposed a consensus on the skills and competencies necessary for a good professional performance of nutritionists in Public Health that can contribute to a more adequate and thorough training for professional practice [6,9,15]. Thus, it is important

to evaluate the “educational training of nutritionists in public health” [16,17]. The objective of this systematic review was to synthesize the findings of studies in the literature on the educational training of nutritionists in Public Health.

METHODS

A systematic review was conducted according to the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) [18]. The review protocol is listed in the International Prospective Register of Systematic Reviews (PROSPERO) (CRD 42016050010).

The systematic review question was defined using the Participants, Exposure, Comparison or control, Outcome measures, Studies included (PECOS) system terminology (Chart 1): How has the educational training of nutritionists in public health been provided?

Information sources

A systematic literature search was conducted in the following databases: PubMed, Science Direct, Lilacs, PsycINFO, Scopus, and Web of Science. Additional search was conducted in the gray literature (Google Scholar, OpenGrey, and ProQuest). The reference lists and citations in the selected articles were also analyzed.

Chart 1. Description of the PECOS criteria used to define the research question.

Criteria	Description
Participants (P)	Nutritionist, Dietician and Nutrition Technician.
Exposure (E)	Staff Development, Health Human Resource Training, Higher Education and Professional Training in Nutrition Public Health.
Comparison or control (C)	-
Outcome measures (O)	Health Promotion, Food and Nutrition Security, Food Advocacy, Food and Nutrition Education, Nutrition Education.
Types of Studies included (S)	Observational studies with quantitative and qualitative approach.

Note: PECOS: Participants, Exposure, Comparison or control, Outcome measures, Studies included.

Search strategy

The search strategy was developed in April 2016 and updated in June 2017 using descriptors drawn from the Health Science Descriptors

(DeCS) and Medical Subject Headings (MeSH) lists. The descriptor combinations were adapted for each database (Chart 2). All references were managed using the EndNote Web software, and duplicates were removed.

Chart 2. Databases and Individualized Truncations of Words.

Database	Descriptors used
PudMed	(Nutritionist OR Dietician OR Nutritionists OR Dieticians OR "Nutrition Technician") AND ("Staff Development" OR "Health Human Resource Training" OR "Higher Education" OR "Human Resources Capacity Building Centers" OR "Human Resources Development Centers" OR "Capacity Building" OR "Professional Training") AND ("Nutrition Public Health" OR "Public Health") AND ("Health Promotion" OR "Food and Nutrition Security" OR "Food Advocacy" OR "Food and Nutrition Education" OR "Nutrition Education")
Lilacs	((((("NUTRICIONISTA") or "NUTRICIONISTAS") or "DIETISTAS") or "DIETISTA") or "TECNICO EN NUTRICION") or "TECNICO EM NUTRICAÇÃO" [Palavras] and ((((((("DESARROLLO DE PERSONAL") or "DESENVOLVIMENTO DE PESSOAL") or "CAPACITACION DE RECURSOS HUMANOS EN SALUD") or "CAPACITACAO DE RECURSOS HUMANOS EM SAUDE") or "EDUCACION SUPERIOR") or "EDUCACAO SUPERIOR") or "CAPACITACION PROFESIONAL") or "CAPACITACAO PROFISSIONAL") or "FORMACAO PROFESIONAL" [Palavras] and ((("NUTRICION EN SALUD PUBLICA") or "NUTRICAÇÃO EM SAUDE PUBLICA") or "SALUD PUBLICA") or "SAUDE PUBLICA" [Palavras]
Scopus	(ALL (nutritionist OR nutritionists OR dietician OR dieticians OR "Nutrition Technician")) AND (ALL ("Staff Development" OR "health human resources training" OR "Higher Education" OR "human resources capacity building centress" OR "Human Resources Development Centers" OR "Capacity Building" OR "Professional Training")) AND (ALL ("Nutrition Public Health" OR "Public Health")) AND (ALL ("Health Promotion" OR "Food and Nutrition Security" OR "Food Advocacy" OR "Food and Nutrition Education" OR "Nutrition Education")))
Web of Science	TS= (Nutritionist* OR Dietician* OR "Nutrition Technician") AND TS= ("Staff Development" OR "Health Human Resource Training" OR "Higher Education" OR "Human Resources Capacity Building Centers" OR "Human Resources Development Centers" OR "Capacity Building" OR "Professional Training") AND TS= ("Nutrition Public Health" OR "Public Health" OR "Nutrition") AND TS= ("Health Promotion" OR "Food and Nutrition Security" OR "Food Advocacy" OR "Food and Nutrition Education" OR "Nutrition Education")
PsycINFO	Any Field : Nutritionist OR Nutritionists OR Dietician OR Dieticians OR "Nutrition Technician" AND Any Field : " Staff Development" OR " Health Human Resource Training" OR " Higher Education" OR " Human Resources Capacity Building Centers" OR " Human Resources Development Centers" OR " Capacity Building" OR " Professional Training" AND Any Field : " Nutrition Public Health" OR " Public Health" OR " Nutrition" AND Any Field : " Health Promotion" OR " Food and Nutrition Security" OR " Food Advocacy" OR " Food and Nutrition Education" OR " Nutrition Education"
Science Direct	All (Nutritionist* OR Dietician* OR "Nutrition Technician") AND All ("Staff Development" OR "Health Human Resource Training" OR "Higher Education" OR "Human Resources Capacity Building Centers" OR "Human Resources Development Centers" OR "Capacity Building" OR "Professional Training") AND All ("Nutrition Public Health" OR "Public Health") AND All ("Health Promotion" OR "Food and Nutrition Security" OR "Food Advocacy" OR "Food and Nutrition Education" OR "Nutrition Education")
Open Grey	Nutritionist* OR Dietician* AND "Staff Development" OR "Higher Education" AND "Nutrition Public Health" AND "Health Promotion" OR "Food and Nutrition Security" OR "Food and Nutrition Education"
Google Scholar	Nutritionists OR "Higher Education" OR " Nutrition Public Health"
ProQuest	Nutritionists OR "Higher Education" OR " Nutrition Public Health"

Eligibility Criteria

Original studies evaluating the educational training of nutritionists in public health in undergraduate courses in "higher education institutions were included". No language or date restrictions were applied. Observational (cross sectional and longitudinal), quantitative, "mixed methods (quantitative and qualitative)" studies were included.

Comments, letters, books, editorials, communications, essays, opinions, reviews, cases, consensuses, report studies, and conference abstracts were excluded. Studies addressing other nutrition-related fields, as well as other health professionals, were also excluded. Similarly, studies on the educational training of nutritionists in public health in graduate courses and programs and their practice in the labor market were excluded.

Article selection

Articles were selected in two stages. In stage I, two independent reviewers read the titles and abstracts of all articles identified in the electronic databases. In stage II, the same reviewers evaluated the full text of the selected articles and checked whether the inclusion and exclusion criteria were met to confirm eligibility. The reference list of the selected studies was critically evaluated by both reviewers. Any disagreements between the two reviewers in the first or second stages were resolved through discussion until mutual agreement was reached. When there was no consensus between the two reviewers, a third reviewer was consulted for a "final decision".

Data collection and items analyzed

Two reviewers collected the data using a "standardized" "approach" to data "collection", based on the Cochrane Consumers and Communication Review [19]. They gathered the

necessary information from the selected articles and checked the retrieved information. A "third reviewer" was involved to offer input when "consensus" could not be "reached".

The following information was extracted from the eligible articles: author and year of publication, country of origin, target audiences and sample, study design, methods, variables of interest (contents taught, subjects offered, relationship between theory and practice, internship workload, skills and competencies, weaknesses and positive points of the education provided), main results, and conclusions.

Risk of bias in the articles selected

The quality of the studies was evaluated using the critical appraisal tools of the Joanna Briggs Institute (JBI) [20]. The Checklist for Analytical Cross Sectional Studies [21] was used to evaluate the risk of bias in the observational studies and the Critical Appraisal Checklist for Qualitative Research [22] was used to evaluate it in qualitative studies. Qualitative and longitudinal studies were evaluated using adapted JBI [20] appraisal tools. The risk of bias was classified as 'high' if 49% of the answers to the signaling questions were "yes"; 'moderate' for 50%-69% of "yes" answers; and 'low' for 70% or more of "yes" answers. Two independent reviewers assessed the quality of each study included. Disagreements between these reviewers were resolved by the decision of a third reviewer.

RESULTS

A total of 633 articles were initially identified in the six databases. Sixty-six articles met the inclusion criteria and were eligible for reading and analysis of the full text; of these 66, 12 were included in the systematic review, as shown in the flowchart of article selection process (Figure 1).

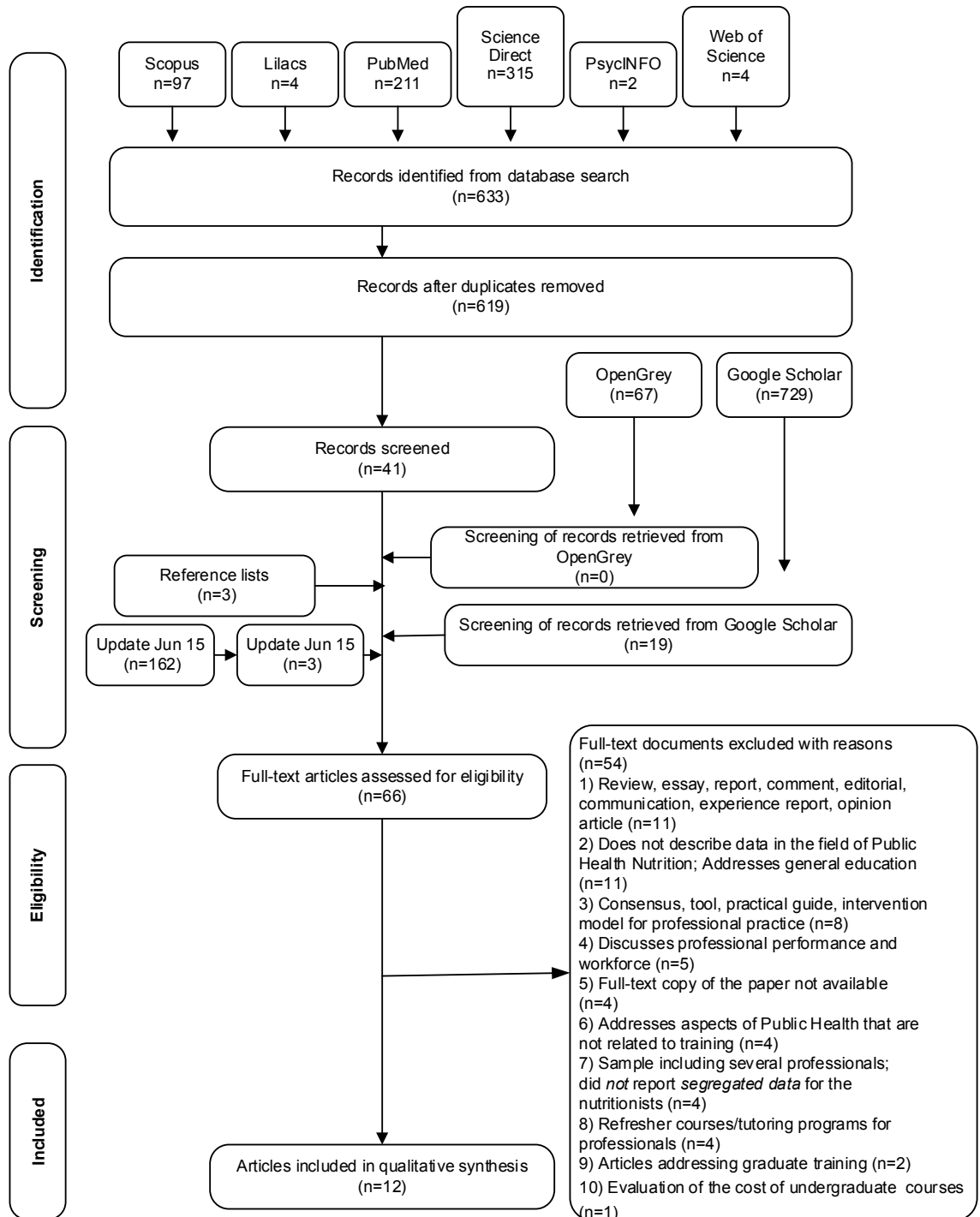


Figure 1. Flow Diagram of Literature Search and Selection Criteria1.

Note: Adapted from PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analysis.

Characteristics of the studies selected

The twelve articles screened (7 Latin American, 1 North American, 1 Asian, 1 Eurasian,

and 2 European articles) cited articles from 28 different countries, published between 2008 and 2017. The most frequent study subjects were students, educators, and nutritionists.

The samples consisted of 12-283 respondents. Cross-sectional and qualitative studies were prevalent, and the documents and methods used to evaluate educational training of nutritionists in public health included: undergraduate course curriculum, syllabus, and pedagogical projects; face-to-face and telephone interviews; written records; focus group; and online questionnaire. The main research questions were: skills and competencies addressed in the educational training of nutritionists, Public Health Nutrition (PHN) in disciplines, and professional practice settings. The summary of the characteristics of the studies is shown in Chart 3.

Quality assessment

Of the 12 articles analyzed, two had a moderate risk of bias (50%-69% of "yes" answers) and 10 had low risk of bias (70% of "yes" answers). "Mixed method" studies revealed a weakness in terms of issues related to the epistemological perspective. The main limitations in the cross-sectional studies were the identification and control of potential confounding variables. Chart 4 shows a detailed description of the quality assessment of the studies included in the systematic review.

Synthesis of results

Public Health is recognized by the students as one of the main areas of interest in the education of nutritionists [11], and it is one of the most frequent fields in their senior year projects [23]. However, undergraduate programs still need to provide high quality and effective teaching in order to meet the social demands [13] and a more comprehensive curriculum that goes beyond the biologist model focus of the undergraduate nutrition courses [11,24,25].

With regard to the public health-related disciplines in nutrition courses, only one Brazilian study [25] reported the presence of 14 different

disciplines. The most common PHN disciplines are: nutritional assessment, nutritional education, community nutrition, epidemiology, health promotion, and primary health care [14,25,26].

According to Pinheiro *et al.* [11], Vieira & Cervato-Mancuso [24], Recine *et al.* [25], there is a certain linear approach in the teaching of Public Health in the education of nutritionists. This indicates the educational training offered focuses on theoretical aspects in the initial years of undergraduate courses, whereas field practice classes are offered at the end of the program. This hinders the integration of the contents taught, fragmenting the learning process due to the insufficient articulation between the different disciplines and areas.

It is worth mentioning that the relationship between theory and practice was evaluated as a decisive factor for the development of skills and competencies in the educational training provided, and the practical experience in "nutrition" care was evaluated as an opportunity to contextualize and deepen the knowledge acquired [11,13,24]. However, practical activities were considered insufficient, and there was a lack of teacher supervision. The student assumes the responsibilities and plays the role of a professional during the curricular internship [11,24,27]. The length, frequency, and workload of internships in PHN are usually low and vary among the countries and higher education institutions [14,23,25,26,28-30].

In Brazil, these practical activities correspond to approximately a quarter of the total number of "allocated hours" for the "disciplines" of public health area, and the internships correspond to an average of 197.3 practical hours [26]. On the other hand, in European countries no information was found on workload and the length of Public Health internship varied from one week in Slovenia to 20 weeks in the Netherlands, with an average of 20 weeks in kindergarten and schools and 7.5 weeks in community health care centers [14].

Chart 3. Summary of the main information extracted from the studies included in the present systematic literature review.

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Author Year Country	Target audience/ sample	Research Method/ Methodology	Method of data collection	Variables of interest	Main results	Conclusion
Pinheiro <i>et al.</i> [11]	206 participants: Students, Brazil-Latin America nutritionists, lecturers, and FCN supervisor	Mixed- methods study (quali- quantitative approaches)	-Structured Questionnaire and Focus Group - Descriptive analysis and Collective Subject Discourse	Teaching, participation in extension projects, and skills and competencies in PHN	According to the students, PHN was the second most common area of interest (35.0%). The theory-practice relationship shows linear approach in the teaching method adopted and the biologicist focus of the courses. The lack of integrality in the educational training of nutritionists indicates curricular structure fragmentation. Fifty-six percent of the students took PHN extension courses during their undergraduate studies. Due to the lack of nutritionists in the teaching- service programs, HEI need to adopt education strategies in order to provide students with practical experience, and students have to play the role of a professional during the curricular internships. Desired skills and competencies: reflection, proactivity, individual and collective attention, program coordination activities, teamwork, FNS assessment, implementation of actions to promote healthy eating, and participation in Nutritional Surveillance.	There is a need to review the traditional and hegemonic pedagogical perspective, which is based on the vertical knowledge transmission. New pedagogical practices should improve dialogue dimensions, interdisciplinary approach, problem- posing and critical analysis in PHN education.
Aksoydan & Mizikaci [13]	283 participants students, (lecturers, and nutritionists) 6 universities from 3 different provinces	Mixed methods study	- Questionnaire - 5-point Likert scale to evaluate the effectiveness of the programs	Importance and effectiveness of the knowledge and skills taught in undergraduate programs	All students, scholars, and nutritionists rated theory, practice, and extracurricular courses as "important" and "very important" to acquire skills and knowledge. There was a difference between the students, nutritionists, and lecturers in terms of the importance of theoretical courses in basic science and community nutrition. Practical teaching was considered as the most important by all participants. As for the	Nutrition and dietetics programs should be systematically evaluated and revised to ensure that the needs and expectations of society and the profession are met.

Chart 3. Summary of the main information extracted from the studies included in the present systematic literature review.

Author Year Country	Target audience/ sample	Research Method/ Methodology	Method of data collection	Variables of interest	Main results	Conclusion
					effectiveness of the programs in providing knowledge and skills, the students gave higher ratings than the lecturers and nutritionists. Lecturers gave Higher ratings to the effectiveness of the programs in providing knowledge and skills to theory and practice of community nutrition (4.30±0.23 and 4.14±0.15, respectively) than the other participants ($p<0.05$). Importance and effectiveness of Community nutrition programs received the lowest ratings in terms of importance and effectiveness in promoting knowledge and skills, when compared to other fields such as, basic science, nutrition science, and nutrition and dietetics.	
Looy <i>et al.</i> [14] Europe ^a	HIE partners of The DIETS network in 2007 (n=37) and 2009 (n=4) 25 European countries	Longitudinal study	- Online questionnaire with qualitative and quantitative questions	Teaching, Disciplines, and Knowledge area	Most HEI offer practice in health promotion and primary health care, but the highest prevalence is in the clinical area. Length in weeks of internships in the areas of health promotion and primary health care varied between countries; one week in Slovenia and 20 weeks in the Netherlands. Unlike other countries, the courses in Slovenia were strictly focused on educational training in Public Health. In 2002/2007, Public Health and Health promotion were taught in 60.0% -70.0% of HEI; in 2009, they were taught in 70.0%-80.0% HEI. Students were trained to counsel groups (100.0%) and individuals (94.0%), and to take responsibility for feeding groups of people (83.0%).	The time spent in practical learning is on average in agreement with the EDBS. Despite the many advances, many HEI have not yet included the full breadth of subjects accepted by the EFAD, which means that this may hinder the ability of nutritionists to meet workplace challenge.

Chart 3. Summary of the main information extracted from the studies included in the present systematic literature review.

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Author Year Country	Target audience/ sample	Research Method/ Methodology	Method of data collection	Variables of interest	Main results	Conclusion
Menezes <i>et al.</i> [23] Brazil-Latin America	195 SYP from 5 nutrition courses in <i>Rio Grande do Norte</i> state.	Bibliometric study	- Document and statistical analysis	Core knowledge areas and settings for research	The area of interest in most senior year projects was public health ($p < 0.001$). Public health services accounted for 10.3% of the places or settings where the research was carried out. Most research projects used the quantitative approach. Collective health was the most researched topic.	Core knowledge areas which indicates a social perspective that goes beyond the biological focus. Ineffective methods were used in the research projects, suggesting the need to improve the scientific method in undergraduate courses.
Vieira & Cervato- Mancuso [24] Brazil-Latin America	39 participants (nutritionists and lecturers/ course coordinators) 6 curricula of HEI' Nutrition courses	Qualitative exploratory study	- Semi- structured interviews, focus group, and document analysis - Descriptive analysis and Collective Subject Discourse	Topics included in the educational training in FNS	According to nutritionists and course coordinators: FNS course contents are fragmented; humanistic approach is important, but there is a need for a more comprehensive approach; practical activities are considered as important but insufficient, and there is a lack of professional supervision; the courses contribute to FNS actions through internships, visits and extension courses; education of nutritionists is inadequate showing essentially technical characteristics; there is limited and superficial reflection about Public Health and Public Health policies; teaching projects should have interdisciplinarity of the FNS contents; the proposed professional profile includes the humanistic approach; there is a combination between theory and practice. Desired skills and competencies: communication and teamwork. Education and training in Public Health and public policies were not mentioned in the curricula.	There is a need for human resource training that can effectively contribute to FNS promotion. HEI need more support to redesign the courses they offer. There is also a need to implement the measures according to the intersectoral policies between health and education.

Chart 3. Summary of the main information extracted from the studies included in the present systematic literature review.

Author Year Country	Target audience/ sample	Research Method/ Methodology	Method of data collection	Variables of interest	Main results	Conclusion
Recine et al. [25] Brazil-Latin America	46 Public and private HEI that offer the Nutrition undergraduate courses 517 of PHN syllabuses 46 political-pedagogical projects	Qualitative cross-sectional study	Document analysis of teaching plans and pedagogical political projects <i>Use of Alceste data analysis software</i>	Significant and recurrent words in the documents of the PHN disciplines	Most of the content addressed in the PPP referred to course structure and design. The structure and design of the courses are related to the teaching/research/extension triad; integration between academy and community; curricular approaches (practical activities, disciplines, and internship). In the PPP of the nutrition courses, the term educational training was related to curricular process and SYP. Disciplines such as nutritional assessment and those related to life stages corresponded to 34.2% of the syllabuses, whereas only 9.7% of the disciplines addressed aspects related to educational training and professional performance. In the syllabuses, educational training for professional practice referred to actions, such as analyzing, reflecting, planning, and identifying, associating interventions with the local reality. Topics such as culture and social sciences in nutrition were briefed mentioned in the syllabuses.	The PPP have less information about the role of the professionals than information about operational and descriptive characteristics of the professional practice. The proposals of the nutrition courses need to go beyond the Cartesian paradigm, which focuses on treatment overlooking prevention and promotion. There is a need to bridge the gap between the biological and social and to encourage and promote reflection and attention to the professional practice.
Recine et al. [26] Brazil-Latin America	65 coordinators of HEI undergraduate nutrition courses	Cross-sectional study	- Online questionnaire	PHN disciplines, workload, and theoretical and practical classes	In 89.2% of the courses evaluated, up to 50.0% of lecturers were responsible for Public Health Nutrition disciplines (80.0% in public institutions and 95.0% in private ones). On average, the courses offered 14.06 disciplines (mandatory and elective) that were considered PHN disciplines; 13.1 in public HEI and 14.7 in private institutions. The percentage of the course credits (or hours in class hours) allocated to the study of Public Health disciplines, considering only	There is a need to offer more disciplines that can contribute to the educational training of professionals focusing on the Unified Health System. The alignment between educational training of nutritionists and current and future challenges faced by Health and PHN areas

Chart 3. Summary of the main information extracted from the studies included in the present systematic literature review.

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Author Year Country	Target audience/ sample	Research Method/ Methodology	Method of data collection	Variables of interest	Main results	Conclusion
					the compulsory disciplines, was between 12.0-44.5%. Most courses (72.2%) allocated a maximum of 30.0% of the total workload to PHN disciplines. On average, 82.2% of PHN disciplines are mandatory. Almost a quarter of the PHN disciplines' workload referred to practical activities. The most commonly offered PHN disciplines were: Nutrition Assessment, Nutrition Education, Social Nutrition Internship, PHN, and Epidemiology.	requires a deep reflection about its social role and insertion in public policies and programs.
Toledo & Gambardella [27]	12 nutrition graduates (from 1940 to 2006)	Qualitative exploratory descriptive study	- Semi-structured interviews	Educational training Perception	According to the graduates, education training in public health made them aware of social issues and taught them critical and comprehensive thinking, which are distinct characteristics of Nutrition undergraduate courses in Brazil. Some weaknesses of the educational training programs pointed out include: insufficient PHN practical activities (in the first programs) and availability of PHN internships. According to the graduates, PHN internships should be associated with public services instead of private companies. They considered Nutrition public policies as important factors to enhance professional practice.	The educational training of nutritionists included health disciplines, especially public health, with strong influence of educators who were sanitarians and recognized the value of community actions.
Brazil- Latin America			- Content analysis			
Lourenço <i>et al.</i> [28]	16 participants (9 students, 4 preceptors, 3 lecturers)	Qualitative study	- Written reports - Thematic content analysis	Training Extension activities	The education extension activities proved to be an important experience enabling the interaction between theory and practice, promoting a greater contact of students with the local reality and with the <i>Sistema Único de Saúde</i> (SUS, Unified Health System) routine, contributing to a more socially engaged education.	The education extension activities are important to redirect Nutrition education, allowing the interaction between undergraduate students and practical field experiences within the SUS.
Brazil-Latin America						

Chart 3. Summary of the main information extracted from the studies included in the present systematic literature review.

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Author Year Country	Target audience/ sample	Research Method/ Methodology	Method of data collection	Variables of interest	Main results	Conclusion
					Practical experience enables learners to be participatory actors in the learning process. The education extension activities stimulated interdisciplinarity. According to the lecturers, having contact with preceptors made them feel closer to professional practice and contributed to their education.	
Fox <i>et al.</i> [29] Canada- North America	29 key informants (Nutrition professionals and representatives of regulatory agencies, Public Health stakeholders, and government representatives)	Qualitative study	Situational assessment of PHN practice using key informant telephone interviews	Training and qualification	A small number of internship programs focus on community and public health; however, educational training in clinical nutrition and food services remain the focus of most programs.	Most participants considered the development of specific competencies for PHN practice as an important strategy for the promotion of knowledge construction through various education channels.
Looy <i>et al.</i> [30] Europe ^b	39 HEI or National Associations of Dietitians from 19 European countries	Cross-sectional study	- Online questionnaire	Diversity of fields for internship	Internships in Public Health, education, and social care were mentioned by 28% of the respondents as important in the pre-qualification placement of nutrition students, with a period of practice of 5 weeks. In the Public Health education and social care areas the most mentioned internships locations were: health promotion (39.0%); Local council and public health; government department; and nongovernmental agency (33.0%); Health centers (33.0%); and schools and kindergarten (31.0%). The duration in weeks of the internships in Public Health according to the median and the inter quartile range were: local health center (7.5, 3.5-20.0); health promotion (5.0, 2.5-7.8); schools and	There was a diversity of internship locations, selection methods, and duration among the countries. Higher education has an important role in quality of learning experiences learning and ensuring that the learning environment is able to offer new work environments for health professionals.

Chart 3. Summary of the main information extracted from the studies included in the present systematic literature review.

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Author Year Country	Target audience/ sample	Research Method/ Methodology	Method of data collection	Variables of interest	Main results	Conclusion
Pham <i>et al.</i> [31]	139 Nutrition Lecturers	Cross- sectional study	- Online questionnaire	Barriers to teaching FNS and nutrition training courses to lecturers	kindergarten (2.0, 2.0-4.0); local council/public health/ government department/ non-governmental agencies (6.0, 3.5-8.5). The main barriers to teaching FNS are: large classes preventing lecturers from using interactive teaching methods (81.7%); lack of on-the-job training for nutrition lecturers (78.8%); and very rigid curricula framework (70.2%). Nutrition training courses that teachers would like to take the following courses related to food policies: food security and sustainability (28.1%); food system (18.8%); and food policies (18.8%).	The participant professionals showed a strong preference for training in the traditional focus on the biological dimension of nutrition science. This suggests the need to improve PHN professional development among university lecturers in Vietnam.

Note: ^aEuropean countries that participated in the study conducted by Looy *et al.* [14]: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Ireland, Lithuania, Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland, Turkey, and United Kingdom.

^bEuropean countries that participated in the study conducted by Looy *et al.* [30]: The Netherlands, Portugal, Belgium, The Czech Republic, France, Greece, Spain, Austria, Hungary, Israel, Sweden, Lithuania, Ireland, Luxembourg, The Slovak Republic, The United Kingdom, Iceland, and Liechtenstein.

HEI: Higher Education Institution; FCN: Federal Council of Nutritionists; FNS: Food and Nutrition Security; PPP: Political-Pedagogical Projects; SYP: Senior year project; EDBS: European Dietetic Benchmark Statement; PHN: Public Health Nutrition; EDBS: European Dietetic Benchmark Statement; EFAD: European Federation of the Associations of Dietitians; NDA: National dietetic association; DIETS: Dietitians Improving Education and Training Standards.

The main skills and competencies required to ensure a good quality education and training of nutritionists in Public Health, including the course syllabus, concern the following: analysis, reflection, identification of priorities, planning, proactivity, teamwork, program coordination activities, evaluation of the Food and Nutrition Security, promotion of healthy eating, and participation in Nutritional Surveillance [11,13,24,25]. Considering that topics such as public policies and programs, management of actions, and organization of nutritional care are still insufficiently addressed, it is of primary importance to invest in the education of professionals including the “teaching of”

critical thinking skills to increase the capacity to introduce and carry out actions according to the local reality and needs [24,27,28].

In the context of food policies, nutrition educators reported the interest and need for improvement in topics such as food and nutrition security, food and sustainability, food system, and food and nutrition policies. In addition to the need to improve the training of teaching staff, the reported barriers to teaching Public Health include the rigid curricula framework, and large class sizes, which hinder the adoption of and participatory and problem-posing approaches [31].

Chart 4. Checklists used to assess quality of quantitative, qualitative and mixed-methods studies.

Checklist for Qualitative Research ²²											Risk of bias ¹
Studies	1	2	3	4	5	6	7	8	9	10	
Vieira & Cervato-Mancuso [24]	a	a	a	a	a	c	b	a	a	a	Low
Fox <i>et al.</i> [29]	c	a	b	c	a	c	b	a	a	a	Moderate
Toledo & Gambardella [27]	c	a	a	a	a	a	b	a	a	a	Low
Lourenço <i>et al.</i> [28]	a	a	c	a	a	a	b	a	b	a	Low
Checklist for Analytical Cross Sectional Studies ²¹											Risk of bias ¹
	1	2	3	4	5	6	7	8	9	10	
Menezes <i>et al.</i> [23]	a	a	a	a	b	b	a	a	a	a	Low
Recine <i>et al.</i> [26]	a	a	a	a	b	b	a	a	a	a	Low
Looy <i>et al.</i> [30]	c	a	a	a	b	b	a	a	a	a	Moderate
Pham <i>et al.</i> [31]	a	a	a	a	c	a	a	a	a	a	Low
Checklist adapted for evaluation of mixed methods studies ²⁰											Risk of bias ¹
	1	2	3	4	5	6	7	8	9	10	
Pinheiro <i>et al.</i> [11]	c	c	a	a	a	a	a	a	a	a	Low
Recine <i>et al.</i> [25]	a	a	a	a	b	a	b	a	a	a	Low
Aksoydan & Mizikaci [13]	b	c	a	a	a	a	a	a	a	a	Low
Checklist adapted for evaluation of longitudinal studies ²⁰											Risk of bias ¹
	1	2	3	4	5	6	7	8	9	10	
Looy <i>et al.</i> [14]	a	a	a	b	a	a	a	c	a	b	Low

Note: ¹The risk of bias was classified as 'high' if 49% of the answers to the signaling questions were yes; 'moderate' for 50%-69% of "yes" answers; and 'low' for 70% or more of "yes" answers.

Letters: a (yes), b (no), c (Unclear), d (not applicable).

The numbers from 1 to 10 are equivalent to the question numbers of the respective checklists.

Checklist adapted for evaluation of mixed methods studies²⁰

1) Is the epistemological perspective explicit in the study? 2) Is there an alignment between the epistemological perspective and the research methodology? 3) Is there consistency between objectives and methods? 4) Were the inclusion criteria for participants clearly defined? 5) Is there triangulation of qualitative and quantitative methods? If so, is it satisfactory? 6) Are the data analysis methods used appropriate for research? Are the results clearly presented? 8) Is the research conclusion consistent with the objectives and results? 9) Are the ethical aspects considered in the research?

Checklist adapted for evaluation of longitudinal studies²⁰

1) Were the participants' characteristics similar over time and were they recruited from the same population? 2) Are the inclusion criteria for the participants clearly defined? 3) Are the methods valid and appropriate according to the objective? 4) Was the percentage of participants lost to follow-up considered in the sample size calculation? 5) Is the participant loss to follow-up reported in the research? 6) Were the exposition conditions measured the same way over the years? 7) Is there a reliable evaluation of the results obtained? 8) Is the statistical analysis used appropriate? 9) Is the research conclusion consistent with the objectives and results? 10) Was the research approved by the Ethics Committee?

DISCUSSION

The results presented indicate that the educational training of nutritionists in Public Health is a comprehensive field of knowledge and practices, requiring a teaching-learning process focused on interdisciplinarity and the recognition of the value of ethical and citizenship postulates, considering the sanitary, sociocultural, and

political dimensions of health and food and nutrition [32,33]. For example, in Western and Eastern Europe, eight out of 14 countries indicated the interest and need for educational training in public health and more community nutrition practices in nutrition courses [34].

Despite this recognition, some limitations were observed. In Middle Eastern countries, there is a shortage of academic programs in

Public Health nutrition and of professionals to work in this field [35]. In Brazil, for example, a representative study involving 587 nutritionists from five different regions in the country found that only 10.2% of those professionals work in Public Health nutrition [36]. In India, there are 190 institutes that offer nutrition courses, but none of them has PHN as an independent discipline [37]. A study carried out in 16 West African countries reported that only 24.0% of undergraduate nutrition programs emphasize the teaching of Public Health [38].

A generalist and reflective training does not depend only on classroom training but also on the implementation of the teaching/research/extension triad [32]. In this systematic review, a Brazilian study highlighted the high number of research projects carried out on Public Health [23], a fact that, according to Costa *et al.* [39], contributes to addressing local problems and transforming knowledge into concrete actions. However, some studies emphasize the presence of the research-teaching dichotomy in formal education, and the lecturers were predominantly focused on research activities, overlooking teaching [39-41].

The educational training in Public Health in Nutrition courses presupposes the teaching of different topics such as, biology; epidemiology; management of health prevention, promotion, recovery, maintenance, and education actions [26], as also reported in the present systematic review. According to Medeiros [3], it is of great importance to associate elements of the Natural Sciences and Human and Social Sciences in order to ensure a more comprehensive education. Some studies show that the presence of contemporary topics for the educational training of nutritionists in Public Health, such as Food and Nutrition Security (FNS), food systems [8,3,32], protection and promotion of food culture and heritage, school feeding, and health and healthy eating promotion, need to be explicitly incorporated into Nutrition courses [25,26,42]. According to Neves *et al.* [10] and

Recine *et al.* [26], although these topics are specifically addressed in certain disciplines, they have become areas of knowledge or fields of professional practice, demanding a more comprehensive and detailed education of these professionals.

Some authors reported that Public Health teaching still adopts the traditional and hegemonic pedagogical perspective, with limited understanding of the broad "scope" of "Public Health" and its interface with other sciences [10]. There is a clear focus on treatment but not on the health-disease-care process. The gap between theory and practice and basic and specialized knowledge was also easily visible. The criticisms about this training model are centered on the predominance of a curative, reductionist, hospital-centric, and expensive approach, which does not take into consideration epidemiological problems related to the morbimortality profile of contemporary societies, whose determinants are associated with environmental modifiable factors [10,25,43]. These findings corroborate those of the present systematic review, indicating a fragmented, linear, and biologicistic focus of Public Health education.

Given that the educational training of nutritionists in Public Health faces a set of challenges, the teaching method used must be rooted in a pedagogical and curricular project based on problem-posing and reflective teaching strategies formulated according to the reality [10]. A study carried out in Colombia [44] describes the analysis of changes made in the curricular structure of the courses included in the educational training of dietitians, at the *Universidad Nacional de Colombia*. The authors highlighted the importance of enhancing practical experiences since they are an indispensable element in the development of professional skills [44]. The results of the present systematic review also demonstrate the need to strengthen the relationship between theory and practice and, above all, recognize the importance of practical activities and internships for the

contextualization of the contents addressed in the classroom.

The feasibility of including practical activities in the education of nutritionists, both in Public Health and in other areas of knowledge, depends on a variety of factors, such as the lack of material and equipment, unsatisfactory structure, administrative procedures for acquisition of laboratory equipment [45], barriers to establishing partnerships in order to set up "internship" programs [10,27], insufficient number of professionals to supervise the practical training; and insufficient internship workload [26].

In Brazil, curricular practical activities account for approximately one-quarter of the total workload of Public Health disciplines [26]. In European countries, the Public Health practical training programs' length range from 1-20 weeks, mainly in local health care centers [14]. The Brazilian experiences indicate the need for transversalization of Public Health contents throughout all disciplines and practical activities, and broadening the range of "placement" and "internship" options to go beyond the health sector. According to some authors, practical activities demand the presence of supervising lecturers from different areas of knowledge, the placement of students in different locations, and the interaction of lecturers and students with other service professionals [10].

Accordingly, two other challenges faced in the educational training of nutritionists are the pedagogical knowledge of lecturers and the teaching practices adopted. The development of innovative teaching projects using active strategies and tools for distance learning is not enough. Lecturers must have good subject knowledge and experience in order to develop them [38,40].

In addition to the reduced number of lecturers and the excessive workload, there is a need to deepen the reflection on the pedagogical skills and practices adopted by educators and on the provision of continuing education for them

[40,45]. According to Luz *et al.* [45], rethinking lecturers' education and the upgrade of their skills or expansion of their "knowledge" base is essential to change teaching approaches and to ensure that students develop critical thinking skills and become more participative, ethical, inquisitive, and interactive. Therefore, there would be more qualified professionals entering the job market.

A study carried out by Sadeghi-Ghotbabadi *et al.* [46] compared the essential competencies for "PHN practice". The authors found that the ability to "asses and analyze" was the only common competency needed among some countries, such as Iran, Australia, Canada, the United States, and some European countries [46]. Mentoring is an important strategy for competency development and also for promoting the development of skills, workforce competence, and more effective practical experience programs [47,48]. Both mentors and students considered mentoring as a dialogic, reflexive, and motivational approach in the educational process [49,50].

In Brazil, the *Diretrizes Curriculares Nacionais* (DCN, National Curriculum Guidelines) for undergraduate Nutrition courses, from 2001 are still used today. These guidelines have been developed to support the reorganization of educational practices and the incorporation of active teaching-learning strategies, contributing to a more comprehensive education. Their central focus is on professional profile, principles of professional practice in nutrition, and skills and competencies required, overlooking the contents to be taught and the duration and workload of internships [42]. It worth highlighting that these guidelines also provide guidance for the training and education of nutritionists to work within the the national *Sistema Único de Saúde* (SUS, Unified Health System).

Globally speaking, the analysis of the outcome documents of the 2nd International Conference on Nutrition, organized by the Food and Agriculture Organization (FAO) of the

United Nations (UN) and the World Health Organization (WHO) in 2014, and the framework for action of the Decade of Action on Nutrition, highlights that capacity development is one of the essential elements to promote actions aimed at the prevention and treatment of all forms of malnutrition [51]. Low- and middle-income countries deserve greater attention [52,53] because their nutrition-related workforce needs to tackle maternal and child undernutrition, which are the objectives to sustainable development [52].

CONCLUSION

The educational training of nutritionists in Public Health is still addressed using traditional approaches with hegemonic biologicist focus and a fragmented curricular structure, hindering the dialogue with other sciences. Students, educators, and professionals have shown interest in Public Health education, emphasizing the importance of the relationship between theory and practice, the teaching-research-extension dimensions, and practical activities and internships. Public Health education enables the development of skills and competencies that can exert an impact on professional performance. However, there are gaps in this process, such as the verticalization of academic programs and the lack of clarity with respect to these skills in political-pedagogical projects of undergraduate Nutrition courses. It is hoped that Public Health nutritionists will be able to critically reflect on the multi-determination of food problems contributing to effective actions that meet the needs of the population. It is also hoped that they will work within the boundaries of their professional practice in an interdisciplinary and multiprofessional way, focusing on the broad scope of nutritional care actions and the promotion of healthy eating and adequate nutrition.

One limitation of the present systematic review is the fact that there are few studies

available on the educational training of nutritionists in Public Health in undergraduate programs. On the other hand, this clearly fact demonstrates the originality and innovation nature of the presents study, contributing to the advancement of knowledge in this field, based on the synthesis of information found in the literature. Furthermore, it is worth highlighting that that more countries should address this topic since most of the studies found in the systematic review were carried out in Brazil. Further studies are needed to deepen the analysis of the role of education due to the demands of society and the required professional attributes of Public Health nutritionists.

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CONTRIBUTORS

GM ALMEIDA and KHD OLIVEIRA contributed to the formulation of the research question, the conception of this study, data analysis, and manuscript writing and discussion. JS MONTEIRO contributed to the formulation of the research question, the conception of this study, writing and interpretation of results. MAT MEDEIROS contributed to the interpretation of results and manuscript writing and discussion. EGG RECINE contributed to the conception of this study, data analysis, interpretation of results, and manuscript writing and discussion.

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