Systematic reviews in Nutrition using artificial intelligence tools: a brief review

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Abstract.
Systematic literature reviews are a rigorous, transparent and reliable method for different science fields, including Nutrition. However, in face of the age of big data, developing rigorous systematic reviews can become more and more challenging for researchers. To address these issue, artificial inteligence (AI) tools have been proposed and incorporated into scientific research. Thus, the objective of this study is to conduct a literature review on the use AI tools in systematic reviews developed in the field of Nutrition. The search in the 3 databases retrieved a total of 45 studies, refined into 4 publications dated from 2015 to 2021, all from global North. The AI tools applied showed some variety, although the use of text mining, usually associated with other techniques and processes, was remarkable. The research questions also showed some homogeneity, wih the central theme being the relationships between dietary aspects and the etiology of diseases. Its good coverage of documents available on-line, the fact that these tools represent a somewhat different unit of the field and enrich the experts' conceptualization, as well as the outstanding feature of benefiting from transdisciplinary work are pointed out by the authors of the reviewed studies as advantages of AI tools. This brief review has shown that, although there is high potential and benefits for the use of AI tools in systematic reviews in the field of Nutrition, its realization is still quite incipient.

Keywords. Systematic reviews, Nutrition Science, artificial intelligence,

1. Introduction

Systematic literature reviews are recognized by different scientific disciplines as a rigorous method (1) that enhances objectivity, reproducibility and transparency in the process of collecting and synthesizing the state of the art (2) regarding specific research questions of particular historical moments. Indeed, when conducted according to rigorous standards of accuracy, they are able to synthesize the best scientific evidence available to date, which is fundamental for the scientific advancement (3)

In the health field, which is very much guided by the biomedical model, the evidence-based medicine pyramid is well established. In this tool, studies are organized hierarchically, according to the research methodology adopted (4).

The pyramid is organized in the following categories, from bottom to top: expert opinions, in vivo and in vitro studies; case series and case reports; case-control studies; cohort studies; randomized-controlled trials; and finally meta-analyses and systematic reviews (4).

Thus, systematic reviews occupy the apex of the pyramid, in the sense that they are considered "the most substantial knowledge available for medical decision-making". Their main advantages are high quality and critical appraisal, but this method also has some disadvantages, such as the possibility of using a small number of studies, depending on the topic in question (4).

But it is not only in evidence-based medicine that systematic reviews are so valued and necessary. In the field of nutrition they are considered an important element in decision making (1).

Extending beyond the biomedical disciplines, systematic reviews can inform political decisions, including or especially those related to environmental management, which often need to be taken urgently and, at the same time, extremely

assertively. This is because its characteristics reduce the bias risck and increase its reliability (2,5).

Even in the social sciences, which have their own methodologies that involve very careful selection and analysis, systematic literature reviews have proven to be of great value (6).

However, we are currently living in the age of big data, marked by the exponential growth of scientific publications every year. This generates a "data deluge" marked by the so-called "5Vs": volume, velocity, variety, value, and veracity (6,7).

In this scenario, developing rigorous systematic reviews in which the most recent, relevant and reliable information is compiled, without data being lost along the way, can become a challenging, time consuming – and sometimes overwhelming - task for researchers (7).

To address these issues, artificial inteligence (AI) tools have been proposed and incorporated into scientific research. This is the case of text mining, which has become popular over the last few years with the purpose of screen publications and identify trends in the literature (7).

One of the methods of finding these trends is Latent Dirichlet Allocation (LDA), an unsupervised machine learning algorithm classified as a category of topic modeling (7).

Topic modeling comprises a set of methods and algorithms that enable the organization, understanding, search, and summarization of large amounts of textual information at a scale that would be humanly unfeasible to analyze (8).

Thus, the objective of this study is to conduct a literature review on the use of AI tools in systematic reviews developed in the field of Nutrition.

2. Methods

2.1 Databases and search strategies

The literature review was conducted from three databases, namely: Google Scholar, Scopus and Web of Science. The choice of the databases was due to the amplitude of themes and scientific publications indexed in both databases, which could expand the possibilities of satisfactory results.

As a search strategy, the terms "Systematic review" and "Nutrition Science" were used, connected through the Boolean term AND with the terms "text mining", "topic modeling" and "Latent Dirichlet Allocation" connected through the Boolean term OR. All terms consisting of two words were enclosed in quotation marks to restrict the search to terms that are commonly related but do not meet the search strategy. The terms were searched in all fields, with no restriction to title or abstract, for example.

No limits have been set on the date or language of publication.

Inclusion criteria were determined to be the completion of systematic literature reviews that have used as a method of selection, organization and/or analysis text mining, represented especially by topic modeling, more specifically LDA.

Considering Nutrition Science as the primary interest, studies that met the inclusion criteria but did not fall within any of the fields of Nutrition were excluded.

2.2 Selection and analysis

The publications obtained from the databases were exported to the Rayyan platform, a tool for creating and managing systematic reviews. There, they went through four selection stages, namely: exclusion of duplicates, sorting of study types, evaluation of titles and abstracts, and reading of the full texts.

Once selected, the publications were exported to Microsoft Excel for deeper analysis.

3. Results

The search in the three databases retrieved a total of 45 publications, which were analyzed and selected according to the inclusion and exclusion criteria, as shown in Figure 1.
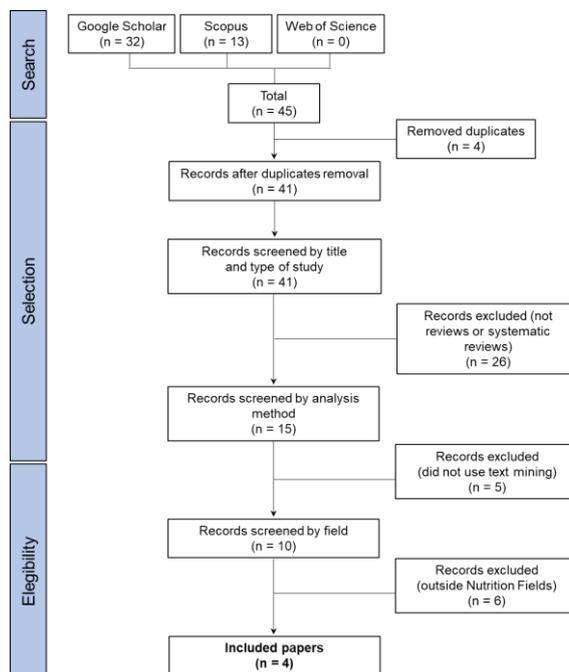

Fig. 1 - Publication selection flowchart.

In the end, the corpus of this brief review included 4 publications, whose details are available in Table 1.

The publications date from 2015 to 2021, which demonstrates that the use of text mining tools in systematic reviews in the field of Nutrition is relatively recent. Two of the selected papers (50%) date from 2020, but because of the small number of

publications included in the review, it is not possible to establish a trend regarding the frequency .

It is interesting to note that all the papers come from the global North, which may show that the method has been used more in the so-called developed countries.

Regarding the number of studies reviewed in each of the publications, as well as artificial intelligence tools used and the mais research question, Table 2 provides more details.

The number of studies reviewed in each publication varied widely, with a minimum of 200 and a maximum of over 4,800.

Tab. 1 – Main editorial characteristics of the selected publications.

First author	Journal	Authors' location	Publication country	Year
Gubiani D	Conference on Data Mining and Data Warehouses	Slovenia	Slovenia	2015
O'Connor L	Avances in Nutrition	United States	United States	2020
Chen SI	Food and Function	Taiwan	United Kingdom	2020
Kiss A	Journal of the International Society of Sports Nutrition	Hungary	International	2021

Tab. 2 - Methodological and thematic detailing of the selected publications.

First author	Number of studies included	AI tools	Main research question
Gubiani D	4,839	Text-mining techniques in combination with an user interface were used to support the construction of ontologies	Connections between dietary issues and degenerative diseases
O'Connor L	369	Text mining was used to build word clouds; mapping global data package was used to develop figures	Muscle foods categorization and description in research assessing primary prevention of nutrition-related chronic diseases
Chen SI	201	Use of various data mining models, including decision tree classification and association rule assessment	Relationship between soy phytoestrogens or proteins/peptides and the risk of breast cancer development
Kiss A	3,889	Multi-step methodology combining text mining and bibliometric processes	Recent international trends and topics of sport nutrition science

The artificial intelligence tools applied also showed some variety, although the use of text mining techniques, usually associated with other techniques and processes, was remarkable.

Although the research questions also varied among the selected publications, one central theme is striking in most of them (n=3 or 75%): relationships between dietary aspects, of greater or lesser specificity, and the etiology of diseases (neurodegenerative, chronic diseases and breast cancer, respectively).

Only one of the publications (25%) escaped this pattern, but developed an important review regarding the trends and topics addressed by the field of sports nutrition over 18 years (2000 and 2018). Thus, it demonstrated the applicability of text mining tools in bibliometric studies as well.

Some of the publications presented advantages, as well ways to improve the use artificial intelligence tools in their work, which are available in Table 3.

Tab. 3 - Advantages and ways to improve the use of AI tools, according to the authors.

First author	Advantages of using AI tools	Ways to improve
Gubiani D	• Literature mining methodologies are general; • Can be applied in different fields to guide discovery processes, providing that there is a good coverage of documents available on-line.	• The process is more efficient if there is a field expert available to cooperate in the guidance in selecting rare or joint terms.
O'Connor L	-	-
Chen SI	• Makes it possible to obtain valuable insights for healthcare professionals and have helped to determine the medical decision.	-
Kiss A	• Represent a somewhat different unit of the field and enrich the experts' conceptualization.	-

4. Discussion

This brief review had a slightly different objective than "traditional" reviews, because instead of assessing the state of the art of a specific research problem or outcome, it was devoted to evaluating the use of artificial intelligence tools in the development of systematic reviews in the field of Nutrition.

In this sense, although the set of selected publications evaluated a total of almost 9,300 studies, it is not possible - nor is it intended - to discuss their results, but rather the characteristics of the selected publications and the methods used.

From a total of 45 publications, the selection process arrived at a corpus of only 4 publications, which makes it unsafe to perform more assertive analyses.

Still, it is possible to highlight some interesting features that can be confirmed or refuted in future studies, concerning the recent temporal concentration (as of 2015) and the geographic concentration (global North) of the selected publications.

On the other hand, the low number of publications composing the corpus is also an important result, as it demonstrates that the use of AI tools in systematic reviews in the field of Nutrition, specifically, is still incipient.

The development of systematic reviews is critical to guide evidence-based decision making in the field of Nutrition (1). Precisely in this sense are the advantages presented by the authors of some of the studies included in this brief review (9,10).

One aspect highlighted by Kiss and colleagues (2021) is the fact that AI tools are able to "complement or contrast the expert interpretation of a research field with the interpretation based on academic communication".

A quick search conducted on PubMed, a leading medical publication database, with the term "Nutrition" demonstrates the impressive increase in the number of publications from 18,898 in 2010 to 37,484 in 2015 and 59,998 in 2020, which demonstrates the trend of a progressive increase in the volume of scientific publications over the years.

Unlike years ago, all these publications are available online, which makes it easier to apply AI tools. As the years progress and information accumulates more and more, conducting systematic reviews can become increasingly challenging without the use of these tools.

It is worth noting that none of the publications included pointed out disadvantages or drawbacks in the use of these methodologies, since they made it possible to successfully reach the objectives of the studies.

An equally important and sometimes challenging or even neglected point in the practice of science is that the application of AI tools benefits from transdisciplinary work. The involvement of experts in the field to be researched and experts in the methods can be a factor of marked enrichment in the works that opt for the use of such methodologies.

4.1 Limitations and perspectives

Although this is an important result, the low number of publications seized by the present review may also indicate some weakness in the search strategy, which should be improved in future similar studies.

An important volume of studies using text mining and artificial intelligence techniques for social media analysis was found, which were not included in this review while respecting its core objectives. However, such studies point to a growing and very interesting field of research in health communication and nutrition. The very specific term "Social media analytics in nutrition research"(11) makes the rise of this field clear, which can be an important inspiration for future research.

5. Conclusions

This brief review has shown that, although there is high potential for the use of AI tools in systematic reviews in the field of Nutrition, its realization is still quite incipient.

The few studies that met the established inclusion criteria highlight advantages in the use of such tools, from a practical point of view. At the same time, they do not highlight disadvantages or major obstacles, which may be a valuable criterion for scientists to consider these tools when developing new studies.

The promotion of transdisciplinary work in science is a potential positive aspect to be highlighted in the adoption of AI tools in the development of systematic reviews, which should be valued.

6. Acknowledgements

7. References

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