Analysis of mobile applications reporting on nutritional recipes: a review of the scientific literature

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Abstract: At present the planet faces a pandemic originated by the COVID-19, causing social isolation and decrease in the world economy; limiting more and more the resources of many people, which produces a deficient feeding, In this document a systematic review of literature was made considering scientific articles between the years 2010 and 2020 from sources like, IEEE Xplore, Concytec, Proquest, Scopus, WoS and Scielo, having as objective to know the best characteristics of mobile applications to inform about nutritional recipes. A total of 50 articles were studied and it was concluded that there are databases with nutritional information of foods that help greatly in improving the nutrition of people, also found various techniques for obtaining data from new technologies.

1 INTRODUCTION

Poor nutrition is a universal problem and remains the leading cause of poor health, according to the World Health Organization (WHO, 2020) 150.8 million children are stunted, 50.5 million are wasted and 38.3 million are overweight, and 38.9% of adults are obese or overweight, mostly in Africa and North America.

Governments often provide assistance to sectors where they do not have many economic resources, and now that in times of food and money shortages, caused by the Covid-19 crisis, many people are in a state of malnutrition, (C. Díaz-Méndez, 2018) they point out that whether through social assistance or procurement strategies to adjust shortages to their reduced income, families affected by lack of job opportunities actively confront their difficult food problems, according to (UNICEF, 2019) the nutritional problem is not just about getting enough food, but about getting the right food, which is a challenge today.

In a world increasingly dependent on technology, there are more and more users of smart phones, and fewer households without at least one device being used. Serrano, Hernantes and Gallardo (N. Serrano, 2013) point out that smart phones are the main portable device for more than one billion people; mobile web applications are a necessity in both the technical and commercial fields, which is why there is a need for studies on mobile devices and the contributions they can make to the subject of nutrition.

The aim of the research is to analyse the extent to which a mobile application helps to report on nutritional recipes using limited inputs. To this end, scientific magazines and articles, in Spanish and English, from the health, nutrition and technology sectors were taken into account.

2 METHODOLOGY

The type of study used is the systematic review of the scientific literature with the Prism methodology, according to (B. Moreno, 2018) a systematic review is a concise summary of the information provided by other researchers regarding a topic of social interest.

2.1 Research question:

The research question used was the following: RQ. What are the best characteristics for the development of a mobile application that reports on nutritional recipes with limited inputs?

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2.2 Search strategies

Bibliographic search of scientific studies published between 2010-2020 in virtual scientific libraries: IEEE Xplore, Proquest, Scielo, Scopus and WoS.

When carrying out the search, the following key words were taken into account: "computer system AND nutrition" "system OR mobile application" "vulnerable sector AND nutrition" "food security AND nutrition", in the discipline of Engineering, Technology, Health and Nutrition.

2.3 Inclusion and exclusion criteria

Scientific articles no older than 10 years in Spanish and English, as well as studies based on mobile applications directly related to food improvement, were considered as inclusion criteria.

As criteria for exclusion, doctoral theses, conferences, articles not published in scientific journals, studies published before 2010, articles with content other than Spanish or English were not considered

3 RESULTS

A total of 82 articles from the virtual databases indicated above were reviewed, of which, applying the exclusion and inclusion criteria, we were left with 50 studies.

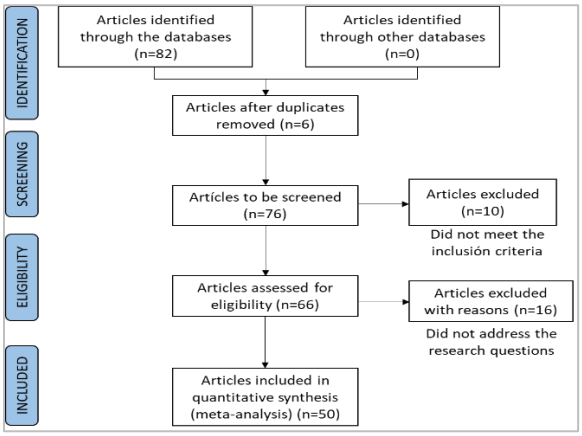

Fig. 1 Flowchart of the search

Of the studies reviewed we found more publications in the United States with 16 articles, then Spain with 6 articles, followed by Chile with 4 as well as Colombia, followed by 3 from Peru and the rest of the countries have one or two scientific articles.

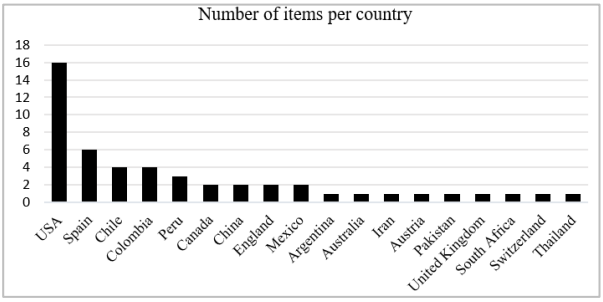

Fig. 2 Articles by country

The greatest number of scientific studies investigated were carried out in 2018 with a total of 13 scientific articles, compared to 2011 when only one scientific article was found according to the exclusion and inclusion criteria.

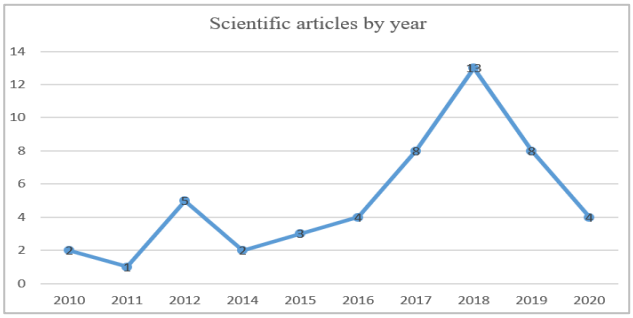

Fig. 3 Items per year

From the scientific studies analyzed, it can be divided into 2 groups of research topics: "Malnutrition" focusing on suggestions to improve inadequate nutrition and "Pro-Nutrition Technology" that uses technological tools to support nutrition detailed in Table I.

Table 1. Central theme literatures

N°	CENTRAL THEME	REFERENCES
1	Malnutrition	(C. Díaz-Méndez, 2018), (Z. E. Aguirre, 2018), (M. D. P. Díaz-Beltrán, 2019), (R. Sodjinou, 2015), (B. Moreno, 2018), (A. F. López, 2018), (C. Troncoso-Pantoja, 2019), (A. L. Rubio, 2019), (A. White, 2011), (A. F. Valdivia, 2015), (E. R. Godoy, 2020), (M. Ruiz, 2017), (N. J. Ruiz-Ruiz, 2018), (G. Marquez, 2020), (P. R. Jaramillo, 2016), (F. Goiana-Da-Silva. 2019), (A. A. Fuentes Cuiñas, 2019), (J. L. Ibarra-Mora, 2019), (P. L. Briceño , 2019), (M. Qaim , 2017), (V. Tuffrey, 2016), (ud Din, 2018)
2	Pro-Nutrition Technology	(C. H. Chen, 2018), (H. Jiang, 2018), (J. P. McNamara, 2012), (S. Gillespie, 2017), (P. Sundaravadivel, 2018), (L. Jiang, 2020), (S. Sadegholvad, 2017), (R. Sodjinou, 2014), (K. H. Uesugi, 2016), (Z. Lei, 2018), (P. Pouladzadeh, 2014), (H. El Bilali, 2019), (P. Rold, 2020), (F. Zhu, 2010), (S. Ruiz, 2017), (J. Cawley, 2015), (E. Hazel, 2018), (Brown, 2012), (S. Turmchokkasam, 2018), (N. Hezarjaribi, 2018), (D. Katz, 2010), (Burke, 2012), (R. Yera Toledo, 2019), (Y. Han, 2020)

In Table 2 you can see organized the nutritional bases that were used for the elaboration of researches in the field of nutrition and technology, Open food Facts, USDA (United States Department of Agriculture), Health Canada and Health Ministry of Peru.

Table 2. Nutritional basis

N°	NUTRITIONAL BASIS	COUNTRY	REFERENCES
1	Open Food Facts	EE.UU.	(C. H. Chen, 2018)
2	USDA	EE.UU.	(C. H. Chen, 2018), (N. Hezarjaribi, 2018), (H. Jiang, 2018), (L. Jiang, 2020), (Burke, 2012)
3	Health Canada	Canadá	(P. Pouladzadeh, 2014)
4	Ministry of Health of Peru	Perú	(C. Troncoso-Pantoja, 2019)

In the scientific articles reviewed, different approaches to poor nutrition during times of crisis were found. Three aspects were found to be causal: socioeconomic, according to (30) (2), the economic crisis also modifies household consumption, a basic good such as food is affected by prioritizing other expenditures, leaving the issue of food as secondary. Political, according to (34) good nutrition is key to the development of a society that improves global well-being. Genetically, according to (10), (4), malnutrition is a multifactorial and complex problem, just like obesity, with major genetic causes. It is believed that the molecules involved in human metabolism would be controlled directly and indirectly by genes and therefore nutritional health can be optimised through personalised dietary advice.

Table 3. Causes of poor nutrition

N°	CAUSES	REFERENCES
1	Socioeconomic	(N. J. Ruiz-Ruiz, 2018), (C. Díaz-Méndez, 2018)
2	Political	(P. R. Jaramillo, 2016)
3	Genetic	(S. Gillespie, 2017), (C. H. Chen, 2018)

The literature review also found development of food decision systems based on different processing and data entry (Table IV), among them: obtaining genetic data on a person and on food, which can be used to carry out simulations with all possible combinations of the five main nutritional factors, namely energy, fat, protein, sugar and salt, on the basis of genetic data on phenotypes. They proposed a framework covering the whole process of data collection, separation by data categories from a neural network and thus generating recommendations for food products (C. H. Chen, 2018), (J. P. McNamara, 2012), another type of processing that stands out is the one of augmented reality which is based on the use of google glass to place the information in real life scenarios like in the kitchen, a store, market or supermarket, this model combines the search of images of inverse sense and the mining of texts, which is compared with a database with nutritional information, as well as the nutritional information and preferences entered directly to your mobile.

Table 4. Data processing

N°	PROCESSING TYPE	REFERENCES
1	A person's genetic data	(C. H. Chen, 2018), (J. P. McNamara, 2012)
2	Information by voice	(N. Hezarjaribi, 2017)
3	Nutritional needs and food preferences	(R. Yera Toledo, 2019)
4	Augmented reality	(H. Jiang, 2018)
5	Images captured by a cellular device	(P. Pouladzade, 2014)

Of the results of scientific studies with a higher percentage than 80% in positive aspects due to their high degree of effectiveness in the application of their procedures for each established case study, the following information is shown (see Table V).

Table 5. Results of recommendations

N°	RESULTS	QUANTITY	REFERENCES
1	>90%	2	(N. Hezarjaribi, 2018), (P. Pouladzadeh, 2014)
2	90%><80%	3	(H. Jiang, 2018), (C. H. Chen, 2018), (R. Yera Toledo,2019)
6	<80%	22	(J. P. McNamara, 2012), (S. Gillespie, 2017), (P. Sundaravadivel, 2018), (L. Jiang, 2020) (S. Sadegholvad, 2017), (R. Sodjinou, 2014), (K. H. Uesugi, 2018), (Z. Lei, 2018), (H. El Bilali, 2019), (P. Rold, 2015), (F. Zhu, 2010), (S. Ruiz, 2017), (J. Cawley, 2017), (E. Hazel, 2018), (Brown, 2014), (S. Turmchokkasam, 2018), (D. Katz, 2010), (Burke, 2012), (Y. Han, 2020)

4 DISCUSSION

A review of the scientific literature shows that, over the last 10 years, various countries, both developed and underdeveloped, are going through stages of food resource scarcity, due to various factors such as socio-economic, political and genetic (Table 3).

Many scientists are described as developing new ideas for solutions to the problems raised with the support of new technological trends that are easily adaptable to diverse scenarios in which a person can improve his or her nutrition through only one cellular device (Table 1, 4).

Of the research reviewed, aspects such as the ease of sending information for comparison with the nutritional database, either by voice (A. Fuentes, 2019), or by a Google glass device, were mostly employed (M. D. P. Díaz-Beltrán, 2019). Another aspect that was taken into account is the complexity of information analyzed in the case of genetic data, where a user test is required to determine nutritional dietary recommendations. And the one that was found to have the most positive characteristics, due to its speed and simplicity of execution, is the application which, by means of nutritional needs and food preferences entered in writing into the application, is compared with nutritional databases and

food options are recommended that are in line with what the user has entered (Burke, 2012).

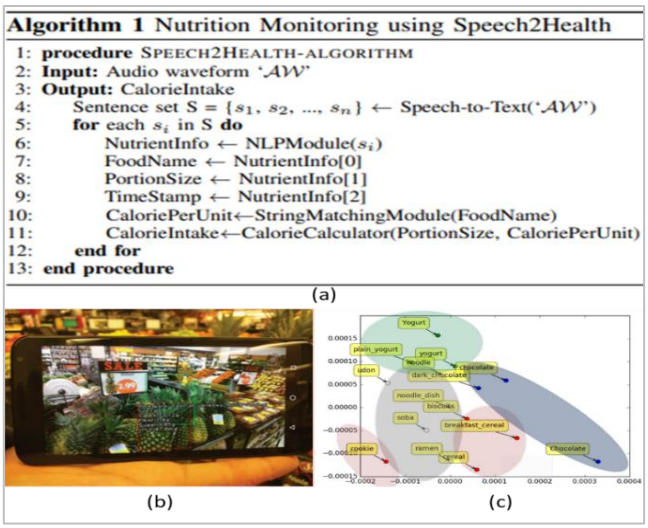

Fig. 4 (a) Voice recognition nutrition algorithm, (b) Augmented reality nutritional information using Google Glass (c) Convolutional neural networks for food recommendations according to genetic data

Other systematic reviews related to the recommendation of nutrients in foods such as (C. Nutriotional, 2013) concluded that it would be optimal in the use of labels in products with the Five Color Nutrition Label (SPN-5-CNL), complies with reporting but not in a personalized way as it can be with the use of a mobile application, as well as the systematic review (I. J. Pérez-López, 2015) that has as one of its conclusions regarding the improvement of the diet the change of methodologies using ICT (information and communication technology). This review focuses on the following.

5. CONCLUSION

This study presents a systematic review of literature with a total of 50 selected articles that answer the research question posed, RQ: "What are the best characteristics for the development of a mobile application that reports on nutritional recipes with limited inputs?", The results show that with the help of nutritional databases such as those provided by the Peruvian Ministry of Health, the USDA, Health Canada and Open Food Facts have led to better food decisions (Table 2), In addition, these mobile developments must go hand in hand with various procedures to collect information starting with nutritional needs and food preferences followed by the entry of information by voice, likewise, better results would be obtained if the mobile application previously knew the genetic data of the study population. (Table 4, 5).

For future work, it is recommended to develop, based on the data collection methods and nutritional databases shown in the research, a more in-depth analysis of economic characteristics and a specific population food pattern.

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