



The food insecurity and the young generations' perception: A systematic review

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Abstract

Food insecurity is a global problem mainly generated by financial issues, critical geopolitical situations and constantly changing weather conditions that have direct effects on availability and prices of food products. These issues reduce capacity to manage the available resources with the consequence of obtaining an approximate distribution of food all over the world. Food insecurity involves multiple population groups and different generations, including University students. In order to evaluate the relationship between food insecurity and University students investigated from different points of view, this article provides a systematic literature review dedicated to this topic with the aim of identifying any research gaps. For this purpose, a selection of 29 articles was created and the subsequent analysis highlighted the main objectives dedicated to this topic i.e. “Food safety, nutrition and health”, “Food safety and determinants”, “Food security linked to financial issues”, “Food security linked to school performance” and “Food security and socio-demographic variables”. In particular, food insecurity exists in campuses mainly due to living costs, income and budget, dietary priority; it affects physical health, mental health and ultimately impacts on students' academic performance. All surveys mainly concern

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individual University campuses in countries developed or in development and therefore a lack of studies dedicated to the comparison of campuses belonging to countries with different socio-economic conditions is highlighted. In light of the results obtained, the authors propose further comparative studies on the perception of food insecurity among University campuses in different geographical areas in order to provide new knowledge on the subject.

Introduction

Food security is a real global problem. The United Nations identified it as one of the sustainable development goals, i.e. Goal 2 - Zero Hunger. Indeed, the “State of Food Security and Nutrition in the World 2018” report drafted by FAO, and other international agencies and programs indicate that the number of people suffering from hunger and malnutrition is on the rise after a prolonged decline. Analyses show that the number of undernourished people has increased to 821 million in 2017 from 804 million in 2016 (FAO *et al.*, 2018). This new trend amplifies the scope of the problem and emphasizes how it can be considered relevant for the entire planet and not only for developing countries.

The situation is worsening in South America and in most parts of Africa, meanwhile in Asia the trend towards food insecurity seems to slow down significantly. On the other hand, overweight and obesity increase and coexist with malnutrition, i.e. there is a “double burden” phenomenon. Indeed, poor access to food, particularly healthy food, contributes not only to malnutrition, but also to overweight and obesity (Popkin *et al.*, 2020). The implementation and strengthening of interventions aimed at guaranteeing access to food is necessary to interrupt the intergenerational cycle of malnutrition and a change of food production systems is needed to produce safe foods and promote healthier diets (Baker & Friel, 2016).

Some countries suffer from food insecurity more than others and motivations are numerous. On the one hand, geopolitical situations e.g. military conflicts, and weather conditions e.g. climate change, do not allow production, conservation and supply of food useful to guarantee an adequate level of food security. Meteorological adversities have as a direct consequence on available foodstuffs and increase in the price of food due to the reduced presence in market. To these are added, the increase in world population and therefore the increase in demand for food, and the reduced capacity to manage the economically more evolved resources in a geographical area e.g. the food waste phenomenon, with the consequence of obtaining an

approximate management of the planet's food capacities (Munesue *et al.*, 2015).

On the other hand, other issues are determinant to reduce the food access to the population. Indeed, the definition of food security, although it incorporates the concepts of availability, access, use and stability of food, seems to be oriented mainly towards increasing the quantity of food available. However, the current trend suggests that access to food is significantly limited even in times of increasing food availability. This phenomenon leads to the distinction between household food security and individual food security i.e. families can have immediate access to food supplies but an individual level access to food requires adequate resources, markets and social networks (Stringer, 2016). More generally, the reduction in food access can be caused by critical issues in the area of economic and financial resources, e.g. in 2007 several States chose austere economic measures to counter the period of economic and financial crisis, with enormous nutritional and health implications. Therefore, a reduction in food security can be mainly caused by a limitation of financial resources dedicating to social policies (Caraher & Coveney, 2016; Riches & Silvasti, 2014).

The continuous transformations of the political and operational frame of reference have for a long time limited the possibility of reaching a univocal definition of the concept of "food security". Consider that around two hundred definitions were still counted in the early 1990s (Smith *et al.*, 1992).

The evolutionary path in the field of food security began in the 1970s in conjunction with the great world food crisis, aggravated by the oil shock, when the United Nations gave a first definition of food security, i.e. "*Availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices*" (United Nations, 1975).

Since the early 1980s, the availability of access to food has been increasingly recognized as a determinant of food security. In 1983, FAO expanded its concept by emphasizing the importance of guaranteeing access to food at any time, understood as basic food, both in terms of the economic sphere and the physical sphere: "*Ensuring that all people at all times have both physical and economic access to the basic food that they need*" (FAO, 1983). In 1986, the World Bank gave a further clarification of the concept of food security, highlighting the importance of leading an active and healthy life, i.e. "*Access of all people at all times to enough food for an active, healthy life*" (Reutlinger, 1986).

The definition of officially recognized food security was given as part of the World Food Summit, convened by FAO in 1996, i.e. "*Food security exists when all people, at all times, have physical and economic access to*

sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” which in fact also underlines the nutritional aspect of food (FAO, 1996).

In 2001 a clarification on the social aspect was introduced into the notion of food security, i.e. *“A situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”* (FAO, 2002). The social character of access to food is extremely important in contexts where belonging to a certain social group, ethnic group or gender is an obstacle to healthy eating. In this case, the concept of food security is close to the concept of consumption and, especially, of food demand by the most vulnerable people, highlighting the right of access to food for individuals and families. Indeed, Sen showed that in times of famine, food was often available but did not reach the population, and sometimes even was destined for export with greater harm to the local people. These findings led Sen to highlight the key role of the lack of rights as the main cause of death and suffering on a large scale rather than the insufficient availability of food (1981). Different tools have been activated to reduce hunger also in recent times e.g. food banks, but are not the final response for a durable free food access (Riches & Silvasti, 2014).

The definition of food security prepared by FAO evidences the two dimensions that make up food security, one physical and one temporal. The physical dimension is divided into three sub-dimensions: food availability, food accessibility, and food use. The temporal dimension is understood as the stability of the offer. All four dimensions must be met simultaneously to reach the food security objectives (VAM, 2009).

The concept of availability is closely connected to the need to have enough food for oneself and for one’s own family in order to guarantee an active and healthy life. However, the real availability of produces should be matched with their accessibility to satisfy people’s needs.

The definition of access is divided into physical, social and economic access. The food raw materials can be physically available to the consumer who also needs to have the necessary resources to acquire them, but there may be non-economic barriers that limit access to food i.e. social reasons, wars, civil conflicts, poor infrastructures and inadequate logistics. Physical access refers to a logistical aspect, to the presence of infrastructures that allow food to be present in all places even if characterized by conflicts. Social access underlines the fact that food security is granted only when all people have adequate access to food, regardless of the social group, ethnic group or gender they belong to. Economic access indicates the possibility of buying food regularly using family income, without having to give up basic needs; it also implies that food is available at reasonable prices.

The definition of use by the World Food Summit is “*safe and nutritious food that meets dietary needs*”. Use relates to the adequacy of food with respect to physiological needs and cultural needs and is strictly connected to the possibility of following a balanced diet, having access to clean water, living in adequate hygienic-sanitary conditions, relying on assistance and health care and having the necessary data on food preservation and preparation. In this case, the connection between food security and food safety is evident.

Finally, the concept of stability refers to the constant presence of the other three components over time. The dimension of stability makes it possible to make a distinction between chronic food insecurity and transitory insecurity (Maxwell & Frankenberger, 1992). In the first case, this is a long-term condition linked to the persistent impossibility of satisfying basic food needs due to poverty, lack of own resources and inadequate access to other financial or productive resources. On the other hand, transitory insecurity is temporary or cyclical/seasonal. Stability is particularly important for assessing whether a territory suffers from food insecurity only over a short period, or has structural difficulties in the nature of the offer, and therefore there are deeper reasons for fearing the chronic appearance of this phenomenon.

In order to appraise the concept of food security, the Economist Intelligence Unit has structured a tool called the global food security index (GFSI), meant to understand the root causes of food insecurity by looking at food system dynamics around the world (The Economist, 2017). Indeed, the meaning of food security and its interpretation can be influenced by culture, environment and geographical location, but the index provides a useful approach to understanding food security risks without capturing the characterizing elements of each individual country. Since its establishment, the GFSI has become a means of political control for governments and a national diagnostic tool for investments. Non-governmental organizations have turned to the GFSI as a research key to identify countries in which to focus advocacy efforts on changes to food security and development policy.

At the same time, other measurement tools were carried out e.g. Food Insecurity Experience Scale (FIES). Indeed, Cafiero *et al.* (2018) describe the procedures for defining the FIES in eight headings as a contribution to the creation of an indicator for the global monitoring of food insecurity. Obtained results from their study would allow annual monitoring of performances and any improvements in the Agenda 2030 perspective.

On the other hand, some systematic reviews were carried out on the food insecurity topic. Candel (2014), through the systematic review, underlined the importance of the role of governance in the management of food security, highlighting, on the one hand, its value in solving problems, on the other, the need to resort to new empirical investigations to analyze

governance agreements also at subnational level. Moreover, Bruening *et al.* (2017) and Nikolaus *et al.* (2020) evidenced several studies dedicated to University students and food (in)security. Bruening *et al.* (2017) highlighted that food insecurity seems to be quite widespread among the University student population, with particular reference to gray literature, and it is associated mainly with financial independence, poor health and unfavorable academic results. Nikolaus *et al.* (2020) carried out a review dedicated to food insecurity among US University students using peer-reviewed literature and gray literature. The results of the study suggest the need to change conventional detection methods to have a more precise classification of University students.

In this context, this paper aims to select the pertinent research studies i.e. peer-reviewed papers, and highlights the following key questions i.e.

- “What are the most salient issues investigated on food insecurity among University students?”
- “Are there studies dedicated to the comparison on food insecurity perception among University students from Universities in developed and developing countries?”

To this end, a systematic review was carried out to collect studies dedicated to this phenomenon among University students and related concerns the world over. The paper is structured as follows: the first section describes the methodology used to carry out the systematic review and the analysis of the process to select the eligible papers (Methodology section); the second section presents the findings of the review underlining the main issues and concerns on interaction between food security and University students (Findings section); the third section is dedicated to synthesis of the aspects emerged from the present study with indication of potential applications, feasible implications and suggestion for future researches (Conclusion section).

1. Methodology

A systematic literature review was carried out, in line with other authors (Moher *et al.*, 2009; Briner & Denyer, 2012; Poulsen *et al.*, 2015). This activity allowed to identify, assess and define an in-depth analysis on literature in order to address the research questions of this paper. Beginning on PRISMA guidelines (Moher *et al.*, 2009), a systematic literature review was conducted following a six-step analysis (Table 1) (McGrath *et al.*, 2012; Boren & Moxley, 2015).

The first step was dedicated to identify and well-define the research topic based on available literature related to the link between food security issues and University students all over the world.

The second step defined the databases used to select papers on the research topic. In this case, Scopus (Elsevier) and Web of Science (WoS) (Clarivate Analytics) were chosen for an identification of research papers considered appropriate for a systematic literature review on this topic.

The third step formulated the search strategy, in line with the topic identified in the first step. The literature search was carried out in 2019, on the 28th of August, using in Scopus the TITLE-ABS-KEY search query for “food security” AND “University student”. Then, the TITLE-ABS-KEY search query was also used for “food insecurity” AND “University student”. At the same time, a literature search was carried out in the Web of Science Core Collection database using the ALL FIELDS search query for “food security” AND “University student” and then for “food insecurity” AND “University student”. Other words in search queries were not considered to obtain as many papers as possible dedicated to the topic. The time period used was “All years” for each search query to the scope of verifying relevant time evolution in this topic. In total, 76 papers were initially identified through these search processes; 27 out of 76 papers were duplicated and, therefore, removed.

The fourth step was dedicated to applying the screening criteria for analysing the contents of the abstracts. The authors separately analysed the subjects of selected papers in order to identify the papers that satisfied the scope of the research and separate the papers that were not relevant. In the latter case, the exclusion criterion was if the topic was not in line with the scope of this study. This situation can occur if the title and abstract reply positively to the research query, but the abstract contents of the candidate papers are not in line with the scope of research. In this case, several papers investigated the food insecurity phenomenon on the whole population and University students were cited in the abstract but they were not the main subject of the study. Moreover, only peer-reviewed articles were considered excluding other contributions such as reviews, notes to editors and comments.

After this first individual screening, authors divided the candidate papers into two lists, one of papers “probably accepted” and one of papers “probably rejected”, both integrated by a brief comment. Thus, authors compared their results, discussed differences in order to warrant a double examination of each paper and defined the potential eligible abstracts. This stage enabled to select the papers deemed suitable for systematic review. At the end of this phase, 19 out of 49 papers were declared not eligible for the aim of this research and, therefore, rejected. Moreover, authors carried out a full-text availability check at the libraries of the authors’ institutions in order to assess potentially eligible papers and ensure that the contents of the papers were in line with the aim of the study. At the end of this stage, 29 articles were available (Figure 1).

Figure 1 - Systematic review process and number of selected papers

Identification databases		Scopus (Elsevier) and Web of Science (WoS)
Papers identified through databases searching by selected keywords (TITLE-ABS-KEY and ALL FIELDS screening)		N=76
Papers duplicated	N=27	
Screening after exclusion of duplicates		N=49
Contents abstract not eligible	N=20	
Selected papers after contents analysis		N=29

The fifth stage was based on a paper content analysis by main data and information extraction in order to satisfy the scope of review. In this phase, selected papers were coded on the basis of year of publication and later classified according to the content analysis on the basis of two requirements: the scope of the study and related issues, i.e., presentation of the study problem and research questions, the research main results, implication and conclusion.

The sixth step was structured as an in-depth assessment of papers related to the main classification criteria of the fifth step and a synthesis of the systematic review based on the main topic and the aim of the study.

Table 1 - Synthesis of the six-step systematic review

Steps	Activities
First	Identifying and well-defining the research topic based on available literature
Second	Selecting databases to extract probably eligible papers
Third	Formulating search strategy and extracting potentially eligible papers
Fourth	Screening criteria analysis to define selected papers
Fifth	Extraction of the main data and information
Sixth	Synthesis of the systematic review

2. Results and discussion

2.1. Descriptive analysis of the selected papers

The main evidences obtained from the systematic review dedicated to the relationship between the concept of food (in)security and University students are shown as follows. The application of the constraints in the systematic review has led to the identification of 29 papers. The selected papers are reported with the indication of an identification code (code), useful for reading and linking the following analysis, and with the main information i.e. authors, title, year of publication and language used (Table 2).

Table 2 - Selected Papers with code and main information

Code	Authors	Year	Title	Language
1	Hughes <i>et al.</i>	2011	Student food insecurity: The skeleton in the University closet	English
2	Sulaiman <i>et al.</i>	2013	Food insecurity among public University students receiving financial assistance in Peninsular Malaysia	English
3	Munro <i>et al.</i>	2013	Hunger for knowledge: Food insecurity among students at the University of KwaZulu-Natal	English
4	Gallegos <i>et al.</i>	2014	Food insecurity: Is it an issue among tertiary students?	English
5	Micevski <i>et al.</i>	2014	Food insecurity among University students in Victoria: A pilot study	English
6	van den Berg & Raubenheimer	2015	Food insecurity among students at the University of the Free State, South Africa	English
7	Anuar <i>et al.</i>	2015	Pilot study on the prevalence of food insecurity among sub-urban University students during Holy Ramadan	English
8	Morris <i>et al.</i>	2016	The Prevalence of Food Security and Insecurity Among Illinois University Students	English
9	Deepika Priyadarshani <i>et al.</i>	2017	Access to healthy foods and indications of food insecurity among private University students in a Colombo suburb, Sri Lanka	English
10	Farahbakhsh <i>et al.</i>	2017	Food insecure student clients of a University-based food bank have compromised health, dietary intake and academic quality	English
11	Reynold <i>et al.</i>	2018	Prevalence and correlates of food security among students attending a small, rural Canadian University	English
12	van Woerden <i>et al.</i>	2018	Food insecurity negatively impacts academic performance	English
13	Cuy Castellanos & Holcomb	2018	Food insecurity, financial priority, and nutrition literacy of University students at a mid-size private University	English

Table 2 - continued

Code	Authors	Year	Title	Language
14	Lee <i>et al.</i>	2018	Exploring the Experience of Food Insecurity among University Students Caring for Children: A Qualitative Descriptive Study	English
15	Davidson & Morrell	2018	Food insecurity prevalence among University students in New Hampshire	English
16	Martinez <i>et al.</i>	2018	Food insecurity in California's public University system: What are the risk factors?	English
17	Olauson <i>et al.</i>	2018	Student food insecurity: Examining barriers to higher education at the University of Saskatchewan	English
18	Bruening <i>et al.</i>	2018	Hungry to learn: The prevalence and effects of food insecurity on health behaviors and outcomes over time among a diverse sample of University freshmen	English
19	Theodoridis <i>et al.</i>	2018	Food insecurity and Mediterranean diet adherence among Greek University students	English
20	McArthur <i>et al.</i>	2018	A High Prevalence of Food Insecurity Among University Students in Appalachia Reflects a Need for Educational Interventions and Policy Advocacy	English
21	Eche & Hernández	2018	Studying food security among students: A comparative case study between public and private Universities in Quito-Ecuador	English
22	Sabi <i>et al.</i>	2019	Students' vulnerability and perceptions of food insecurity at the University of KwaZulu-Natal	English
23	Weaver <i>et al.</i>	2019	University student food insecurity and academic performance	English
24	Hattangadi <i>et al.</i>	2019	"Everybody I know is always Hungry. But nobody asks why": University students, food insecurity and mental health	English
25	Raskind <i>et al.</i>	2019	Food insecurity, psychosocial health and academic performance among college and University students in Georgia, USA	English
26	Ramlee <i>et al.</i>	2019	Food insecurity among University students at two selected public Universities in Malaysia	English
27	Abu & Oldewage-Theron	2019	Food insecurity among college students in West Texas	English
28	Ukegbu <i>et al.</i>	2019	Food Insecurity and Associated Factors Among University Students	English
29	Martinez <i>et al.</i>	2019	Pathways from Food Insecurity to Health Outcomes among California University Students	English

The theme appears to be relatively new and emerging, raising a growing interest in the scientific community and gaining popularity over the last few years i.e. 19 out of 29 papers have been published in the last two years. Indeed, in the 2013-2017 period the topic was investigated with a certain

consistency i.e. 1-2 papers per year, followed by 11 publications in 2018 and 8 in 2019 (partial, January-August period).

The geographical area of study provides some interesting indications on the subject. First of all, the investigated issues seem to be of particular interest to North America, indeed 11 out of 29 studies were carried out in the USA and 5 out of 29 in Canada, mainly orientated on and nutrition and financial issues. Other studies were implemented in Africa (1 in Nigeria and 3 in South Africa), in Asia (3 in Malaysia and 1 in Sri Lanka), in Australia (3), in South America (1) and in Europe (1). Moreover, the North American interest is also recent since all papers with the study area in North America have been published in the 2016-2019 period. The papers published in Australia, Asia and South Africa are mainly more dated: indeed, the first 7 (out of 10) papers were published in the 2011-2015 period in these areas (Table 3).

Table 3 - Papers by study area

Continent	Nation	Author code	No. of articles
North America	USA		11
		California	(29) (16)
		Texas	(27)
		Georgia	(25)
		New Jersey	(23)
		North Carolina	(20)
		Arizona	(18) (12)
		New Hampshire	(15)
		Ohio	(13)
		Illinois	(8)
		Canada	
		Alberta	(24) (14) (10)
		Nova Scotia	(11)
		Saskatchewan	(17)
Africa	Nigeria	(28)	1
	South Africa	(22) (6) (3)	3

Table 3 - continued

Continent	Nation	Author code	No. of articles
Asia	Malaysia	(26) (7) (2)	3
	Sri Lanka	(9)	1
Australia and Oceania	Australia		3
	Victoria	(5)	
	Queensland	(4) (1)	
South America	Ecuador	(21)	1
Europe	Greece	(19)	1

The journals interested in publishing on this subject are numerous i.e. 15 out of 21 journals have published only one paper on this topic; 5 out of 21 journals have published two or more papers. The involved research categories of these journals are “Nursing: Nutrition and Dietetics” (14 times), “Medicine” (10), “Agricultural and biological sciences” (6), “Social sciences” (5), “Environmental science” (1), “Health professions” (1) and “Economics, Econometrics and Finance” (1) (Table 4).

Table 4 - Sources and categories

Source	No. of articles	Author code	Category
Journal of Hunger and Environmental Nutrition	4	(17) (16) (15) (14)	Social Sciences: Health (social science). Medicine: Public Health, Environmental and Occupational Health. Nursing: Nutrition and Dietetics.
Nutrition and Dietetics	3	(10) (5) (1)	Nursing: Nutrition and Dietetics.
Journal of American College Health	2	(23) (13)	Medicine: Public Health, Environmental and Occupational Health.
South African Journal of Clinical Nutrition	2	(22) (6)	Nursing: Nutrition and Dietetics. Medicine: Medicine (miscellaneous).
Journal of Nutrition Education and Behavior	2	(20) (8)	Medicine: Medicine (miscellaneous). Nursing: Nutrition and Dietetics.

Table 4 - continued

Source	No. of articles	Author code	Category
Canadian Journal of Dietetic Practice and Research	1	(11)	Medicine: Medicine (miscellaneous). Nursing: Nutrition and Dietetics.
Nutrients	1	(29)	Agricultural and Biological Sciences: Food Science. Nursing: Nutrition and Dietetics.
Food and Nutrition Bulletin	1	(28)	Social Sciences: Geography, Planning and Development. Agricultural and Biological Sciences: Food Science. Nursing: Nutrition and Dietetics.
British Food Journal	1	(27)	Agricultural and Biological Sciences: Food Science.
Malaysian Applied Biology	1	(26)	Agricultural and Biological Sciences: General Agricultural and Biological Sciences.
Public Health Nutrition	1	(25)	Medicine: Public Health, Environmental and Occupational Health; Medicine (miscellaneous). Nursing: Nutrition and Dietetics.
Sustainability	1	(24)	Social Sciences: Geography, Planning and Development. Environmental Science: Management, Monitoring, Policy and Law.
Nutricion Hospitalaria	1	(21)	Medicine: Medicine (miscellaneous). Nursing: Nutrition and Dietetics.
Nutrition, Metabolism and Cardiovascular Diseases	1	(19)	Medicine: Cardiology and Cardiovascular Medicine; Endocrinology, Diabetes and Metabolism; Medicine (miscellaneous). Nursing: Nutrition and Dietetics.
International Journal of Behavioral Nutrition and Physical Activity	1	(18)	Health Professions: Physical Therapy, Sports Therapy and Rehabilitation. Nursing: Nutrition and Dietetics. Medicine: Medicine (miscellaneous).
Journal of Public Affairs	1	(12)	Social Sciences: Political Science and International Relations; Public Administration.
Malaysian Journal of Nutrition	1	(9)	Agricultural and Biological Sciences: Food Science. Nursing: Nutrition and Dietetics.
Pakistan Journal of Nutrition	1	(7)	Nursing: Nutrition and Dietetics. Agricultural and Biological Sciences: Food Science. Medicine: Public Health, Environmental and Occupational Health.
Higher Education	1	(6)	Nursing: Nutrition and Dietetics.
Perspectives in Education	1	(3)	Social sciences: Education.
Malaysian Journal of Consumer and Family Economics	1	(2)	Economics, Econometrics and Finance: General Economics, Econometrics and Finance.

A total of 117 authors participated in the selected papers. The number of authors per paper is between 2 i.e. 5 times, and 9 i.e. 1 time. The number of authors is 4 in 11 papers, the most frequent (Table 5).

Table 5 - Number of authors per paper and authors with two papers on the topic

No. of authors	Authors code
9	(19)
7	(23)
6	(10) (9)
5	(29) (28) (26) (7)
4	(24) (22) (20) (18) (17) (16) (14) (8) (3) (1) (11)
3	(25) (12) (5) (4) (2)
2	(27) (21) (15) (13) (6)

A total of 7 out of 117 authors have taken part in two research teams. The most influential authors in the research strand have different affiliations located in North America i.e. University of California, Arizona State University, University of Alberta. More details are presented in Table 6.

Table 6 - Affiliations of the most influential authors in the research strand

Authors	Affiliation	Author code
Souzanna M. Martinez	Department of Epidemiology and Biostatistics, University of California, San Francisco, CA, USA	(29) (16)
Lorenne D. Ritchie	Nutrition Policy Institute, University of California Division of Agriculture and Natural Resources, Berkeley, CA, USA	(29) (16)
Meg Bruening	College of Health Solutions, Arizona State University, Phoenix, USA	(18) (12)
Irene van Woerden	College of Health Solutions, Arizona State University, Phoenix, USA	(18) (12)
Geoff D.C. Ball	Department of Pediatrics, University of Alberta, Edmonton, Canada	(14) (10)
Anna Farmer	Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Canada	(14) (10)
Noreen D Willows	Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Canada	(14) (10)

2.2. Assessment of contents of the reviewed papers and related classification

After the description of the selected papers by different characteristics i.e. main information, publication year, study area, sources and study categories, number of authors per paper and number of papers per author, a new process of classification was implemented. On the basis of this process, the literature review was divided into five research topics: Food insecurity and determinant factors; Food insecurity, nutrition and health; Food insecurity related to financial issues; Food insecurity related to academic performance; Food insecurity and socio-demographic variables (Table 7).

Table 7 - Literature classification on the basis of content assessment

Topics	Author code
Food insecurity, nutrition and health	(29) (25) (24) (20) (19) (18) (10) (9)
Food insecurity and determinant factors	(28) (26) (17) (16) (14) (5) (4) (3)
Food insecurity related to financial issues	(27) (21) (15) (13) (2) (11)
Food insecurity related to academic performance	(23) (22) (12) (10)
Food insecurity and socio-demographic variables	(8) (7) (6) (1)

The following sub-paragraphs briefly discuss each identified group of papers showing main characteristics of the selected researches and related aim and findings. The provided information will be useful to identify the research gaps in the academic literature and describe the conclusion of this review and related implications for future researches.

Food insecurity, nutrition and health: Food security in a healthy college experience is important. Studies (18; 29) show that it affects the health related outcome for college students. Food insecurity, psychological and/or mental health do also matter for academic performance (20; 24; 25). Research also shows that Food insecurity compromises students' health, limits their diet and academic performances. Moreover, inadequate accessibility to acquire food can turn into food insecurity, and campus food banks do not seem to be a solution for student hunger (10); even a relationship between diet adherence and food insecurity is evidenced (19). Finally, lack of access to healthy foods might indicate the risk of food insecurity among University students (9).

Food insecurity and determinant factors: The prevalence of food insecurity and related consequences among University students can be due

to monthly allowance, daily amount spent on food, and source of income (28). Food access and financial aid with age, race as well as ethnicity are considered as risk factors for food insecurity (16). Government student loans, government payments and financial aid are also found as determining factors (3; 4; 17). High cost of living (26), living arrangements (5), student with children (14) are also found causing food insecurity in campuses.

Food insecurity related to financial issues: Food insecurity and prevalent coping strategies are also investigated. Food budget seems to be the main determinant of food insecurity; financial aid displays similar effects as well (2; 11; 27). Along with economic restrictions, students are food insecure due to the increase in food prices and household food spending (21). Financial priorities and dietary literacy are also linked (13) and, lastly, financial aid might cause food insecurity among University students (15).

Food insecurity related to Academic Performance. Food insecurity among University students can be linked to reduced academic performance and poor health conditions (12; 22; 23). In the latter case, the learning abilities of University students are reduced to the risk of compromising their level of education. Government and University institutions should plan policies and programs to improve the situation of students at risk of food insecurity (10).

Food insecurity and socio-demographic variables: Food security among University students can be related to factors such as race, average grades, loan use and place of residence in order to identify the most effective tools to develop services for those in need (8). Severe food insecurity in University students can contribute to increasing the attrition rate that can be found in Universities (6). University students could be helped by the establishment of food banks to reduce their needs (7) but in any case other studies should be carried out to carefully assess the determinants of food insecurity and, therefore, identify fitting strategic solutions, including social support policies, in this population group (1).

3. Conclusion, limitations and future research

The concept of food security can have two declinations. On the one side, the quantitative meaning, i.e. meeting the product-market system requirements of a defined group of population; on the other, the qualitative meaning, i.e. meeting the intrinsic quality requirements of food so as to satisfy the health needs of a defined group of population. The provided review demonstrates that food insecurity also involves University students who can be considered a weak category in term of access to food. Sometimes it is about perception, in some cases it is about financial issues, governance, income or family matters, in line with other authors (Candel, 2014; Bruening

et al., 2017). Not only in poorer countries, but also in developed countries, students and authorities should be more aware of the need, habit and supply of food in college campuses for better health and academic performance. The discussion of the above mentioned literature shows that further investigation is required to identify the ways to improve the situation. Moreover, the review shows a lack in students' perception of food security when considering a comparison amongst University students in different geographical areas with diverse economic development.

However, collected data have some limitations. Some identified criteria for the papers selection present lacks by e.g. the choice to limit the search to two databases and the "University student" key-search. WoS and Scopus are the most popular repositories with multidisciplinary products. This choice has allowed to access contributions and papers belonging to the peer-reviewed literature only, excluding gray literature. The "University student" key-search limited the extraction to the papers where this key was present in the title, abstract or keywords, excluding papers with e.g. "post-secondary student" or "tertiary student".

Lastly, findings show food insecurity in developed countries such as US and Canada as well as Malaysia and South Africa. Seemingly, a comparative study can be depicted on food insecurity in developed and developing countries. The study would explain relative prevalence, coping strategies, academic performance, demographic status, financial issues and government policy in a comparative manner. It would provide new insights for researchers to fill the gap in focusing on comparative food insecurity in colleges and Universities in both developed and developing countries. Therefore, this situation leaves space to further focusing on relative food insecurity among college students. In this context, the Nikolaus *et al.* (2020)'s considerations could contribute to identify the adequate methods of analysis.

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