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Stress factors and food purchase prioritization during the pandemic of coronavirus disease 2019

Laura Quezada-Acuña [a], Solange Parra-Soto [b, c], Samuel Durán-Agüero [a], Yadira Morejón-Terán [d], Luisa Pérez-Ocampo [e], Luis Miguel Becerra-Granados [f], Israel Ríos-Castillo [g], Gloria Prada-Gómez [h], Mónica Ramos de Ixtacuy [i], Roxana Carla Fernández-Condori [j], María Celeste Nessier [k], Ana Guerrero-Gómez [l], Laura González [m], Edna J. Nava-González [n], José Luis Moya-Osorio [o, *]

[a] Escuela de Nutrición y Dietética. Facultad de Ciencias para el Cuidado de la Salud, Universidad San Sebastián, Sede Los Leones, Providencia, Chile
[b] Departamento de Nutrición y Salud Pública, Factultad de Ciencias de la Salud y de los Alimentos, Universidad del Bío-Bío, Chillan, Chile
[c] School Cardiovascular and Metabolic Health, University of Glasgow, United Kingdom
[d] Centro de Investigación en Salud Pública y Epidemiología Clínica (CISPEC), Facultad de Ciencias de la Salud Eugenio Espejo, Universidad UTE, Quito 170129, Ecuador
[e] Universidad del Desarrollo, Santiago, Chile
[f] Pontificia Universidad Javieriana de Cali, Colombia
[g] Organización de las Naciones Unidas para la Alimentación y Agricultura (FAO), Escuela de Nutrición y Dietética, Facultad de Medicina, Universidad de Panamá, Ciudad de Panamá, Panama
[h] Docente jubilada de la Universidad Industrial de Santander, Colombia
[i] Nutricionista, Docente horario Universidad Rafael Landivar, Quetzaltenango, Guatemala
[j] Facultad de Nutrición y Alimentación, Universidad Femenina del Sagrado Corazón, UNIFE, Lima, Peru
[k] Instituto de Investigaciones de la Facultad de Ciencias de la Salud - Universidad Católica de Santa Fe, Argentina
[l] Docente en Universidad Tecnológica de El Salvador, El Salvador
[m] Universidad Nacional de Asunción, Facultad de Ciencias Químicas, Dirección de Investigación, Departamento de Nutrición, San Lorenzo, Paraguay
[n] Facultad de Salud Pública y Nutrición, Universidad Autónoma de Nuevo León, Monterrey, Nuevo León, Mexico
[o] Docente de la carrera de Nutrición y Dietética, departamento de Ciencias de la Salud, Facultad de Medicina, Pontificia Universidad Católica de Chile, Santiago, Chile

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SUMMARY

Background: The pandemic of coronavirus disease 2019 (COVID-19) pandemic confinement has an impact on stress levels, which causes changes in food purchase and consumption behaviors. The objective of this study is to associate food purchase prioritization with stress level during the COVID-19 pandemic confinement.
Methods: Multicenter, observational and cross-sectional study, an online questionnaire that included data on sociodemographic variables, stress factors and food purchase prioritization was disseminated through digital platforms and social networks.
Results: A number of 6357 participants were included, of whom 83.6% were female, 56.3% were from the middle socioeconomic level, 71.2% had completed higher education and 78.3% had a job. At greater stress levels it was observed a higher prioritization of canned foods (Odds ratio (OR): 1.91, 95% CI: 1.56; 2.34), sweets (OR: 1.58, 95% CI: 1.06; 2.34) and flours (OR: 1.45, 95% CI: 1.25; 1.68). While lower stress levels are associated with nuts (OR: 0.75, 95% CI: 0.66; 0.85), vegetables (OR: 0.82, 95% CI: 0.72; 0.94), and fruits (OR: 0.90, 95% CI: 0.80; 1.01), after adjusting for confounders.
Conclusions: There is an association between food purchase prioritization and stress level during the COVID-19 confinement. At greater stress levels, individuals purchase more food, both healthy and unhealthy. The later may have a negative impact on people's health, leading to or further aggravating malnutrition by excess and nutrition-related noncommunicable diseases.

* Corresponding author. Avenida Vicuña Mackenna 4860, Macul, Santiago, Chile.
E-mail address: joseluis.moya@uc.cl (J.L. Moya-Osorio).

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1. Introduction

After the outbreak of a disease caused by a new coronavirus (COVID-19) took place in Wuhan, a city of the province of Hubei, in China, a rapid spread has been reported at community, regional and international levels, with an exponential increase in the number of cases and deaths. On March 11, 2020, the World Health Organization (WHO) declared the situation of COVID-19 as a global pandemic [1]. COVID-19 has had significant repercussions on Latin America both from economic and social points of view, since the Gross Domestic Product (GDP) contracted 6.8% in 2020 at a regional level [2]. This has been further combined with the fact that social distancing and confinement measures have particularly affected the informal sector, which represents a significant part of the overall employment market in Latin America [3]; indicators such as undernutrition and food insecurity have increased as a consequence of the confinement measures, as well as poverty [4]. In addition, it has been found that psychological distress increased during the COVID-19 pandemic due to the higher prevalence of food insecurity [5].

Regarding the social impact, extreme poverty increased to 13.8% in 2021, which means a 27-year setback in this indicator in the region [6]. Furthermore, hunger affects more than 56 million people and the prevalence of moderate and severe food insecurity reach 54.8% of the inhabitants from Latin America and the Caribbean (LAC) [7]. This is primarily caused by disruptions of the supply chain, reduced purchasing power to support healthy food acquisition, and the promotion and opportunistic advertising of food items [8], which in turn led to behavioral changes in the consumers, due to the disruption of daily life routines, the increase in panic buying and disinformation, caused by the anxiety and uncertainty regarding food shortages [9].

The stress generated by the COVID-19 pandemic fostered the appearance of a wide variety of psychological alterations, related to food shortages [10]. This resulted in changes in purchasing and consumption behaviors in the population [11]. Therefore, it is necessary to investigate the impact that the COVID-19 pandemic had on changes in food purchasing and consumption behaviors, especially given the epidemiological profile of LAC, characterized by an increase in overweight and obesity [12]. The objective of this work was to associate food purchase prioritization with stress level during the COVID-19 confinement.

2. Methods

2.1. Study design and population

Multicenter, observational, cross-sectional study in which 10 Latin American countries participated: Argentina, Chile, Colombia, Ecuador, El Salvador, Guatemala, Panama, Paraguay, Peru, and Mexico. Data were collected through an online survey conducted between October 14, 2020 and February 15, 2021.

The sample size was calculated based on the Latin American population (677 million), considering an error of 3% and a 95% confidence interval, giving a sample size of 6357 participants. The non-probability snowball sampling technique was used to recruit participants. Subjects were invited to participate in the study through different digital platforms and social networks, including Facebook, Instagram, Twitter, and personal and institutional emails. To be included, subjects had to be 18 years of age or older and accept online informed consent.

Pregnant or breastfeeding women during the first four months postpartum; individuals undergoing pharmacological treatment or psychological therapies for depression, anxiety disorders, stress or mood disorders; and subjects diagnosed with pathologies requiring dietary treatment were excluded from the study. An initial screening questionnaire including questions to identify exclusion criteria, e.g., currently diagnosed mood disorders, depression, or pregnancy, was used to recruit participants. Subjects who answered "Yes" to any of the questions were disqualified, and the questionnaire automatically closed.

2.2. Data collection

Data were collected through an online questionnaire (Google LLC, Menlo Park, CA, USA). The survey consisted of different sections: the first contained information about the study. At this stage, participants could give informed consent and continue with the study or not to give informed consent and abandon the process. The second section consisted of the initial selection to identify the exclusion criteria mentioned above and questions about socioeconomic status. The last section addressed purchase prioritization. Participants could respond only once.

2.3. Purchasing prioritization

To determine purchase prioritization, subjects replied to questions about different foods and selected a high, medium, low, or no purchasing prioritization level. Foods that are part of the basic food basket in Latin America [12] include cereals, meats, fish, dairy products, eggs, oils, fruits, vegetables, legumes, potatoes, sugar, sugar-sweetened beverages, wine, dried fruits, and sausages.

2.4. Stress factors

Twenty-two questions were included in the scale. A summary of the variables included is shown in Table S1. Every question answered as "yes" was scored as 1, and as 0 when the answer was "no" or "not applicable". The higher the average score, the higher the number of stress factors shown. Subsequently, the variables were dichotomized, $0 < 6$ stressors $1 \geq 6$ stressors. An adaptation of the stress factors proposed by Temple was carried out [13].

2.5. Other variables

Self-reported data for sociodemographic characteristics, including age, sex, education, occupation, people living in the household, children under 10 years of age, and adults over 60, and the perception of nutritional status by identifying human silhouettes.

2.6. Ethical considerations

The study followed the guidelines of the Declaration of Helsinki for human studies and was carried out in accordance with the Singapore Statement on Research Integrity, and it was approved by the Scientific Ethics Committee of the Pontificia Universidad Católica de Chile ID200327001.

2.7. Statistical analysis

A descriptive analysis was conducted using frequency distribution, and continuous data were expressed as mean ± SD, in addition to the contingency tables obtained by crossing the purchase prioritization variable with the socioeconomic level. The ANOVA statistical test was used to evaluate the association between food prioritization and stress factors.

Logistic regression was used to evaluate the association between stress factors and food prioritization adjusted for confounders. The variables were dichotomized, the outcome was stressors, $0 < 6$

stressors 1 ≥ 6 stressors, foods in 1 high priority and 0 the other categories. Model 1 was unadjusted, Model 2 was adjusted by age, sex, socioeconomic level and quarantine.

3. Results

3.1. Sociodemographic characteristics of the study participants

The results captured the sociodemographic characteristics of the participants which are presented in Table 1. A number of 6357 people participated. The mean age of the participants was 35.7 years (SD 12.5), and 83.6% of the sample was female. Regarding educational level, 6.5% had only completed primary and secondary education, 22.3% had incomplete higher education and 71.2% had complete higher education. With respect to different socioeconomic levels: 20.9% corresponded to high/medium–high socioeconomic levels, 56.3% to medium socioeconomic level and 22.8% to low/medium-low socioeconomic level. Regarding occupation, 11.8% were housewives, 7.4% were unemployed, 2.5% were retired, 53.3% were dependent workers, and 25.0% were self-employed. According to the number of people living in the household, the mean was 3.6 members (SD 1.5). Of the participants, 34.1% lived with children under ten years of age and 30.8% with older adults.

Table 1
Sociodemographic characteristics of the study participants (n and %).

Characteristics	Overall (N = 6357/%)
Gender	
Female	5314 (83.6)
Male	1030 (16.2)
Other	13 (0.2)
Age	
Mean (SD)	35.7 (12.5)
Educational level	
Primary education	34 (0.5)
Secondary education	380 (6.0)
Incomplete higher education	1419 (22.3)
Complete higher education	4524 (71.2)
Occupation	
Housewife	751 (11.8)
Unemployed	473 (7.4)
Retired	157 (2.5)
Independent worker	1589 (25.0)
Dependent worker	3387 (53.3)
Number of people living in your household	
Mean (SD)	3.6 (1.5)
Under ten years old	
No	4192 (65.9)
Yes	2165 (34.1)
Older than 60 years	
No	4399 (69.2)
Yes	1958 (30.8)
Covid-19 Quarantine	
Yes	2701 (42.4)
No	3284 (51.7)
Never quarantined	372 (5.9)
Quarantine period	
1–3 months	1362 (21.4)
4–6 months	2046 (32.2)
Seven or more	1771 (27.9)
One or less	428 (6.7)
Never quarantined	750 (11.8)
Socioeconomic level	
High	208 (3.3)
Medium-high	1118 (17.6)
Medium	3580 (56.3)
Medium-low	1259 (19.8)
Low	192 (3.0)
BMI	
<30 kg/m^2	5943 (93.49)
≥30 kg/m^2	414 (6.51)

The data is presented in both numbers and percentages.

Finally, 11.8% of the participants never quarantined, 6.7% were less than one month in quarantine, 21.4% for 1–3 months, 32.2% for 4–6 months and 27.9% for more than seven months.

3.2. Comparison between stress factors and food purchase prioritization

Table 2 shows the comparison between stress factors and food purchase prioritization, showing that people with higher stress scores prioritize the purchase of items such as milk, sugar, flour, oil, canned foods, legumes, packaged cookies and sweets, among others.

3.3. Comparison between stress factors and food purchase prioritization

The association between stress factors and food purchase prioritization is shown in Fig. 1. Most of the food items were associated with a higher priorization for purchase, except for snacks, legumes, sugary drinks, alcohol and meat. Food items that showed higher associations with stress factors were canned foods (OR: 1.91, 95% CI: 1.56; 2.34), followed by sweets (OR: 1.58, 95% CI: 1.06; 2.34), and flour (OR: 1.45, 95% CI: 1.25; 1.68). Meanwhile, food items associated with lower stress factors were nuts (OR: 0.75, 95% CI: 0.66; 0.85), vegetables (OR: 0.82, 95% CI: 0.72; 0.94), and fruits (OR: 0.90, 95% CI: 0.80; 1.01), after adjusting for confounders (Fig. 1).

4. Discussion

The objective of our study was to associate food purchase prioritization with stress level during the COVID-19 confinement in a sample of Latin American adults. Individuals with higher stress levels prioritize items from the basic food basket, packaged food and long-life food products such as flour, sugar and milk. On the other hand, the least prioritized food items are fruits, fresh vegetables and nuts.

Some of the prioritized healthy foods are part of the basic basket in most Latin American countries, especially non-perishable products, such as potatoes, flour, legumes, canned goods, non-caloric sweeteners, coffee, tea, oil, eggs, dairy products, fresh fruits and vegetables [14]. These foods are characterized for having a more economic value, being more versatile and providing critical nutrients that are essential throughout the life span of the individual [15].

In most Latin American countries, flour is fortified with folate, vitamins of the B complex, vitamin A, iron, calcium and zinc. Therefore, its consumption is essential, since fortification has been a public health measure to control micronutrients deficiency in the general population [16].

Among the least prioritized foods at higher stress levels we can mention fruits, vegetables and dried fruits, that provide a range of nutrients and bioactive compounds including phytochemicals (phenolics, carotenoids), vitamins and minerals, whose consumption has been negatively related to the risk of developing chronic diseases such as obesity, type 2 diabetes, hypertension, metabolic syndrome, coronary disease and cancer [17].

On the other hand, more stressed subjects prioritize unhealthy foods such as cookies, candies, chocolates and sugar, which are characterized for being more energy-dense and containing critical nutrients which are detrimental to health. Income level has been reported among the most salient stress factors influencing food choice, therefore, it is necessary to take initiatives that allow accessibility to healthy food through public policies and health emergency measures [18].

Table 2
Comparison between stress factors and food purchase prioritization.

Food	Prioritization of food purchases				p-value
	High	Medium	Low	Do not buy	
Potatoes	6.26 (2.96)	5.73 (2.99)	5.47 (3.00)	5.38 (3.04)	<0.001
Powdered/liquid milk	6.05 (2.90)	5.61 (3.07)	5.56 (3.02)	5.47 (3.16)	<0.001
Packaged cookies	6.39 (3.17)	6.03 (2.99)	5.83 (2.98)	5.48 (2.98)	<0.001
Cheese	5.94 (2.91)	5.63 (3.00)	5.80 (3.18)	5.51 (3.40)	0.0018
Snacks	6.35 (3.24)	6.17 (2.87)	5.76 (2.96)	5.70 (3.06)	0.0002
Oil (all types)	6.15 (3.00)	5.75 (2.94)	5.63 (2.98)	5.45 (3.18)	<0.001
Sugar	6.28 (3.13)	5.80 (2.99)	5.74 (2.97)	5.42 (2.89)	<0.001
Non-caloric sweeteners	6.04 (2.85)	5.79 (2.89)	5.84 (3.18)	5.70 (3.00)	0.0215
Canned foods	6.62 (2.79)	5.96 (2.97)	5.61 (2.99)	5.48 (3.11)	<0.001
Flour (wheat or corn)	6.35 (3.02)	5.89 (2.97)	5.58 (2.98)	5.42 (2.98)	<0.001
Legumes (tender and dry grains)	5.90 (2.99)	5.68 (2.97)	5.71 (3.09)	5.67 (3.20)	0.0458
Sugary drinks and juices	6.19 (3.29)	5.93 (3.07)	5.97 (3.10)	5.62 (2.88)	<0.001
Alcohol (wine/beer/other)	6.06 (2.96)	5.69 (2.94)	5.73 (2.92)	5.86 (3.08)	0.1487
Sweets (candy/chocolates)	6.66 (2.95)	5.99 (3.02)	5.90 (3.02)	5.59 (2.97)	<0.001
Coffee/tea/mate	5.96 (2.88)	5.69 (3.02)	5.69 (3.15)	5.74 (3.16)	0.0085
Nuts	5.38 (2.92)	5.71 (2.94)	5.99 (3.07)	6.35 (3.03)	<0.001
Fresh fruits	5.72 (2.94)	5.74 (3.09)	6.27 (3.23)	6.09 (2.85)	0.0001
Fresh Vegetables	5.73 (2.94)	6.02 (3.18)	6.27 (3.33)	7.26 (3.11)	0.0004
Meat (beef/pork/chicken/fish)	5.83 (2.89)	5.69 (3.16)	5.94 (3.48)	5.72 (3.42)	0.355
Eggs	5.84 (2.93)	5.53 (3.29)	5.72 (3.38)	5.86 (3.24)	0.0364

The number of stress factors are presented as average and their standard deviation, ANOVA statistical test, a continuous scale was made by adding all the stress factors. 1 point if the answer was yes and 0 points if it was no or not applicable.

Although sugar-sweetened beverages did not show significant differences, they are highly consumed all across Latin America and have been positively related to weight gain and the risk of suffering type 2 diabetes, cardiovascular disease and some types of cancer, according to dose–response studies [19–21]. In general, individuals diagnosed with type 2 diabetes have an increased likelihood of consuming this type of beverages, which is related to continued weight gain and a high burden of chronic diseases [22].

Unhealthy snacks such as cookies, chocolates and candies are characterized as being high in energy, saturated fats, sugars and salt, and having a low nutritional value, and have a negative impact on blood pressure, obesity and type 2 diabetes [23]. In Australian adults, a positive dose–response association was found between the consumption of ultra-processed foods and the risk of obesity by overconsumption of nutrients [24].

Additionally, our study observed a high prioritization of purchasing ultraprocessed foods such as sugary beverages, cookies, snacks, cheese, and sweets in the presence of stressors. These foods are rich in calories, saturated fats, trans fats, sugars, and sodium, and current evidence shows that their consumption contributes to the development of various diet-related chronic diseases [25–27]. On the other hand, guidelines issued during the COVID-19 pandemic recommend adopting a healthy diet and ensuring proper hydration during the quarantine period, especially for individuals with comorbidities [28]. Several studies have shown that confinement was generally associated with the consumption of unhealthy foods [29,30]. An example of the above is a study in adolescents conducted in Italy, Spain, Brazil, Chile, and Colombia, which showed an increase in the consumption of ultra-processed foods, particularly in Latin American countries [31]. Another study carried out in Iberoamerica, both in the general population and among university students, revealed high consumption of unhealthy foods [29].

In general, stressful situations are known to alter dietary habits and increase the risk of malnutrition by excess. More stressed individuals or those unable to manage stress consume more snacks, such as sweet snacks, in an exacerbate manner [32,33]. During the COVID-19 pandemic, it was observed that stress levels experienced before and during the pandemic (financial hardship) in families with children were positively associated with snack intake, which could have potential impacts on child obesity risk [34]. A cross-sectional study showed that a group of university young adults increased their BMI, mental stress, and their consumption of bread and confectionaries [35]. During the COVID-19 pandemic, it was observed that higher levels of perceived stress could be positively related to emotional [36]. Emotional eating is more frequent among women [37] and it is positively associated with obesity, intake of more energy-dense foods (fats and sugar), number of meals and frequency of fast food, and is negatively correlated with increased family income [38]. A cross-sectional study conducted in a group of adult Americans showed that emotional overeating may escalate stress-associated intake of high-sugar foods, while subjects with cognitive flexibility, that is, those who are resilient in the face of stress, may attenuate the intake of high-fat foods [39]. On the other hand, during the period of COVID-19 lockdown, it was noted that in Latin American populations diet quality was inversely associated with anhedonia and anxiety [40]. On the other hand, in Temple's article, it is emphasized that stress factors are more frequently expressed in situations of food insecurity. Furthermore, it is mentioned that individual levels of resilience and vulnerability, along with support systems provided by family, friends, the government, and the community at large, play a crucial role in managing the potential adverse effects of these stressors. Therefore, it becomes essential to reinforce support networks, especially in times of crisis, at both governmental and community levels [13].

A poor-quality diet is associated with less healthy foods, more palatable food, fried food, increased serving size [41] and greater self-reported weight [42]. Nutritional follow-up should be considered in the case of more stressed individuals, since food cravings and anxiety have an impact on decision making when choosing foods of lower nutritional quality, characterized by a high content of fats and sugars; moreover, serving size has negatively influenced nutritional status and may contribute to the development of non-communicable chronic diseases in the future.

Among the weaknesses of this study we can mention that the sample is not representative of the ten Latin American countries. In addition, this is a cross-sectional study, therefore, it is not possible to determine causality but only associations. Furthermore, stress level was obtained as a result of adding together stress factors before and after the COVID-19 pandemic, and the sample

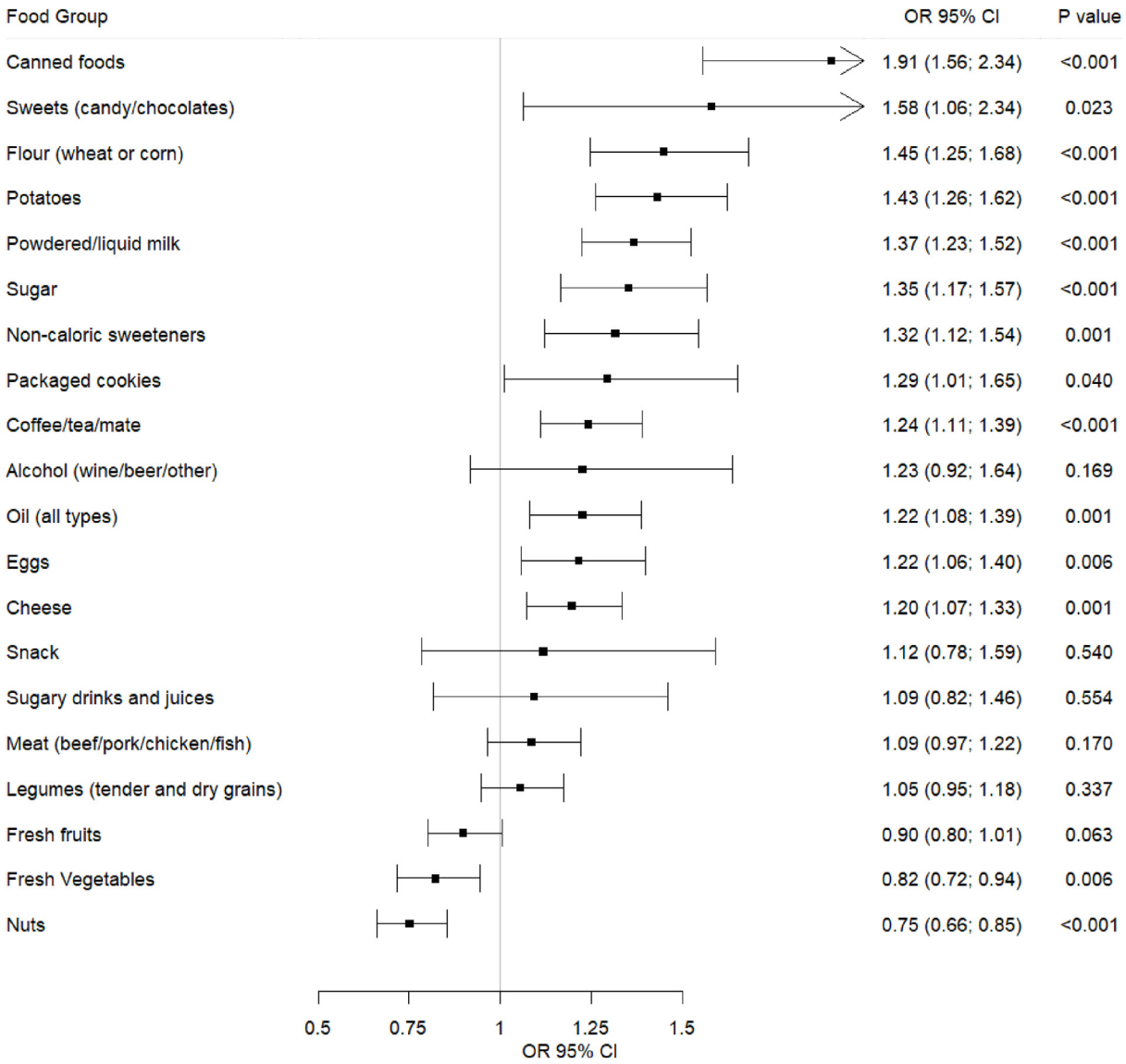

Fig. 1. Association between stress factors and food purchase prioritization. Data are presented in Odds ratio (OR) with their 95% confidence interval (CI), variables were dichotomized, the outcome was stressors, 0 < 6 stressors 1 ≥ 6 stressors, foods in 1 high priority and 0 the other categories. The model was adjusted by age, sex, socioeconomic level, quarantine and body mass index.

representing low socioeconomic level was small, since the sampling method implemented consisted of an online survey, and low socioeconomic level is likely to experience the greatest stress levels. Consequently, participation was conditioned by digital literacy of the population groups and the availability of Internet, computers and participants' computer usage/skills, which are generally poorer in this group, Finally, in the food-related section, only inquiries about prioritizing purchases based on a predetermined list were made, without specifically addressing food consumption. For future research, it would be relevant to include questions about eating habits.

Among the strengths we may highlight the use of a validated survey, so it is possible to compare our data with other studies of similar characteristics performed in the other regions studied.

In conclusion, there is an association between food purchase prioritization and stress level during the COVID-19 confinement. At greater stress levels individuals purchase more food, both healthy and unhealthy. The later may have a negative impact on people's health, leading to or further aggravating malnutrition by excess and nutrition-related noncommunicable diseases.

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Authors' contributions

LQA – SPS – SDA – JLMO – YMT: Conceptualization, Methodology. YMT – SPS: Statistical analysis. LQA – SPS – SDA – YMT – LMBG – IRC – GPG – MRI – RXFC – MCN – AGG – LG – EJNG - JLMO: Writing, Preparation of the original draft: LQA – SPS – SDA – YMT – LMBG – IRC – GPG – MRI – RXFC – MCN – AGG – LG – EJNG – JLMO. Supervision. Validation, revision, editing: LQA – SPS – SDA – YMT – LMBG – IRC – GPG – MRI – RXFC – MCN – AGG – LG – EJNG – JLMO.

Declaration of competing interest

Authors declare no conflicts of interests.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.clnesp.2024.03.001.

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