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Citation: Dezanetti, T., Quinaud, R. T., Caraher, M. & Jomori, M. M. (2022). Meal preparation and consumption before and during the COVID-19 pandemic: The relationship with cooking skills of Brazilian university students. *Appetite*, 175, 106036. doi: 10.1016/j.appet.2022.106036

This is the accepted version of the paper.

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Permanent repository link: <https://openaccess.city.ac.uk/id/eprint/28177/>

Link to published version: <https://doi.org/10.1016/j.appet.2022.106036>

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1. Introduction

Cooking skills are defined as a combination of the confidence, attitude, and knowledge of individuals in performing cooking tasks. These tasks involve planning menus, shopping, and preparing unprocessed (fresh foods), minimally processed (e.g., polish in rice, fermentation in cheese and yogurt), processed (e.g., canned foods with added salt or sugar, industrialized bread), or ultra-processed foods (Jomori et al., 2018). Ultra-processing is related to techniques which transform the original food, adding a lot of preservatives, salt, sugar and fat, to help with preservation, storage and distribution, generally, making the food ready to eat (Brazil, 2014). High levels of the use cooking skills are associated with an increase in the consumption of fresh fruits and vegetables, which may be related to healthy eating habits among adults and adolescents (Caraher et al., 1999; Laska et al., 2012; Utter et al., 2018; Wolfson & Bleich, 2015).

Processes involved in individual meal preparation (planning, transportation, shopping, preparing, and cleanup) were described as being an ‘overwhelming responsibility’ (Murray et al., 2016) aside from other barriers to cook among university students, leading them to have low cooking skills and low meal preparation frequency (Bernardo et al., 2017; Murray et al., 2016; Wilson et al., 2017; Sprake et al., 2018; de Borba et al., 2021), low consumption of fruits and vegetables, and high intake of fast foods, snacks, deep-fried foods, refined grains, sweets, carbonated, and other sugar-sweetened beverages (Bernardo et al., 2017).

Low cooking skills and low frequency of meal preparation or behaviors are related to poor diets, with low consumption of fruits and vegetables, high consumption of ultra-processed foods, **meals away from home, take-way** and fast food, **related to high energy-dense food intake** in these population (Bernardo et al., 2017; **Bezerra et al., 2020**; de Borba et al., 2021; Graham et al., 2013; Knol et al., 2019; Lavelle et al., 2016; **Santos et al., 2015**; Sprake et al., 2018; Utter et al., 2018; **Vilela et al., 2014**; Wilson et al., 2017). Additionally, factors related to greater access, convenience and consumption of ready-to-eat foods (ultra-processed foods) can be identified, such as difficulties in accessing healthy foods and fresh fruits and vegetables, lack of time, money, kitchen facilities, knowledge, and confidence to cook, and their living arrangements (Graham et al., 2013; Jones et al., 2014; Knol et al., 2019; Murray et al., 2016; Pulz et al., 2017; Sprake et al., 2018; Utter et al., 2018; Wilson et al., 2017).

33 Recommendations to promote healthy eating practices, encouraging meal
34 preparation and the development of cooking skills are found in the United Kingdom
35 (Tsouros et al., 1998; Dooris & Doherty, 2010; Community Food and Health Scotland,
36 2013), Northern Ireland (Food Standards Agency, 2012), Canada (Chenhall, 2010), in
37 the United States of America (USDA, 2013) and in Brazil (Brasil, 2014). The Health
38 Promotion Universities Network (REDUPS) that operate in collaboration with the Pan
39 American Health Organization (OPAS/OMS) (REDUPS, 2013) has a commitment to
40 health promotion in the university environment (Dooris & Doherty, 2010; Oliveira,
41 2017; REDUPS, 2013; Soares et al., 2015; Tsouros et al., 1998; WHO, 2015). In Brazil,
42 the accreditation of universities at RIUPS is being implemented (Oliveira, 2017). One
43 of the strategies to promote healthy eating practices among university students to
44 achieve the recommendation of these documents could be to develop or improve their
45 cooking skills and encourage them to prepare their own meals frequently (Bernardo et
46 al., 2017; Wilson et al., 2017) or offer healthy foods at canteens and cafeterias (Pulz et
47 al., 2017).

48 One of the concerns in promoting these policies is based on the barriers to
49 cooking that students face ranging from access to food to the application of skills, as
50 mentioned before (Jones et al., 2014; Wilson et al., 2017). Due to the COVID-19
51 pandemic, a suspension of presential classes and academic activities at universities have
52 been put in place. As a result, university students have been affected by food insecurity,
53 probably because many of them have lost their part-time jobs and have not been
54 registered by student assistance programs, as well as the inaccessibility to university
55 cafeterias that were closed during the pandemic. This requires the planning, purchasing,
56 and preparation of their own food (Owens et al., 2020).

57 In this context, long periods at home require knowledge and skills to plan and
58 prepare meals or any culinary involvement. Young people tended to increase their
59 consumption of ultra-processed foods and reduce their consumption of fresh foods
60 during the pandemic (Jribi et al., 2020; Owens et al., 2020; Ruiz-Roso et al., 2020). On
61 the other hand, purchases of ready-made meals, such as instant ‘TV dinner’, were
62 reduced during the pandemic by Italian individuals, although ultra-processed food’s
63 consumption (e.g., chocolate, ice-cream, desserts, and salty snacks) has been increased
64 (Scarmozzino & Visioli, 2020). Moreover, studies have shown that working and
65 studying from home can increase the frequency of home cooking and homemade-

66 recipes, reduce the food waste, and encourage attention to food behaviors (Deschasaux-
67 Tanguy et al., 2020; Di Renzo et al., 2020; Gerritsen et al., 2020; Restrepo & Zeballos,
68 2020; Reyes-Olavarría et al., 2020; United Nations, 2015).

69 *It is important to consider social and individual characteristics that influence*
70 *the cooking skills and meal preparation. A systematic review involving 38 papers about*
71 *the relationship of social determinants and home cooking showed that the main*
72 *determinants included gender (women and girls are more likely to be involved in*
73 *cooking than men and boys), greater available time to cook and employment (those who*
74 *have restrictions in time or working more tend to cook less than who have greater*
75 *available time), close personal relationships (those who live with a partner or children*
76 *were more likely to cook) and culture and ethnic background (Mills et al. 2017).Short*
77 *and Gatley make the point that wider structural and economic determinants in the food*
78 *environment influence both the acquisition and use of cooking skills (Gatley, Caraher*
79 *and Lang 2014; Short 2006)*

80 To improve university students' diets, it is necessary to increase their
81 consumption of fresh foods, such as fruits and vegetables, rather than ultra-processed
82 foods (Graham et al., 2013; Knol et al., 2019; Larson et al., 2006; Laska et al., 2012;
83 Sprake et al., 2018; Utter et al., 2018; Wilson et al., 2017). However, it is important to
84 consider the difficulty in preparing fresh foods, as they require the use of basic pre-
85 preparation cooking techniques to scratch cook, as well as individual factors (i.g.
86 attitude, confidence and knowledge to cook) (Jomori et al., 2018).

87 Researchers have identified the need for increases culinary skills and their usage
88 among young people to improve their diet during this period when they are at home for
89 long periods of time (Jribi et al., 2020; Owens et al., 2020; Ribeiro et al., 2020; Ruiz-
90 Roso et al., 2020). However, to our knowledge, none of these studies have evaluated
91 meal consumption and preparation related to their level of culinary skills and healthy
92 eating practices during the pandemic. Therefore, it is an opportunity to identify the
93 students' level of culinary skills and relate them to their characteristics and the food
94 environment during the COVID-19 pandemic (Fulkerson et al., 2019; Owens et al.,
95 2020; Rathi et al., 2018; Ribeiro et al., 2020; Ruiz-Roso et al., 2020).

96 In this context, this study aimed to estimate the probabilities of meal preparation
97 and the place of consumption by university students before and during the COVID-19
98 pandemic, according to their individual characteristics and cooking skills.

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1. Methods

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1.1. Study design and participants

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This descriptive cross-sectional study was conducted from June to August 2020, with undergraduate students from the Federal University of Rio Grande do Sul (UFRGS) and Federal University of Santa Catarina (UFSC), Brazil. Based on the total number of students enrolled at UFSC (n = 30,000) and UFRGS (n = 31,000), a minimum of 830 and 731 students, respectively, were calculated to be required bearing in mind a possible 10% loss, 2.0 effect, and 5% random error (Jomori et al., 2017).

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The eligibility criteria were the enrollment in any undergraduate course at this institution. Those enrolled in postgraduate courses or those who did not answer all the questions provided in the questionnaire were excluded from analysis.

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This study was approved by the Human Research Ethics Committee of the Federal University of Santa Catarina (UFSC) and Federal University of Rio Grande do Sul (UFRGS) under the approval number 09427219.5.3001.0121. Participants provided online informed consent prior to all analyses and were assured that all data would be used only for research purposes.

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1.2. Measurements

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The Brazilian Cooking Skills and Healthy Eating Questionnaire (BCSQ) was used to assess cooking skill levels. The BCSQ is an adapted and validated questionnaire for the Brazilian population (Jomori et al., 2017; Jomori et al., 2022). The questionnaire was shortened to 36 items and was distributed across seven factors, incorporating all items and structure from the U.S. version, as shown in supplementary material. Higher value of measures indicated higher cooking skills practiced or used.

124

1.3. Recruitment and data collection

125 The participants were recruited between June and July 2020 through university
126 e-mail distribution lists and social media related to undergraduate courses, containing
127 messages with a link and a quick response code (QRcode) to easily access an online
128 questionnaire.

129 The participants voluntarily completed the online questionnaire. The total
130 number of answers and distribution per course was observed **and controlled** until the
131 established sample size was achieved. *For those courses that had no or few answers,*
132 *the questionnaire was resent through e-mail asking to the course coordinators asking*
133 *them to send the the study details to their students in order to have a heterogeneous*
134 *sample between the different study areas. When sufficient numbers of participants*
135 *from these courses were achieved, data collection was stopped.* The data collected
136 included the following variables: gender (male or female); living arrangement (alone,
137 colleagues, parents, or partner); frequency (never, 1 to 2 times a month, once a week,
138 several times a week, or daily) of meal preparation (homemade meals prepared with
139 fresh ingredients, homemade meals prepared with ultra-processed food, homemade
140 meals prepared with fresh ingredients combined with ultra-processed food);
141 consumption (fast food or delivery); self-reported cooking knowledge (yes or no);
142 availability and accessibility of fruits and vegetables (low, medium, or high), cooking
143 skills (low, medium, or high); and cooking knowledge (low or high).

144

145 **1.4. Data analysis**

146 Bayesian multilevel ordinal regression models were used to estimate the
147 probabilities of meal preparation and local consumption by Brazilian university students
148 before and during the COVID-19 pandemic, according to their individual characteristics
149 and cooking skills. *A Bayesian approach considers parameters as random variables. It*
150 *estimates the probability distribution based on the data available and the prior*
151 *distribution information that measures the uncertainty about parameters (McElreath,*
152 *2015). Taking into account the different sources of inferential uncertainty, Bayesian*
153 *methods allow for combining the known information before seeing the data (i.e., the*
154 *prior uncertainty concerning a parameter or hypothesis expressed as a probability*
155 *distribution). Then this is identified from the observed data (i.e., the likelihood of the*

156 *data conditioned on the parameter or hypothesis) to update knowledge expressed as*
157 *the posterior distribution (Lee; Wagenmakers, 2013; Kennedy; Gelman, 2020).*

158 Bayesian data analysis reallocates credibility across the possibilities. It allows
159 the combination of prior knowledge with the observed data, resulting in what is called
160 posterior distribution (Kruschke & Liddell, 2018), as well as reducing bias and variance
161 for posterior estimates (Gao, Kennedy, Simpson, & Gelman, 2020). Additionally, the
162 use of multilevel regression models advances over traditional regressions (i.e., considers
163 data structure at just one level) by considering the nested data structure and the different
164 sources of variation (i.e., within and between groups) (Gelman & Hill, 2007).

165 The use of ordinal models also lies on the structure of the questionnaire, which
166 our dependent variables are peoples' responses on ordinal categories. Although these
167 variables are not metric, researchers commonly analyze them as metric responses,
168 which can cause misinterpretation of the results (Liddell & Kruschke, 2017).
169 Additionally, Bayesian multilevel ordinal models has been recommended as a better
170 option for analyzing rating, which allow for unequal distances between responses
171 (Verissimo, 2021).

172 The responses about university students' food consumption and place of
173 consumption of the main meal were estimated across time by gender (female and male),
174 age group (< 24 years old and > 25 years old), self-reported cooking knowledge (yes or
175 no), living arrangements (alone, colleagues, parents, or partner), cooking ability (low,
176 medium, or high), and cooking knowledge (low or high). Models were fitted using
177 "time" (before and during COVID-19) as a fixed effect (population-level effect). To
178 regularize the estimations, weakly informative prior distributions, normal prior (0, 10)
179 for population-level effects, and normal priors (0, 1) for group-level effects were used.
180 Additionally, to guarantee the Markov's convergence, two chains were run for 4000
181 iterations with a warm-up length of 1000 iterations. The analysis was performed using
182 the BRMS package (Burkner, 2017) in R (R Core Team, 2018).

183 Cooking ability was derived from the Likert's measures CA, CB, SEPC, SEC,
184 and SEFVS scored between 1 and 5 points. One question on the CA scale had a
185 reversed score. Total scores were calculated and ranged from 20 to 100 points. Based on
186 the sum, the classification of individuals was high cooking skill level (> 73 points),
187 medium (44 – 73 points), and low (< 44 points). Cooking knowledge was calculated

188 based on responses where the correct answer was scored 1 point. A total score of six or
189 higher was characterized as having high cooking knowledge (Jomori et al., 2022).

190 It is important to note, when interpreting the results, that estimates are expressed
191 in standard deviation and can be interpreted as a standardized effects size. Additionally,
192 reference categories are fixed as one and interpretations of standardized effect sizes are
193 based on these categories. The literature recognizes that the interpretation of such
194 effects is not immediately obvious. Thus, results are plotted to have a natural metric
195 interpretation (Burkner & Vuerre, 2019).

196 Results

197 A total of 1919 students were eligible for the present study out of the 2061 total
198 students who responded to the online survey. Participants were aged 23.9 (\pm 6.8) years
199 on average, and the majority were female (73.48%), living with parents (48.93%), and
200 believed that they knew how to cook (92.03%). The demographic and cooking
201 characteristics are presented in Table 2.

202 **Table 1.** Demographic and cooking characteristics of the students from two
203 Brazilian universities (n=1919).

Variables	N	SD or %
Age (years)	23.9	6.8
Gender		
-Female	1410	73.48
-Male	509	26.52
Living Arrangement		
-Alone	348	18.13
-With Parents	939	48.93
-With Partner	248	12.92
-With Colleagues	384	20.01
Do you believe that you know how to cook?		
- Yes	1766	92.03
- No	153	7.97

204 SD: standard deviation

205 Table 3 shows the cooking skills and healthy eating characteristics, such as the
206 level of availability of fruits and vegetables, cooking skills, and cooking knowledge.

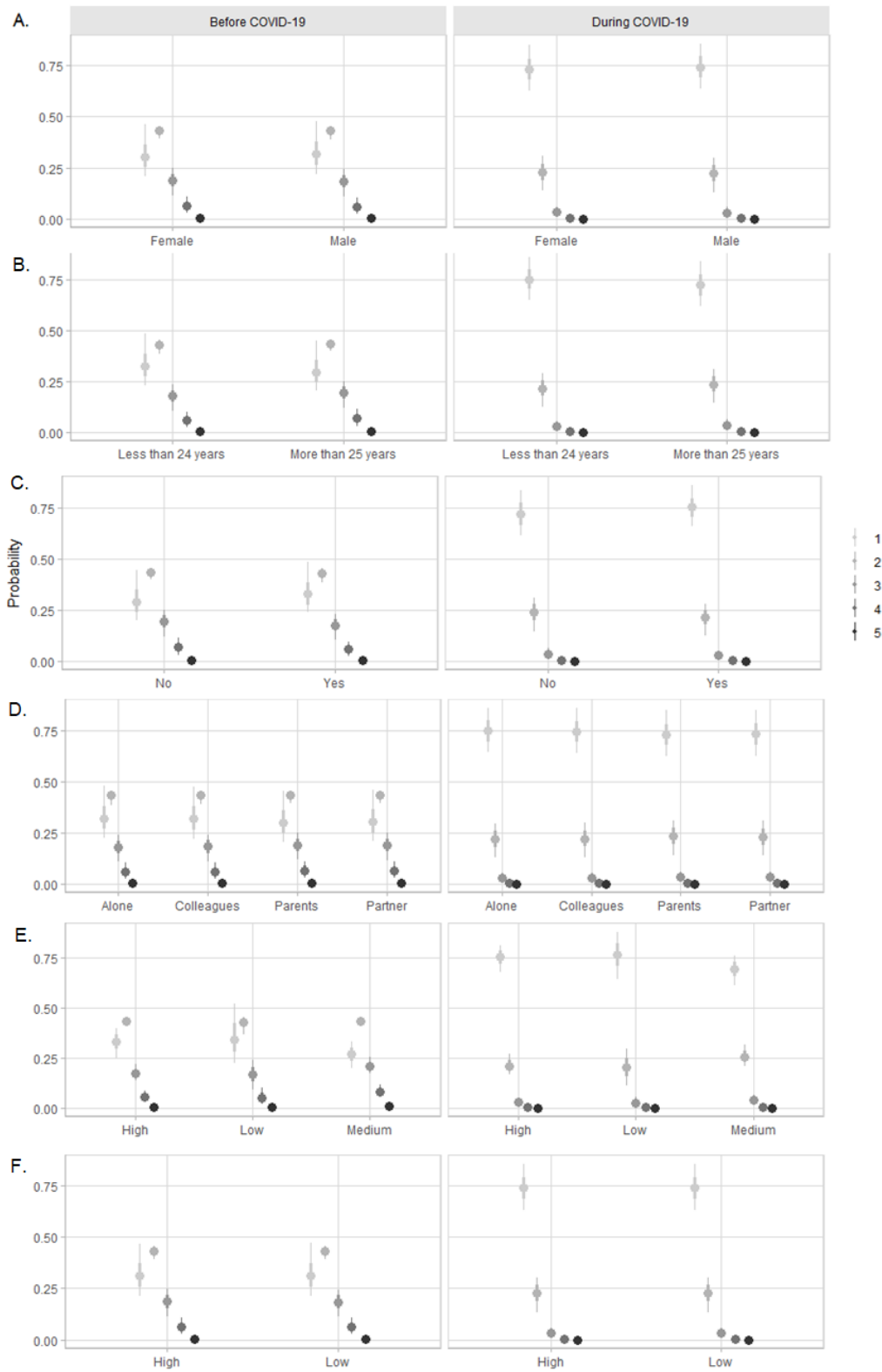
207 Most participants reported high availability of fruits and vegetables (73.01%), high
 208 levels of cooking skills (70.71%), and approximately half of them had high scores for
 209 cooking knowledge (50.65%).

210 **Table 2.** Level of availability of fruits and vegetables, cooking skills, and cooking
 211 knowledge of Brazilian university students (2020).

Measures	N	%
Availability and Accessibility of Fruits and Vegetables (AAFV)		
-Low	110	5.73
-Medium	408	21.26
-High	1401	73.01
Cooking skills		
-Low	14	0.73
-Medium	548	28.56
-High	1357	70.71
Cooking knowledge		
-Low	947	49.35
-High	972	50.65

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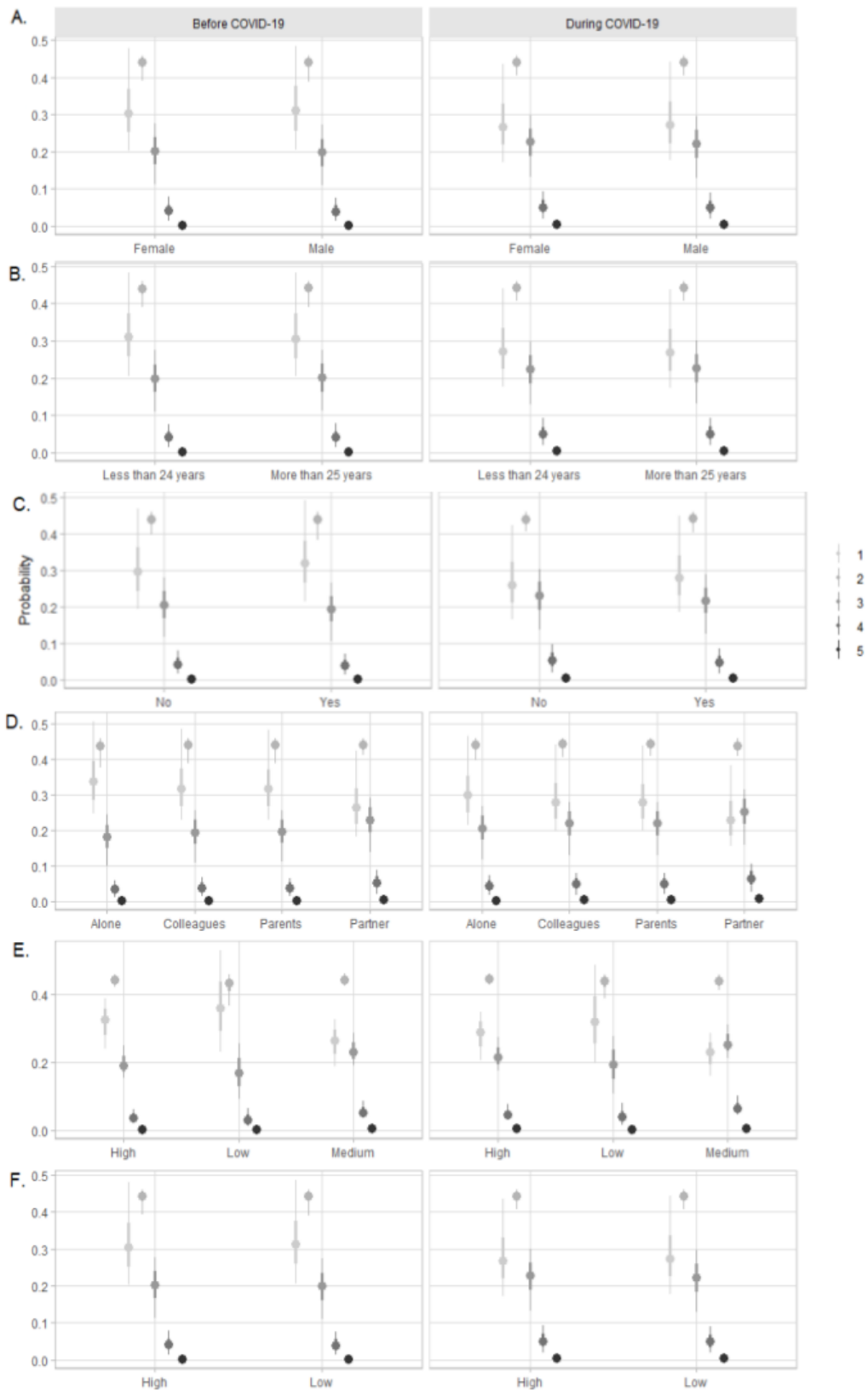
213 Multilevel ordinal regression models were plotted (Figures 1-5), and the
 214 estimates and confidence intervals are presented in Supplementary Table 1. The
 215 response categories are presented as 1 (never), 2 (1 to 2 times a month), 3 (once a
 216 week), 4 (several times a week), and 5 (daily). In relation to the consumption of fast
 217 food (Figure 1), university students decreased their probability of consumption during
 218 the pandemic (standard deviation [*SD*] = -1.13, 95% confidence interval [*CI*] = [-1.21,
 219 -1.06]) compared to consumption before the pandemic, with a high probability of
 220 responding “never” during the pandemic. We did not find substantial variation between
 221 groups for each variable at each time point for consumption of fast food. In Figure 2
 222 (delivery order), university students did not show substantial variation in their responses
 223 between time points (*SD* = 0.11, 95% *CI* = [0.04, 0.18]) or between groups, although
 224 there was a small increase during the pandemic.



225

226 Figure 1. Consumption of fast food before and during COVID-19 according to gender
 227 (A), age (B), whether they know how to cook (C), living arrangements (D), cooking
 228 ability (E), and cooking knowledge (F). Response categories are presented as 1 (never),

229 2 (1 to 2 times a month), 3 (once a week), 4 (several times a week), and 5 (daily). Error
 230 bars indicate 95% of credible intervals.

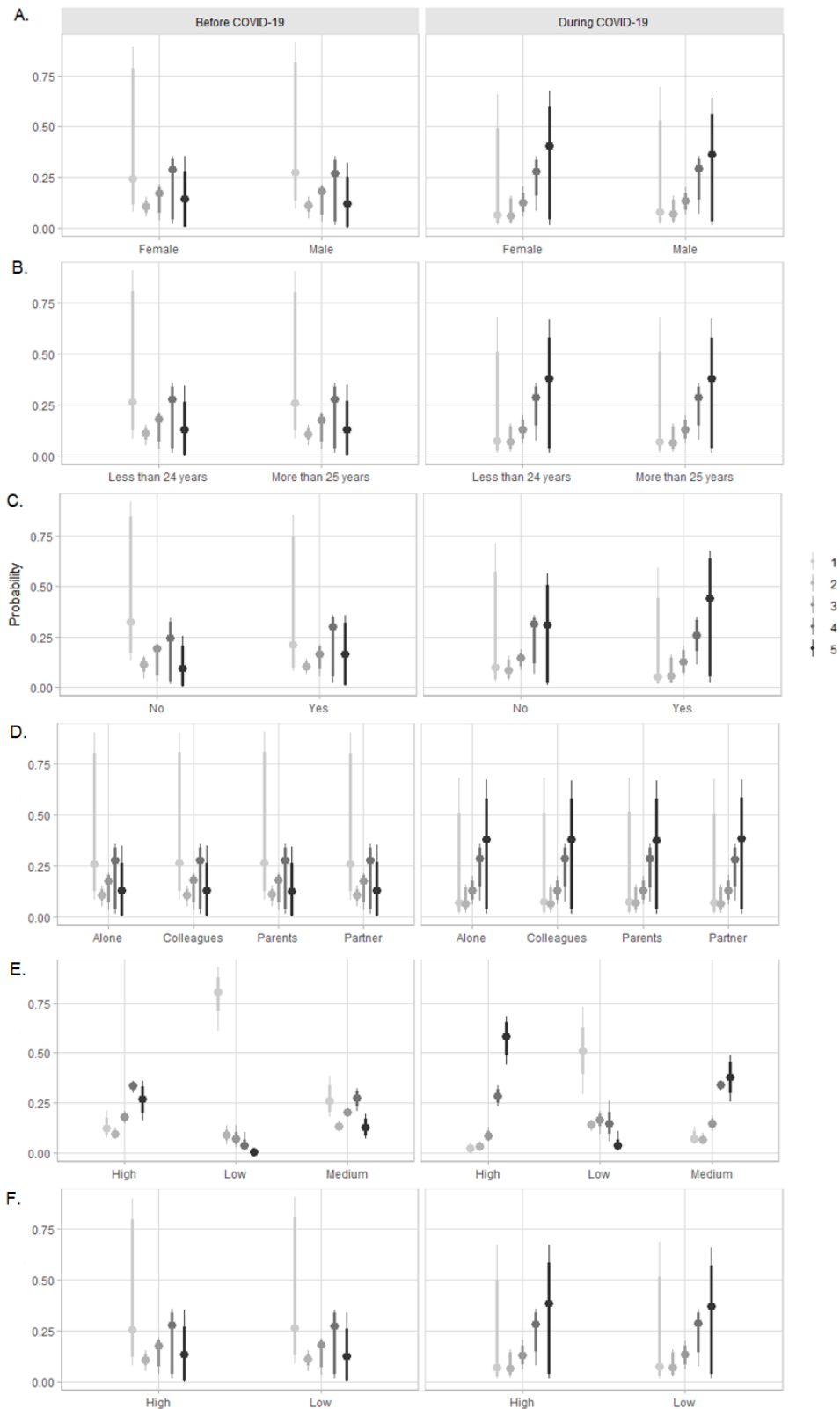


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233 Figure 2. Consumption of delivery before and during COVID-19 in relation to gender
234 (A), age (B), whether they know how to cook (C), living arrangements (D), cooking
235 ability (E), and cooking knowledge (F). Response categories are presented as 1 (never),
236 2 (1 to 2 times a month), 3 (once a week), 4 (several times a week), and 5 (daily). Error
237 bars indicate 95% of confidence intervals.

238 Figure 3 shows the use of fresh ingredients to cook before and during the
239 pandemic. Overall, university students substantially increased the use of fresh
240 ingredients during the pandemic ($SD = 0.83$, 95% CI = [0.75, 0.90]) compared to before
241 the pandemic. Students with high cooking ability increased the probability of using
242 fresh ingredients during the pandemic. The probability of answering “never” was almost
243 zero among these participants whereas responding “daily” substantially increased ($SD =$
244 1.50 , 95% CI = [-0.61, 3.62]). People with a medium level of cooking ability showed a
245 substantial increase in the probability of using fresh ingredients “several times per
246 week” and “daily” during the pandemic when compared with before the pandemic.
247 Those with low cooking ability had a slightly increased probability of using fresh
248 ingredients during the pandemic (1 to 2 times a month, once a week, several times a
249 week, and daily), even though this increase was lower than in students with medium and
250 high cooking abilities (Figure 3). The probability variation of the response of “daily”
251 increased for both groups that responded that they knew or did not know how to cook.

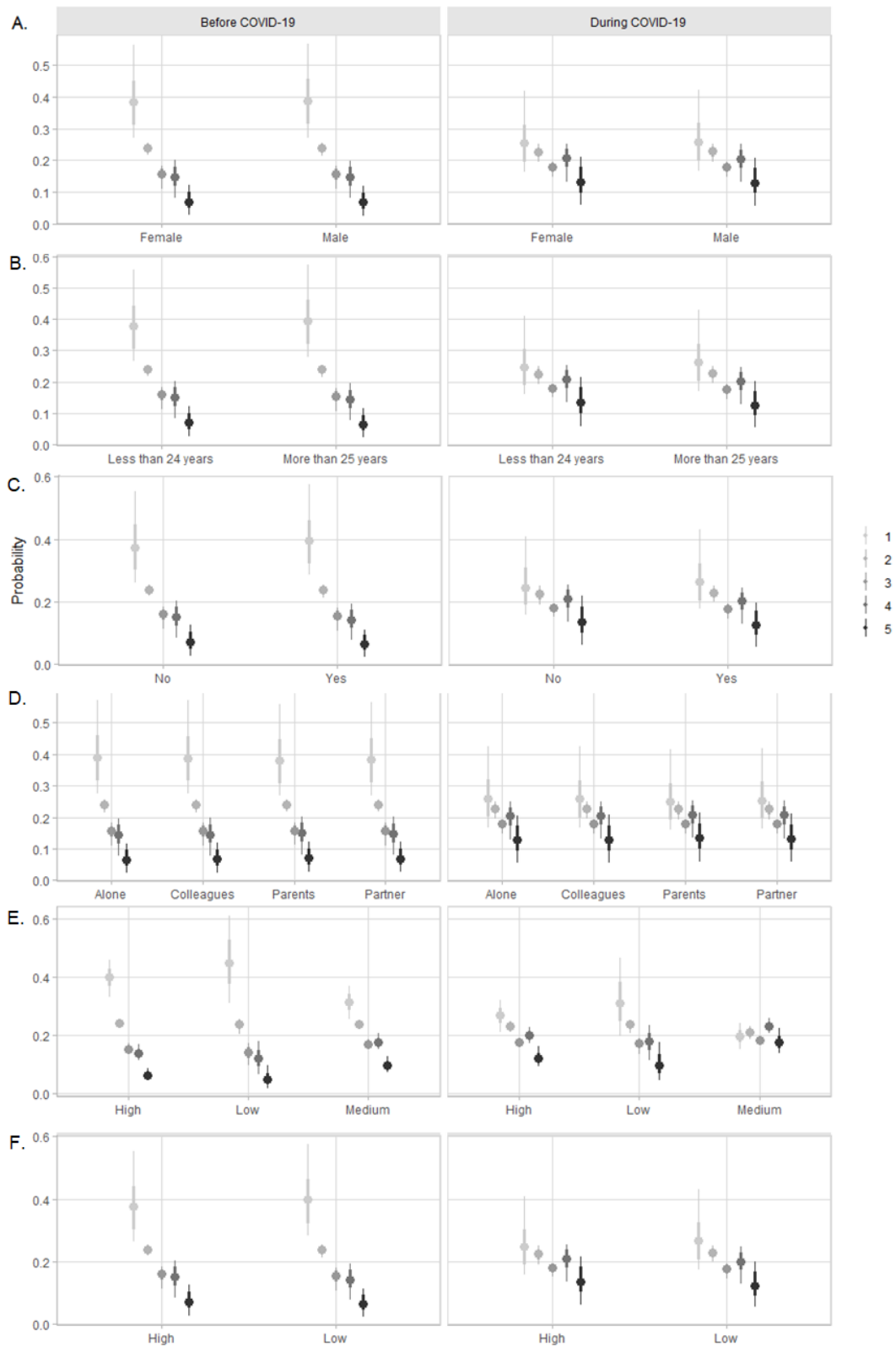


252

253 Figure 3. Use of fresh ingredients to cook before and during COVID-19
 254 according to gender (A), age (B), whether they know how to cook (C), living
 255 arrangements (D), cooking ability (E), and cooking knowledge (F). Response categories

256 are presented as 1 (never), 2 (1 to 2 times a month), 3 (once a week), 4 (several times a
257 week), and 5 (daily). Error bars indicate 95% of confidence intervals.

258 Regarding the use of ultra-processed foods (Figure 4), university students
259 increased the probability of using this type of food during the pandemic ($SD = 0.37$,
260 95% CI = [0.30, 0.43]) when compared to before the pandemic. Students with low,
261 medium, and high cooking skills had a decreased probability of responding “never” and
262 an increased probability of responding “daily” ($SD = 1.49$, 95% CI = [-0.19, 3.11]). The
263 probability of using combined fresh ingredients with ultra-processed foods (Figure 5)
264 substantially increased during the pandemic ($SD = 0.57$, 95% CI = [0.50, 0.64])
265 compared to before the pandemic. University students with high cooking ability
266 presented a higher probability of responding “daily” ($SD = 1.28$, 95% CI = [-0.57,
267 3.07]) compared to the other groups. Additionally, the probability of answering “never”
268 to this behavior decreased for all groups (low, medium, and high cooking skills).
269 Participants who reported that they did or did not know how to cook had an increased
270 probability of responding “daily” and a decreased probability of responding “never”
271 although with no substantial variation between the two groups.

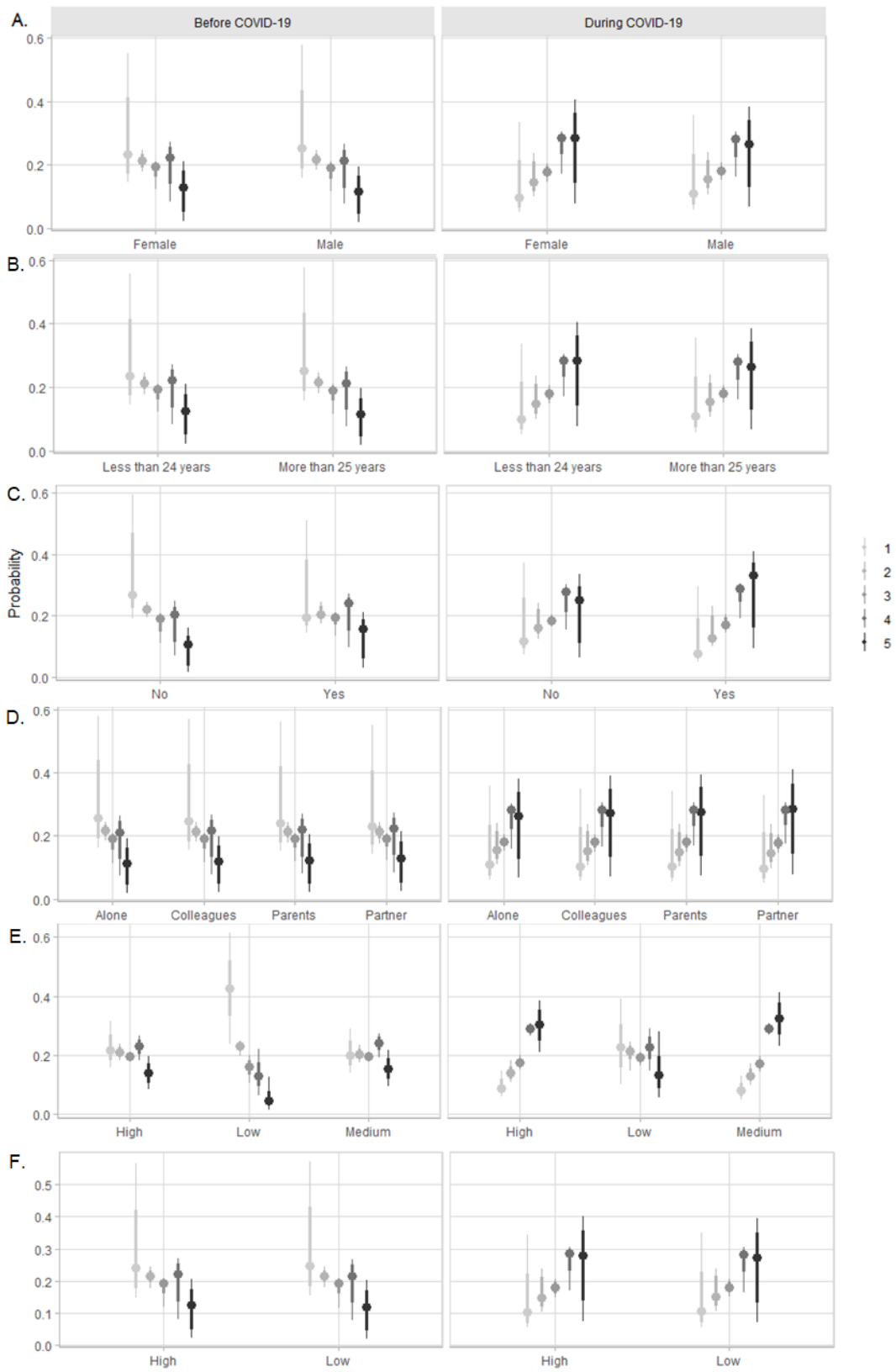


272

273 Figure 4. Use of ultra-processed food to cook before and during COVID-19 according
 274 to gender (A), age (B), whether they know how to cook (C), living arrangements (D),
 275 cooking ability (E), and cooking knowledge (F). Response categories are presented as 1

276 (never), 2 (1 to 2 times a month), 3 (once a week), 4 (several times a week), and 5
 277 (daily). Error bars indicate 95% of confidence intervals.

278



279

280 Figure 5. Use of fresh ingredients and ultra-processed food to cook before and
281 during COVID-19 according to gender (A), age (B), whether they know how to cook
282 (C), living arrangements (D), cooking ability (E), and cooking knowledge (F). Response
283 categories are presented as 1 (never), 2 (1 to 2 times a month), 3 (once a week), 4
284 (several times a week), and 5 (daily). Error bars indicate 95% of confidence intervals.

285 **2. Discussion**

286 This study **assessed** the characteristics of meal preparation and consumption by
287 Brazilian university students before and during the COVID-19 pandemic according to
288 their cooking skill level and individual characteristics. Overall, the sample showed
289 higher availability and accessibility of fruits and vegetables at home, higher scores in
290 their cooking skills, a decrease in the consumption of fast food and an increase in
291 homemade meals made with fresh ingredients, ultra-processed food, or both during the
292 pandemic compared to the period before the pandemic.

293 The high availability and accessibility of fruit and vegetable scores **showed**
294 **during the pandemic** (Table 2) **is related to the fact that** living at home may have
295 resulted in others taking responsibility for shopping and purchasing of foods. Thus, an
296 access barrier to food supply may have been averted and account for the reported high
297 availability. Studies have shown that high availability and accessibility of fruits and
298 vegetables are consistently positively correlated with fruit and vegetable intake.
299 Neumark-Sztainer et al. (2003) carried out a study with 3957 teenagers and found that
300 the availability of fruits and vegetables at home was one of the factors most related to
301 the consumption of these foods. A study by Kratt et al. (2000) investigated the
302 availability of fruits and vegetables as a moderating variable for fruit and vegetable
303 consumption relationships and how these relationships might change with varying
304 levels of fruit and vegetable availability. The **authors found** that homes with more fruits
305 and vegetables had a larger and stronger set of motivating factors for the consumption
306 of these foods by parents and children compared to those with low availability. This
307 suggests that participants **of the present study** not only have a high availability of fruits
308 and vegetables, but also may have a high intake of fruits and vegetables once they **also**
309 showed an increase in the probability of using fresh ingredients to cook (**Figure 3**),
310 independent of their cooking skill level.

311 Utter et al. showed in a longitudinal study carried out through a questionnaire
312 with young adults (18-23 years, n=1158), and with results from the same questionnaire
313 applied a decade later (30-35 years), that a quarter of their sample had very adequate
314 cooking skills as young adults (18-23 years). Utter and colleagues found found that
315 having cooking skills led these participants to better eating behaviors through greater
316 involvement in cooking and a lower consumption of fast food 10 years later in
317 adulthood (Utter et al., 2018). **The present study sample reported high scores for**
318 **cooking skills during COVID-19 (Table 2), this suggests that they are more likely to**
319 **experience long-term benefits, such as healthy dietary behaviors, compared to the low**
320 **level of cooking skills' participants.**

321 On the other hand, approximately half of our sample achieved a high level of
322 cooking knowledge (Table 2), **and half of these** recorded high frequency cooking
323 practices. Cooking knowledge involves perceptual skills (judging flavors, combining
324 and replacing ingredients with a minimum number of errors at the end of preparation,
325 and adjusting the time to perform culinary tasks), conceptual skills (predicting results,
326 knowing how to adapt ingredients, planning menus, knowledge of culinary terms and
327 techniques, and using appropriate equipment, utensils, and ingredients), and academic
328 knowledge (knowledge about nutrition, food hygiene, and food trends). This knowledge
329 is part of person-centered cooking skills; therefore, they can have an impact on
330 confidence, attitude, and individual cooking behavior (Jomori et al., 2018).

331 **The lack of culinary knowledge may not necessarily influence the practice and**
332 **food choices of the participants, but the lack of culinary knowledge can impact on**
333 **confidence and culinary attitudes, leading to less healthy choices.** Murray et al. (2016)
334 carried out a focus group with college students who did not live on campus, and thus
335 were not part of the campus meal system, but lived independently of their parents
336 (n=24) and found no evidence that culinary knowledge at different levels had a direct
337 impact on food choices and culinary practices of these students. Those living at home
338 **with others** may be less likely to be the sole food preparers and may in fact benefit from
339 the activities of others in the household.

340 **Long stay-at-home time** during the COVID-19 pandemic **may lead to a decrease**
341 **in the probability of fast-food consumption by the participants of our study in all the**
342 **variables analyzed, showing that it was independent of their level of cooking skills and**
343 **knowledge.** The closure of restaurants, social distancing by imposing safety standards,

344 and fear of the disease could be the factors that justify the decrease in the consumption
345 of fast-food and food delivery orders (Figure 1 and 2), as a structural determinant. One
346 study carried out in Brazil with people over 18 years old showed that people were more
347 likely to go to restaurants where they could see safety standards were in place such as
348 mask wearing, social distancing and eating in well ventilated places or outside during
349 the pandemic (Piton Hakim et al., 2021). Likewise, Husain and Ashkanani (2020)
350 carried out an online questionnaire with adults (18-73 years old) in Kuwait and found
351 that 49% of their sample were likely to consume fast food 1–2 times per week before
352 the pandemic, while up to 82% reported not consuming fast food during the pandemic.
353 Błaszczyk-Bębenek et al. (2020) also found a reduction on the daily servings of fast-
354 food consumption in Polish adults during lockdown, where during the pandemic the
355 percentage of participants who do not consume fast food daily increased to 41,7% from
356 26% before the pandemic.

357 On the other hand, the present study showed that the long stay-at-home period
358 increased the probability of cooking homemade meals, as observed in other studies
359 worldwide during the pandemic (Deschasaux-Tanguy et al., 2020; Di Renzo et al.,
360 2020; Gerritsen et al., 2020; Reyes-Olavarría et al., 2020). In Chile, Reyes-Olavarría et
361 al. (2020) found that almost 60% of the adult participants in their study increased home
362 cooking during the pandemic compared to before the pandemic. Di Renzo et al. (2020)
363 showed that their Italian sample aged between 12-86 years had increased homemade
364 recipes during the pandemic. In New Zealand, Gerritsen et al. (2020) showed that adult
365 participants had increased home cooking and baking from scratch during quarantine. A
366 study was conducted in France with 37,252 adults from a web-based cohort-filled
367 lockdown-specific questionnaire in April-May 2020. They verified that 40% of the
368 participants had increased home-made meals during the pandemic (Deschasaux-Tanguy
369 et al., 2020). These studies concluded that even though the pandemic resulted in a small
370 overall shift towards an unhealthy diet, they also created an opportunity for some people
371 to improve their cooking and nutritional behaviors, beginning with home cooking
372 practices, as also shown in the present study. Over a period of extended lockdown there
373 are reports of changing culinary practices, so reports of increased cooking from scratch
374 were verified in the early stages but as lockdown continues some of this initial impetus
375 is lost (Cummins et al., 2020).

376 Some of this is also influenced by the fact that although eating out may have
377 been difficult due to restrictions the catering industry adapted quickly to use online
378 ordering and offer home delivery of fast food. A study by Scarmozzino and Visioli
379 (2020) in Italy with 1932 participants **assessed** the effects of COVID-19-induced
380 confinement policies on self-reported food consumption through an online
381 questionnaire. They found a reduction of nearly 50% in the purchase of ready meals
382 during the pandemic. **Nevertheless**, these data show that, even in the middle of a
383 pandemic, people continued to have access to fresh ingredients, going out to purchase
384 them frequently. These attitudes, such as prioritizing fresh products, preparing
385 homemade meals, and limiting ultra-processed foods, are encouraged by the World
386 Health Organization during the pandemic (WHO, 2020).

387 The results of the present study reflect some of the above with people with the
388 highest level of cooking skills reporting that they had already used fresh ingredients
389 more frequently than those with medium or low cooking skills before the pandemic and
390 had a proportional increase during the pandemic among the high, medium, and low
391 cooking skill groups. People who self-reported that they knew how to cook in our study
392 **also** claimed they used to use more fresh ingredients than those who reported that they
393 did not know how to cook before the pandemic, even though both groups increased the
394 use of this kind of food **during the pandemic**. De Borba et al. (2021) analyzed self-
395 efficacy in cooking and consuming fruits and vegetables among 766 first-year students
396 from a university in southern Brazil. In their study, most participants reported that they
397 knew how to cook (72%), and among them, the majority were confident or extremely
398 confident in cooking from basic ingredients, including fresh vegetables.

399 The fact that the participants of the present study were in the period of
400 quarantine, where social distancing was imposed and the participants were staying at
401 home for longer periods of time, suggests that they looked for ways to increase their
402 access and use of fresh ingredients to cook. This may lead to the belief that they are
403 cooking healthier and more frequently during the pandemic when compared to before
404 the imposition of social distancing.

405 At the same time, the frequency of using ultra-processed foods to cook was also
406 increased by participants during the pandemic in all variables. However, this increase
407 was not as significant as the increase in fresh ingredients (Figure 4). The group with low
408 cooking skills was the group with the highest probability of never using ultra-processed

409 foods before and during the pandemic and the smallest probability of using several
410 times per week and daily when compared to the medium and high cooking skills groups.
411 The reason for this could be that they did not cook at all before or during the pandemic,
412 even though the consumption of ultra-processed food requires lower cooking skills than
413 fresh ingredients (Caraher & Lang, 1999; Chenhall, 2010). Conversely, Wolfson and
414 Bleich (2015) showed that individuals who had a high cooking frequency had a lower
415 frequency of meals taken from fast-food or frozen meals/pizzas per week in the past 30
416 days, when compared to people with low cooking frequency.

417 On the other hand, the use of a combination of fresh ingredients and ultra-
418 processed foods had the highest increase during the pandemic among people who had
419 high cooking skills, followed by the medium cooking skills group. Although the group
420 with low cooking skills also increased the consumption of this combination of foods,
421 the probability was lower than in the medium and high cooking skills groups, and they
422 maintained the highest probability of never using combined ingredients before and
423 during the pandemic. This can be justified by the fact that they might not have enough
424 confidence to use some techniques, plan meals, use a large variety of ingredients, and
425 cook from scratch, depending on the type of ultra-processed food (Jomori et al., 2018).
426 In addition, both students who self-reported knowing and not knowing how to cook
427 reported a higher probability of using combined ingredients during the pandemic when
428 compared to the period before, **being higher in** the group who reported knowing how to
429 cook.

430 In a study carried out by Murray et al. (2016) with 24 students through focus
431 groups, the participants remarked that they would eat more healthily if they had the
432 knowledge and information to prepare healthy foods. This shows that interventions can
433 be important to this group to develop cooking knowledge, especially regarding the use
434 of fresh ingredients and cooking skills, resulting in the improvement of their diet
435 behaviors. Seabrook et al. (2019) **and Bernardo et al (2018)** showed that students who
436 had taken a food and nutrition course, **and culinary intervention** had more cooking skills
437 than those who had not taken the course. **Higher cooking skills acquisition is supported**
438 **when university students take a culinary intervention and remains in place for long time**
439 **(Bernanrdo et al., 2018).**

440 Cooking knowledge can be related to cooking skills and practices, **which are**
441 **linked to healthy diets.** Study of Utter et al. (2018) found that having cooking skills led

442 the participants to better eating behaviors, greater involvement in cooking, and a lower
443 consumption of fast-food in adulthood. Wolfson and Bleich (2015) found a significant
444 association between the habit of making dinner at home with better diet quality and
445 lower consumption of energy, carbohydrates, fat, and sugar, fewer energy from meals
446 consumed outside home, or frozen or ready-to-eat meals. Similarly, Hartmann et al.
447 (2013) showed that cooking skills correlated positively with weekly vegetable
448 consumption, but negatively with weekly convenience food consumption frequency.
449 Thus, there might be a high probability that university students with high levels of
450 cooking skills are more likely to use fresh ingredients to improve their diet compared to
451 those with low levels of cooking skills.

452 The results of the present study indicate the demand for stimulating and
453 promoting the use of fresh ingredients, teaching how to prepare and cook from scratch,
454 in order to reduce the use of ultra-processed food and to increase the availability and
455 consumption of fruits and vegetables by university students, mainly those with medium
456 and lower cooking skills. The fact that students with low cooking skills have lower
457 probabilities of increasing their frequency of cooking any kind of food leads to the
458 belief that they are not encouraged to cook, faced by several barriers reported in the
459 literature (Graham et al., 2013; Jones et al., 2014; Murray et al., 2016; Wilson et al.,
460 2017; Pulz et al., 2017; Sprake et al., 2018; Utter et al., 2018; Knol et al., 2019). This
461 highlights the need for strategies focused on cooking skills **and excluding these barriers**,
462 especially because in Brazil, there are no public policies that promote healthy eating
463 among university students or guidelines for this group. Thus, policies and interventions
464 need to be focused on solving this aspect, **independently of the pandemic situation**.

465 **3. Conclusion**

466 This study demonstrated that most of the students showed a high level of
467 cooking skill and high availability and accessibility of fruits and vegetables. However,
468 only half of the participants showed high cooking knowledge, even though most
469 believed that they knew how to cook. This suggests that more attention should be given
470 to those who have low cooking knowledge, because the lack of cooking knowledge may
471 affect their confidence in cooking, and in this way, affect their food choices. In addition,
472 the participants increased their cooking frequency during the pandemic, regardless of
473 their cooking skills. However, the group with low cooking skills had only a slight
474 increase in the use of fresh ingredients, possibly because lack sufficient knowledge and

475 confidence to cook from scratch using ingredients that require more cooking skills.
476 Based on these results, interventions to disseminate information about cooking to
477 university students are highly recommended to increase cooking knowledge and
478 cooking skills, focusing on the preparation of fresh ingredients and offering options to
479 increase positive cooking attitudes, such as easy and convenient cooking techniques or
480 ways to use fresh foods. Further follow-up studies are required to assess whether these
481 students will retain their cooking knowledge, high cooking skills, and great availability
482 and accessibility of fruits and vegetables after college.

483

484 **4. Limitations and strengths**

485 The strengths of the study included the large sample size, multilevel analysis,
486 and use of the validated BCSQ, which presents several variables related to healthy
487 eating practices. Moreover, the relationship found between cooking skills and location
488 of meal preparation and consumption before and during the pandemic was able to
489 indicate which situations or university students' profiles need support to improve their
490 cooking skills, cooking knowledge, and diet.

491 On the other hand, this study was conducted in only two Brazilian universities in
492 southern Brazil. Even if they receive students from all over the country, this research
493 does not represent all the countries and could be conducted in other Brazilian regions.

494 Furthermore, our sample included a higher percentage of females (73.48%). This
495 can be justified by the fact that women are usually more concerned about health or diet
496 issues. Recall bias may also be a limitation. However, it was important to analyze this
497 scenario during the pandemic to plan interventions with this population that, in Brazil,
498 does not have a specific public policy.

499 Moreover, the study did not evaluate measures before and during the pandemic,
500 at different times, but is a cross-sectional study, depending on the record of students.
501 Further analysis is recommended for the follow-up.

502

503 **Acknowledgements**

504 We thank the contributions of the undergraduate students Clara Nogueira
505 Pacheco, Fernanda Riscado de Souza, and Patrícia Linhares da Cunha from Federal
506 University of Santa Catarina who carried out the data collection, all the university
507 students that participated in our research, the undergraduate course coordinators and
508 students' organizations that contributed to the recruitment of participants. We also
509 acknowledge the contributions of Professor Vanuska Lima da Silva, Federal University
510 of Rio Grande do Sul, regarding the design of the study. We acknowledge the National
511 Council for Scientific and Technological Development – CNPq (*Conselho Nacional de*
512 *Desenvolvimento Científico e Tecnológico*) from Brazil by the financial support of the
513 research and the scholarship. Finally, we thank the support by from Federal University
514 of Santa Catarina to support internship to students

515

516 **Author Contributions**

517 **Talissa Dezanetti:** Acquisition of data, Interpretation of data, Investigation, Writing as
518 well as for the choice of the Journal.

519 **Ricardo Teixeira Quinaud:** The design of the study, data analysis, interpretation of
520 results and manuscript review.

521 **Martin Caraher:** contributed for the design, literature, interpretation of results and
522 manuscript review.

523 **Manuela Mika Jomori:** Design of the study, Supervision, Interpretation the data,
524 Project administration, Writing and Review, Funding acquisition, and for drafting the
525 manuscript.

526

527 **Funding support**

528 Funding was supported by National Council for Scientific and Technological
529 Development – CNPq (*Conselho Nacional de Desenvolvimento Científico e*
530 *Tecnológico*), [grant number 424989/2018-2].

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532 **References**

- 533 Bernardo, G. L., Jomori, M. M., Fernandes, A. C., Colussi, C. F., Condrasky, M. D., & Proença, R.
534 P. da C. (2018). Positive impact of a cooking skills intervention among Brazilian university
535 students: Six months follow-up of a randomized controlled trial. *Appetite*, *130*, 247–255.
536 <https://doi.org/10.1016/j.appet.2018.08.014>
- 537 Bernardo, G. L., Jomori, M. M., Fernandes, A. C., & Proença, R. P. da C. (2017). Food intake of
538 university students. In *Revista de Nutricao* (Vol. 30, Issue 6, pp. 847–865). Revista de
539 Nutricao. <https://doi.org/10.1590/1678-98652017000600016>
- 540 Bezerra, I. N., Medeiros, H. B. N., De Moura Souza, A., & Sichieri, R. (2020). Contribution of
541 away-from-home food to the energy and nutrient intake among Brazilian adolescents.
542 *Public Health Nutrition*, 2–9. <https://doi.org/10.1017/S1368980020001573>
- 543 Błaszczyk-Bębenek, E., Jagielski, P., Bolesławska, I., Jagielska, A., Nitsch-Osuch, A., & Kawalec,
544 P. (2020). Nutrition behaviors in polish adults before and during COVID-19 lockdown.
545 *Nutrients*, *12*(10), 1–16. <https://doi.org/10.3390/nu12103084>
- 546 Brasil. (2014). *Dietary Guidelines for the Brazilian* (M. da Saúde (ed.); 2nd ed.).
- 547 Brasil. (2020). *Decreto nº 544, de 16 de junho de 2020*. (Issue 61, pp. 60–61).
- 548 Bürkner, P. (2017). brms: An R Package for Bayesian Multilevel Models using Stan. *Journal of*
549 *Statistical Software*, *80*(1-28).
- 550 Burkner P., Vuerre, M. Ordinal Regression Models in Psychology: A Tutorial. *Advances in*
551 *Methods and Practices in Psychological Science*, *2*(1), 77-101.
552 <https://doi.org/10.1177/251524591882319>
- 553 Caraher, M., & Lang, T. (1999). Can't cook, won't cook: A review of cooking skills and their
554 relevance to health promotion. *International Journal of Health Promotion and Education*,
555 *37*(3), 89–100. <https://doi.org/10.1080/14635240.1999.10806104>
- 556 Caraher, Martin, Dixon, P., Carr-Hill, R., & Lang, T. (1999). The state of cooking in England: The
557 relationship of cooking skills to food choice. *British Food Journal*, *101*(8), 590–609.
558 <https://doi.org/10.1108/00070709910288289>
- 559 Chenhall, C. (2010). Improving Cooking and Food Preparation Skills: A Synthesis of the
560 Evidence to Inform Program and Policy Development. *Healthy Living Issue Group (HLIG)*
561 *of the Pan-Canadian Public Health Network*, 1–39. <http://www.healthcanada.gc.ca>
- 562 Community Food and Health Scotland. (2013). *The impact of cooking courses on families: A*
563 *summary of a research study comparing three different approaches*.
564 [http://www.communityfoodandhealth.org.uk/wpcontent/uploads/2013/04/CFHS-](http://www.communityfoodandhealth.org.uk/wpcontent/uploads/2013/04/CFHS-impact-cooking-courses-families.pdf)
565 [impact-cooking-courses-families.pdf](http://www.communityfoodandhealth.org.uk/wpcontent/uploads/2013/04/CFHS-impact-cooking-courses-families.pdf)
- 566 Condrasky, M. D., Williams, J. E., Catalano, P. M., & Griffin, S. F. (2011). Development of
567 psychosocial scales for evaluating the impact of a culinary nutrition education program
568 on cooking and healthful eating. *Journal of Nutrition Education and Behavior*, *43*(6), 511–
569 516. <https://doi.org/10.1016/j.jneb.2010.09.013>
- 570 Cummins, S., Berger, N., Cornelsen, L., Eling, J, ER, V., Greener, R., Kalbus, A., Karapici, A., Law,
571 C., Nnlovu, D. (2020). COVID-19: impact on the urban food retail system and dietary
572 inequalities in the UK. *Cities & Health*, [S.L.], 1-4,
573 <http://dx.doi.org/10.1080/23748834.2020.1785167>.

- 574 de Borba, T. P., da Silva, M. V., Jomori, M. M., Bernardo, G. L., Fernandes, A. C., Proença, R. P.
575 da C., Rockenbach, G., & Uggioni, P. L. (2021). Self-efficacy in cooking and consuming
576 fruits and vegetables among Brazilian university students: the relationship with
577 sociodemographic characteristics. *British Food Journal*, *ahead-of-p*(ahead-of-print).
578 <https://doi.org/10.1108/bfj-04-2020-0311>
- 579 Deschasaux-Tanguy, M., Druésne-Pecollo, N., Esseddik, Y., de Edelenyi, F. S., Allès, B.,
580 Andreeva, V. A., Baudry, J., Charreire, H., Deschamps, V., Egnell, M., Fezeu, L. K., Galan,
581 P., Julia, C., Kesse-Guyot, E., Latino-Martel, P., Oppert, J. M., Péneau, S., Verdout, C.,
582 Hercberg, S., & Touvier, M. (2020). Diet and physical activity during the COVID-19
583 lockdown period (March-May 2020): Results from the French NutriNet-Santé cohort
584 study. *MedRxiv*, *May*. <https://doi.org/10.1101/2020.06.04.20121855>
- 585 Di Renzo, L., Gualtieri, P., Pivari, F., Soldati, L., Attinà, A., Cinelli, G., Cinelli, G., Leggeri, C.,
586 Caparello, G., Barrea, L., Scerbo, F., Esposito, E., & De Lorenzo, A. (2020). Eating habits
587 and lifestyle changes during COVID-19 lockdown: An Italian survey. *Journal of*
588 *Translational Medicine*, *18*(1). <https://doi.org/10.1186/s12967-020-02399-5>
- 589 Dooris, M., & Doherty, S. (2010). Healthy universities - Time for action: A qualitative research
590 study exploring the potential for a national programme. *Health Promotion International*,
591 *25*(1), 94–106. <https://doi.org/10.1093/heapro/daq015>
- 592 Food Standards Agency. (2012). *Fresher Food – A Student Survival Guide to Food*.
593 <http://webarchive.nationalarchives.gov.uk/20121205153510/http://www.food.gov.uk/northern-ireland/nutrition/niyoungpeople/fresherfood/>
- 595 Fulkerson, J. A., Telke, S., Larson, N., Berge, J., Sherwood, N. E., & Neumark-Sztainer, D. (2019).
596 A healthful home food environment: Is it possible amidst household chaos and parental
597 stress? *Appetite*, *142*(January), 104391. <https://doi.org/10.1016/j.appet.2019.104391>
- 598 Gao, Y., Kennedy, L., Simpson, D., & Gelman, A. (2020). Improving multilevel regression and
599 poststratification with structured priors. *Bayesian Analysis*, *26*. Doi: 10.1214/20-BA1223
- 600 Gelman, A., & Hill, J. (2007). *Data analysis using regression and multilevel/hierarchical models*
601 Cambridge: Cambridge University Press.
- 602 Gerritsen, S., Egli, V., Roy, R., Haszard, J., Backer, C. De, Teunissen, L., Cuykx, I., Decorte, P.,
603 Pabian, S. P., Van Royen, K., & Te Morenga, L. (2020). Seven weeks of home-cooked
604 meals: changes to New Zealanders' grocery shopping, cooking and eating during the
605 COVID-19 lockdown. *Journal of the Royal Society of New Zealand*, *0*(0), 1–19.
606 <https://doi.org/10.1080/03036758.2020.1841010>
- 607 Graham, D. J., Pelletier, J. E., Neumark-Sztainer, D., Lust, K., & Laska, M. N. (2013). Perceived
608 Social-Ecological Factors Associated with Fruit and Vegetable Purchasing, Preparation,
609 and Consumption among Young Adults. *Journal of the Academy of Nutrition and Dietetics*,
610 *113*(10), 1366–1374. <https://doi.org/10.1016/j.jand.2013.06.348>
- 611 Hartmann, C., Dohle, S., & Siegrist, M. (2013). Importance of cooking skills for balanced food
612 choices. *Appetite*, *65*, 125–131. <https://doi.org/10.1016/j.appet.2013.01.016>
- 613 Husain, W., & Ashkanani, F. (2020). Does COVID-19 change dietary habits and lifestyle
614 behaviours in Kuwait: A community-based cross-sectional study. *Environmental Health*
615 *and Preventive Medicine*, *25*(1). <https://doi.org/10.1186/s12199-020-00901-5>
- 616 Jomori, M. M., de Vasconcelos, F. de A. G., Bernardo, G. L., Uggioni, P. L., & Proença, R. P. da C.
617 (2018). The concept of cooking skills: A review with contributions to the scientific debate.

- 618 *Revista de Nutricao*, 31(1), 119–135. <https://doi.org/10.1590/1678-98652018000100010>
- 619 Jomori, M., Proença, R., Bernardo, G., & Fernandes, A. C. (2017). Construct validity of Brazilian
620 cooking skills and healthy eating questionnaire by the known-groups method. *Article in*
621 *British Food Journal*, 119 (5), 1003-1016. <https://doi.org/10.1108/BFJ-10-2016-0448>
- 622 Jomori, M., Caraher, M., Bernardo, G. L.; Uggioni, P. L., Echevarria-Guanilo, M. E., Condrasky,
623 M., Proença, R. P. da C. (2021). How was the cooking skills and healthy eating evaluation
624 questionnaire culturally adapted to Brazil? *Ciência & Saúde Coletiva*, 26 (6), 2379-2393.
625 <http://dx.doi.org/10.1590/1413-81232021266.22102019>.
- 626 Jomori, M., Quinaud, R. T., Condrasky, M., Caraher, M. (2022). Brazilian Cooking Skills
627 Questionnaire evaluation of using/cooking and consumption of fruits and vegetables.
628 *Nutrition*, 95. <https://doi.org/10.1016/j.nut.2021.111557>
- 629 Jones, S. A., Walter, J., Soliah, L. A., & Phifer, J. T. (2014). Perceived motivators to home food
630 preparation: Focus group findings. *Journal of the Academy of Nutrition and Dietetics*,
631 114(10), 1552–1556. <https://doi.org/10.1016/j.jand.2014.05.003>
- 632 Jribi, S., Ben Ismail, H., Doggui, D., & Debbabi, H. (2020). COVID-19 virus outbreak lockdown:
633 What impacts on household food wastage? *Environment, Development and*
634 *Sustainability*, 22(5), 3939–3955. <https://doi.org/10.1007/s10668-020-00740-y>
- 635 Kennedy, L., Gelman, A. J. A. P. A. (2020). Know your population and know your model: Using
636 model-based regression and poststratification to generalize findings beyond the observed
637 sample.
- 638 Kerrison, D. A., Condrasky, M. D., & Sharp, J. L. (2017). Culinary nutrition education for
639 undergraduate nutrition dietetics students. *British Food Journal*, 199, 1045–1051.
640 <https://doi.org/10.1108/eb011686>
- 641 Knol, L. L., Robb, C. A., McKinley, E. M., & Wood, M. (2019). Very Low Food Security Status is
642 Related to Lower Cooking Self-Efficacy and Less Frequent Food Preparation Behaviors
643 Among College Students. *Journal of Nutrition Education and Behavior*, 51(3), 357–363.
644 <https://doi.org/10.1016/j.jneb.2018.10.009>
- 645 Kratt, P., Reynolds, K., & Shewchuk, R. (2000). The role of availability as a moderator of family
646 fruit and vegetable consumption. *Health Education and Behavior*, 27(4), 471–482.
647 <https://doi.org/10.1177/109019810002700409>
- 648 Kruschke, J. K., & Liddell, T. M. (2018). Bayesian data analysis for newcomers. *Psychonomic*
649 *Bulletin & Review*, 25(1), 155-177. Doi: 10.3758/s13423-017-1272-1
- 650 Larson, N. I., Perry, C. L., Story, M., & Neumark-Sztainer, D. (2006). Food Preparation by Young
651 Adults Is Associated with Better Diet Quality. *Journal of the American Dietetic*
652 *Association*, 106(12), 2001–2007. <https://doi.org/10.1016/j.jada.2006.09.008>
- 653 Laska, M. N., Larson, N. I., Neumark-Sztainer, D., & Story, M. (2012). Does involvement in food
654 preparation track from adolescence to young adulthood and is it associated with better
655 dietary quality? Findings from a 10-year longitudinal study. *Public Health Nutrition*, 15(7),
656 1150–1158. <https://doi.org/10.1017/S1368980011003004>
- 657 Lavelle, F., McGowan, L., Spence, M., Caraher, M., Raats, M. M., Hollywood, L., McDowell, D.,
658 McCloat, A., Mooney, E., & Dean, M. (2016). Barriers and facilitators to cooking from
659 ‘scratch’ using basic or raw ingredients: A qualitative interview study. *Appetite*, 107, 383–
660 391. <https://doi.org/10.1016/j.appet.2016.08.115>

- 661 Lee, M. D., Wagenmakers, E. J. (2013) *Bayesian Cognitive Modeling: A Practical Course*.
662 *Cambridge University Press*
- 663 Liddell, T., & Kruschke, J. K. (2017). Analyzing ordinal data with metric models: What could
664 possibly go wrong? *Journal of Experimental Social Psychology, 79*, 328–348.
- 665 McElreath, R. (2015). *Statistical rethinking: a Bayesian course with examples in R and Stan*.
666 *Chapman & Hall/CRC Press*. xvii, 469.
- 667 Michaud, P. (2007). *Development and evaluation of instruments to measure the effectiveness*
668 *of a culinary and Nutrition education program*.
- 669 Mills, S., White, M., Brown, H., Wrieden, W., Kwasnicka, D., Halligan, J., Robalino, S., Adams, J.
670 (2017). Health and social determinants and outcomes of home cooking: A systematic
671 review of observational studies. *Appetite, 111*, 116-134
- 672 Murray, D. W., Mahadevan, M., Gatto, K., O'Connor, K., Fissinger, A., Bailey, D., & Cassara, E.
673 (2016). Culinary efficacy: An exploratory study of skills, confidence, and healthy cooking
674 competencies among university students. *Perspectives in Public Health, 136(3)*, 143–151.
675 <https://doi.org/10.1177/1757913915600195>
- 676 Neumark-Sztainer, D., Wall, M., Perry, C., & Story, M. (2003). Correlates of fruit and vegetable
677 intake among adolescents: Findings from Project EAT. *Preventive Medicine, 37(3)*, 198–
678 208. [https://doi.org/10.1016/S0091-7435\(03\)00114-2](https://doi.org/10.1016/S0091-7435(03)00114-2)
- 679 Oliveira, C. de S. (2017). A Universidade Promotora da Saúde: uma revisão de literatura.
- 680 Owens, M. R., Brito-silva, F., Kirkland, T., Moore, C. E., Davis, K. E., Patterson, M. A., Miketinas,
681 D. C., & Tucker, W. J. (2020). Prevalence and Social Determinants of Food. *Nutrients,*
682 *12(9)*, 1–18.
- 683 Piton Hakim, M., D'Avoglio Zanetta, L., & Thimoteo da Cunha, D. (2021). Should I stay, or
684 should I go? Consumers' perceived risk and intention to visit restaurants during the
685 COVID-19 pandemic in Brazil. *Food Research International, 141*, 110152.
686 <https://doi.org/10.1016/j.foodres.2021.110152>
- 687 Pulz, I. S., Martins, P. A., Feldman, C., & Veiros, M. B. (2017). Are campus food environments
688 healthy? A novel perspective for qualitatively evaluating the nutritional quality of food
689 sold at foodservice facilities at a Brazilian university. *Perspectives in Public Health, 137(2)*,
690 122–135. <https://doi.org/10.1177/1757913916636414>
- 691 Rathi, N., Riddell, L., & Worsley, A. (2018). Indian adolescents' perceptions of the home food
692 environment. *BMC Public Health, 18(1)*, 1–7. <https://doi.org/10.1186/s12889-018-5083-8>
- 693 R Core Team. (2018). *R: A Language and Environment for Statistical Computing*.
- 694 REDUPS. (2013). *Guía para la autoevaluación y reconocimiento de instituciones de educación*
695 *superior promotoras de la salud* (p. 34). [https://deportes.udem.cl/wp-](https://deportes.udem.cl/wp-content/uploads/2016/11/09-Guía-para-la-Autoevaluación-y-Reconocimiento-de-Instituciones-de-Educación-Superior-Promotoras-de-la-Salud-Red-Chilena-de-Universidades-Promotoras-de-la-Salud.pdf)
696 [content/uploads/2016/11/09-Guía-para-la-Autoevaluación-y-Reconocimiento-de-](https://deportes.udem.cl/wp-content/uploads/2016/11/09-Guía-para-la-Autoevaluación-y-Reconocimiento-de-Instituciones-de-Educación-Superior-Promotoras-de-la-Salud-Red-Chilena-de-Universidades-Promotoras-de-la-Salud.pdf)
697 [Instituciones-de-Educación-Superior-Promotoras-de-la-Salud-Red-Chilena-de-](https://deportes.udem.cl/wp-content/uploads/2016/11/09-Guía-para-la-Autoevaluación-y-Reconocimiento-de-Instituciones-de-Educación-Superior-Promotoras-de-la-Salud-Red-Chilena-de-Universidades-Promotoras-de-la-Salud.pdf)
698 [Universidades-Promotoras-de-la-Salud.pdf](https://deportes.udem.cl/wp-content/uploads/2016/11/09-Guía-para-la-Autoevaluación-y-Reconocimiento-de-Instituciones-de-Educación-Superior-Promotoras-de-la-Salud-Red-Chilena-de-Universidades-Promotoras-de-la-Salud.pdf)
- 699 Restrepo, B. J., & Zeballos, E. (2020). The effect of working from home on major time
700 allocations with a focus on food-related activities. *Review of Economics of the Household,*
701 *18(4)*, 1165–1187. <https://doi.org/10.1007/s11150-020-09497-9>
- 702 Reyes-Olavarría, D., Latorre-Román, P. Á., Guzmán-Guzmán, I. P., Jerez-Mayorga, D., Caamaño-
703 Navarrete, F., & Delgado-Floody, P. (2020). Positive and Negative Changes in Food Habits,

- 704 Physical Activity Patterns, and Weight Status during COVID-19 Confinement: Associated
705 Factors in the Chilean Population. *International Journal of Environmental Research and*
706 *Public Health*, 17(15), 5431. <https://doi.org/10.3390/ijerph17155431>
- 707 Ribeiro, K. D. D. S., Garcia, L. R. S., Dametto, J. F. D. S., Assunção, D. G. F., & Maciel, B. L. L.
708 (2020). COVID-19 and Nutrition: The Need for Initiatives to Promote Healthy Eating and
709 Prevent Obesity in Childhood. *Childhood Obesity*, 16(4), 235–237.
710 <https://doi.org/10.1089/chi.2020.0121>
- 711 Ruiz-Roso, M. B., Knott-Torca, C., Matilla-Escalante, D. C., Garcimartín, A., Sampedro-Nuñez,
712 M. A., Dávalos, A., & Marazuela, M. (2020). COVID-19 Lockdown and Changes of the
713 Dietary Pattern and Physical Activity Habits in a Cohort of Patients with Type 2 Diabetes
714 Mellitus. *Nutrients*, 12(8). <https://doi.org/10.3390/nu12082327>
- 715 Santos, S., Vilela, S., Padrão, P., Caraher, M. (2015). Sex-related dietary changes of Portuguese
716 university students after migration to London, UK. *Nutrition & Dietetics*, 72, 340-346.
- 717 Scarmozzino, F., & Visioli, F. (2020). Covid-19 and the Subsequent Lockdown Modified Dietary
718 Habits of Almost Half the Population in an Italian Sample. *Foods*, 9(5), 675.
719 <https://doi.org/10.3390/foods9050675>
- 720 Seabrook, J. A., Dworatzek, P. D. N., & Matthews, J. I. (2019). Predictors of food skills in
721 university students. *Canadian Journal of Dietetic Practice and Research*, 80(4), 205–208.
722 <https://doi.org/10.3148/cjdr-2019-011>
- 723 Soares, A. M., Pereira, A. M. S., & Canavarro, J. M. A. P. (2015). Promoção da Saúde nas
724 Instituições de Ensino Superior Portuguesas: Reflexões e Desafios. *Revista Portuguesa de*
725 *Pedagogia*, 115–137. https://doi.org/10.14195/1647-8614_49-2_6
- 726 Sprake, E. F., Russell, J. M., Cecil, J. E., Cooper, R. J., Grabowski, P., Pourshahidi, L. K., & Barker,
727 M. E. (2018). Dietary patterns of university students in the UK: A cross-sectional study.
728 *Nutrition Journal*, 17(1), 1–17. <https://doi.org/10.1186/s12937-018-0398-y>
- 729 Tsouros, A., Dowding, G., Thompson, J., & Dooris, M. (1998). *Health promoting universities*.
730 <http://www.ncbi.nlm.nih.gov/pubmed/18447035>
- 731 United Nations. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development*
732 (p. 35). <https://doi.org/10.1163/157180910X12665776638740>
- 733 USDA. (2013). *My Plate on Campus Toolkit* (Issue March).
734 <http://choosemyplate.gov/MyPlateOnCampus/downloads/MyPlateOnCampusToolkit.pdf>
- 735 Utter, J., Larson, N., Laska, M. N., Winkler, M., & Neumark-Sztainer, D. (2018). Self-Perceived
736 Cooking Skills in Emerging Adulthood Predict Better Dietary Behaviors and Intake 10
737 Years Later: A Longitudinal Study. *Journal of Nutrition Education and Behavior*, 50(5),
738 494–500. <https://doi.org/10.1016/j.jneb.2018.01.021>
- 739 Veríssimo, J. (2021). Analysis of rating scales: A pervasive problem in bilingualism research and
740 a solution with Bayesian ordinal models. *PsyArXiv*.
741 <https://doi.org/10.31234/osf.io/4m2ap>.
- 742 Vilela, S., Santos, S., Padrao, P., Caraher, M. (2014). Length of migration and eating habits of
743 Portuguese university students living in London, United Kingdom. *Ecol Food*
744 *Nutr*, 53, 419– 435.
- 745 Warmin, A., Sharp, J., & Condrasky, M. D. (2012). Cooking with a chef: A culinary nutrition
746 program for college aged students. *Topics in Clinical Nutrition*, 27(2), 164–173.

- 747 <https://doi.org/10.1097/TIN.0b013e3182542417>
- 748 WHO. (2020). *Food and nutrition tips during self-quarantine*.
749 [https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-](https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/publications-and-technical-guidance/noncommunicable-diseases/food-and-nutrition-tips-during-self-quarantine?fbclid=IwAR0lxmHZqgX)
750 [19/publications-and-technical-guidance/noncommunicable-diseases/food-and-nutrition-](https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/publications-and-technical-guidance/noncommunicable-diseases/food-and-nutrition-tips-during-self-quarantine?fbclid=IwAR0lxmHZqgX)
751 [tips-during-self-quarantine?fbclid=IwAR0lxmHZqgX](https://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/publications-and-technical-guidance/noncommunicable-diseases/food-and-nutrition-tips-during-self-quarantine?fbclid=IwAR0lxmHZqgX)
- 752 WHO, W. H. O. (2015). Global School Health Initiatives: Achieving Health and Education
753 Outcomes Report of a meeting. *Geneva: World Health Organization, 23-25 November*.
754 <http://apps.who.int/iris/bitstream/10665/259813/1/WHO-NMH-PND-17.7-eng.pdf?ua=1>
- 755 Wilson, C. K., Matthews, J. I., Seabrook, J. A., & Dworatzek, P. D. N. (2017). Self-reported food
756 skills of university students. *Appetite, 108*(2017), 270–276.
757 <https://doi.org/10.1016/j.appet.2016.10.011>
- 758 Wolfson, J. A., & Bleich, S. N. (2015). Is cooking at home associated with better diet quality or
759 weight-loss intention? *Public Health Nutrition, 18*(8), 1397–1406.
760 <https://doi.org/10.1017/S1368980014001943>
- 761 Wrieden, W. L., Anderson, A. S., Longbottom, P. J., Valentine, K., Stead, M., Caraher, M., Lang,
762 T., Gray, B., & Dowler, E. (2007). The impact of a community-based food skills
763 intervention on cooking confidence, food preparation methods and dietary choices - An
764 exploratory trial. *Public Health Nutrition, 10*(2), 203–211.
765 <https://doi.org/10.1017/S1368980007246658>