1   **Cross-cultural adaptation and validation of a questionnaire on eating habits and**

2   **lifestyles of university students in confinement due to COVID-19**

3   **Objective:** The purpose of this study was to carry out the translation to the Spanish language,

4   the cross-cultural adaptation, and the validation of an online questionnaire to assess eating

5   habits and lifestyles of university students under confinement due to COVID-19.

6   **Design:** Generation of a cross-sectional online survey to university students conducted

7   during confinement due to COVID-19. The study was divided into 2 phases.

8   **Settings:** Students of Catholic University of Maule, Chile.

9   **Participants:** Phase 1 considered the participation of twelve bilingual dietitians for the

10   cultural adaptation, discussion, evaluation and the generation of a pilot to validate the new

11   format. In Phase 2, information from the questionnaire was collected from two hundred and

12   sixty-eight university students, with ages 16 to 30 years old, mean age 21.6 (3.3) The major

13   proportion of participants were female (82 %).

14   **Results:** The adapted questionnaire was statistically validated in three dimensions: (A) Self-

15   report of COVID-19, (B) Eating habits and behaviors during quarantine, and (C) Lifestyle

16   changes during the quarantine. The reliability of Cronbach's α for dimensions A, B and C

17   was 0.79, 0.59 and 0.43, respectively. The complete questionnaire obtained 0.71. A

18   statistically significant positive correlation matrix was observed.

19   **Conclusions:** The adaptations of this questionnaire demonstrated adequate reliability and

20   validity to assess people's eating habits and lifestyle in the context of the COVID-19

21   confinement. Therefore, this is a practical tool to obtain information for public health

22   decision-making and to establish appropriate strategies to prevent adverse effects on people's

23   health in future re-emerging outbreaks.

24   **Keywords:** COVID-19, Coronavirus, Eating habits, Lifestyle, Quarantine, Validity tool.

25

Introduction

The unprecedented coronavirus disease (COVID-19) pandemic has demanded public health experts and government officials to take several measures to contain the spread of infections and prevent the massive death of the affected population. They have accomplished this by establishing strict quarantines and strengthening health facilities to control the disease until effective vaccines are available.[1] In several countries including Chile, the effort to reduce the spread of the COVID-19 virus (SARS-CoV-2) among the younger and adult populations, has prompted the widespread closure of schools, colleges, universities, and other educational institutions.

Although extremely necessary, the first evidence of the confinement impacts shows an increase in people's stress and anxiety[2], particularly in college students.[3] Likewise, worsened people's eating habits and lifestyles have also been observed.[4-6] So, it is likely that the higher consumption of processed foods with higher caloric content, saturated fats, sugars, and refined carbohydrates, and of greater durability, easier access, and use[7], in addition to sedentarism, anxiety and stress caused by this uncertain and confined scenario, can contribute to increasing the prevalence of obesity in the times of COVID-19.[8]

On the other hand, adequate dietary intake and healthy lifestyles may be essential to protect against an excessive inflammatory response to SARS-Cov-2 infection, preventing the evolution of the infection to severe or improving its outcome.[9] As recently discussed by the European Society for Clinical Nutrition and Metabolism (ESPEN)[10], the obesity condition is dangerous to the severity of COVID-19. It has emerged as one of the most prominent risk factors increasing the disease mortality.[11, 12] In this sense, nutritional status, eating habits, and lifestyles might influence the individual risk for the progression of SARS-CoV-2; however, information is incipient.

To know the potential impact of the COVID-19 outbreak on the eating habits and lifestyles, validated instruments culturally adapted to the local reality[13] of each country are needed. This will lead to information for public health decision-making and establish appropriate strategies in future re-emerging outbreaks. Therefore, this study aimed to carry out cross-cultural adaptation and validate an English questionnaire on eating habits and lifestyles of university students under confinement due to COVID-19.

56 **Methods**

57 **Study Design**

58 The present cross-sectional online study was developed in two phases. Phase 1 considered
59 the participation of twelve bilingual dietitians for the cultural adaptation, discussion,
60 evaluation of experts, and the generation of a pilot to validate the changed format from the
61 original English version of the questionnaire[14] to a Spanish version. In phase 2, the
62 questionnaire's reliability and validity were evaluated in a population of university students.

63 **Phase 1: Cross-cultural adaptation questionnaire**

64 The original questionnaire called "Dietary choices and habits during COVID-19 Lockdown"
65 was developed by Sidor A[14] in Poland in the English language. The translation of the
66 questionnaire was made by twelve bilingual dietitians, who compared the consistency and
67 the adaptation of the questions and answers. The conceptual equivalence was evaluated with
68 a Likert scale from 1 to 7, where 1 was "Very understandable / Very equivalent", and 7 was
69 "Poorly understandable / not equivalent". It was then submitted to an expert judgment
70 composed of two researchers in the behavior area who unified the criteria to obtain the first
71 version of the questionnaire. Subsequently, a pilot study of the online questionnaire was
72 carried out through the Google Form platform. Sixty university students from the Faculty of
73 Health Sciences evaluated face validity, cultural adaptation, and instrument relevance. The
74 students also verified the feasibility of applicability and comprehension of the text. Finally,
75 with the data collected and the observations made, the instrument's final version was adjusted
76 and applied.

77 It is important to highlight that the original questionnaire does not declare a reliability
78 analysis.
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84 **Phase 2: Reliability and Validity of the questionnaire**

85 The questionnaire adapted to the Spanish language included three dimensions:

86 **(A) COVID-19 self-report:** Signs, symptoms, and diagnosis of SARS-CoV2 in six questions
87 presented dichotomously distribution.

88 **(B) Eating habits and behaviors during quarantine:** In total, nineteen answers reported
89 quarantine conduct due to COVID-19. A daily number of meals and snacks consumed, the
90 frequency of consumption of selected food products (fresh vegetables and fruits, legumes,
91 cereals, meat products, dairy products, fast foods, sweets, and salty snacks), the frequency of
92 breakfast consumption, and the weight change observed during the quarantine were
93 considered.

94 **(C) Lifestyle changes during quarantine:** This dimension has three sub-dimensions **a)**
95 Perception of change during the quarantine in the lifestyle behaviors, for example, frequency
96 of alcohol consumption and frequency of smoking; **b)** Identification of the level of fear of
97 getting infected by SARS-CoV-2 during grocery shopping and through contact with food
98 products. **c)** Indication of the level of physical activity development.

99 The link to the instrument was sent by mass email. The data was conducted through the
100 Google Form platform for three weeks from August 24th, 2020 to September 11th, 2020. The
101 data collection process was anonymous to guarantee the participants' health safety in
102 pandemic conditions.

103 To evaluate the metric properties (reliability and validity) of the Spanish version of the
104 questionnaire, the sample size was calculated based on the recommendations of Streiner et
105 al.[(15)] The final sample size was 268 participants. The eligibility criteria applied were students
106 enrolled in the four University faculties: Health of Sciences, Education, Medicine, and
107 Agricultural and Forestry Sciences, and that agreed to participate in the study. Finally, the
108 questionnaire was applied, and the feedback was consolidated, analyzed, and discussed by
109 the research team.

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Statistical Analysis

Descriptive statistics were applied to categorical variables and expressed as frequencies and percentages. The quantitative variables were expressed as means and standard deviations. The instrument's reliability was analyzed by internal consistency by Cronbach's alpha evaluation, and the validity was evaluated by factorial analysis using as an extraction method a principal components analysis with Varimax rotation for dimension C. P values <0.05 were considered as significant. The data analyses were performed using SPSS Statistics for Windows, Version 19.0 (IBM Corp, NY).

Results

Cross-cultural adaption process

The results of the cross-cultural adaption of the questionnaire are presented in Figure 1. The mean of interpretability and conceptual equivalence for the dimensions A, B and C were 2.1, 2.0, and 1.2, respectively. These results indicate an adequate cross-cultural process.

Figure 1. Mean interpretability and conceptual equivalence reported by twelve bilingual dietitians according to the back-translation process for each dimension.

Demographic Characteristics

Two hundred and sixty-eight university students participated in the validation of the instrument according to eligibility criteria. The summary of demographic characteristics is presented in Table 1. Mean age of 21.6 (3.3) years was obtained, observing greater participation in women (82 %). According to their geographical distribution, there is a higher frequency of participants from the country's central area, representing 94.7 %. Concerning their membership to the University faculties, a higher percentage of students that participated are from the Faculty of Health Sciences (51.1 %), followed by Education (26.8 %), Medicine (14.5 %), and the Faculty of Agricultural and Forestry Sciences (7.4 %).

Regarding the time of quarantine, a mean of 21.1 (20.5) weeks was observed, with the mean confinement being higher in the group of women (21.7 weeks).

140 The self-report of body weight was higher in men with 76.0 (13.1) g compared to women
141 with 65.8 (14.0) kg. It was observed a greater malnutrition was reported in female group
142 (overweight 23.8 % and obesity 14.5 %). It is important to note that according to the self-
143 report, 50 % of the students possess a normal nutritional status according to the BMI.

144 **Table 1.** Demographic characteristics of surveyed participants (n =268).

145 **Psychometric properties**

146 Table 2 shows the analysis of the internal consistency or reliability of the questionnaire.

147 The instrument has three dimensions. Dimension A "COVID-19 self-report" was consulted
148 using a dichotomous scale and consisted of the presence of symptoms, signs, or positive
149 diagnostic of Covid-19 (Q11-Q16). This dimension showed adequate internal consistency
150 based on Cronbach's Alpha ($\alpha = 0.787$). The data of the question Q15 and Q16 presented no
151 dispersion (SD=0) since they were discarded from the analysis as both questions were
152 oriented to hospitalization given Covid-19. The Alpha value did not improve when
153 eliminating any of the items, so it should be applied considering all the elements of the
154 dimension.

155 Dimension B "Eating habits and behaviors during quarantine" presented a Cronbach's Alpha
156 of 0.592. No questions were excluded from this analysis. Alpha's value raised to 0.600 by
157 eliminating the question oriented to fruit consumption (Q23), but its elimination is not
158 justified given the nutritional importance of the question.

159 Finally, Dimension C "Lifestyle changes during quarantine" has three sub-dimensions:
160 "Perception of change lifestyle" (Q37-Q39) that consulted for changes in body weight,
161 tobacco, and alcohol consumption. This dimension presented the lowest value of Cronbach's
162 Alpha ($\alpha = 0.288$). "Risk perception" (Q40-Q41) which is related to the risk perception of
163 COVID-19 contact, presented a Cronbach's Alpha ($\alpha = 0.845$). Ultimately, "Physical
164 activity" (Q42-Q43), which aimed to evaluate changes in exercise performance, presented a
165 Cronbach's Alpha ($\alpha = 0.966$). Eliminating any of these elements lowers the Cronbach's
166 Alpha value below to 0.5, so the instrument must be applied in its entirety.

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168 **Table 2.** Internal consistency of the questionnaire.

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170   A significant positive correlation was identified between the dimension "Eating habits and

171   behaviors in a pandemic" and the sub-dimension "Perception of change" ($r = 0.210$, $p < 0.01$),

172   that is, the higher the perception of changes, the higher the score in the dimension Eating

173   habits and behaviors in pandemic (Table 3). It is relevant to mention that two of the three

174   sub-dimensions of "Changes during quarantine" presented high and significant correlations

175   with the dimension's total score; however, among them, the correlations were low.

176   **Table 3.** Correlation matrix of the questionnaire domains

177   **Discussion**

178   Current literature analyzes the effect of Covid-19 on the population; however, few studies

179   indicate any cultural adaptation, validity, and reliability of the instrument applied. The use

180   of validated instruments culturally adapted to each country's local reality allows obtaining

181   sensitive, specific, and reproducible data to make decisions. In this direction, applied studies

182   in university students have shown that psychometric instruments' validation allows an

183   adequate evaluation of eating behavior and lifestyle.[16, 17]

184   COVID-19 confinement and measures of its containment have an evident impact on the

185   population's lifestyle-related behavior. [18] This situation is critical considering the current

186   obesity epidemic.[19] In this study, we translated to Spanish the English language

187   questionnaire of Sidor et al[14], with no previous validation. Posteriorly, we culturally adapted

188   it to Chilean reality. The questionnaire demonstrated adequate validity and reliability in

189   university students, like some recent studies that showed high confidence and validity to

190   analyze eating behavior and lifestyle during confinement by Covid-19 in university

191   students.[17, 20]

192   This questionnaire is a short, concise, and user-friendly tool possible to be completed in 10

193   to15 min, avoiding respondents' lack of patience and, consequently, inaccuracy in the

194   assessment. It consists of four dimensions covering all critical information required to assess

195   the participants' eating habits (intake, meal pattern, and snack consumption) and lifestyles

196   (exercises, tobacco, and alcohol).

197 This study's limitations are reporting bias due to the web-based survey, social desirable bias,

198 memory bias, and inability to determine the concurrent and predictive validity, which would

199 require a long-term follow-up.

200 This questionnaire has the potential to assess the eating habits and lifestyle-related behavior

201 of university students during the COVID pandemic in Chile and Spanish-speaking countries.

202 Overall, the questionnaire applied in this study was shown to be reproducible and valid.

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204 **Conclusions**

205 The adaptations of this questionnaire demonstrated adequate reliability and validity to assess

206 people's eating habits and lifestyle in the context of the COVID-19 confinement. Therefore,

207 this is a practical tool to obtain information for public health decision-making and to establish

208 appropriate strategies to prevent negative effects on people's health in future re-emerging

209 outbreaks.

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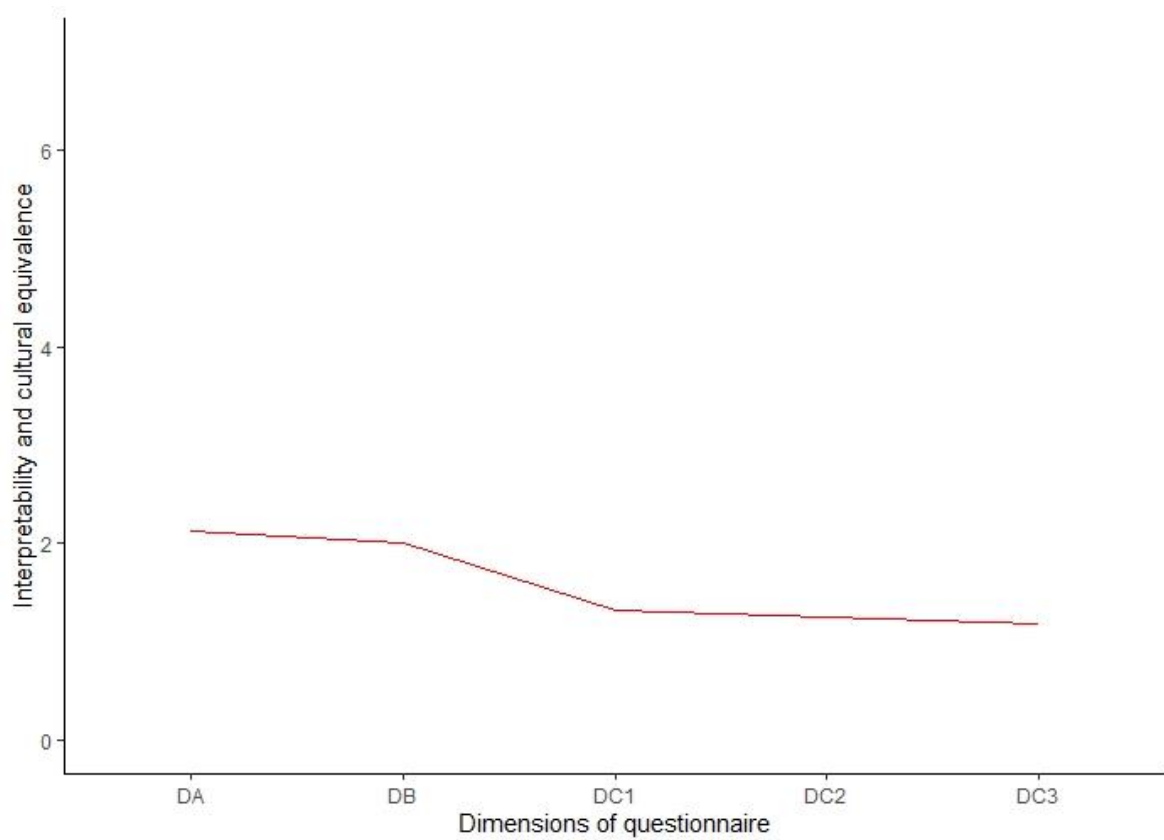
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Figure 1. Mean interpretability and conceptual equivalence reported by twelve bilingual dietitians
according to the back-translation process for each dimension

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286   **Table 1.** Demographic breakdown of surveyed participants (n =268).

Variables	Female n = 220	Male n =48	Overall n =268
Age in years	21.6 (3.3)	21,7 (3.4)	21.6 (3.3)
District			
North, n (%)	7 (2.6)	1 (0.4)	8 (3.0)
Middle, n (%)	208 (77.6)	46 (17.1)	254 (94.7)
South, n (%)	5 (1.9)	1 (0.4)	6 (2.2)
Faculty			
Health of Sciences, n (%)	120 (44.7)	17 (6.3)	137 (51.1)
Education, n (%)	57 (21.2)	15 (5.6)	72 (26.8)
Medicine, n (%)	29 (10.8)	10 (3.7)	39 (14.5)
Agricultural and Forestry Sciences, n (%)	14 (5.2)	6 (2.2)	20 (7.4)
Weeks in quarantine	21.7 (22.0)	18.0 (11.0)	21.1 (20.5)
Self report			
Bodyweight, kg	65.8 (14.0)	76,0 (13.1)	67,6 (14.4)
Size, cm	159.6 (9.0)	169.3 (12.2)	161,4 (10.3)
BMI, kg/m2	25.9 (5.4)	26.9 (6.1)	26.1 (5.6)
Nutritional status			
Normal, n (%)	113 (42.1)	23 (8.5)	136 (50.6)
Overweight, n (%)	64 (23.8)	14 (5.2)	78 (29.0)
Obesity, n (%)	39 (14.5)	10 (3.7)	49 (18.2)

287   Values are presented as mean and SD or numbers and percentages

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292   **Table 2. Internal consistency of the questionnaire.**

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Domain	Questions	Mean	SD	Corrected Item-total Correlation	Cronbach Alpha If Item Deleted	Cronbach Alpha per Domain
A. COVID-19 self-report						0.787
	Q11	1.91	0.29	0.612	0.726	
	Q12	1.85	0.36	0.658	0.708	
	Q13	1.88	0.33	0.629	0.719	
	Q14	1.97	0.18	0.580	0.771	
	Q15	2.00	0.00	*	*	
	Q16	2.00	0.00	*	*	
B. Eating habits and behaviors during the quarantine						0.592
	Q17	3.51	1.13	0,339	0,564	
	Q18	4.24	0.99	0,349	0,566	
	Q19	3.43	1.12	0,362	0,562	
	Q20	1.61	0.95	0,221	0,579	
	Q21	3.09	1.27	0,120	0,589	
	Q22	4.03	1.05	0,106	0,590	
	Q23	4.15	1.68	0,077	0,600	
	Q24	5.05	1.30	0,165	0,584	
	Q25	3.55	0.98	0,141	0,587	
	Q26	3.53	1.75	0,158	0,587	
	Q27	3.31	1.48	0,237	0,574	

	Q28	3.00	1.39	0,201	0,579	
	Q29	4.26	1.83	0,244	0,572	
	Q30	2.41	1.31	0,241	0,574	
	Q31	2.40	1.42	0,208	0,578	
	Q32	3.05	1.84	0,199	0,581	
	Q33	2.49	1.57	0,214	0,577	
	Q34	2.66	1.51	0,254	0,571	
	Q35	2.49	1.74	0,126	0,592	
	Q36	3.30	1.97	0,202	0,581	
C. Changes of lifestyle during quarantine:						0.430
Sub-Dimensions						
Perception of Change	Q37	3.06	1.13	-0.030	0.465	0.288
	Q38	0.31	0.95	0.090	0.405	
	Q39	1.71	0.95	0.164	0.375	
Perception of Risk	Q40	3.44	1.44	0.267	0.310	0.845
	Q41	2.89	1.50	0.373	0.228	
Physical Activity	Q42	2.67	1.19	0.188	0.362	0.966
	Q43	2.54	1.13	0.191	0.360	

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298   **Table 3.** Correlation matrix of the questionnaire domains

	COVID-19 self-report	Eating habits and behaviors during the quarantine	Changes during quarantine: Sub-Dimensions	Perception of Change	Perception of Risk	Physical Activity
COVID-19 self-report	1					
Eating habits and behaviors during the quarantine	0.059	1				
Lifestyle changes during quarantine: Sub-Dimensions	0.035	0.105	1			
Perception of Change	0.037	0.210**	0.517***	1		
Perception of Risk	-0.021	0.074	0.682***	0.105	1	
Physical Activity	0.054	-0.082	0.475	-0.064	0.069	1

299   P values <0.05 were considered as significant, **p<0.01 *** p<0.001