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School stress, nutritional health, and academic performance in university students: a multi-center study

Estrés escolar, salud nutricional y rendimiento académico en estudiantes universitarios: un estudio multicéntrico

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Juan Pablo Sánchez-Domínguez
https://orcid.org/0000-0002-4375-2865
jsanchez@pampano.unacar.mx
Universidad Autónoma del Carmen. Campeche, Mexico

Teresa del Jesús Brito-Cruz
https://orcid.org/0000-0002-7030-4187
tbrito@pampano.unacar.mx
Universidad Autónoma del Carmen. Campeche, Mexico

Addy Leticia Zarza-García
https://orcid.org/0000-0002-3305-9899
azarza@pampano.unacar.mx
Universidad Autónoma del Carmen. Campeche, Mexico

Rafael Villanueva-Echavarría
https://orcid.org/0000-0001-6227-4793
jvillanueva@pampano.unacar.mx
Universidad Autónoma del Carmen. Campeche, Mexico

Gloria Esther Acevedo-Olvera
https://orcid.org/0000-0003-1706-2278
gacevedo@pampano.unacar.mx
Universidad Autónoma del Carmen. Campeche, Mexico

Ángel Esteban Torres-Zapata
https://orcid.org/0000-0002-6066-3258
macronutriente@hotmail.com
Universidad Autónoma del Carmen. Campeche, Mexico

Abstract

Academic stress affects the physical, mental, and nutritional health of university students, influencing their eating habits and academic performance. Therefore, this study aimed to analyze the relationship between academic stress (AS), nutritional health (NH), and academic performance (AP) in first-year nutrition students. A multicenter, quantitative, cross-sectional, and correlational study was conducted in five universities in southeastern Mexico, with the participation of 1,392 students. Academic stress was measured using the Perceived Stress Scale (PSS-10), nutritional health through body mass index (BMI), and academic performance with the university's academic records. ANOVA, Student's t-test, and Pearson correlation were used for the analysis, with ethical committee approval. The results indicated a mean AS score of 20.63, with 53.45% of students at a high level and 38.51% at a moderate level. The average BMI was 24.50, with 61.49% of students having a normal weight and 36.78% being overweight or obese. The average AP score was 84.22, with 81% of students performing at good or excellent levels. The correlations between the variables were weak: AS-NH (r = -0.096), AS-AP (r = 0.302), and NH-AP (r = -0.213). Although moderate stress was positively related to academic performance and weakly negatively related to BMI, the overall associations were low and not significant. It was concluded that stress, nutritional health, and

academic performance are weakly linked. Further research is recommended, along with the development of institutional strategies to improve stress management and promote healthy lifestyles among university students.

Keywords: stress, academic performance, nutritional health.

Resumen

El estrés escolar afecta la salud física, mental y nutricional de los estudiantes universitarios, influyendo en sus hábitos alimentarios y en su rendimiento académico. De allí que, este estudio tuvo como objetivo analizar la relación entre el estrés escolar (EE), la salud nutricional (SN) y el rendimiento académico (RA) en estudiantes de primer año de Nutrición. Se llevó a cabo un estudio multicéntrico, cuantitativo, transversal y correlacional en cinco universidades del sureste de México, con la participación de 1,392 estudiantes. El EE se midió mediante la Escala de Estrés Percibido (EEP-10), la SN a través del índice de masa corporal (IMC) y el RA con el Kardex institucional. Para el análisis se emplearon ANOVA, t de Student y correlación de Pearson, con la aprobación del comité de ética. Los resultados indicaron una media de EE de 20.63, con un 53.45 % de estudiantes en nivel alto y 38.51 % en nivel medio. El IMC promedio fue 24.50, donde el 61.49 % tenía peso normal y el 36.78 % sobrepeso u obesidad. El RA presentó una media de 84.22, con 81 % de estudiantes en niveles buenos y excelentes. Las correlaciones entre variables fueron débiles: EE-SN (r = -0.096), EE-RA (r = 0.302) y SN-RA (r = -0.213). Aunque el estrés moderado se relacionó positivamente con el rendimiento académico y débilmente de forma negativa con el IMC, las asociaciones generales fueron bajas y no significativas. Se concluye que el estrés, la salud nutricional y el rendimiento académico están débilmente vinculados. Se recomienda ampliar la investigación y desarrollar estrategias institucionales para mejorar el manejo del estrés y fomentar estilos de vida saludables en los estudiantes universitarios.

Palabras clave: estrés, rendimiento académico, salud nutricional.

Introduction

Stress is a common phenomenon in today's society and has been extensively studied due to its relationship with various diseases affecting the physiological, metabolic, and immune systems. These conditions increase the risk of suffering from respiratory infections, cardiovascular diseases, and cancer (Sánchez-Domínguez et al., 2025). In particular, chronic stress is associated with significant deterioration in both physical and mental health, even leading to premature mortality (Canto-Carrillo et al., 2024). University students are a particularly vulnerable group, as they face multiple academic demands that can heighten their stress levels (Silva-Ramos et al., 2020). Additionally, experts in human development point out that the university stage is crucial for consolidating behaviors related to physical and mental well-being, including dietary habits (Torres-Zapata et al., 2024).

According to Hernández and Sánchez (2024), school stress (SS) is commonly defined as an adaptive response that occurs when academic demands exceed a student's coping capacity, manifesting in physical, emotional, and behavioral symptoms that affect their overall well-being and academic performance. Gambini (2024) adds that among the most common symptoms in university students are anxiety, depression, eating disorders, and poor academic performance (Sánchez et al., 2025).

Various studies have shown that students with high levels of SS tend to exhibit inadequate dietary patterns, characterized by increased consumption of fast food, saturated fats, and sugars. This raises the risk of eating disorders and contributes to the deterioration of nutritional health, manifested in overweight and obesity (Romero et al., 2024). Adorna (2024) notes that inappropriate nutritional behavior often leads to excessive increases in body fat and body mass index (BMI), which are relevant indicators for assessing nutritional health (NH). In this regard, experts in anthropometry consider that measuring these factors is a useful tool for analyzing nutritional status (Romero et al., 2024).

As noted, SS also generates negative alterations in academic performance (AP), a key indicator for evaluating educational quality, the study of which has gained relevance recently (Cruz, 2025). Pérez et al. (2021) emphasize that AP is commonly addressed as the degree of knowledge acquired in official programs, with grades being the most concrete indicator. In a literature review, Milla (2024) concluded that in most studies, SS can predict university failure.

On the other hand, following the COVID-19 lockdown, there has been an interest in investigating the impact of NH on AP (Romo & Escobar, 2024). Bravo et al. (2021) highlight that lockdown and virtual teaching promoted sedentary behavior and affected dietary habits, resulting in cognitive alterations that impacted learning

and, consequently, academic performance. According to Tous-Carrillo et al. (2023), long hours of academic work without adequate psychological mechanisms increase SS among students.

Historically, most studies on SS in university students have focused on its relationship with academic factors (Milla, 2024), while exploring its link with nutritional behaviors is limited (Hernández & Sánchez, 2024). Available evidence indicates that SS is often associated with inadequate dietary habits, although further research is needed to reach a clear consensus (Muñoz et al., 2023). In this regard, Fernández et al. (2022) present a strong negative association between SS and NH, while Romo & Escobar (2024) report a weak negative relationship.

In summary, SS represents a significant risk factor for NH and AP in university students. While the relationship between SS and AP is well-established, it is necessary to expand the evidence on how these variables relate to NH, in order to develop comprehensive strategies that promote healthy eating habits and improve the overall and academic well-being of students (Chávez-Mendoza et al., 2021; Hernández & Sánchez, 2024).

Therefore, this paper presents the results of a multicenter study aimed at analyzing the relationship between school stress, nutritional health, and academic performance in university students.

Methodology

This study utilized a quantitative approach with a non-experimental, cross-sectional, observational, and correlational design. It was conducted at five universities, focusing on first-year students enrolled in the Bachelor of Nutrition program. To determine the sample size, simple random sampling was applied using the formula for finite populations, with a 95% confidence level and a 5% margin of error, resulting in a total of 1,392 students. The sample consisted of 912 women (65.5%) and 480 men (34.5%), with an average age of 19.3 years, ranging from 18 to 29 years; the distribution was slightly asymmetric, with a majority concentrated around the mean age. Students officially enrolled during the 2024 academic year, who were in their first year and provided informed consent, were included. Those lacking regular status in their academic program were excluded.

To assess levels of school stress, the Perceived Stress Scale (PSS-10) was used, previously validated in a sample of Colombian university students by Campo et al. (2009), with adequate internal reliability (Cronbach's alpha $\alpha = 0.86$). This instrument consists of 10 items with five response options: never (0 points), almost never (1 point), sometimes (2 points), often (3 points), and very often (4 points). The score is obtained by summing the responses of each item, reversing the values for items 4, 5, 7, and 8. Interpretation is based on established cutoff points (see Table 1) (Hernández, 2024). The estimated time to complete the scale is approximately 10 minutes, and the instrument was administered via a digital form on Google Forms.

Table 1

Cutoff points for interpreting stress levels

Stress level	Total score on PSS-10
No Stress (NS)	0 – 6
Low Stress (LS)	7 – 13
Moderate Stress (MS)	14 – 20
High Stress (HS)	21 – 27

Source. Hernández (2024)

To evaluate NH, following the methodology described by Torres-Zapata et al. (2021), conventional anthropometric instruments were used: an analog scale to measure body weight and a stadiometer for height. Using this data, the body mass index was calculated using the formula BMI = weight (kg) / height² (m²). The results were classified into four categories according to the parameters set by the World Health Organization (WHO) (see Table 2).

Table 2

Cutoff points for interpreting nutritional status

BMI Classification	Range (kg/m²)
Underweight (UW)	Less than 18.5

Normal Weight (NW)	18.5 – 24.9
Overweight (OW)	25.0 – 29.9
Obesity (OB)	30.0 or more

Key: kg/m² = kilograms per square meter

Academic performance (AP) was determined using the individual Kardex of each participant, meticulously reviewed by the research team. For analysis, only the overall averages obtained in the immediately preceding semester were considered. The classification of performance was based on previously established cutoff points (see Table 3).

Table 3
Cutoff points for academic performance

Performance category	Grade range
Sufficient (S)	60 – 69.9
Regular (R)	70 – 79.9
Good (G)	80 – 89.9
Excellent (E)	90 – 100

Source. Brito-Cruz et al. (2025)

Procedure

The study was conducted during the first semester of 2024. In January of that year, the research protocol was reviewed and approved by the Ethics Committee of the Academic Body of Applied Nutrition and Education (Folio PI-018-2024/I). Subsequently, at a first meeting between the researchers, faculty, and authorities of the participating universities, the study's approach and scope were presented in order to obtain written permissions necessary to carry out all investigative activities. Then, in a second session specifically directed at the students who would collaborate in the research, the data collection procedure was explained in detail. During this same meeting, students were informed that their participation would consist of completing surveys and undergoing anthropometric assessments, in addition to voluntarily signing the informed consent.

During February, the research group, in coordination with the teaching staff of each institution, scheduled the administration of the Perceived Stress Scale (PSS-10). This was conducted in the computer centers of the collaborating universities. To ensure better control during the administration of the scale, groups of approximately 50 students were formed at each university, with a total of 27 sessions distributed according to the number of participants from each institution. Each session lasted approximately 30 minutes and was supervised by three researchers.

In March 2024, the study team evaluated the nutritional status of the participants in the laboratories of each university, following the guidelines of the standardized procedures manual from the International Society for the Advancement of Kinanthropometry (ISAK).

Finally, in May, the Kardex of the students were requested and collected for subsequent analysis.

Statistical analysis

Data capture and analysis were conducted using the Statistical Package for the Social Sciences (SPSS), version 21. First, descriptive statistics were applied to characterize the main variables of the study: school stress (SS), academic performance (AP), and nutritional health (NH), the latter measured through body mass index (BMI). Subsequently, in the inferential analysis, associations and significant differences between these variables were explored.

To evaluate the homogeneity of variances among groups classified by stress level, academic performance, and nutritional health, Levene's F test was used. Then, the Student's t-test was applied to compare the means of SS and AP based on academic condition (level). Additionally, Pearson correlation coefficients were calculated to analyze the relationship between school stress, academic performance, and nutritional health (BMI). All analyses were conducted with a statistical significance level set at $\alpha = 0.05$.

Results

Elevated levels of school stress can negatively affect eating habits and increase body mass index, as well as decrease concentration and academic performance (Silva-Ramos et al., 2020). However, the literature shows conflicting results: while some studies confirm a significant relationship between these variables (Santa et al., 2024), others indicate that such a correlation is weak or even nonexistent depending on the population analyzed (Calatayud et al., 2022). This diversity of findings underscores the importance of continuing to investigate these associations in different contexts.

Regarding the descriptive results on SS, it was found that the majority of evaluated university students exhibited elevated stress levels overall. When analyzed closely by categories (see Table 1), it was noted that 38.51% of participants fell into a moderate stress level, 53.45% into a high level, and only 8.05% into a low level; moreover, no student was classified in the no stress category. The overall mean was 20.63 points, a value close to the upper limit of the moderate level and nearly reaching the threshold that defines high stress. Furthermore, the mean by group showed a progressive increase as the stress level rose, confirming the coherence and consistency of the obtained data (see Table 4).

Table 4

Descriptive results of SS levels in university students

Statistics	Population	LS (7-13)	MS (14-20)	HS (21-27)
Mean	20.63	11.57	18.04	23.85
Standard Error	0.12	0.12	0.09	0.09
Median	21	12	19	23
Mode	20	11	20	22
Standard Deviation	4.45	1.30	2.09	2.48
Sample Variance	19.82	1.69	4.35	6.16
Kurtosis	-0.10	-0.29	-1.10	-0.17
Skewness	-0.33	-0.76	-0.64	0.81
Range	22.00	4.00	6.00	10.00
Minimum	9	9	14	21
Maximum	31	13	20	31
Sum	28712	1296	9672	17744
Count	1392	112	536	744
%	100.00	8.05	38.51	53.45
Confidence Level (95.0%)	0.23	0.24	0.18	0.18

Source. Authors' own elaboration based on the PSS-10

Regarding NH, determined from BMI, it was found that 61.49% of students fall within the normal weight range (NW). This is followed by 22.41% with overweight (OW) and 14.37% with obesity (OB), while only 1.72% present underweight (UW). The overall mean BMI was 24.50, situated near the upper limit of the normal range. On the other hand, in the groups classified as overweight and obese, the mean BMIs were 27.15 and 32.58, respectively, evidencing a progressive increase in the index according to the nutritional category (see Table 5).

Table 5

Descriptive results of NH in university students

Statistics	Population	UW (<18.5)	NW (18.5-24.9)	OW (25.0 – 29.9)	OB (30->)
Mean	24.5	15.96	21.89	27.15	32.58
Standard Error	0.12	0.23	0.06	0.08	0.11

Median	23.61	15.56	22.14	27.43	32.00
Mode	19.03	15.56	19.03	26.42	30.86
Standard Deviation	4.40	1.12	1.84	1.44	1.59
Sample Variance	19.33	1.25	3.39	2.08	2.52
Kurtosis	-0.18	6.21	-0.95	-1.25	0.73
Skewness	0.63	-1.64	-0.27	0.23	1.25
Range	24.51	5.78	6.46	4.35	5.65
Minimum	12	12	18.02	25.06	30.86
Maximum	36.51	17.78	24.49	29.41	36.51
Sum	34109	383	18739	8472	6515
Count	1392	24	856	312	200
%	100.00	1.72	61.49	22.41	14.37
Confidence Level (95.0%)	0.23	0.47	0.12	0.16	0.22

Source. Authors' own elaboration based on the assessment of NH using BMI

Regarding the academic performance (AP) of the evaluated population (n = 1,392), the good category predominated, with an overall mean of 84.22. Analyzing the distribution by levels (see Table 3), it was observed that 46.55% of the students were in the good category and 34.48% in the excellent level. In contrast, low levels were infrequent, representing 13.22% in the sufficient category and only 5.75% in the regular category.

The group that achieved the excellent category presented the highest mean (92.97) and the lowest variability, with a standard deviation of 2.20, reflecting high and consistent academic performance. On the other hand, the group with sufficient performance recorded the lowest mean (64.83) and showed greater dispersion in their scores. In general, the mode was 80 points, just at the lower limit of the good level, which coincides with the most frequent category among students.

Concerning the shape of the distributions, a negative skewness was detected in the groups with lower academic performance, while a positive skewness was found in the excellent level group (see Table 6). These findings allow us to appreciate the diversity in academic performance within the studied population.

Table 6
Descriptive results of academic performance

Statistics	Population	S (60-69.9)	R (70–79.9)	G (80–89.9)	E (90–100)
Mean	84.22	64.83	75.40	84.33	92.97
Standard Error	0.25	0.19	0.33	0.13	0.10
Median	86.765	65	76	84	93
Mode	80	67	78	80	94
Standard Deviation	9.42	2.57	2.96	3.30	2.20
Sample Variance	88.77	6.61	8.75	10.89	4.84
Kurtosis	0.10	-0.97	-0.43	-1.47	0.79
Skewness	-0.95	-0.26	-0.98	-0.02	0.93
Range	38.6	9	8	9.5	8.6
Minimum	60	60	70	80	90
Maximum	98.6	69	78	89.5	98.6
Sum	117235.6	11928	6032	54648.48	44627.2
Count	1392	184	80	648	480
%	100.00	13.22	5.75	46.55	34.48
Confidence Level (95.0%)	0.50	0.37	0.66	0.25	0.20

Source. Authors' own elaboration based on the academic Kardex

Finally, Table 7 shows the results of the analysis of association between the main variables of the study. It details the correlations and relationships identified, allowing for a comprehensive understanding of how school stress (SS), nutritional health (NH), and academic performance (AP) interrelate in the evaluated population.

Tabla7
Associations between study variables

Analyzed relationship	Type of analysis	Key result	Interpretation
SS – NH (BMI)	Mean and variance	SS: M = 3.45, Var = 0.41 / BMI: M = 2.49, Var = 0.57	Different averages; greater variability in NH (BMI).
	Pearson correlation	r = -0.096	Very weak but significant negative correlation (indicates a slight association).
	Linear regression	β = -0.081, p = 0.00035 / R^2 = 0.009	Significant inverse relationship, but with low explanatory power.
	ANOVA (columns = NH (BMI))	F = 1194.05 / p ≈ 0.000	NH (BMI) varies significantly by levels of SS.
	F-test (variances)	F = 0.71 / 2.1×10^{-10}	Different variances; evidence of heterogeneity.
	Covariance	Cov = -0.046	Slight negative linear relationship.
	t-test	t = 36.15 / p ≈ 0	Significant difference in means of SS and NH (BMI).
SS – AP	Mean and variance	Stress: M = 3.45, Var = 0.41 / Performance: M = 3.02, Var = 0.93	Moderate levels; greater dispersion in AP.
	Pearson correlation	r = 0.302	Medium positive correlation between SS and AP.
	Linear regression	β = 0.168 / p < 0.001 / R^2 = 0.091	Stress explains approximately 9% of the variability in AP.
	ANOVA (rows = SS)	F = 5.62 / p = 0.003	Significant differences between groups of SS.
	ANOVA (columns = AP)	F = 201.95 / p < 0.00001	AP significantly influences groups.
	t-test	t = 13.89 / p < 0.00001	Significant difference between means of SS and AP.
	Covariance	Cov = 0.155	Moderate positive relationship.
NH (BMI) – AP	Mean and variance	BMI: M = 2.49, Var = 0.57 / AP: M = 3.02, Var = 0.93	Moderate differences; AP more dispersed.
	Pearson correlation	r = -0.213	Weak but significant negative correlation.
	Linear regression	β = -0.167 / p < 1×10^{-15} / R^2 = 0.045	Significant inverse relationship; NH (BMI) explains 4.5% of AP.
	ANOVA (by groups – AP)	F = 214.56 / p ≈ 2.7×10^{-45}	Significant differences between groups of AP according to NH (BMI).
	ANOVA (regression)	F = 65.77 / p < 1×10^{-15}	The regression model is valid; NH (BMI) influences AP.

	t-test	$t = -16.09 / p < 1.3 \times 10^{-46}$	Robust differences in NH (BMI) according to AP.

Source. Authors' own elaboration

Discussion

The association between school stress (SS) and academic performance (AP) was moderate, reflected in a correlation coefficient of r = 0.302, suggesting that higher levels of SS are also associated with better outcomes in AP. The linear regression analysis revealed a positive and significant effect (β = 0.168, p < 0.001), with a coefficient of determination R^2 = 0.091, indicating that SS explains approximately 9% of the variability in AP. Furthermore, the results from ANOVA and the t-test confirmed significant differences among the analyzed groups. These findings contrast with previous studies, such as that of Calatayud et al. (2022), which reported a negative correlation between high levels of SS and AP. However, recent research, like that of Calzadilla (2022), suggests that a moderate level of SS may serve as a stimulus to improve AP, which could justify the positive relationship observed in this case.

Regarding the correlation between school stress and nutritional health measured by body mass index (BMI), the results indicate a weak inverse association between these variables. The Pearson correlation was r = -0.096, indicating a slight but statistically significant negative relationship. The linear regression also showed significance (β = -0.081, p = 0.00035), although with a low coefficient of determination (R^2 = 0.009), indicating that SS explains only 0.9% of the variability in BMI. ANOVA and the F-test revealed significant differences in BMI according to levels of SS (F = 1194.05, p ≈ 0.000) and heterogeneity in variances among groups (F = 0.71, p < 0.0001), reinforcing the presence of variability among the studied conditions.

These results partially align with those of Jalca et al. (2020), who observed a strong positive association between overweight and moderate levels of SS in Peruvian university students. However, other studies, such as those by Chávez-Mendoza et al. (2021) and Moguel-Ceballos et al. (2025), found no significant relationship between these variables, suggesting that mediating factors such as coping styles or lifestyle could influence this association.

Regarding the relationship between nutritional health (BMI) and academic performance, a weak negative correlation was observed (r = -0.213), indicating that a higher BMI is associated with lower academic performance. The linear regression confirmed this inverse relationship (β = -0.167, $p < 1 \times 10^{-15}$, R^2 = 0.045), and ANOVA showed significant differences in AP according to groups of nutritional health (F = 214.56, p < 0.00001). These results align with those reported by Sánchez-Hernández et al. (2022), who documented that overweight and obesity are related to a decrease in AP, possibly due to factors such as fatigue, low self-esteem, and school absenteeism.

On the other hand, López-Agudo and Marcenaro-Gutiérrez (2021), studying students from various countries, found that overweight was not associated with differences in AP compared to normal-weight students. Similarly, Cota et al. (2024), in a sample of Mexican health students, reported a null relationship between nutritional health and AP, although they highlighted that this relationship may be affected by multiple factors, including dietary habits and lifestyle.

Conclusions

The relationship between SS and nutritional health measured by BMI, as well as between AP and nutritional health, turned out to be negative, very weak, and not statistically significant. This indicates that such associations may be influenced by other variables that were not considered in this study. Therefore, it is necessary to conduct more research to deepen the understanding of these relationships and their implications for the academic success of university students.

In relation to the institutions where the research was conducted, it is recommended to implement strategies aimed at emotional management and coping with stress, which contribute to promoting adequate control of SS. Additionally, it is essential to foster healthy lifestyles that enhance the overall well-being of students, thereby supporting both their personal development and academic performance.

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AUTHORSHIP CONTRIBUTION:

1. Conceptualization: Juan Pablo Sánchez-Domínguez
2. Data curation: Ángel Esteban Torres-Zapata
3. Formal analysis: José Rafael Villanueva-Echavarría, Addy Leticia Zarza-García, Gloria Esther Acevedo-Olvera
4. Funding acquisition: N/A
5. Research: Ángel Esteban Torres-Zapata, Juan Pablo Sánchez-Domínguez
6. Methodology: Juan Pablo Sánchez-Domínguez, Ángel Esteban Torres-Zapata
7. Project management: Teresa del Jesús Brito-Cruz, Ángel Esteban Torres-Zapata, Addy Leticia Zarza-García
8. Resources: Teresa del Jesús Brito-Cruz, Addy Leticia Zarza-García
9. Software: José Rafael Villanueva-Echavarría, Addy Leticia Zarza-García
10. Supervision: Juan Pablo Sánchez-Domínguez, Ángel Esteban Torres-Zapata
11. Validation: Teresa del Jesús Brito-Cruz, Gloria Esther Acevedo-Olvera
12. Visualization: Teresa del Jesús Brito-Cruz, Gloria Esther Acevedo-Olvera
13. Writing – original draft: Juan Pablo Sánchez-Domínguez, Ángel Esteban Torres-Zapata
14. Writing – proofreading and editing: Juan Pablo Sánchez-Domínguez, Ángel Esteban Torres-Zapata

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