

Adolescents' self-perceived health, life satisfaction and subjective vitality during the COVID-19 pandemic: an analysis based on education level, gender and physical activity status

Autopercepciones de salud, satisfacción con la vida y vitalidad subjetiva de los adolescentes durante la pandemia de COVID-19: un análisis basado en el nivel educativo, género y el estado de actividad física

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Abstract. During the COVID-19 pandemic, disruptions to adolescents' routines manifested in increased sedentary behaviors, reduced physical activity (PA), diminished social contacts, and adverse effects on mental health. The study's objective was to analyze and compare adolescents' self-perceptions concerning health, vitality, and life satisfaction based on gender, PA, and education levels during the pandemic's restrictive timeframe before the January 2021 lockdown. A total of 1369 Portuguese students (621 boys and 748 girls; M_{age} : 14.4 years; SD : 1.74) participated in this study. Group differences were analyzed via ANCOVA, considering age, standardized BMI, socioeconomic status, and daily moderate-to-vigorous PA both pre- and during the pandemic. Only 3.1% of adolescents adhered to international PA guidelines. Results indicated generally low levels of adolescents' health self-perceptions, particularly among girls. The study sheds light on adolescents' self-perceptions of health and well-being during the COVID-19 pandemic, emphasizing the associations between restrictive measures and adolescents' health perceptions and PA levels. Future studies are necessary to assess students' self-perceptions upon returning to normalcy and understand lingering negative effects on adolescents' well-being.

Keywords: Adolescents; self-perceived health; vitality; life satisfaction; physical activity; COVID-19.

Resumen. Durante la pandemia de COVID-19, las interrupciones en las rutinas de los adolescentes se manifestaron en un aumento de comportamientos sedentarios, una reducción de la actividad física (AF), contactos sociales disminuidos y efectos adversos en la salud mental. El objetivo de este estudio fue analizar y comparar las auto-percepciones de salud, vitalidad y satisfacción con la vida de los adolescentes según el género, la AF y los niveles de educación durante el período restrictivo de la pandemia antes del confinamiento de enero de 2021. Participaron un total de 1369 estudiantes portugueses (621 niños y 748 niñas; edad media: 14.4 años; DE: 1.74). Las diferencias entre grupos se analizaron mediante ANCOVA, considerando la edad, el IMC estandarizado, el estatus socioeconómico y la AF moderada a vigorosa diaria tanto antes como durante la pandemia. Solo el 3.1% de los adolescentes cumplían con las pautas internacionales de AF. Los resultados indicaron niveles generalmente bajos de auto-percepciones de salud en los adolescentes, especialmente entre las niñas. El estudio arroja luz sobre las auto-percepciones de salud y bienestar de los adolescentes durante la pandemia de COVID-19, destacando las asociaciones entre las medidas restrictivas y la percepción de salud y los niveles de AF de los adolescentes. Futuros estudios son necesarios para evaluar las auto-percepciones de los estudiantes al volver a la normalidad y comprender los efectos negativos persistentes en el bienestar de los adolescentes.

Palabras clave: Adolescentes; salud auto-percibida; vitalidad; satisfacción con la vida; actividad física; COVID-19.

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Introduction

When World Health Organization (WHO) declared the COVID-19 a global pandemic (WHO, 2020), many countries implemented measures to curb contagions, including school closures and stringent social contact restrictions. Several studies have reported adverse effects on children and adolescents due to these measures, such as increased sedentary behaviors, decreased physical activity (PA), significantly reduced social contacts, and negative impacts on mental health (Chaabane, Doraiswamy, Chaabna, Mamtani, & Cheema, 2021; Chambonniere et al., 2021; Meyers, Friedman, & Anderson-Burnett, 2021; Miranda de Oliveira et al., 2022; Singh et al., 2020; Tuñón, Laíño, & Weisstaub, 2024; Wunsch, Kienberger, & Niessner, 2022; Xiang, Zhang, & Kuwahara, 2020). The decline in PA levels and increased sedentary behaviors during COVID-19 may be linked to poor mental health. Several studies have indicated that adolescents with more sedentary time or lower PA levels tend to perceive their health less favorably and are more susceptible to depressive or anxiety states (Lubans et al., 2016; Piko, 2000; Rodriguez-Ayllon et al., 2019).

Adolescence, marked by significant transformations and

development, involves identity formation and the establishment of behavioral patterns (Beauchamp, Puterman, & Lubans, 2018; Nelson, Kling, Wängqvist, Frisén, & Syed, 2018). Perceptions of personal health and life during this phase play a crucial role in adopting a healthy lifestyle, influencing factors such as PA and nutrition choices (Bombak, 2013; Marques, Mota, Gaspar, & de Matos, 2017). Self-perceived health (SPH) serves as a reliable indicator of both physical and mental status (Piko, 2000; Shields & Shoostari, 2001), even demonstrating predictability for mortality (Larsson, Hemmingsson, Allebeck, & Lundberg, 2002). SPH is subjective and indicative of psychosocial health (Piko, 2007), with psychosocial factors playing a pivotal role in determining health and illness during adolescence (Ghandour, Overpeck, Huang, Kogan, & Scheidt, 2004; Heistaro, Jousilhti, Lahelma, Vartiainen, & Puska, 2001; Piko, 2007). The well-being dimension of health encompasses not only the absence of illness but also an individual's perception of health, including feelings of physical vitality and having adequate strength and energy for daily activities (Kern, Allen, Furlong, Vella-Brodrick, & Suldo, 2021; Seligman, 2012). Subjective vitality (SV) has been linked to higher levels of mental health, positive emotions,

and self-motivation, as well as lower levels of psychological distress or negative emotions (Ryan & Deci, 2000). Life satisfaction (LS), a cognitive indicator of subjective well-being (SWB), has been shown to positively impact adolescents' psychological development, acting as a buffer against stress-induced mental problems (Gross-Manos, Shimoni, & Ben-Arieh, 2015; Park, 2004).

Prolonged lockdowns and altered daily routines during the COVID-19 pandemic adversely affected families, particularly children and adolescents (Singh et al., 2020). Emotional experiences, crucial for young people's mental health (Olino et al., 2011), may have been disrupted by COVID-19-related stressors, contributing to disturbances in adolescents' emotionality and well-being.

Adolescence appears to be a period when depressive symptoms tend to rise (Biddle, Ciaccioni, Thomas, & Vergeer, 2019). Data from 2019 revealed Portugal with the highest percentage of chronic depression among the population aged 15 years and older, particularly among girls (Eurostat Statistics Explained, 2019).

Two significant factors correlated with health self-perceptions and PA are socio-economic status (SES) and body mass index (BMI). Recognizing their importance, we included SES and BMI as control variables in our study. BMI is associated with adolescents' PA and fitness (Moeini et al., 2021; Rauner, Mess, & Woll, 2013; Rusillo Magdaleno, Suarez-Manzano, Solas Martínez, & Ruiz Ariza, 2023) levels and health self-perceptions (Fonseca & Gaspar de Matos, 2005). Several studies have demonstrated associations between mental health problems and overweight, particularly regarding weight stigma and its association with poor mental health (Warnick, Darling, West, Jones, & Jelalian, 2022). Low SES is also linked to lower PA engagement in children and adolescents (Pearson et al., 2022).

In this study, we aimed to analyze adolescents' SPH, LS, and SV during the COVID-19 pandemic, comparing by students' educational level, gender and PA status, at the time when students returned to face-to-face education after the first lockdown but in a context of severe restrictions and changes to their daily and school routines.

Materials and methods

Participants

We surveyed 1369 students (621 boys and 748 girls), aged 12 to 18 years (M_{age} : 14.4; SD : 1.74), from 13 schools in northern Portugal, belonging to levels two (lower secondary) and three (upper secondary) of the International Standard Classification of Education (ISCED) classification. The schools were integrated in different socioeconomic contexts and only students who were attending physical education classes participated.

Procedures and data collection

An online survey was conducted using an open-source survey online platform upon the return to face-to-face teaching after the March 2020 lockdown, still amidst the

pandemic. Students adhered to various restrictive rules to prevent contagion (mandatory use of mask; social contact limited to classmates; prohibition of games and PA in the playground; mandatory circulation routes in the school to avoid crowding; daily disinfection of hands and material). Participation was voluntary and anonymous, with no incentives provided. Informed consent was obtained from participants and their legal guardians. Exclusion criteria included the absence of parental/legal guardian consent and non-attendance of physical education classes.

The survey was open for responses in November and December 2020. The final sample of 1369 respondents comprised students who completed the entire survey. School teachers facilitated the survey during class time using the school's digital devices.

Ethical considerations

The research adhered to ethical standards, with approval by the Ethics Council for Research of Faculty of Human Kinetics, University of Lisbon (Opinion no. 16/2020) and the Ministry of Education of Portugal (no. 0666900005, approved in March 2020), in line with the Declaration of Helsinki.

Instruments

Several questionnaires and scales from the IMPACT-PE project (IMPACTPE, 2017) were used, including those validated and applied in Portugal. Participants' PA level was assessed based on the international guideline of 60 minutes of moderate-to-vigorous daily PA (MVPA).

To assess the participants' PA level, item two was adjusted by adding the phrase "before COVID-19", to determine the pre-pandemic PA levels. Following the PA frequency assessment tool by Prochaska et al. (Prochaska, Sallis, & Long, 2001), the answers to the two questions concerning the weekly PA frequency, ranged from "0 to 7 days". Alike previous studies (Mata et al., 2021; Mata, Onofre, & Martins, 2022), students who met the international guideline of 60 minutes of moderate-to-vigorous daily PA (MVPA) (Bull et al., 2020) were considered "active".

Five questions were included to gather information on participants' age (years), gender (boy/girl), weight (kg), height (m), and education level (ISCED 2 / ISCED 3). The BMI (kg/m^2) and BMI Z-Score were calculated, adjusted for age and gender, in accordance with the WHO reference values (WHO, 2021).

SES was evaluated utilizing the Family Affluence Scale (FAS), a six-item instrument designed for application in adolescent surveys (Matos, 2018; Sigmundová et al., 2019; Torsheim et al., 2016). The FAS scale comprises six items, each associated with family asset-based wealth, and the corresponding answers/scores (with higher scores denoting greater affluence). A single variable, representing the SES, was derived from these items.

LS was evaluated employing the Cantril (1965) scale, as

utilized in Portugal within the framework of the Health Behavior in School-Aged Children (HBSC) study (Matos, 2018). This single item scale is designed to gauge satisfaction with life as a whole and is structured with 11 levels. The scale ranges from the lowest level (0), representing the worst possible life, to the highest level (10), indicating the best possible life.

SPH was gauged using 4-level scale, with one answer corresponding to each level, replying the question "What do you think about your health status?". Level 1: *I don't feel very healthy*; level 2: *I feel reasonably healthy*; level 3: *I feel in good health*; level 4: *I feel in very good health*. This health perception scale was used in the HBSC study in Portugal, in a representative sample of young people (Matos, 2018).

SV was quantified utilizing the translated and validated version by Moutão et al. (2013), derived from the original subjective vitality scale developed by Ryan & Frederick (1997). This 5-item scale, also employed in studies such as the one conducted across five European countries (Papaioannou et al., 2013), measures feelings of energy and vitality. All items were rated on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). The scale items were: *I felt alive and vital*; *I had energy and spirit*; *I looked forward to each new day*; *I nearly always felt alert and awake*; *I felt energized*.

Data analysis

The online platform used to administer the questionnaire automatically compiled the survey results into Excel format, subsequently exporting them to SPSS version 28 for macOS (SPSS Inc., Chicago, IL). Within SPSS, data underwent reorganization, and statistical analyses were conducted. Categorical variables were subjected to absolute (n) and relative (%) frequency calculations, while continuous variables were assessed for means (M) and standard deviations (SD). The assumptions inherent to this analysis were met, namely homoscedasticity of variances, assessed using the Levene test, normality of residuals, assessed using the Kolmogorov-Smirnov test, and observation of the histogram.

The effect of education level, gender, and physical activity (PA) levels (conforming to international PA guidelines) on SPH, LS, and SV was examined through ANCOVA (Analysis of Covariance), adjusting for age, standardized BMI, SES, 60 minutes of pre-COVID-19, and during COVID-19 PA. Results are presented in Mean (M) and standard deviation (SD) format. Education level comparisons were stratified by gender, while gender comparisons were stratified by education level and PA status (inactive/active). When results were stratified by PA (inactive/active), adjustments were made for variables such as age, pre-COVID-19 PA, SES, and BMI (Z-score); notably,

PA post-COVID-19 was excluded from the statistical models. The significance level was set at 0.05.

Results

Table 1 outlines the sample description, emphasizing low compliance with 60 minutes of daily MVPA both pre-pandemic (4.9%) and during the pandemic (3.1%). Girls exhibited lower PA levels than boys and worse health-related self-concept indicators across all dimensions (Table 2). Only 30.4% of adolescents reported being very healthy.

Table 1.
Sample description – frequencies (n / %) and M/SD

	Total (n = 1369)	Boys (n = 621)	Girls (n = 748)
	n (%) or M ± SD	n (%) or M ± SD	n (%) or M ± SD
Age	14.4 ± 1.74	14.3 ± 1.74	14.4 ± 1.74
School grade			
ISCED 2	817 (59.7)	385 (62.0)	432 (57.8)
ISCED 3	552 (40.3)	236 (38.0)	316 (42.2)
PA (60 min./day) before COVID-19	67 (4.9)	43 (6.9)	24 (3.2)
PA (60 min./day) during COVID-19	43 (3.1)	26 (4.1)	17 (2.2)
Subjective Vitality	3.54 ± 0.83	3.69 ± 0.82	3.40 ± 0.85
Life Satisfaction	6.77 ± 1.98	7.03 ± 2.02	6.51 ± 1.95
Self-perceived Health	3.10 ± 0.03	3.19 ± 0.04	3.01 ± 0.03
BMI category *			
Normal weight	1171 (86.3)	535 (87.4)	636 (85.5)
Overweight	185 (13.7)	77 (12.6)	108 (14.5)

*13 missing cases (0.9%)

M: Mean; SD (±): Standard Deviation

Table 2.
Self-perceived health – descriptive results (n/%)

Self-perceived health	n	%
Negative health perception	246	18.0
I do not feel very healthy	36	2.7
I feel reasonably healthy	210	15.3
Positive health perception	1123	82.0
I feel in good health	706	51.6
I feel in very good health	417	30.4
Total	1369	100.0

Table 3 indicates that girls at both education levels exhibited significantly poorer indicators of SV and LS compared to boys. Among older students, girls reported significantly worse self-perceived health than boys. In Table 4, no significant differences were observed in the three assessed dimensions among boys at both education levels. Younger girls displayed significantly higher values for SV and self-perceived health than their older counterparts. Table 5 shows that inactive boys demonstrated significantly better indicators of SV, LS, and SPH than inactive girls. Among active students, the only significant difference was found in SPH, where boys reported higher values than girls.

Table 3.

ANCOVA: comparisons by gender stratified by education level

	ISCED 2			ISCED 3		
	Boys	Girls	p-value	Boys	Girls	p-value
	(n=385)	(n=432)		(n=236)	(n=316)	
Subjective Vitality	3.75 (0.81)	3.55 (0.81)	<i>p = 0.004</i>	3.63 (0.84)	3.17 (0.90)	<i>p < 0.001</i>
Life Satisfaction	7.29 (1.88)	6.69 (2.01)	<i>p < 0.001</i>	6.70 (2.17)	6.26 (1.89)	<i>p = 0.032</i>
Self-perceived health	3.20 (0.04)	3.15 (0.03)	<i>p = 0.284</i>	3.18 (0.05)	2.88 (0.04)	<i>p < 0.001</i>

Analysis was adjusted for age; BMI (Z-score); SES; pre- and during Covid-19 PA

Results presented in M (SD) format; Statistical significances are presented in bold

ISCED 2: International Standard of Education, level 2; ISCED 3: International Standard of Education, level 3

Table 4.

ANCOVA: comparisons by education level stratified by gender

	Boys			Girls		
	ISCED 2	ISCED 3	p-value	ISCED 2	ISCED 3	p-value
	(n=385)	(n=236)		(n=432)	(n=316)	
Subjective Vitality	3.75 (0.81)	3.63 (0.84)	<i>p = 0.277</i>	3.55 (0.81)	3.17 (0.90)	<i>p = 0.006</i>
Life Satisfaction	7.29 (1.88)	6.70 (2.17)	<i>p = 0.863</i>	6.69 (2.01)	6.26 (1.89)	<i>p > 0.990</i>
Self-perceived health	3.20 (0.04)	3.18 (0.05)	<i>p = 0.355</i>	3.15 (0.03)	2.88 (0.04)	<i>p = 0.044</i>

Analysis was adjusted for age; BMI (Z-score); SES; pre- and during Covid-19 PA

Results presented in M (SD) format; Statistical significances are presented in bold

ISCED 2: International Standard of Education, level 2; ISCED 3: International Standard of Education, level 3

Table 5.

ANCOVA: comparisons by gender stratified by Inactive / Active

	Inactive ¹			Active ²		
	Boys	Girls	p-value	Boys	Girls	p-value
	(n=578)	(n=724)		(n=43)	(n=24)	
Subjective Vitality	3.66 (0.81)	3.38 (0.85)	<i>p < 0.001</i>	4.38 (0.72)	3.99 (1.19)	<i>p = 0.162</i>
Life Satisfaction	6.99 (1.98)	6.49 (1.97)	<i>p < 0.001</i>	8.37 (1.93)	7.39 (1.88)	<i>p = 0.092</i>
Self-perceived health	3.17 (0.03)	3.03 (0.03)	<i>p < 0.001</i>	3.54 (0.10)	3.17 (0.13)	<i>p = 0.031</i>

Analysis was adjusted for age; BMI (Z-score); SES; pre-Covid-19 PA.

1 - Does not perform 60 min of PA before COVID-19; 2 - Performs 60 min of PA during COVID-19

Results presented in M (SD) format. Statistical significances are presented in bold

ISCED 2: International Standard of Education, level 2; ISCED 3: International Standard of Education, level 3

Discussion

Given the observed association of physical activity (PA) with the analyzed constructs in this study, the noteworthy concern arises from the low compliance with PA recommendations (Bull et al., 2020) during COVID-19 pandemic. These findings fall below the levels of PA reported in recent studies involving Portuguese adolescents (Martins et al., 2019; Matos, 2018). The decrease in PA between the pre-COVID-19 and during the pandemic periods appears to be linked to the restrictive measures implemented to control the virus, as suggested by various studies (Chambonniere et al., 2021; Pombo, Luz, Rodrigues, Ferreira, & Cordovil, 2020; Rossi, Behme, & Breuer, 2021; Wunsch et al., 2022; Xiang et al., 2020). Across both periods, girls consistently exhibited lower PA levels than boys, aligning with the majority of studies and recent data (Baptista et al., 2012; Guthold, Stevens, Riley, & Bull, 2020; Martins et al., 2019). The declining participation in PA with age, particularly among girls who tend to disengage early, may be influenced by family, social, and school contexts for adolescents (Pate et al., 2019). It underscores the need for strategies encouraging adolescents to enhance their PA levels as a means to improve health and quality of life.

Only 18.1% of the adolescents self-rated their life as the *best possible life* (9 and 10 on the LS scale). This result may be attributed to the socially deprived environment and the pervasiveness of the disease in adolescents' daily lives. The significantly lower LS in girls aligns with findings from some

studies (Breslin et al., 2012; Moksnes & Espnes, 2013). However, as noted by Chen et al. (Chen, Cai, He, & Fan, 2020), in their meta-analysis, conclusive evidence on gender differences in adolescents' LS is generally lacking. Importantly, their analysis did not include studies from the pandemic period, complicating direct comparisons with our data. In a longitudinal study comparing LS by gender before and during COVID-19, within the lockdown period, boys' LS decreased significantly at follow-up, while girls' LS remained unchanged (van der Laan et al., 2021). It is crucial to acknowledge that our study took place in the post-lockdown period, albeit still in the midst of the pandemic.

While low PA levels may correlate with poor LS perceptions, the potential influence of the pandemic context on LS, especially in girls displaying worse LS indicators in the inactive/active groups, should be considered. In this study, only "active" students exceeded the value "8." This suggests that higher PA is associated with positive LS perceptions, and these students may exhibit greater resilience to the challenges posed during the pandemic.

One in three students reported feeling in very good health. Girls consistently exhibited significantly worse self-perceived health (SPH) than boys across various comparisons (education level; inactive/active), with older girls reporting worse SPH than their younger counterparts. This data mirrors the LS results and likely reflects the pandemic-related negative context and perceptions triggered, rather than actual illness. Previous studies have linked SPH to a

wide range of physical and mental health concerns, emphasizing its importance as a reliable measure of health outcomes from adolescence to early adulthood (Zhang, Lu, & Wu, 2020). Although limited to a specific and unprecedented period, the findings revealed an alarming situation, particularly for girls, requiring re-evaluation in future studies. Assessing SPH is crucial for identifying adolescents with poor health and designing health intervention programs. It is essential to underscore the role of PA in SPH, as higher PA levels and lower sedentary behaviors correlate with improved SPH (Zhang et al., 2020). Promoting active lifestyles and reducing sedentary behaviors remains a priority for public health and educational authorities to enhance the health status of children and adolescents.

Girls, at both education levels, consistently exhibited significantly worse indicators of subjective vitality (SV) than boys. Among girls, older individuals reported lower SV perception than their younger counterparts. In the "inactive" group, girls self-perceived significantly lower SV than boys. While no significant differences were found between boys and girls, the "active" students exhibited the highest SV values, with boys recording a mean value of 4.38. This aligns with numerous studies reporting a positive association between high PA levels and increased vitality perception in adolescence (Biddle et al., 2019; Gianfredi et al., 2020; Rodriguez-Ayllon et al., 2019). PA's potential to counteract negative effects on adolescents' mental health and well-being during the pandemic is evident (Wright, Williams, & Veldhuijzen van Zanten, 2021). Therefore, PA should be promoted during periods of lockdown or severe constraints in order to contribute to good mental health and well-being of adolescents (Wright et al., 2021). Therefore, promoting PA during lockdowns or severe constraints is essential to contribute to adolescents' mental health and well-being. Individuals with high subjective vitality are likely to experience more positive feelings, including energy and aliveness (Arslan, Yıldırım, & Aytac, 2022). Moreover, they are inclined to focus on positive thoughts about the consequences of the coronavirus, aiding in coping with the negative impacts of coronavirus anxiety during this period (Arslan et al., 2022).

The results underscore the worrisome potential impact of the pandemic on the mental health and well-being of adolescents, revealing a consistent negative trend for girls compared to boys across all assessed constructs. Eurostat (Eurostat Statistics Explained, 2019) had previously highlighted unfavorable indicators in Portugal, particularly among girls, making it even more pertinent for future research. Studying and evaluating the post-pandemic effects on mental health and designing programs to support and enhance adolescents' physical, psychological, and social well-being are crucial.

Considering that adolescents with high Body Mass Index (BMI) and low socioeconomic status (SES) tend to exhibit worse health and PA indicators, future interventions should specifically target young people from these two groups.

While the study has limitations, including the self-report method for assessing PA, which may lack accuracy compared to objective methods, the sample size and the restrictive context justified this approach. The data from this study are not generalizable but provide valuable insights into a unique and unprecedented context. The focus on analyzing differences between groups with a convenience sample represents a limitation, emphasizing the need for caution in drawing broad conclusions.

As strengths of the study, we highlight the robust sample size, data collection during the return to school in the midst of the pandemic, and the rarity of studies addressing adolescent self-perceptions of health, vitality, and life satisfaction during this time frame.

Conclusions

This study offers insights into adolescents' self-perceptions of health and well-being during the COVID-19 pandemic, emphasizing the negative effects of restrictive measures on PA levels and mental health. Future studies should assess students' self-perceptions upon returning to normalcy and investigate lingering negative effects on adolescents' mental health and well-being resulting from the pandemic. The results found in this study reinforce the urgent need to design programs that support and enhance adolescents' physical, psychological, and social well-being post-pandemic. In particular, attention should be given to girls and also adolescents with high BMI and low SES, who may require specific interventions. Despite the limitations, this study provides valuable and rare insights into a unique context, shedding light on the potential impact of the pandemic on adolescents' mental health and well-being.

Author Contribution

Information omitted for revision

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Institutional Review Board Statement

The study was approved by the Ethics Council for Research (Faculty of Human Kinetics, University of Lisbon, no.16/2020) and by the Portuguese Ministry of Education (no. 0666900005, approved on March 2020).

This research was carried out in line with the Declaration of Helsinki, which states the ethical principles for medical research involving human subjects.

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data presented in this study are available on request from the corresponding author. The data are not publicly available as they were collected, processed, and calculated by the author.

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Conflicts of Interest

The authors declare no conflicts of interest.

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