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THE IMPACT OF LIFESTYLE ON ADOLESCENT BEHAVIOUR: PRELIMINARY INSIGHTS INTO HEALTHY LIVING AND MENTAL HEALTH

O IMPACTO DO ESTILO DE VIDA NO COMPORTAMENTO DE ADOLESCENTES: CONSIDERAÇÕES INICIAIS SOBRE VIDA SAUDÁVEL E SAÚDE MENTAL

EL IMPACTO DEL ESTILO DE VIDA EN EL COMPORTAMIENTO ADOLESCENTE: PRIMERAS PERSPECTIVAS SOBRE VIDA SALUDABLE Y SALUD MENTAL

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ABSTRACT

This study investigated the associations between lifestyle behaviours and psychosocial functioning among adolescents in a public high school in northeastern Brazil. Using a cross-sectional, school-based design, data were collected in October 2024 from a sample of 61 students aged 15 to 19 years. Participants completed two validated instruments: the Individual Lifestyle Profile (*Perfil do Estilo de Vida Individual* – PEVI), which assesses health-related behaviours across five lifestyle domains, and the Strengths and Difficulties Questionnaire (SDQ), a widely used tool for screening psychosocial functioning. Findings revealed key vulnerabilities in health behaviours, including inadequate nutrition, low levels of physical activity, and poor stress management. Notable sex differences were identified: girls

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were more likely to report internalising symptoms and difficulties in interpersonal relationships, while boys reported higher levels of physical activity and overall psychosocial well-being. These disparities reflect persistent sociocultural barriers to female participation in physical activity, which may negatively affect self-esteem, emotional well-being, and social connectedness. Despite these challenges, prosocial behaviours remained relatively preserved, suggesting potential resilience factors that may be strengthened through targeted interventions. Overall, the results suggest that adolescent mental health is influenced by a range of modifiable lifestyle behaviours and social dynamics. These behavioural patterns, even in less urbanised contexts, appear to reflect broader cultural shifts and evolving epidemiological trends. The findings underscore the need for integrated, school-based interventions that are both gender-sensitive and contextually relevant. Promoting physical activity, enhancing peer relationships, and encouraging healthy lifestyle habits during adolescence may contribute to reducing psychosocial distress and support broader public health goals centred on well-being and disease prevention.

Keywords: Healthy Lifestyle. Adolescent Behaviour. Mental Health. Psychopathology. Disease Prevention.

RESUMO

Este estudo investigou as associações entre comportamentos de estilo de vida e funcionamento psicossocial entre adolescentes de uma escola pública no nordeste do Brasil. Utilizando um delineamento transversal de base escolar, os dados foram coletados em outubro de 2024, a partir de uma amostra de 61 estudantes com idades entre 15 e 19 anos. Os participantes responderam a dois instrumentos validados: o Perfil do Estilo de Vida Individual (PEVI), que avalia comportamentos de saúde em cinco domínios, e o Strengths and Difficulties Questionnaire (SDQ), medida amplamente utilizada para o rastreio do funcionamento psicossocial. Os resultados revelaram vulnerabilidades importantes em hábitos de saúde, como alimentação inadequada, baixos níveis de atividade física e dificuldade na gestão do estresse. Diferenças significativas entre os sexos foram identificadas: meninas apresentaram mais sintomas internalizantes e dificuldades nos relacionamentos interpessoais, enquanto os meninos relataram níveis mais adequados de atividade física e melhor funcionamento psicossocial geral. Tais desigualdades refletem barreiras socioculturais persistentes à participação feminina em atividades físicas, impactando negativamente a autoestima, o bem-estar emocional e a integração social. Apesar das vulnerabilidades observadas, os comportamentos pró-sociais mostraram-se relativamente preservados, indicando fatores de resiliência que podem ser potencializados por estratégias de intervenção adequadas. De modo geral, os achados sugerem que a saúde mental de adolescentes é influenciada por um conjunto de fatores modificáveis relacionados ao estilo de vida e às dinâmicas sociais. Esses padrões comportamentais, mesmo em contextos menos urbanizados, refletem influências de normas culturais globalizadas e mudanças no perfil epidemiológico. Destaca-se, portanto, a importância de intervenções integradas no ambiente escolar, que considerem as especificidades de gênero e o contexto sociocultural. A promoção da atividade física, o fortalecimento dos vínculos interpessoais e a adoção de hábitos saudáveis durante a adolescência podem contribuir para a redução do sofrimento psicossocial e para o alcance de metas mais amplas de saúde pública e bem-estar.

Palavras-chave: Estilo de Vida Saudável. Comportamento do Adolescente. Saúde Mental. Psicopatologia. Prevenção de Doenças.

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RESUMEN

Este estudio investigó las asociaciones entre los comportamientos relacionados con el estilo de vida y el funcionamiento psicosocial en adolescentes de una escuela secundaria pública en el noreste de Brasil. Utilizando un diseño transversal de base escolar, se recopilaron datos en octubre de 2024 a partir de una muestra de 61 estudiantes de entre 15 y 19 años. Los participantes completaron dos instrumentos validados: el Perfil del Estilo de Vida Individual (PEVI), que evalúa comportamientos relacionados con la salud en cinco dominios del estilo de vida, y el Cuestionario de Fortalezas y Dificultades (SDQ), una herramienta ampliamente utilizada para evaluar el funcionamiento psicosocial. Los resultados revelaron vulnerabilidades clave en los comportamientos de salud, incluyendo una alimentación inadecuada, bajos niveles de actividad física y dificultades en el manejo del estrés. Se identificaron diferencias significativas por sexo: las chicas tendieron a reportar más síntomas internalizantes y dificultades en las relaciones interpersonales, mientras que los chicos informaron mayores niveles de actividad física y bienestar psicosocial general. Estas disparidades reflejan barreras socioculturales persistentes que limitan la participación femenina en actividades físicas, lo cual puede afectar negativamente la autoestima, el bienestar emocional y la conexión social. A pesar de estos desafíos, los comportamientos prosociales se mantuvieron relativamente preservados, lo que sugiere la presencia de factores de resiliencia que podrían fortalecerse mediante intervenciones específicas. En general, los resultados sugieren que la salud mental de los adolescentes está influenciada por una variedad de comportamientos modificables relacionados con el estilo de vida y por dinámicas sociales. Estos patrones conductuales, incluso en contextos menos urbanizados, parecen reflejar cambios culturales más amplios y tendencias epidemiológicas en evolución. Los hallazgos destacan la necesidad de intervenciones escolares integradas que sean sensibles al género y adecuadas al contexto. Promover la actividad física, fortalecer las relaciones entre pares y fomentar hábitos de vida saludables durante la adolescencia puede contribuir a reducir el malestar psicosocial y apoyar objetivos más amplios de salud pública centrados en el bienestar y la prevención de enfermedades.

Palabras clave: Estilo de Vida Saludable. Conducta del Adolescente. Salud Mental. Psicopatología. Prevención de Enfermedades.

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1 INTRODUCTION

Adolescence represents a critical window in human development, characterised by profound physical maturation, cognitive transformation, and evolving social roles. These complex transitions render adolescents particularly susceptible to mental health challenges, which commonly manifest as internalising behaviours—such as depression, anxiety, and withdrawal—as well as externalising behaviours, including aggression, hyperactivity, and conduct problems (Patton *et al*., 2016). These psychological difficulties not only compromise adolescents' immediate quality of life but are also linked to adverse long-term outcomes, such as impaired academic achievement, difficulties in interpersonal relationships, increased risk of substance abuse, and the potential onset of chronic mental illnesses in adulthood (WHO, 2021a).

Recent years have seen growing recognition of the influence of lifestyle factors on mental health outcomes, particularly during adolescence—a period marked by heightened neuroplasticity and responsiveness to environmental stimuli. There is accumulating evidence that positive health behaviours, including regular physical activity, nutritious eating patterns, sufficient sleep, and effective stress regulation, contribute meaningfully to psychological resilience and emotional regulation in youth (Wright *et al.,* 2023; Firth *et al.,* 2020). These lifestyle factors do not merely enhance general well-being but are increasingly regarded as protective mechanisms capable of reducing the incidence and severity of mental health symptoms, particularly those related to internalising and externalising behaviours (Santos *et al.,* 2023).

However, despite this growing body of research, the literature remains fragmented. Many existing studies have adopted a siloed approach, focusing on isolated behaviours such as physical activity or screen time, rather than considering the synergistic effects of multiple lifestyle factors on adolescent mental health. This gap is particularly concerning in the context of rising trends in unhealthy behaviours among youth, including sedentary lifestyles, excessive screen time, irregular sleep, and poor diet quality—factors associated with heightened psychological vulnerability (Twenge *et al.*, 2019). The urgent need for an integrative, multidimensional understanding of how lifestyle influences adolescent mental health is clear.

Socioeconomic status (SES) plays a pivotal role in shaping adolescents' lifestyle behaviours and mental health outcomes. Adolescents from lower SES backgrounds often face barriers such as limited access to nutritious foods, safe recreational spaces, and health

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education, which can lead to unhealthy behaviours like poor dietary habits, physical inactivity, and increased screen time (Gautam *et al.,* 2023). These lifestyle factors are closely linked to higher incidences of mental health issues, including anxiety and depression, among economically disadvantaged youth (Gautam *et al.,* 2023; Matar *et al.,* 2024). Conversely, adolescents from higher SES families may have better access to health-promoting resources but are not immune to mental health challenges. Studies have shown that higher SES adolescents may engage in risky behaviours such as early alcohol consumption and substance use, potentially due to factors like greater disposable income and social pressures (Gautam *et al.*, 2023; Matar *et al.,* 2024). These findings underscore the complex interplay between socioeconomic factors, lifestyle choices, and mental health, highlighting the necessity for tailored interventions that address the unique needs of adolescents across the socioeconomic spectrum.

In response to these gaps, the present study aims to investigate the association between adherence to healthy lifestyle behaviours and the frequency of internalising and externalising mental health challenges in adolescents. Specifically, it explores the protective role of comprehensive lifestyle adherence in mitigating emotional and behavioural symptoms, while identifying which health behaviours exert the most significant influence. The findings are expected to contribute to evidence-based recommendations for public health policies, school-based interventions, and clinical practices aimed at promoting mental well-being through sustainable lifestyle modifications during this pivotal stage of development.

2 METHOD

2.1 STUDY DESIGN AND POPULATION

This study reports data collected in October 2024 as part of a larger, ongoing observational, analytical, cross-sectional project aimed at promoting adolescent health in a small municipality in northeastern Brazil. The municipality is in the state of Pernambuco (PE), within the Zona da Mata Norte region, approximately 60 km northwest of Recife, the state capital. It is a relatively small town (approximately 18,000 inhabitants), with a local economy based on agriculture, small-scale industry, and services.

The study sample consisted of 61 adolescents, aged 15 to 19 years, of both sexes, all enrolled in the second year of the town's only public high school. Participation was contingent upon the completion of two consent forms: the Participant Information and Informed Consent Form (PICF) (*Termo de Consentimento Livre e Esclarecido* – TCLE), signed by the parents

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or legal guardians, and the Participant Information and Informed Assent Form (*Termo de Assentimento Livre e Esclarecido* – TALE), signed by the adolescent participants themselves. The study received ethical approval from the Research Ethics Committee of the Federal University of Pernambuco (*Universidade Federal de Pernambuco* – UFPE), under CAAE number 80111524.7.0000.5208.

Adolescents with special needs, including hearing, visual, or cognitive impairments, were excluded from participation. This exclusion criterion ensured the ethical and practical feasibility of the study, as the research required participants to fully comprehend and engage with its procedures.

2.2 DEPENDENT VARIABLE - THE STRENGTHS AND DIFFICULTIES QUESTIONNAIRE

The Strengths and Difficulties Questionnaire (SDQ), developed by Goodman (1997), is a behavioural screening instrument designed to assess emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship difficulties, and prosocial behaviour. It comprises 25 items scored on a three-point Likert scale, with subscale scores combined to generate a total difficulties score. Based on established thresholds, results are classified as normal, borderline, or abnormal. The SDQ is available in parent, teacher, and self-report versions for individuals aged 11 years and older. It exhibits strong psychometric qualities, with Cronbach's alpha values ranging from 0.73 to 0.83 and test-retest reliability exceeding 0.70. Its cross-cultural validity supports its use in international research contexts. In the present study, the combined scale yielded a Cronbach's alpha of 0.75.

2.3 INDEPENDENT VARIABLE - INDIVIDUAL LIFESTYLE PROFILE (*PERFIL DO ESTILO DE VIDA INDIVIDUAL* – PEVI)

The Individual Lifestyle Profile (*Perfil do Estilo de Vida Individual* – PEVI), based on the Pentacle of Well-Being model proposed by Nahas *et al.* (2000), assesses five dimensions of lifestyle: nutrition, physical activity, preventive behaviour, social relationships, and stress control. Responses are rated on a Likert scale, with higher scores indicating healthier behaviours. The PEVI has demonstrated strong psychometric properties, with Cronbach's alpha exceeding 0.70 for most domains. Validated across diverse populations, the instrument is widely used in both research and clinical settings to evaluate lifestyle patterns and guide intervention strategies. In the present study, the combined scale yielded a Cronbach's alpha of 0.60.

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2.4 COVARIABLES

To account for potential confounding variables, biological sex and age group (15–16 vs. 17–19 years) were included as covariates in all analyses. Sex was recorded as male or female, consistent with binary biological categorisation, and reflects well-documented differences in both health-related behaviours and the expression of mental health symptoms during adolescence. Age grouping was employed to distinguish between mid- and late-adolescence, capturing relevant developmental transitions. These variables were selected based on their theoretical and empirical relevance and were statistically controlled to isolate the associations between lifestyle behaviours and psychosocial outcomes.

2.5 STATISTICAL ANALYSES

All analyses were conducted using Stata version 13.0 for Windows. Prior to analysis, data were cleaned and checked for accuracy, with missing values handled via pairwise deletion. Composite scores for the PEVI and SDQ were computed according to established guidelines. Descriptive statistics were used to summarise the sample, including frequencies and percentages for categorical variables and means and standard deviations for continuous variables.

Pearson's chi-squared tests were used to examine associations between lifestyle behaviours (PEVI domains) and psychosocial outcomes (SDQ scores). Binary variables were created for PEVI domains (healthy vs. risk behaviour) and SDQ outcomes (e.g., abnormal total difficulties, internalising and externalising problems). Pearson correlation coefficients were also calculated to explore linear associations between lifestyle indicators and SDQ subscales.

Binary logistic regression models were used to assess the predictive value of specific health behaviours on psychosocial difficulties. Odds ratios (ORs) with 95% confidence intervals (CIs) were reported. Statistical significance was set at $p < 0.05$ for all inferential tests.

3 RESULTS

The study sample consisted of adolescents aged 15 to 19 years, with a majority identifying as female (76.7%). Most participants were 16 years old (53.3%), followed by those aged 17 (40.0%). Regarding race/skin colour, participants self-identified according to categories defined by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* – IBGE, 2023): White, Black, Brown (*Pardo*), Indigenous, or Asian

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(Yellow). The majority identified as Brown (51.7%), followed by White (25.0%) and Black (20.0%).

Table 1 presents the distribution of lifestyle profiles according to the Individual Lifestyle Profile (*Perfil do Estilo de Vida Individual* – PEVI). Unhealthy patterns were predominant in four of the five lifestyle dimensions, with the most frequent unhealthy behaviours related to nutrition (81.9%) and stress control (90.1%). Only 73.7% of adolescents reported engaging in positive preventive behaviours. Statistically significant gender differences were observed in two subscales: physical activity and relationships. Males were significantly more likely to report adequate physical activity levels (64.3%) compared to females (25.5%; $p = 0.007$). Similarly, difficulties in relationships were more frequently reported by females (61.7%) than males (21.4%; $p = 0.009$), indicating notable psychosocial disparities. Although no statistically significant differences were observed across age groups, there was a trend toward more positive preventive behaviours among older adolescents (85.2% in the 17–19 age group versus 64.7% in the 15–16 age group; $p = 0.064$).

Table 1

Description of the Individual Lifestyle Profile (ILP), according to sex and age

Subscales (N=61)			Sex					Age				
			Female		Male			15-16 years		17-19 years		
	n	%	n	%	n	%	*p-value*	n	%	n	%	*p-value*
Nutrition												
Healthy	11	18.03	7	14.89	4	28.57		5	14.71	6	22.22	
Unhealthy	50	81.97	40	85.11	10	71.43	0.215[a]	29	85.29	21	77.78	0.448
Physical active												
Adequate	21	34.43	12	25.53	9	64.29		12	35.29	9	33.33	
Sedentary behavior	40	65.57	35	74.47	5	35.71	**0.007**	22	64.71	18	66.67	0.873
Preventive behavior												
Yes	45	73.77	33	70.21	12	85.71		22	64.71	23	85.19	
No	16	26.23	14	29.79	2	14.29	0.213[a]	12	35.29	4	14.81	0.064[a]
Relationships												
Healthy	29	47.54	18	38.30	11	78.57		15	44.12	14	51.85	
Difficulty	32	52.46	29	61.70	3	21.43	**0.009**[a]	19	55.88	13	48.15	0.548
Stress management												
Yes	6	9.84	5	10.64	1	7.14		4	11.76	2	741	
No	55	90.16	42	89.36	13	92.86	0.580[a]	30	88.24	25	92.59	0.453[a]
Total ILP												
Healthy	2	3.28	1	2.13	1	7.14		1	2.94	1	3.70	
Unhealthy	59	96.72	46	97.87	13	92.86	0.409[a]	33	97.06	26	96.30	0.693[a]

Source: Elaborated by the authors (2025).
[a] Fisher's exact test

As shown Table 2 below, 37.3% of adolescents scored in the abnormal range on the Total Difficulties Score of the SDQ. The highest prevalence was observed in the emotional

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problems subscale (44.2%), followed by hyperactivity/inattention (34.4%). When grouped into broader categories, internalising problems were present in 49.1% of the sample, while externalising problems affected 39.3%. Significant sex differences were identified across several domains: girls were more likely to report abnormal scores in internalising problems (49.1% vs. 21.4%; p = 0.018) and emotional symptoms (44.2% vs. 21.4%; p = 0.047) than boys. In contrast, a greater proportion of boys fell within the normal range for total difficulties compared to girls (85.7% vs. 55.3%; p = 0.036). No statistically significant differences were observed between age groups; however, peer relationship problems appeared more frequent among older adolescents (18.5% vs. 3.8%), though this trend did not reach statistical significance (p = 0.231).

Table 2

Frequency of strengths and difficulties among adolescents, by sex and age

N=61	Sex							Age				
			Female		Male							
	n	%	n	%	n	%	*p-value*	n	%	n	%	*p-value*
Total de difficulties												
Normal	38	62.30	26	55.32	12	85.71		22	64.71	16	59.26	
Abnormal	23	37.30	21	44.68	2	14.29	**0.036**[a]	12	35.29	11	40.74	0.663
Externalizing problems												
Normal	37	60.66	29	61.70	8	57.14		20	58.82	17	62.96	
Abnormal	24	39.34	18	38.30	6	42.86	0.759	14	41.18	10	37.04	0.475
Hyperactivity												
Normal	40	65.57	31	65.96	9	64.29		22	64.71	18	66.67	
Abnormal	21	34.43	16	34.04	5	35.71	0.908	12	35.29	9	33.33	0.873
Conduct problems												
Normal	52	85.25	40	85.11	12	85.71		29	85.29	23	85.19	
Abnormal	9	14.75	7	14.89	2	14.29	0.662[a]	5	14.71	4	14.81	0.633[a]
Internalizing problems												
Normal	31	50.82	20	42.55	11	78.57		17	50.00	14	51.85	
Abnormal	30	49.18	27	57.45	3	21.43	**0.018**[a]	17	50.00	13	48.15	0.886
Emotional problems												
Normal	34	55.74	23	48.94	11	78.57		19	55.88	15	55.56	
Abnormal	27	44.26	24	51.06	3	21.43	**0.047**[a]	15	44.12	12	44.44	0.592
Peer relationship problems												
Normal	53	86.89	40	85.11	13	92.86		31	91.18	22	81.48	
Abnormal	8	13.11	7	14.89	1	7.14	0.406[a]	3	8.82	5	18.52	0.231[a]
Prosocial behavior												
Normal	60	98.36	46	97.87	14	100.00		34	96.30	26	100.00	
Abnormal	1	1.64	1	2.13	0	0.00	0.770[a]	1	3.70	0	0.00	0.443[a]

Source: Elaborated by the authors (2025).
[a] Fisher's exact test

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Table 3 shows the association between individual lifestyle profiles and behavioural outcomes. A statistically significant association was found between unhealthy nutrition and externalising problems (χ^2, p = 0.003). While not all comparisons reached statistical significance, a pattern of higher prevalence of externalising problems was observed among adolescents with unhealthy lifestyle profiles, particularly in relation to physical inactivity, poor stress control, and negative social behaviours. For internalising problems, statistically significant associations were observed with sedentary behaviour (p = 0.001) and peer relationship difficulties (p = 0.029). Although unhealthy nutrition, negative preventive behaviour, and poor stress control were more frequent among adolescents with internalising problems, these differences were not statistically significant.

Table 3

Association between Individual Lifestyle Profile and adolescent behavioral problems

Variables (N=61)			Behavioral problems					
			Externalizing			Internalizing		
			No	Yes		No	Yes	
	n	%	n (%)	n (%)	*p-value*	n (%)	n (%)	*p-value*
Nutrition								
Healthy	11	18.0	11 (29.7)	0 (0.0)		8 (25.8)	3 (10.0)	
Unhealthy	50	82.0	26 (70.3)	24(100.0)	**0.003**[a]	23 (74.2)	27 (90.0)	0.108[a]
Physical activity								
Adequate	21	34.43	16 (43.2)	15 (20.8)		17 (54.8)	4 (13.3)	
Sedentary	40	65.57	21 (56.8)	19 (79.2)	0.072	14 (45.2)	26 (86.7)	**0.001**[a]
Preventive behavior								
Yes	45	73.77	27 (73.0)	18 (75.0)		24 (77.4)	21 (70.0)	
No	16	26.23	10 (27.0)	6 (25.0)	0.860	7 (22.6)	9 (30.0)	0.510
Relationships								
Healthy	29	47.54	19 (51.3)	10 (41.7)		19 (61.3)	10 (33.3)	
Difficulty	32	52.46	18 (48.7)	14 (58.3)	0.459	12 (38.7)	20 (66.7)	**0.029**
Stress management								
Yes	6	9.84	5 (13.5)	1 (4.2)		3 (9.7)	3 (10.0)	
No	55	90.16	32 (86.5)	23 (95.8)	0.231[a]	28 (90.3)	27 (90.0)	0.966[a]

Source: Elaborated by the authors (2025).
[a] Fisher's exact test

Bivariate analysis results are presented in Table 4. Adolescents with sedentary behaviour were nearly eight times more likely to present internalising problems (OR = 7.9; 95% CI: 2.2–28.1; p = 0.001), and those with peer relationship difficulties were over three times more likely to do so (OR = 3.2; 95% CI: 1.1–9.0; p = 0.031), compared to their peers without such problems. Furthermore, sedentary adolescents had more than ten times the

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odds of exhibiting overall behavioural problems based on the SDQ total score (OR = 10.5; 95% CI: 2.2–51.2; *p* = 0.004).

Table 4

Bivariate analysis of the association between Individual Lifestyle Profile and adolescent behavioral problems

Variables (N=61)			Behavioral problems								
			Externalizing			Internalizing			SDQ-Total score		
			No	Yes		No	Yes		No	Yes	
	n	%	n (%)	n (%)	OR (IC 95%)	n (%)	n (%)	OR (IC 95%)	n (%)	n (%)	OR (IC 95%)
Nutrition											
Healthy	11	18.0	11 (29.7)	0 (0.0)	-	8 (25.8)	3 (10.0)	1	9 (23.7)	2 (8.7)	1
Unhealthy	50	82.0	26 (70.3)	24 (100.0)	-	23 (74.2)	27 (90.0)	3.1 (0.7-13.2)	29 (76.3)	21 (91.3)	3.3 (0.6 -16.7)
Physical activity											
Adequate	21	34.4	16 (43.2)	15 (20.8)	1	17 (54.8)	4 (13.3)	1	19 (50.0)	2 (8.7)	1
Sedentary	40	65.6	21 (56.8)	19 (79.2)	2.9 (0.9-9.4)	14 (45.2)	26 (86.7)	**7.9[ǂ] (2.2 -28.1)**	19 (50.0)	21 (91.3)	**10.5[¥] (2.2 -51.2)**

Variables (N=61)			Behavioral problems								
			Externalizing			Internalizing			SDQ-Total score		
			No	Yes		No	Yes		No	Yes	
	n	%	n (%)	n (%)	OR (IC 95%)	n (%)	n (%)	OR (IC 95%)	n (%)	n (%)	OR (IC 95%)
Preventive behavior											
Yes	45	73.8	27 (73.0)	18 (75.0)	1	24 (77.4)	21 (70.0)	1	30 (79.0)	15 (65.2)	1
No	16	26.2	10 (27.0)	6 (25.0)	0.9 (0.2-2.9)	7 (22.6)	9 (30.0)	1.5 (0.5-4.6)	8 (21.0)	8 (34.8)	2.0 (0.6 -6.4)
Relationships											
Healthy	29	47.5	19 (51.3)	10 (41.7)	1	19 (61.3)	10 (33.3)	1	20 (52.6)	9 (39.1)	1
Difficulty	32	52.5	18 (48.7)	14 (58.3)	1.5 (0.5-4.2)	12 (38.7)	20 (66.7)	**3.2[§] (1.1-9.0)**	18 (47.4)	14 (60.9)	1.7 (0.6 -4.9)
Stress management											
Yes	6	9.8	5 (13.5)	1 (4.2)	1	3 (9.7)	3 (10.0)	1	4 (10.5)	2 (8.7)	1
No	55	90.2	32 (86.5)	23 (95.8)	3.6 (0.4-32.9)	28 (90.3)	27 (90.0)	0.9 (0.2-5.2)	34 (89.5)	21 (91.3)	1.2 (0.2 -7.3)

Source: Elaborated by the authors (2025).
OR[a] (Crude Odds Ratio); IC (Confidence Interval); [ǂ]p=0.001; [§]p=0.031; [¥]p=0.004

4 DISCUSSION

The findings of this study highlight significant lifestyle and psychosocial vulnerabilities among adolescents in a public high school in northeastern Brazil. A key result was the high prevalence of unhealthy dietary habits, with over 80% of participants classified as having poor nutritional behaviours. This is particularly striking given that the school participates in the State School System's mandated nutritional programme, which requires that all meals and snacks be provided by the school and planned by licensed nutritionists, in accordance with the Balanced Assisted Feeding Policy (*Política de Alimentação Balanceada Assistida* –

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PABA, Lei 18.509/2024; Governo do Estado de Pernambuco, 2024). This policy is part of the State's broader efforts to ensure adequate and nutritious food for students in public education. The persistence of self-reported unhealthy eating behaviours despite this structured provision raises important questions about adolescents' dietary patterns outside school hours—such as evenings, weekends, and holidays—when food choices may be shaped by home environments, cultural norms, autonomy in decision-making, and exposure to ultra-processed snacks. These results suggest that nutritional risk is not solely attributable to inadequacies within school meal provision but reflects broader influences from families and commercial food environments. Although causality cannot be inferred, the significant association between poor nutrition and externalising symptoms underscores the role of dietary quality in behavioural regulation, such as hyperactivity and conduct challenges. These findings align with prior Brazilian studies linking ultra-processed food consumption to common mental health issues in adolescents (Faisal-Cury *et al.,* 2022; Gratão *et al.,* 2024).

Equally concerning was the disproportionate distribution of physical activity behaviours, with nearly two-thirds of the sample classified as sedentary. Logistic regression results confirmed that adolescents with low levels of physical activity were significantly more likely to exhibit both internalising and externalising problems and to score in the abnormal range on the total SDQ. These findings align with international evidence identifying physical activity as a protective factor for adolescent mental health (Yang *et al.,* 2023). A large Swedish cohort study, for example, found that each additional hour of physical activity per day at age 11 was associated with a 12% lower risk of psychiatric diagnosis at age 18 (Nyberg *et al.,* 2022).

Closer examination of these behaviours revealed notable disparities across gender. Female adolescents in the sample were significantly less likely to meet recommended physical activity levels, a pattern that mirrors broader sociocultural barriers to girls' participation in sports and exercise. These barriers, well-documented in both national and international literature, may include limited access to safe recreational spaces, gendered expectations around appearance and behaviour, and a lack of female role models in physical education (Hills *et al.,* 2015; UNESCO, 2015). According to the World Health Organization, reducing these disparities is a key priority within the 2030 Agenda for Sustainable Development, which calls for increased efforts to promote physical activity among girls and young women (WHO, 2020). In addition to the physical health benefits, regular engagement in physical activity is positively associated with a range of psychosocial outcomes. Higher

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levels of physical activity have been linked to improved self-esteem, greater self-confidence, more positive body image, and enhanced mood—factors which may, in turn, reduce symptoms of anxiety and depression (Biddle; Asare, 2011; Eime *et al.,* 2013). These improvements can also foster greater social connectedness, making adolescents more likely to engage in and benefit from peer interactions. Such findings underscore the potential of physical activity not only as a preventive health strategy but also as a means of strengthening interpersonal relationships and overall psychosocial functioning. Meanwhile, male students were more likely to engage in adequate physical activity and to fall within the normal range of overall psychosocial functioning, suggesting distinct protective and risk profiles between genders (Zahn-Waxler *et al.,* 2008).

In contrast, preventive behaviours such as avoiding substance use and violent environments were generally well-represented in the sample, although a sizeable minority still reported risk-related practices. Age-related patterns, though not statistically significant, also pointed toward developmental shifts that may influence health behaviours and psychosocial outcomes. Older adolescents showed a trend toward improved preventive behaviours (e.g., avoiding substance use) but also reported increased peer-related difficulties. This may reflect a growing sense of autonomy and self-regulation, coupled with the heightened complexity of social relationships in late adolescence (Crone; Dahl, 2012; Steinberg; Morris, 2001). No significant associations, however, were observed between preventive behaviours and SDQ outcomes. This suggests that while such behaviours are crucial for overall health, their impact on psychosocial functioning may be less direct or may require longitudinal assessment to detect meaningful effects (Garcia-Cerde *et al.,* 2024; Schneiderman *et al.,* 2021).

The domain of peer relationships exhibited a near-equal distribution between healthy and problematic functioning. Peer difficulties were significantly associated with internalising symptoms such as anxiety and social withdrawal. This underscores the importance of fostering social connectedness and peer support in school settings, particularly given the developmental significance of peer relationships during adolescence. These findings echo previous cross-cultural evidence emphasising the role of peer dynamics in adolescent well-being (Núñez Sahr *et al.,* 2024).

Notable sex differences were observed across several psychosocial domains. Female adolescents were significantly more likely to report elevated scores on measures of internalising difficulties and emotional symptoms compared to their male counterparts. This

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finding is consistent with a substantial body of evidence indicating that adolescent girls are at greater risk of anxiety, depression, and related emotional disorders (Salk *et al.,* 2017; Bor *et al.,* 2014). In contrast, a higher proportion of boys fell within the normal range for overall psychosocial functioning, suggesting the presence of potential protective factors or differing patterns of symptom expression among male adolescents (Zahn-Waxler *et al.,* 2008). No statistically significant differences were found between age groups; however, peer relationship problems appeared more prevalent among older adolescents—a trend which, although not statistically significant, merits consideration. The absence of robust age effects may reflect the nuanced nature of adolescent development. As individuals transition through adolescence, they face increasing demands for autonomy, self-definition, and the navigation of complex social environments, particularly within peer settings (Steinberg; Morris, 2001). These developmental shifts often give rise to subtle emotional and behavioural changes that may not manifest as large group-level differences but nonetheless play a critical role in shaping psychosocial trajectories. Moreover, differential exposure to environmental stressors, evolving social expectations, and contextual factors—such as school transitions or heightened academic pressure—may influence mental health in ways not easily captured in cross-sectional analyses (Crone; Dahl, 2012). Longitudinal research designs are therefore better positioned to detect and interpret these dynamic patterns over time and may provide a stronger foundation for developmentally informed interventions.

Stress regulation emerged as the most compromised PEVI domain, with over 90% of participants reporting difficulties. Despite its prevalence, no statistically significant associations were found between stress regulation and SDQ scores. This may reflect a lack of variability in the sample or indicate that stress regulation, while broadly impaired, is not independently predictive of mental health outcomes without consideration of additional psychosocial factors. Prior evidence suggests that stress regulation may interact with variables such as family support or exposure to bullying, which were not directly assessed in this study (Arató *et al.,* 2022; Doan *et al.,* 2019).

Moreover, the high prevalence of stress regulation difficulties may be particularly salient in the context of students living in socially vulnerable settings. Adolescents from low-socioeconomic status (SES) backgrounds often face chronic stressors—such as financial instability, unsafe environments, and limited access to supportive educational or mental health resources—that can impair their ability to develop effective self-regulation strategies (Barry *et al.,* 2022; Hackman *et al.,* 2012). The lack of significant associations between stress

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regulation and SDQ scores might thus reflect not only a potential ceiling effect in the measure but also the broader psychosocial landscape in which these youth are embedded—one where stress is pervasive and compounded by systemic inequities.

Additionally, for students navigating a future shaped by limited opportunities and the pressure to succeed in high-stakes evaluative exams, such as university entrance exams, stress may become internalised as a normative yet overwhelming part of adolescence. In such contexts, the inability to manage stress may not manifest in discrete mental health symptoms captured by standard screening tools like the SDQ, but rather in more diffuse outcomes—such as academic disengagement, hopelessness, or psychosomatic complaints (Heleniak *et al.,* 2018; Hjern *et al.,* 2008; Zhang *et al.,* 2022). These patterns are also reflected in the Brazilian context, where students in pre-university preparatory courses experience high levels of psychological distress and burnout linked to academic demands and limited perceived opportunities (Matos; Andrade, 2023). These considerations underscore the importance of contextualizing stress regulation within broader structural and motivational factors, including perceived future opportunities, academic pressure, and the cumulative burden of inequality.

Prosocial behaviours, nonetheless, were largely preserved across the sample, suggesting a high capacity for empathy, cooperation, and social responsibility. This finding contrasts with elevated levels of psychosocial distress in other domains and may reflect protective interpersonal tendencies that could be leveraged in intervention efforts. Factors such as strong attachments, cultural values, social learning, and emotional intelligence have been found to help sustain these behaviours (Lim *et al.,* 2025). In some cases, helping others may even serve as a coping mechanism (Xu *et al.,* 2024). This resilience in prosociality represents a valuable opportunity for interventions that build on existing strengths to promote broader emotional and social well-being.

Taken together, the results of this study demonstrate that physical activity and peer relationships were the most consistent predictors of adolescent mental health outcomes in this sample. Physical activity emerged as a robust protective factor across multiple outcomes, while poor peer relationships were specifically associated with internalising difficulties. Nutrition was significantly associated with externalising problems, reinforcing the view that behavioural health is multidimensional and responsive to modifiable lifestyle factors.

The convergence of these results, obtained in a municipality in the interior of Pernambuco State, with findings from international research may be explained by several

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features of contemporary adolescence. First, the globalisation of lifestyles has led to the homogenisation of habits, values, and behaviours among young people in diverse regions, including rural areas (McKenzie, 2024). Second, widespread access to digital media exposes adolescents—regardless of geographical location—to shared body ideals, consumer habits, social norms, and notions of success (Butler, 2024; Czubaj *et al.,* 2025). Furthermore, the strength of the global market for ultra-processed foods, driven by aggressive marketing strategies, has contributed to the adoption of unhealthy eating habits associated with significant physical and psychological impacts (Machado-Rodrigues *et al.,* 2024). Added to this is the phenomenon of epidemiological and nutritional transition, which has shifted morbidity profiles toward chronic diseases and emotional disorders related to lifestyle, even in less urbanised contexts. Finally, the influence of public policies and standardised curricula at national and international levels contributes to the reproduction of similar discourses, practices, and perceptions among adolescents from different territories (OECD, 2024).

These interrelated factors help explain why the internalising and externalising behaviours observed in this local study reflect global trends. Given the global relevance of these findings, there is a pressing need for health promotion strategies that are both locally sensitive and globally informed. Promoting healthier lifestyles among adolescents offers multifaceted benefits, enhancing not only physical health but also emotional well-being and social competence. Integrated, school-based programmes that simultaneously address multiple lifestyle domains—physical activity, nutrition, stress management, and social connectedness—represent an effective strategy for fostering adolescent health and preventing future disease burden (Sawyer *et al.,* 2012; WHO, 2021b). The utilization of validated tools such as the PEVI and SDQ can further support practitioners and policymakers in identifying at-risk individuals and tailoring interventions accordingly.

Moreover, fostering healthier habits during adolescence contributes to the global effort to reduce the burden of noncommunicable diseases (NCDs) and mental health disorders, thereby supporting the achievement of the United Nations Sustainable Development Goals (SDGs), particularly those related to health (Goal 3) and education (Goal 4) (WHO, 2021b). Effective interventions at this developmental stage thus have the potential to yield substantial individual and societal benefits, reducing healthcare costs and improving population well-being in the long term.

4.1 STRENGTHS AND LIMITATIONS

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This study presents several strengths. First, it offers timely, population-specific data on adolescent health behaviours and psychosocial functioning in a socioeconomically vulnerable region of Brazil. The use of validated, psychometrically sound instruments (e.g., PEVI and SDQ; α = 0.75) supports the reliability of the results. Furthermore, the findings are supported by recent empirical studies conducted both in Brazil and internationally. For instance, Gratão *et al.* (2024) and Faisal-Cury *et al.* (2022) found strong associations between UPF consumption and emotional symptoms in adolescents, while Nyberg *et al.* (2022) confirmed the protective role of physical activity in a large European cohort.

However, some limitations must be considered. The cross-sectional design restricts causal inference. While associations were observed between health behaviours and mental health outcomes, the directionality and mechanisms remain unclear. Longitudinal studies are required to better understand these dynamics. Additionally, the limited variability in some PEVI domains, such as stress regulation and preventive behaviours, may have constrained statistical power. The exclusive reliance on self-report measures may also introduce response biases, particularly in sensitive domains such as diet or social behaviours.

Furthermore, the PEVI does not capture specific subtypes of dietary intake (e.g., ultra-processed foods), which are increasingly recognised as relevant in adolescent mental health research (Faisal-Cury *et al.,* 2022). Finally, the absence of mediating variables such as family functioning, body image concerns, or bullying limits the explanatory scope of the model. These constructs have been shown to moderate the impact of lifestyle behaviours on mental health and should be incorporated in future research.

5 CONCLUSION

This study reinforces the importance of adopting a holistic perspective in adolescent health promotion. Interventions that simultaneously target multiple dimensions of well-being—such as diet, exercise, emotional regulation, and social connections—are likely to be more effective than isolated approaches. Given the high rates of psychosocial difficulties observed, especially internalising symptoms, educational and public health systems must prioritise early detection and multilevel responses tailored to local realities.

Future research should explore the mechanisms through which lifestyle factors influence behavioural and emotional outcomes. Longitudinal designs are particularly needed to establish causality and clarify developmental trajectories. Moreover, the incorporation of objective measures of lifestyle behaviours——such as accelerometery for physical activity or

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biomarkers for nutritional status—would strengthen the validity of research in this area (Hallal et al., 2012). Further investigations into the mediating roles of family environment, peer influence, and school context, as well as potential bidirectional relationships between lifestyle habits and prosocial behaviour, could yield nuanced insights to inform intervention design.

In conclusion, the present study highlights the interconnected nature of adolescent lifestyle behaviours and psychosocial outcomes, identifying key areas for intervention and policy development. Within the Brazilian context, the findings emphasise the need to strengthen the national School Health Programme (Programa Saúde na Escola – PSE; Brasil, 2007). High rates of illiteracy among parents and guardians—particularly common in smaller municipalities in Brazil (Alencar et al., 2020)—may hinder the effectiveness of family-based health guidance, thereby reinforcing the central role of schools in supporting adolescent development. Preparing teachers and adapting school environments to foster health-related competencies is therefore essential. By prioritising inclusive, community-based, and evidence-informed strategies, stakeholders can make meaningful progress in improving adolescent well-being and laying the foundation for healthier adult populations.

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