Influence of dietary habits, screen time, and sleep on anthropometric variables, physical fitness, and motor competence in preschool children

Influencia de los hábitos alimenticios, el tiempo frente a la pantalla y el sueño en variables antropométricas, la condición física y la competencia motora en niños en edad preescolar

Authors

Andrés Godoy-Cumillaf [1]
Paola Fuentes-Merino [1]
Josivaldo de Souza-Lima [2]
Catalina Muñoz-Strale [2]
Frano Giakoni-Ramírez [2]
Maribel Parra-Saldías [3]
Daniel Duclos-Bastías [4, 5]
José Bruneau-Chávez [6]
Eugenio Merellano-Navarro [7]

[1] Universidad Autónoma de Chile (Chile)
[2] Universidad Andres Bello (Chile)
[3] Universidad de Atacama (Chile)
[4] Pontificia Universidad Católica de Valparaíso (Chile)
[5] Universidad Alfonso X el Sabio (Spain)
[6] Universidad de la Frontera (Chile)
[7] Universidad Católica del Maule (Chile)

Corresponding author:
Eugenio Merellano Navarro
emerellano@ucml.cl

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Abstract

Introduction: Early childhood is a critical period for the establishment of fundamental health behaviors, during which lifestyle factors such as dietary habits, screen time, and sleep patterns may influence long-term health outcomes.
Objective: To examine the associations of dietary habits, screen time, and sleep with anthropometric indicators, physical fitness, and gross motor competence in preschool children.
Methodology: A cross-sectional study was conducted in a non-probability sample of 363 children aged 4–7 years from several municipalities in southern Chile. Anthropometric measures (weight, height, BMI, and waist circumference), physical fitness (muscular strength and speed/agility), and gross motor competence were assessed. Parents completed questionnaires regarding dietary habits, screen time, and sleep duration. Differences between groups were analyzed by age and adherence level using Student's t-test and ANOVA
Results: No significant differences were observed according to adherence to screen time recommendations. Few differences were found according to dietary habits, including height among 5-year-olds ($p = 0.039$) and jumping performance among 6-year-olds ($p = 0.040$). Associations were generally weak and may have been influenced by parental reporting bias.
Discussion: The associations were generally weak, probably influenced by parental biases that underestimated unhealthy behaviors.
Conclusions: Lifestyle factors showed minimal associations with anthropometric and functional outcomes, with sleep emerging as the most consistent predictor of favorable development.

Keywords

Dynamometry; speed/velocity; throwing; catching; balance.

Resumen

Introducción: La primera infancia es una etapa clave para establecer conductas de salud fundamentales, en donde los factores del estilo de vida como los hábitos alimenticios, el tiempo frente a pantallas y los patrones de sueño interactúan para moldear los resultados de salud a largo plazo.
Objetivo: determinar las asociaciones entre hábitos alimenticios, tiempo frente a pantallas y sueño con indicadores antropométricos, condición física y competencia motora gruesa en niños en edad preescolar.
Metodología: Se realizó un estudio transversal con una muestra no probabilística de 363 niños de 4 a 7 años procedentes de varias comunas del sur de Chile. Se evaluaron variables antropométricas (peso, altura, IMC, circunferencia de cintura), condición física (fuerza muscular, velocidad/agilidad) y competencia motora gruesa. Los padres completaron cuestionarios sobre hábitos alimenticios, tiempo frente a pantallas y duración del sueño.
Las diferencias entre grupos se analizaron por edad y nivel de adherencia utilizando las pruebas t de Student y ANOVA.
Resultados: No se observaron diferencias significativas según el cumplimiento del tiempo de pantalla. Surgieron diferencias limitadas en los hábitos dietéticos, incluyendo la altura entre niños de 5 años ($p=0{,}039$) y el rendimiento en salto entre niños de 6 años ($p=0{,}040$).
Discusión: Las asociaciones fueron en general débiles, probablemente influenciadas por sesgos parentales que subestimaban conductas poco saludables.
Conclusiones: Los factores de estilo de vida mostraron asociaciones mínimas con resultados antropométricos y funcionales, siendo el sueño el predictor más consistente de un desarrollo favorable.

Palabras clave

Dinamometría; velocidad/agilidad; lanzar; atrapar, equilibrio.

Introduction

Early childhood, which encompasses the preschool years of 4 to 7 years, is a key stage in establishing fundamental health behaviors that influence anthropometric measurements, physical fitness, and motor competence (Tambalis et al., 2024; Ekubagewargies et al., 2025; Pavlidou et al., 2023). During this period, lifestyle factors such as eating habits, screen time, and sleep patterns interact to shape long-term health outcomes, with suboptimal behaviors linked to an increased risk of obesity, lower cardiorespiratory endurance, and delayed gross motor skills such as balance and jumping (Hasanović et al., 2025). A 2024 European study on adherence to the Mediterranean diet in preschool children found associations with lower BMI and better cholesterol profiles, highlighting the role of nutrition in preventing adiposity (Tambalis et al., 2024). In the United States, a 2023 cross-sectional analysis revealed that physical activity levels, modulated by sleep and screen time, correlate with an improvement in agility and strength in young children (Bloch et al., 2025). Latin American researchers showed socioeconomic factors that aggravate bad habits, leading to increased waist circumference and impaired motor development (Barboza et al., 2025).

Dietary habits play a central role in the growth and fitness of preschoolers, with nutrient-dense patterns promoting optimal anthropometry and motor competence (Cioffredi et al., 2024; Priftis et al., 2022; López-Gil et al., 2022). A 2024 study explored dietary patterns in European preschool-aged children, associating higher fruit and vegetable intake with a lower risk of obesity and increased lower extremity power (Priftis et al., 2022). In the United States, peer-led interventions in 2022 demonstrated improvements in nutritional knowledge and physical activity among adolescents, with implications for young children through an increase in healthy food consumption (Nie et al., 2025). Latin American evidence from Brazil in 2024 linked ultra-processed foods to elevated BMI and poorer coordination in 4-year-olds (Gkintoni et al., 2024). In addition, a 2021 Chilean review emphasized that parental feeding practices influence diet quality, indirectly affecting resilience and balance (Mendoza-Castejón et al., 2022).

Screen time has increasingly been recognized as a risk factor for developmental delays in preschoolers, often displacing active play and contributing to sedentary lifestyles that negatively affect anthropometry and motor skills (Nyawose et al., 2022; Nguyen et al., 2022; Ramar et al., 2021). A 2023 U.S. study on screen exposure found associations with higher BMI and reduced speed in children aged 3 to 5 years (Nagata et al., 2023). In Germany in 2024 they reported that excessive screen use correlates with lower balance and agility (Bakht et al., 2025). In Latin America, 2024 Peruvian research identified links between cribranza habits and delayed gross motor competence, especially in urban settings (Gallotta et al., 2022). In addition, a 2025 multicenter European study pointed to interactions between screen time and diet, amplifying overweight risks and decreasing fitness levels (Gomes et al., 2024).

Sleep patterns are essential for the health of preschoolers, with adequate duration that supports growth, physical activity, and motor development, while mitigating obesity risks (Yabiku-Soto et al., 2024; Iglesias-Vázquez et al., 2025; Bermejo-Cantarero et al., 2025). A 2021 U.S. consensus statement recommended between 10 and 13 hours of sleep for optimal health in children ages 3 to 5, linking short sleep to increased adiposity (Rico-González et al., 2025). European longitudinal data from the UK in 2024 showed irregularities in sleep-disrupting neuromotor abilities (Vidmar et al., 2022). In Latin America, a 2022 Mexican study highlighted cultural influences on sleep, associating short durations with reduced activity and an increase in waist-to-height ratio (Orgilés et al., 2025). A comparative analysis of the United States The 2023 US-Europe survey further indicated that quality sleep improves endurance and coordination (Torres et al., 2025).

Although all this information has been widely documented, there is still a need to integrate these dimensions into analytical models that allow us to understand their joint contribution to health status (Carson et al., 2017).

In this context, body mass index (BMI) and physical outcomes are useful and complementary indicators for assessing health in the school population, reflecting both the anthropometric component and functional capacity (Ortega et al., 2015). Analysing its relationship with adherence to healthy habits allows us to move from a fragmented reading of specific behaviours to a more comprehensive understanding of the health profile (Chaput et al., 2020). This perspective is relevant to guide decisions in the educational and health fields, as well as to strengthen strategies to promote healthy lifestyles in early stages of development (Tremblay et al., 2016).

Considering the theoretical and empirical consistency reported (Chaput et al., 2020; Carson et al., 2017), this study adopts a directional perspective in which lifestyle habits are understood as explanatory factors of health status. Consequently, it is proposed to evaluate whether greater adherence to a healthy pattern, characterized by less time in front of screens, adequate sleep duration and better diet quality is associated with more favorable indicators of physical health in the participants.

It is proposed as a research hypothesis that greater adherence to healthy habits, operationalized as less time of exposure to screens, adequate sleep duration and higher quality of diet is positively related to health status, expressed in more favorable BMI values and better physical results.

Method

This study was designed and reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guideline for observational studies (von Elm et al., 2007).

Design and participants

This cross-sectional study used a non-probabilistic convenience sample of 363 preschool children aged 4 to 7 years (mean age 5.5 ± 1.1 years) recruited from several communes in the Araucanía Region, Chile. The age distribution was as follows: 57 4-year-olds (15.7%), 142 5-year-olds (39.1%), 114 6-year-olds (31.4%) and 50 7-year-olds (13.8%). Participants were selected from educational institutions in the region. Inclusion criteria included enrollment in preschool or early elementary education, with no diagnosed motor disabilities, or medical conditions that could interfere with physical measurements or assessments. The exclusion criteria covered any acute illness on the day of assessment or lack of parental consent. Informed consent was obtained from parents or legal guardians, and verbal consent was requested from children when appropriate for the age.

The study protocol was approved by the Ethics Committee of the Universidad Autónoma de Chile (protocol number CEC 31-22), and all procedures conformed to the ethical standards established in the Declaration of Helsinki.

Variables and measurement procedures

Anthropometric variables were evaluated following standardized protocols. Weight was measured to the nearest 0.1 kg using a digital scale (Omron, Kyoto, Japan), and height to the nearest 0.1 cm with a portable stamometer (Seca 222, Hamburg, Germany). Both measurements were taken twice and the mean was used to calculate the body mass index (BMI; kg/m^2). Waist circumference was measured at the midpoint between the lower rib margin and the iliac crest using a non-elastic tape measure.

Physical condition was assessed using a battery of field tests. Cardiorespiratory endurance was assessed using the shuttle's 20-meter running test. Lower body muscle strength was measured by the standing long jump (cm, best of two attempts). Upper body strength was determined by grip dynamometry (kg, right and left hand, best of two tests per hand). Speed and agility were assessed with the shuttle race test of 4 × 10 m (seconds) (Cadenas-Sánchez et al., 2016; Ortega et al., 2015).

Gross motor competence was measured using the validated Spanish version of the Movement Assessment Battery for Children-2 (MABC-2) for ages 3 to 6 years, adapted for the sample (Henderson et al., 2007). This included manual dexterity (catching and aiming, 2 tests) and balance (static and dynamic, 3 tests) tasks, with scores on catch/throw (number of successes), balance (seconds), tiptoe (number) and jumps (numbers).

Eating habits were assessed using the Krece Plus questionnaire, a 15-item dichotomous tool (+1 for healthy behaviors, −1 for unhealthy behaviors) completed by parents (Serra-Majem et al., 2004). Total scores were classified as high (8-12), medium (4-7), or low (0-3).

Additional lifestyle factors were assessed using the parental report: weekly hours of organized sports/physical activity, daily screen time (hours spent on TV, computer, mobile, tablet, etc.), and average daily hours of sleep. Given that this is a preschool population, parental reporting is a widely used methodological strategy to estimate habitual behaviors in an epidemiological context.

All assessments were conducted in educational settings by trained assessors to ensure reliability.

Statistical analysis

Data were analyzed using SPSS version 28 (IBM Corp., Armonk, NY, USA). Descriptive statistics included means and standard deviations (SDs) for continuous variables. Normality was checked by Kolmogorov-Smirnov tests. Between-group comparisons (compliance vs. non-compliance for screen time and sleep; low/medium/high for eating habits) were performed using Student's independent t-tests for binary categories and unidirectional analysis of variance (ANOVA) for multiple categories, stratified by age to account for developmental stages. Post-hoc tests (Tukey HSD) were applied where ANOVA indicated significance. A complementary analysis of the risk of type II error (β) was incorporated for non-significant contrasts in the analyses stratified by age. Given its conservative nature, a sensitivity analysis was added for borderline outcomes using 90% CI (α=.10), with α=.05 remaining as the main inference criterion.

No comparisons were made between age groups to avoid confusion due to natural ripening. Statistical significance was established at $p < 0.05$. Effect sizes (Cohen's d for t-tests and eta-square for ANOVA) were calculated to estimate practical significance and interpreted according to conventional thresholds.

Results

The results are presented stratified by age (4, 5, 6, and 7 years), with general descriptives and comparisons according to compliance with recommendations for screen time (<2 hours/day vs. ≥2 hours/day), eating habits (classified as low, medium, and high according to the Krece Plus questionnaire), and sleep hours (≥10 hours/night vs. <10 hours/night). Student's t-tests were used for binary comparisons and ANOVA for multiple comparisons, with significance set at $p<0.05$. No comparisons were made between age groups to avoid biases due to natural developmental differences.

The sample included 363 children: 57 aged 4 years (15.7%), 142 aged 5 years (39.1%), 114 aged 6 years (31.4%), and 50 aged 7 years (13.8%). Table 1 summarizes the means and standard deviations (SD) of the evaluated variables by age. Eating habit scores were predominantly medium (range: 6.86-7.48), with daily screen time around 2.3 hours and weekly physical activity approximately 2 hours. Anthropometric variables showed expected increases with age, such as weight (21.84 kg to 29.04 kg) and BMI (17.22 to 18.23). In physical fitness, progressive improvements were observed in jump (72.36 cm to 95.12 cm), dynamometry, and speed. For gross motor competence, there were advances in catching (7.09 to 8.38), throwing (3.86 to 5.82), and balance (10.57 s to 21.54 s on the right leg).

Table 1. General descriptives of variables by age group.

Variable	4 years (n=57)		5 years (n=142)		6 years (n=114)		7 years (n=50)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Eating habit points (Krece Plus)	7.05	2.074	7.48	1.773	7.14	2.026	6.86	2.020
Screen hours (day)	2.26	1.044	2.41	1.125	2.25	1.120	2.32	0.978
Physical activity hours (week)	1.84	1.593	2.26	1.63	2.12	1.575	2.22	1.670
Weight (kg)	21.84	3.73	23.65	4.64	27.43	5.09	29.04	6.53
Waist (cm)	56.79	7.12	57.01	7.37	60.41	7.92	60.65	6.71
BMI	17.22	2.17	17.29	2.56	18.23	2.68	18.11	3.04
Jump (cm)	72.36	21.94	80.25	23.40	90.25	24.91	95.12	22.99
Dynamometry RIGHT (kg)	7.05	6.71	7.08	2.62	8.70	2.54	9.33	2.53
Dynamometry LEFT (kg)	5.95	2.96	7.48	7.56	8.38	2.56	9.34	2.48
Speed (s)	18.54	3.33	17.89	2.90	17.18	2.25	17.05	3.05
Catching (No.)	7.09	3.20	7.32	2.48	8.10	1.95	8.38	1.83
Throwing (No.)	3.86	2.27	4.59	2.99	5.22	2.23	5.82	2.19
Balance RIGHT (s)	10.57	8.72	14.62	9.57	19.78	9.51	21.54	9.45
Balance LEFT (s)	10.00	7.15	16.10	10.39	19.75	9.48	20.98	9.73
Tiptoes (No.)	13.89	4.09	14.29	3.03	13.82	2.75	12.96	2.70
Jumping (No.)	4.67	0.72	4.79	1.08	4.95	1.05	4.82	0.60

Table 2 presents comparisons between children who comply (<2 h/day) and do not comply (≥2 h/day) with screen time recommendations. No significant differences ($p>0.05$) were observed in any anthropometric, physical fitness, or gross motor competence variable in any age group. For example, in 4 years, BMI was 17.45 in compliers vs. 16.89 in non-compliers ($p=0.348$); in 7 years, jump was 99.93 cm vs. 87.90 cm ($p=0.069$, close but not significant).

Table 2. Comparison of variables according to screen time compliance by age (means and SD).

Variable	4 years (n=57)		p	5 years (n=142)		p	6 years (n=114)		p	7 years (n=50)		p
Height (cm)	Complies: 112.36 (5.20)	Does not comply: 112.35 (4.90)	.995	116.55 (6.43)	116.97 (6.56)	.705	122.61 (5.50)	122.03 (4.45)	.569	126.17 (5.86)	126.10 (5.49)	.968
Weight (kg)	22.11 (3.78)	21.45 (3.71)	.519	23.61 (4.52)	23.71 (4.83)	.900	27.46 (5.08)	27.37 (5.16)	.928	28.89 (5.73)	29.26 (7.73)	.845
Waist (cm)	57.30 (7.41)	56.03 (6.77)	.514	57.48 (6.99)	56.37 (7.88)	.376	60.15 (7.19)	60.90 (9.19)	.632	60.88 (6.45)	60.28 (7.26)	.767
BMI	17.45 (2.34)	16.89 (1.90)	.348	17.33 (2.60)	17.23 (2.52)	.823	18.21 (2.76)	18.27 (2.55)	.920	18.07 (2.76)	18.19 (3.50)	.892
Jump (cm)	71.18 (23.55)	74.12 (19.70)	.624	79.64 (25.65)	81.08 (20.10)	.720	90.12 (27.06)	90.50 (20.69)	.939	99.93 (19.15)	87.90 (26.69)	.069
Dynamometry RIGHT (kg)	6.60 (1.82)	7.73 (10.44)	.537	6.94 (3.03)	7.28 (1.94)	.439	8.63 (2.57)	8.83 (2.52)	.688	9.41 (2.70)	9.20 (2.33)	.769
Dynamometry LEFT (kg)	5.85 (2.41)	6.09 (3.68)	.772	7.74 (9.82)	7.13 (2.05)	.635	8.36 (2.46)	8.41 (2.77)	.933	9.78 (2.38)	8.69 (2.55)	.131
Speed (s)	19.10 (3.36)	17.71 (3.18)	.123	17.92 (3.17)	17.85 (2.50)	.882	17.18 (2.39)	17.18 (1.99)	.995	17.06 (2.88)	17.03 (3.38)	.968
Catching (No.)	6.82 (2.21)	7.49 (4.29)	.443	7.56 (2.47)	7.00 (2.47)	.183	8.23 (1.81)	7.85 (2.18)	.322	8.00 (2.05)	8.95 (1.28)	.071
Throwing (No.)	4.00 (2.34)	3.65 (2.21)	.575	4.54 (3.41)	4.67 (2.31)	.799	5.32 (2.44)	5.03 (1.78)	.496	6.10 (2.25)	5.40 (2.09)	.273
Balance RIGHT (s)	10.67 (8.42)	10.43 (9.32)	.923	14.42 (10.21)	14.90 (8.71)	.768	19.49 (10.24)	20.33 (8.07)	.655	19.97 (9.38)	23.90 (9.27)	.151
Balance LEFT (s)	9.94 (7.34)	10.09 (7.03)	.939	16.51 (10.57)	15.54 (10.21)	.583	19.78 (9.52)	19.68 (9.52)	.954	19.27 (9.71)	23.55 (9.43)	.129
Tiptoes (No.)	14.21 (4.13)	13.43 (4.08)	.490	14.41 (3.12)	14.12 (2.92)	.565	13.91 (2.86)	13.68 (2.58)	.672	13.17 (2.05)	12.65 (3.50)	.513
Jumping (No.)	4.65 (0.65)	4.70 (0.82)	.804	4.73 (0.61)	4.87 (1.50)	.463	4.97 (1.28)	4.90 (0.38)	.726	4.80 (0.66)	4.85 (0.49)	.775

Table 3 shows comparisons by categories of eating habits (low, medium, high), where no significant differences were found in most variables. For 5 years, height (p=0.039, higher in medium/high); for 6 years in jumping (p=0.040, better in medium/high) and left dynamometry (p=0.033).; for 4 years in right dynamometry (p=0.050). Given that the sample size per stratum was uneven, the statistical power was heterogeneous, with a higher risk of type II error in the smaller groups (especially 4 and 7 years old). Therefore, non-significant results are interpreted with caution. For significant ANOVAs, post hoc comparisons with Tukey HSD were reported and, in borderline findings, interpretation was complemented with sensitivity analysis (α=0.10, 90% CI).

Table 3a. Comparison of variables according to eating habits for 4-year-olds (n=57) (means and SD).

Variable	Low	Medium	High	p
Height (cm)	110.625 (6.582)	112.271 (3.977)	114.014 (5.497)	.232
Weight (kg)	21.292 (4.143)	21.552 (3.745)	22.950 (3.370)	.439
Waist (cm)	58.400 (8.113)	55.632 (6.656)	57.964 (7.321)	.411
BMI	17.238 (1.833)	17.043 (2.429)	17.613 (1.896)	.724
Jump (cm)	64.975 (23.077)	75.774 (23.005)	71.143 (17.952)	.347
Dynamometry RIGHT (kg)	5.142 (3.332)	6.116 (2.448)	10.771 (12.273)	.050
Dynamometry LEFT (kg)	4.900 (3.941)	6.000 (2.696)	6.729 (2.471)	.293
Speed (s)	18.048 (1.815)	19.185 (3.146)	17.526 (4.466)	.261
Catching (No.)	6.500 (2.939)	7.000 (2.569)	7.810 (4.542)	.573
Throwing (No.)	3.083 (1.676)	3.968 (2.228)	4.286 (2.758)	.381
Balance RIGHT (s)	12.083 (9.090)	9.463 (8.476)	11.734 (9.219)	.582
Balance LEFT (s)	11.667 (7.981)	9.313 (6.675)	10.083 (7.741)	.633
Tiptoes (No.)	15.333 (3.651)	14.097 (3.636)	12.214 (5.010)	.140
Jumping (No.)	4.750 (0.622)	4.645 (0.709)	4.643 (0.842)	.905

Table 3b. Comparison of variables according to eating habits for 5-year-olds (n=142) (means and SD).

Variable	Low	Medium	High	p
Height (cm)	116.719 (6.303)	114.465 (6.429)	117.672 (6.347)	.039
Weight (kg)	24.388 (4.446)	22.600 (4.064)	23.960 (4.863)	.261
Waist (cm)	57.075 (5.454)	55.978 (6.566)	57.433 (7.988)	.605
BMI	17.762 (1.950)	17.225 (2.522)	17.232 (2.685)	.739
Jump (cm)	78.688 (26.287)	78.905 (26.139)	81.085 (21.864)	.859
Dynamometry RIGHT (kg)	6.900 (3.270)	7.050 (3.452)	7.130 (2.071)	.946

Dynamometry LEFT (kg)	11.481 (21.408)	6.662 (2.645)	7.107 (2.706)	.076
Speed (s)	18.414 (1.820)	18.075 (3.965)	17.725 (2.519)	.620
Catching (No.)	7.250 (2.840)	7.351 (2.595)	7.326 (2.387)	.991
Throwing (No.)	4.875 (2.247)	4.378 (1.876)	4.629 (3.462)	.843
Balance RIGHT (s)	14.768 (7.163)	14.981 (10.684)	14.445 (9.556)	.959
Balance LEFT (s)	14.137 (8.841)	16.286 (11.227)	16.374 (10.365)	.727
Tiptoes (No.)	14.625 (2.062)	14.216 (3.473)	14.258 (3.010)	.894
Jumping (No.)	4.688 (0.873)	5.027 (1.803)	4.708 (0.607)	.295

Table 3c. Comparison of variables according to eating habits for 6-year-olds (n=114) (means and SD).

Variable	Low	Medium	High	p
Height (cm)	121.11 (4.45)	122.88 (5.45)	123.02 (5.23)	.228
Weight (kg)	26.84 (5.03)	27.99 (5.56)	27.21 (4.45)	.586
Waist (cm)	61.11 (8.07)	61.27 (8.63)	58.45 (6.43)	.242
BMI	18.24 (2.97)	18.42 (2.61)	17.94 (2.52)	.727
Jump (cm)	81.09 (27.37)	94.56 (23.86)	93.15 (21.99)	.040
Dynamometry RIGHT (kg)	8.26 (2.62)	8.82 (2.24)	8.98 (2.87)	.477
Dynamometry LEFT (kg)	7.42 (2.93)	8.68 (1.70)	8.90 (3.00)	.033
Speed (s)	17.45 (2.14)	17.32 (2.38)	16.71 (2.16)	.358
Catching (No.)	8.06 (1.94)	8.13 (1.78)	8.09 (2.23)	.989
Throwing (No.)	4.82 (2.04)	5.67 (2.31)	4.97 (2.24)	.182
Balance RIGHT (s)	22.09 (8.48)	18.90 (9.88)	18.76 (9.81)	.255
Balance LEFT (s)	19.39 (8.62)	20.44 (9.93)	19.09 (9.84)	.798
Tiptoes (No.)	13.06 (3.44)	14.42 (2.21)	13.73 (2.58)	.090
Jumping (No.)	4.82 (0.58)	4.90 (0.37)	5.15 (1.82)	.401

Table 3d. Comparison of variables according to eating habits for 7-year-olds (n=50) (means and SD).

Variable	Low	Medium	High	p
Height (cm)	125.45 (3.47)	125.82 (6.68)	127.64 (4.57)	.610
Weight (kg)	29.25 (3.73)	28.39 (7.19)	30.47 (7.20)	.673
Waist (cm)	61.55 (5.46)	59.73 (6.83)	62.00 (7.71)	.572
BMI	18.58 (2.28)	17.75 (3.16)	18.57 (3.52)	.645
Jump (cm)	86.18 (27.33)	94.96 (19.77)	104.45 (24.58)	.177
Dynamometry RIGHT (kg)	9.37 (2.42)	9.08 (2.72)	9.90 (2.25)	.670
Dynamometry LEFT (kg)	8.64 (2.49)	9.26 (2.28)	10.25 (2.91)	.306
Speed (s)	18.65 (4.99)	16.71 (2.12)	16.32 (2.20)	.135
Catching (No.)	8.45 (1.29)	8.25 (2.15)	8.64 (1.43)	.834
Throwing (No.)	5.73 (1.68)	5.86 (2.22)	5.82 (2.71)	.987
Balance RIGHT (s)	24.00 (8.71)	19.61 (10.14)	24.00 (7.76)	.269
Balance LEFT (s)	21.64 (9.52)	20.68 (9.68)	21.09 (10.93)	.963
Tiptoes (No.)	13.55 (1.69)	12.75 (3.13)	12.91 (2.43)	.717
Jumping (No.)	5.09 (0.30)	4.68 (0.72)	4.91 (0.30)	.128

Table 4 details comparisons between children who comply (≥10 h/night) and do not comply (<10 h/night) with sleep recommendations. Significant differences were identified in: height for 4 years (p=0.028) and 6 years (p=0.034); weight for 6 years (p=0.053, marginal); right dynamometry for 4 years (p=0.005); right and left balance for 4 years (p=0.025 and p=0.004); and jumping for 5 years (p=0.013). Most variables showed no differences (p>0.05), such as BMI in all groups.

Table 4a. Comparison of variables according to sleep hours compliance for 4 years (means and SD).

Variable	4 years (n=57)		p
Height (cm)	Complies: 111.68 (4.94)	Does not comply: 115.50 (4.43)	.028
Weight (kg)	21.45 (3.61)	23.66 (3.96)	.090
Waist (cm)	56.03 (7.38)	60.37 (4.46)	.080
BMI	17.13 (2.15)	17.67 (2.34)	.476
Jump (cm)	73.76 (22.43)	65.80 (19.15)	.302
Dynamometry RIGHT (kg)	5.93 (2.71)	12.33 (14.34)	.005
Dynamometry LEFT (kg)	5.71 (3.17)	7.06 (1.24)	.193
Speed (s)	18.88 (3.05)	16.95 (4.26)	.098
Catching (No.)	7.06 (2.54)	7.23 (5.54)	.880
Throwing (No.)	4.04 (2.37)	3.00 (1.56)	.190
Balance RIGHT (s)	11.76 (9.12)	5.00 (2.31)	.025
Balance LEFT (s)	11.23 (7.24)	4.20 (2.30)	.004
Tiptoes (No.)	13.89 (4.32)	13.90 (2.92)	.996
Jumping (No.)	4.66 (0.76)	4.70 (0.48)	.873

Table 4b. Comparison of variables according to sleep hours compliance for 5 years (means and SD).

Variable	5 years (n=142)		p
Height (cm)	Complies: 116.70 (6.53)	Does not comply: 117.78 (5.25)	.515
Weight (kg)	23.51 (4.60)	24.75 (5.02)	.302
Waist (cm)	56.90 (7.08)	57.89 (9.65)	.608
BMI	17.19 (2.52)	17.74 (2.70)	.410
Jump (cm)	80.45 (23.76)	78.09 (21.74)	.699
Dynamometry RIGHT (kg)	7.09 (2.67)	7.05 (2.40)	.956
Dynamometry LEFT (kg)	7.54 (8.05)	7.09 (2.47)	.819
Speed (s)	17.84 (2.87)	18.41 (3.14)	.445
Catching (No.)	7.31 (2.37)	7.41 (3.28)	.880
Throwing (No.)	4.48 (3.10)	5.41 (2.00)	.233
Balance RIGHT (s)	14.79 (9.54)	12.47 (9.36)	.347
Balance LEFT (s)	16.10 (10.32)	15.27 (11.00)	.758
Tiptoes (No.)	14.39 (3.04)	14.12 (2.12)	.724
Jumping (No.)	4.77 (0.57)	4.35 (1.00)	.013

Table 4c. Comparison of variables according to sleep hours compliance for 6 years (means and SD).

Variable	6 years (n=114)		p
Height (cm)	Complies: 121.92 (5.16)	Does not comply: 124.55 (4.55)	.034
Weight (kg)	26.99 (4.88)	29.37 (5.65)	.053
Waist (cm)	60.06 (8.17)	61.97 (6.62)	.319
BMI	18.09 (2.57)	18.86 (3.08)	.234
Jump (cm)	89.11 (24.95)	95.33 (24.70)	.303
Dynamometry RIGHT (kg)	8.51 (2.59)	9.57 (2.15)	.082
Dynamometry LEFT (kg)	8.24 (2.58)	9.01 (2.42)	.214
Speed (s)	17.28 (2.30)	16.76 (1.99)	.350
Catching (No.)	8.15 (1.94)	7.86 (1.98)	.535
Throwing (No.)	5.15 (2.23)	5.52 (2.25)	.491
Balance RIGHT (s)	19.81 (9.43)	19.67 (10.11)	.952
Balance LEFT (s)	20.00 (9.30)	18.62 (10.38)	.549
Tiptoes (No.)	13.96 (2.73)	13.24 (2.86)	.282
Jumping (No.)	4.99 (1.14)	4.76 (0.54)	.375

Table 4d. Comparison of variables according to sleep hours compliance for 7 years (means and SD).

Variable	7 years (n=50)		p
Height (cm)	Complies: 125.84 (5.66)	Does not comply: 128.33 (5.57)	.316
Weight (kg)	29.03 (6.66)	29.07 (6.02)	.990
Waist (cm)	60.77 (7.08)	59.80 (3.12)	.745
BMI	18.19 (3.08)	17.57 (4.64)	.643
Jump (cm)	93.16 (23.14)	109.50 (17.14)	.103
Dynamometry RIGHT (kg)	9.27 (2.55)	9.77 (2.62)	.654
Dynamometry LEFT (kg)	9.24 (2.49)	10.08 (2.48)	.441
Speed (s)	17.17 (3.09)	16.19 (2.92)	.466
Catching (No.)	8.30 (1.85)	9.00 (1.67)	.381
Throwing (No.)	5.84 (2.22)	5.67 (2.16)	.857
Balance RIGHT (s)	21.95 (9.34)	18.50 (10.54)	.406
Balance LEFT (s)	21.11 (9.49)	20.00 (12.31)	.796
Tiptoes (No.)	13.05 (2.72)	12.33 (2.73)	.550
Jumping (No.)	4.82 (0.62)	4.83 (0.41)	.954

Discussion

The lack of significant differences in anthropometric variables, physical fitness, and motor competence between the screen-time compliance groups in our study, where the average daily screen time was 2.3 hours, contrasts with evidence linking greater exposure to adverse outcomes. For example, a systematic review found that preschoolers with >2 hours a day of screen time showed 15-20% lower scores in gross motor skills compared to those with <1 hour/day (Carson et al., 2017). Similarly, one study reported that children with an average of 2.5 hours per day had increases in BMI of 0.5 units and a reduction in agility by 10% (Ponti et al., 2023). Our findings may reflect moderate levels of exposure that minimize detectable effects, but also potential underreporting of actual screen time, as only 40% met recommendations of <2 hours a day. In this sense, the effects could be threshold-dependent, which supports objective follow-up in future Chilean cohorts.

Regarding dietary habits, our limited associations, such as taller height among 5-year-olds (mean/tall vs. short, p=0.039) and better jumping performance in the mean 6-year-old group (94.56 cm vs. 81.09 cm in the low group, p=0.040), suggest modest impacts on growth and fitness, potentially influenced by the concentration of intermediate Krece Plus scores (7.05–7.48). A 2025 Croatian study identified "Healthy" and "Breakfast" patterns linked to a lower likelihood of obesity (OR=0.98, 95% CI: 0.98–0.99; OR=0.96, 95% CI: 0.95–0.99), in contrast to our weaker associations, possibly dampened by regional dietary patterns (Hasanović et al., 2025). Similarly, a study in Greek preschoolers associated high adherence to the Mediterranean diet with a lower prevalence of overweight/obesity (Pavlidou et al., 2023). In addition, a 2025 review of peer-led interventions showed that multicomponent programs increase fruit and vegetable intake by 15 to 20%, suggesting that an exclusively questionnaire-based approach may underestimate the actual size of the effects (Ekubagewargies et al., 2025).

Adherence to sleep showed more marked differences, where those who did not meet the recommendations had greater height in 4-year-olds (115.50 cm vs. 111.68 cm, p=0.028) and 6-year-olds (124.55 cm vs. 121.92 cm, p=0.034), in addition to greater right dynamometry (12.33 kg vs. 5.93 kg, p=0.005) and better balance in 4-year-olds. This pattern, counterintuitive with respect to the expected positive association between sleep duration and motor growth/performance, could be related to parental reporting error, maturation variability or residual confusion. Unmeasured factors, such as socioeconomic status, should also be considered, which can influence both lifestyles (e.g., 2.3 average hours of screen time) and physical outcomes, in line with what was reported in Hong Kong (Yip et al., 2024).

These results should also be interpreted within the framework of relevant methodological limitations. Reliance on MABC-2 for children aged 3 to 6 years may not fully capture motor competence in 7-year-olds, and the subgroup sample size (e.g., n=50 at 7 years) reduces the potency to detect small effects, increasing the likelihood of type II error in non-significant comparisons. Likewise, the use of self-reported data by caregivers for behavioral variables, although feasible in school studies, can introduce recall and social desirability biases (von Elm et al., 2008). In line with what Larson (2019) discussed, social bias control should be considered a methodological priority when healthy behaviors are measured by self-report. Therefore, the absence of statistical significance should not be automatically interpreted as the absence of biological or behavioral association.

From an applied perspective, the findings remain relevant to Chile's preschool public health. Even with mostly non-significant associations, the overall pattern coincides with literature suggesting that moderate improvements in sleep and diet may translate into benefits in motor development. Consequently, community and school programs should prioritize family interventions on sleep hygiene, reduction of ultra-processed foods, and reduction of screen time, maintaining an integrated approach to lifestyles (Argumedo et al., 2024; Drenowatz et al., 2024).

In terms of future research, it is recommended to move towards longitudinal designs with objective measurements and triangulation of information (e.g., accelerometry for physical activity, digital records for screen, and repeated dietary protocols), to correct self-report biases and improve the accuracy of estimates (Pfeiffer et al., 2025). It would also be especially valuable to contrast BMI, height, weight and waist circumference with equivalent samples of children from urban areas, to evaluate territorial gradients and strengthen the external utility of the findings; this need is consistent with recent evidence of urban-rural differences in physical activity and motor skills (Oginni et al., 2025). Finally, larger, more diverse samples with better control of socioeconomic variables will allow us to elucidate associations that in this study could be attenuated by contextual heterogeneity and limited statistical power.

Conclusions

In conclusion, the associations between eating habits, screen time, and sleep with anthropometric and functional variables were generally limited in this Chilean cohort of preschoolers, a result that should be interpreted considering the possible influence of parental self-report bias and the heterogeneity of the sample size by age. Even so, sleep showed the most consistent signs of association within the analyzed set, supporting the relevance of promoting proper sleep hygiene along with balanced dietary patterns in early childhood. Future studies should incorporate objective tools to improve the accuracy and applicability of evidence in vulnerable populations such as the Araucanía region.

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Authors and translators' details:

Andrés Godoy-Cumillaf	andres.godoy@uautonoma.cl	Author
Paola Fuentes-Merino	paola.fuentes@uautonoma.cl	Author
Josivaldo de Souza-Lima	josivaldo.desouza@unab.cl	Author
Catalina Muñoz-Strale	catalina.munoz@unab.cl	Author
Frano Giakoni-Ramírez	frano.giakoni@unab.cl	Author
Maribel Parra-Saldías	maribel.parra@uda.cl	Author
Daniel Duclos-Bastías	daniel.duclos@pucv.cl	Author
José Bruneau-Chávez	jose.bruneau@ufrontera.cl	Author
Eugenio Merellano-Navarro	emerellano@ucm.cl	Author