Facultad de Medicina

GRADO EN MEDICINA

TRABAJO FIN DE GRADO

CALIDAD DE LA DIETA EN NIÑOS DE 6 AÑOS: EL PAPEL DE LOS FACTORES INDIVIDUALES Y SOCIODEMOGRÁFICOS

QUALITY OF DIET IN 6-YEAR-OLD CHILDREN: THE ROLE OF INDIVIDUAL AND SOCIODEMOGRAPHIC FACTORS

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INDEX

ABSTRACT

Background: Early childhood diet quality is a significant determinant of the child development, growth and lifelong health as shown by numerous recent studies. However, the impact of individual and socioeconomic factors on dietary habits remains poorly studied in Spanish six-year-olds.

Objective: To assess how socioeconomic and individual factors including parental income, education, BMI, family structure, breastfeeding and screen time affect children's diet quality.

Methods: We performed a cross-sectional analysis of 967 participants from the 2018 CoAlhas birth cohort in Cantabria when the kids were 6 years old. Dietary patterns were measured using KIDMED index, a binary indicator of >= one fruit daily and UPF intake dichotomized at the 75th percentile. We used multivariable logistic regression models controlling for child age, birth weight, maternal age, breastfeeding duration and kindergarten attendance. From these models, we derived odds ratios and their 95% confidence intervals to quantify each association.

Results: Optimal adherence to the Mediterranean diet and daily fruit intake were positively linked to higher parental education, household income, breastfeeding and shorter screen time, whereas Ultra-processed food consumption showed the opposite pattern.

Conclusion: Both socioeconomic and individual factors influence diet quality in six-year-olds. Interventions including social support, nutrition education and reduced sedentary behavior may improve children dietary habits.

Keywords: "Diet quality", "Socioeconomic and individual factors", "Screen's use" "Mediterranean diet", "Ultra-processed food"

RESUMEN

Antecedentes: La calidad de la dieta en la primera infancia es un determinante clave del desarrollo, el crecimiento y la salud a lo largo de la vida, como muestran numerosos estudios recientes. No obstante, el impacto de factores individuales y socioeconómicos en los hábitos alimentarios de los niños españoles de seis años está poco estudiado.

Objetivo: Evaluar cómo influyen factores socioeconómicos e individuales (incluyendo ingresos y educación de los padres, IMC, estructura familiar, lactancia y tiempo de uso de pantallas) en la dieta de los niños.

Métodos: Se realizó un análisis transversal de 967 participantes de la cohorte de nacimiento CoAlhas en 2018, en Cantabria, evaluados a los seis años. Se midió la adherencia a la dieta mediterránea (índice KIDMED), el consumo diario de fruta (≥ 1 pieza) y la ingesta de ultra procesados (≥ percentil 75). Se aplicaron modelos de regresión logística multivariable, ajustados por la edad del niño, el peso al nacer, edad materna, duración de la lactancia y asistencia a la guardería, para obtener odds ratio y sus intervalos de confianza al 95%.

Resultados: La adherencia óptima a la dieta mediterránea y el consumo diario de fruta se asociaron positivamente con mayor educación e ingresos parentales, lactancia materna y menor tiempo de pantalla, mientras que el consumo de ultra procesados mostró el patrón inverso.

Conclusión: Tanto los factores socioeconómicos como los individuales influyen en la calidad de dieta de los niños de seis años. Las intervenciones que combinen apoyo social, educación nutricional y disminución de sedentarismo podrían mejorar los hábitos alimentarios de los niños.

Palabras clave: “Calidad de la dieta”, “Factores socioeconómicos e individuales”, “Uso de pantallas”, “Dieta mediterránea”, “Alimentos ultra procesados”

INTRODUCTION

Diet quality is a significant determinant of the child development and growth, and also has a long lasting effect on health and well-being later in life(1). As children are growing, their food preferences are being defined, hence the value of encouraging them from beginning to eat a varied and adequate diet(2).

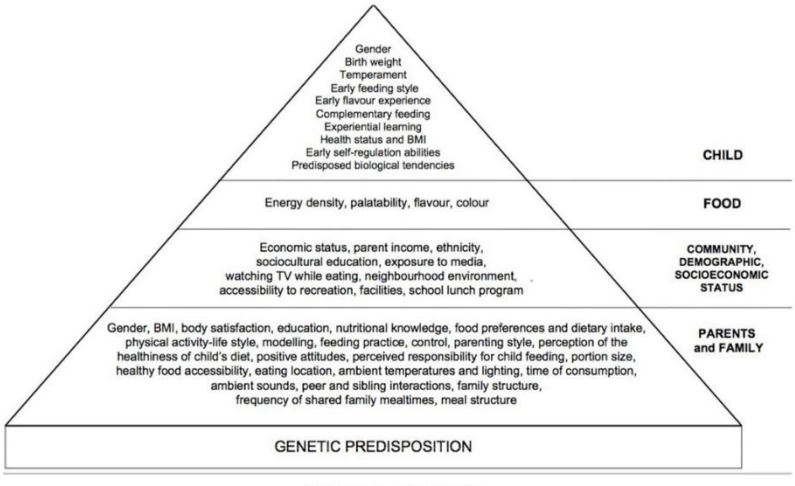
An inadequate diet from early childhood can affect the development of short- and/or long-term health outcomes including cognitive dysfunction in adulthood; cancer; specific nutritional deficiencies which led to different pathologies such us iron deficient anemia; chronic diseases like diabetes, hypertension or coronary heart disease; and childhood obesity(3)(4)(5)(6).

Childhood obesity is an important public health issue, with one- third of all children and adolescents in the US being either overweight or obese(6). Some studies conclude that children who are overweight at kindergarten are four times more likely to be obese at age fourteen compared to healthy-weight children at the same age(7). This suggest that early childhood may be the best window of opportunity for changing potential environmental risk factors for childhood obesity and malnutrition(6).

In a recent meta-analysis, it was found a negative relationship between children BMI and different aspects of neurocognitive function such as attention, motor skills or visuo-spatial performance in healthy children (8). Moreover some other studies concluded that optimal intake of key food in children, acting in synergy with the Mediterranean diet may confer neurocognitive protection(3).

The rates of youth-onset type 2 diabetes are rising globally(9). A diet high in saturated or trans-fat, carbohydrates and calories added to other factors such as physical inactivity or childhood obesity have been implicated in the development of type 2 diabetes. This type of food stresses the physiological regulation of glucose metabolism(10).

Children's eating behavior can be influenced by many factors such as the ones showed in *FIGURE 1*(11).



BMI: Body Mass Index

FIGURE 1: FACTORS INFLUENCING CHILDREN'S EATING BEHAVIOUR(11)

A significant amount of epidemiological data shows that diet quality follows a socioeconomic gradient. While higher quality diets, including whole grains, lean meats, fish, low fat dairy products and fresh fruit and vegetables are more likely to be consumed by people with higher socioeconomic status(SES)- defining SES by parental educational level and family income-, energy dense diets that are nutrient poor, including refined grains, sweets and added fats are more often consumed by people of lower SES(12).

The SES gradient in diet quality might be due in part to the food prices. There is a theory that food price is an important determinant of food choice and not surprisingly, the cheapest diets are also the least healthy. Moreover, easy access to supermarkets has been shown to be linked to a higher consumption of fruit and vegetables and thus low-income families are less likely to have a car of their own and can find more difficult to access to out-of-town supermarkets(12).

Furthermore, some studies show that children who are Black, Hispanic, Native American or other races have a statistically significant increased risk of being overweight compared to White children, which makes us think that race may be a risk factor for obesity(6).

Another factor found to influence children's eating behavior is parental controlling feeding practices. One study shows that while higher amount of restriction is associated with a higher child body mass index z-score, higher amount of pressure to eat was link with a lower BMI z-score(11)(13). This same study concluded that parental pre-pregnancy BMI, mother age, family income and family education at the time of childbirth were importantly associated with the child's BMI.

On the same page, other studies concluded that higher maternal schooling level and family income has a positive effect on children's diets with more consumption of essential foods such as beans and oilseeds and adherence to the Mediterranean diet(5) (14).

Regarding the consumption of ultra-processed food, it has been concluded in some studies that an increase in parental BMI is associated with higher UPF consumption, whereas a higher educational level and father's income are associated with lower UPF consumption. It has also being shown that there is a direct causal link between advertising for food products and children's diets(11).

The aim of this study is to evaluate the influence of individual and sociodemographic factors on diet quality in six-year old children in Spain as there are not many studies approaching this subject in this population.

METHODS:

Design and study population

This project has its origin in a prospective cohort study "The CoAlHas study" performed in the University Hospital Marqués de Valdecilla, a third- level hospital in Cantabria, Spain. A total of 2012 children were recruited in two different periods, pre-pandemic (2018) which included 967 children and pandemic (March 2020-December 2020), which included 1045 children.

In order to study the influence of socioeconomic factors on the diet of six-year old children in Spain, a subpopulation of 967 children recruited at birth between January and June 2018 was selected.

Data Collection

Baseline data were collected at birth, as well as at 6 and 12 months. In 2022 and 2024, parents were recontacted and invited to participate in two follow-up visits at ages 4 and 6 years, respectively.

Information was collected through a combination of phone interviews, face to face interviews and the review of medical records:

1) Socioeconomic data:

- Parental educational level: Educational level of attainment from the mother and from the father were registered. This variable was divided into three categories (basic studies, secondary studies and university studies).
- Parental work status: This variable was gathered into student, working or unemployed.
- Parental Income*:* Mother's and father's monthly income was measured separately through self - reported information through interview. At the beginning parental income was divided into 11 categories regarding different income ranges. Later these 11 categories were divided into 3 groups in order to be able to stratify into low, medium and high incomes. In the end, low economic status was referred to participants whose income was lower than 1300 euros/month; medium economic status for those whose income was between 1300 and 2700 euros per month; and high economic status for those over 2700 euros per month.
- Family's pharmaceutical contribution: Familiar income was measured based on the family's pharmaceutical contribution, which was divided into five categories according to information obtained directly from the National Health System databases: TSI 1 and 2 for families who are unemployed or pensioners, TSI 3 for families with an income under 18,000 euros per year, TSI 4 for families with an income between 18,000 euros and 100,000 euros per year, TSI 5 for families with an income higher than 100,000 euros per year, and TSI 6 for those families with a mutual insurance.

2) Familiar structure:

- Familiar structure: It was categorized into biparental, single parent or divorced/separated families.
- Number of siblings: This variable was divided into four categories (0,1,2 or >2 siblings).
- Birth order: The children birth order was categorized into first born, second born or third born or later.

3) Anthropometric data: Parents weight was divided into three categories depending on their BMI (BMI 18-24.9 normal weight; BMI 25-29,9 overweight; BMI >30 obesity).

4) Data about the children sex: Children were divided depending on their sex in two categories (male and female).

5) Data about the children's place of main meal: During the phone interview, parents were asked where they children typically had their main meal of the day. Response were categorized into four options: at school, with their parents, with their grandparents, or other.

6) Daily screen use data: This information was gathered through a validated questionnaire(15) targeted at children between 5 and 7 years old, based on a register of the activities performed by the child every day during 7 days. This survey includes a register of sedentary activities such as reading, doing homework, watching television, time spent on computer use and videogames. The analysis of a sedentary lifestyle specifically focused on the use of screens. According to distribution of screen time in our cohort, a cut-off point in more than 90 minutes, corresponding to the 75th percentile (p75) of the distribution, was stablished for the analysis.

The outcomes studied in this study included children obesity, consumption of ultra-processed food, daily fruit consumption and adherence to Mediterranean diet.

1) **Children obesity**: In all of the visits during the follow-up, every child was weighted and measured. Extreme percentiles were used in the statical analysis: 95th percentile(p95) representing obesity.

2)**Consumption of ultra-processed food**: To classify ultra-processed foods (UPFs), we used the NOVA classification system (16), which categorizes all foods and food products into four groups based on the extent and purpose of industrial processing. Ultra-processed foods belong to Group 4, which includes ingredients primarily intended for industrial use, derived from a series of industrial processes. These processes begin with the breakdown of whole foods into substances such as sugars, oils, fats, proteins, starches, and fiber, often obtained from a limited number of high-yield plant sources or processed animal remnants. These substances are frequently chemically modified and then reassembled using industrial techniques such as extrusion and molding, with little or no presence of whole foods. Cosmetic additives, including flavors, colors, and emulsifiers, are

often added to enhance palatability or create hyper-palatable products. A detailed list of foods included in this category is available in Annex 1.

In our study, we calculated daily energy intake (kcal/day) derived from UPFs and categorized participants into two groups based on the 75th percentile (p75) of consumption. Individuals with an intake equal to or above p75 were classified as high consumers, while the remaining participants were categorized as low consumers.

3) Fruit consumption: To evaluate fruit consumption, participants were asked whether they consumed at least one piece of fruit per day.

4) Adherence to Mediterranean diet: In order to evaluate the adherence to Mediterranean diet the KIDMED questionnaire has been used. This questionnaire evaluates 16 items, with some contributing positively and others negatively to the final score. Based on the results, the KIDMED score is classified into the following categories: ≤3, very-low-quality diet; 4–7, need to improve the food pattern to adjust it to the Mediterranean one; ≥8, optimal Mediterranean diet(17). The KIDMED score included in this category is available in Annex 2.

Statistical Analysis

Descriptive statistics were used to summarize the characteristics of the study population. Continuous variables were expressed as means and standard deviations (SD), while categorical variables were presented as absolute and relative frequencies. Differences between groups were assessed using the chi-square test for categorical variables and the t-test for continuous variables. To explore the association between socioeconomic factors, parental anthropometric characteristics, and dietary habits, logistic regression models were performed. The dependent variables included adherence to the Mediterranean diet (optimal vs. non-optimal, based on the KIDMED score), fruit consumption (dichotomized as at least one serving per day vs. less than one serving per day), ultra-processed foods consumption (categorized as frequent vs. infrequent by 75th percentile), and childhood obesity (defined as BMI ≥ p95 th percentile vs. BMI < p95th percentile).

For each outcome, odds ratios (OR) and 95% confidence intervals (CI) were estimated, adjusting for potential confounders, including the child's age (in months), birth weight, mother's age (in years), duration of breastfeeding (in months), and kindergarten attendance (yes/no). All statistical analyses were conducted using STATA 18 and a p-value < 0.05 was considered statistically significant.

Ethics

The study was approved by the Clinical Research Ethics Committee of Cantabria (reference: 2021/01245). Participation was entirely voluntary, and the participants' parents provided written informed consent.

RESULTS

Description of the Study Population

Table 1 presents the description of the population that we have chosen for the study, the 2018 cohort. Mother's educational level was found to be higher than father's educational level in the study population. 265 out of 571(46.41%) mothers had university studies while 162 out of 552 fathers (29.35%) had university studies. Most of the fathers had secondary studies (45.29%). However, it was more common to find unemployed/inactive mothers (19.55%) than fathers (4.37%). Likewise, 86.32% of the families were biparental families and 64% of the families had two children. From the study population 50.78% of the children were boys while 49.22% were girls. Interestingly, while 39.96% of mothers where either overweight or obese 57.18% of fathers were overweight or obese.

Factors Associated with Optimal Adherence to the Mediterranean Diet

Table 2 presents the association between various socioeconomic factors and optimal adherence to the Mediterranean diet. Significant associations were found for paternal educational level, parental income-related variables, and overall household income. Specifically, children whose fathers had university education were 4.29 times more likely to adhere to the Mediterranean diet compared to those whose fathers had only basic education (OR = 4.29, 95% CI = 1.17-15.78, p = 0.028).

A positive association was observed between socioeconomic status and optimal adherence to the Mediterranean diet in 6-year-old children. Paternal income showed a clear dose-response relationship: compared to those whose fathers earned less than €1300, children in the medium-income group (€1300–<€2700) were nearly twice as likely to adhere optimally to the Mediterranean diet (OR = 1.94, 95% CI: 0.71–5.32), and this likelihood increased further in the high-income group (>€2700; OR = 4.61, 95% CI: 1.32–16.10; p-trend = 0.019). A similar, but more pronounced, gradient was observed for total household income, with children from high-income families showing significantly higher odds of adherence (OR = 6.98, 95% CI: 1.38–35.27; p-trend = 0.013). In contrast, for maternal income, the association was only evident among children of mothers in the medium-income category (OR = 3.63, 95% CI: 1.62–8.09).

Neither child sex, maternal age, nor parental BMI showed a statistically significant association with optimal adherence to the Mediterranean diet in children.

Table 2 also summarizes associations of family characteristics, sedentary behavior (screen time), and feeding practices with optimal adherence to the Mediterranean diet. Of all these, statistical significance was only found for time of use of screens and breastfeeding. Specifically, children who used screens for more than 90 minutes a day were less likely to have an optimal adherence to Mediterranean diet compared to those who used screens for less than 90 minutes a day (OR = 0.38), 95% CI = 0.15-0.95, p = 0.039).

Additionally, children who were formula-fed showed a strong inverse association with adherence to the Mediterranean diet (OR=0.29, 95% CI (0.10-0.80)

Factors associated with fruit intake

Table 3 presents the association between maternal age, anthropometric and socioeconomic factors and fruit intake in children from the 2018 cohort. When analysing the effect of parental overweight or obesity, we observed a protective effect of maternal overweight, which showed borderline statistical significance (OR=0.55;95%CI:0.30-1.01). Although no significant association was found with the different maternal education levels, daily fruit consumption showed a significant linear trend with the mother's level of education (ptrend = 0.015). Regarding income, significant trend was found for father's income (p trend=0.021).
Children with fathers in the highest income bracket (>€2700/month) were 3.6 times more likely to consume fruit daily than those with paternal income <€1300 (OR = 3.55; 95% CI: 1.20–10.48; p = 0.022).

The association between children's daily fruit intake and selected sociodemographic and behavioral variables is also shown in Table 3. Children who spent more than 90 minutes per day on screens showed a lower likelihood of daily fruit consumption (OR = 0.65, 95% CI: 0.40–1.04), with the association showing borderline statistical significance. Additionally, compared to those exclusively breastfed children at 6 months, those who were mix-fed (OR = 0.29, 95% CI = 0.13–0.62, p = 0.002) or formula-fed (OR = 0.27, 95% CI = 0.014–0.53, p = 0.001) were also less likely to consume fruit daily.

Factors associated with o Ultra-processed Food (UPF) Consumption

Table 4 shows the relationship between socioeconomic, sociodemographic, and behavioral factors and ultraprocessed food consumption.

Regarding socioeconomic factors, a statistically significant association was found only for mother's income. Children of mothers with medium economic level were less likely to consume high amounts of ultra-processed food (OR=0.57; 95%CI=0.35-0.92).

In the case of sociodemographic and behavioral factors, the number of siblings was positively associated with ultra-processed food consumption, with a higher number of siblings corresponding to an increased likelihood of high consumption (p for trend: 0.03). In addition, children who spent more than 90 minutes per day on screens were more than twice as likely to exhibit higher UPF consumption than those with less screen time (OR = 2.49, 95% CI = 1.55-4.01 p < 0.001).

Finally, both mixed feeding and formula feeding were associated with higher UPF intake, with the association being statistically significant in the case of formula feeding (OR=2.57, 95%CI=1.41-4.67).

Association Between Parental BMI and Child's BMI Status

Table 5 shows the association between parental BMI (analysed both as a continuous and categorical variables) and the child's BMI status, categorised using the 95th percentile (P95) as the threshold for obesity.

When maternal BMI was assessed as a continuous variable, the mean BMI was significantly higher among mothers of children with BMI ≥ p95 compared to those with BMI < p95 (24.73 vs 26.66; $p < 0.01$). However, when maternal BMI was analysed categorically, although children with higher BMI had a greater proportion of obese mothers, this difference did not reach statistical significance.

Regarding paternal BMI, although higher values were observed in children with BMI ≥ p95 (27.34 ± 4.34) compared to children with BMI < p95 (26.30 ± 4.02), this difference was not statistically significant ($p = 0.09$). No significant associations were found when paternal BMI was analysed as a categorical variable either.

TABLES AND FIGURES

Table 1: Description of the Study Population

VARIABLE	CATEGORY	N(%)
Mother's age mean (DE)		33.63(5.19)
Mother's educational level	Basic studies	59(10.33)
	Secondary studies	247(43.26)
	University studies	265(46.41)
Father's educational level	Basic studies	140(25.36)
	Secondary studies	250(45.29)
	University studies	162(29.35)
Mother working situation	Unemployed	112(19.55)
	Employed	461(80.45)
Father's working situation	Unemployed	24(4.37)
	Employed	525(95.63)
Global family income	Low economic level(<1300 euros)	156(27.86)
	Medium economic level (1300 to <2700 euros)	298(53.21)
	High economic level (>2700 euros)	106(18.93)
Mother's income	Low economic level(<1300euros)	298(54.58)
	Medium economic level (1300 to <2700euros)	186(34.07)
	Hight economic level (>2700euros)	44(8.06)
	Doesn't know/doesnt't answer	18(3.30)
Father's income	Low economic level(<1300euros)	154(28.26)
	Medium economic level (1300 to <2700euros)	278(51.01)
	Hight economic level (>2700euros)	89(16.33)
	Doesn't know/ doesn´t answer	24(4.40)
Family's pharmaceutical contribution	TSI1- TSI2	147(15.30)
	TSI3	440(45.79)
	TSI4	334(34.76)
	TSI5-NOFAR	14(1.46)
	TSI6	26(2.71)
Family structure	Biparental	366(86.32)
	Single parent	14(3.30)
	Divorced/separated	44(10.38)
Birth order	First born	103(32.19)
	Second born	189(59.06)
	Third born or later	28(8.75)
Number of siblings	No siblings	103(24.35)
	One sibling	271(64.07)
	Two siblings	40(9.46)
	>Two siblings	9(2.13)
Place of main meal	With their parents	261(57.74)
	At school	156(34.51)
	With their grandparents	29(6.42)
	Other	6(1.33)
Mother's BMI	Normal weight	272(60.04)
	Overweight	100(22.08)
	Obesity	81(17.88)
Father's BMI	Normal weight	188(42.82)
	Overweight	173(39.41)
	Obesity	78(17.77)
Children's sex	Female	476(49.22)
	Male	491(50.78)
Children age (in years) at visit number 1 (mean (DE)		4.57(0.23)
Kinder garden starting age in months mean (DE)		13.17(7.70)
Children weight p95 BMI	No	398(91.08)
	Yes	39(8.92)
Breastfeeding at 6 months	Breastfeeding	236(26.19)
	Mixed (breastfeeding and infant formula)	183(20.31)
	Infant formula only	482(53.50)
Breastfeeding at 12 months	Mixed(breastfeeding and infant formula)	237(26.99)
	Infant formula only	641(73.01)
Kindergarden	No	715(74.17)
	Yes	249(25.83)

Table 2. Factors associated with Optimal Adherence to the Mediterranean Diet

VARIABLE	CATEGORY	a/n	OR (95% CI)	p
Mother's age mean(DE)			1.07 (0.98-1.16)	0.116
Children's sex	Female	21/218	1(ref.)	
	Male	19/237	0.86 (0.44-1.70)	0.671
Mother's BMI	Normal weight	24/224	1(ref.)	.
	Overweight	3/80	0.33 (0.09-1.13)	0.07
	Obesity	5/68	0.66 (0.23-1.87)	0.464
Father's BMI	Normal weight	16/157	1(ref.)	.
	Overweight	11/139	0.78 (0.34-1.80)	0.560
	Obesity	3/65	0.44 (0.12-1.60)	0.212
Mother's educational level	Basic studies	0/41	1(ref.)	.
	Secundary studies	11/183	0.51 (0.24-1.08)	0.079
	University studies	28/225	1.00 (1.00-1.00)	.
Father's educational level	Basic studies	3/110	1(ref.)	.
	Secondary studies	15/190	2.55 (0.70-9.23)	0.154
	University studies	19/133	4.29 (1.17-15.78)	0.028
Mother's income	Low economic level(<1300euros)	9/223	1(ref.)	.
	Medium economic level (1300 to <2700euros)	28/184	3.63 (1.62-8.09)	0.002
	Hight economic level (>2700euros)	2/19	2.13 (0.41-11.14)	0.371
	Doesn't know doesnt't answer	1/13	2.29 (0.26-20.417)	0.459
Father's income	Low economic level(<1300euros)	5/107	1(ref.)	*ptrend: 0.019*
	Medium economic level (1300 to <2700euros)	24/266	1.94 (0.71-5.32)	0.196
	Hight economic level (>2700euros)	8/38	4.61 (1.32-16.10)	0.017
	Doesn't know doesnt't answer	1/27	0.89 (0.10-8.32)	0.92
Global family income	Low economic level(<1300euros)	2/79	1(ref.)	*ptrend:0.013*
	Medium economic level (1300 to <2700euros)	28/291	3.80(0.87-16.56)	0.075
	Hight economic level (>2700euros)	9/48	6.98 (1.38-35.27)	0.019
	Doesn't know/ doesn't answer	1/34	1.28 (0.11-15.00)	0.142
Family's pharmaceutical contribution	TSI1- TSI2	2/46	1(ref.)	.
	TSI3	11/191	1.39 (0.29-6.64)	0.678
	TSI4	23/195	2.47 (0.55-11.22)	0.240
	TSI5-NOFAR	0/5	1.00 (1.00-1.00)	.
	TSI6	4/16	5.52 (0.86-35.67)	0.855

Table 2. Factors associated with Optimal Adherence to the Mediterranean Diet (cont.)

VARIABLE	CATEGORY	a/n	OR adjusted (95% CI)	p
Family structure	Biparental	34/359	1(ref.)	.
	Single parent	2/14	1.29 (0.26-6.42)	0.756
	Divorced/separated	3/41	0.89 (0.25-3.13)	0.859
Birth order	First born	8/101	1(ref.)	.
	Second born	16/185	1.04 (0.38-2.86)	0.930
	Third born or later	3/25	1.44 (0.31-6.63)	0.639
Number of siblings	No siblings	12/102	1(ref.)	.
	One sibling	21/264	0.66 (0.31-1.44)	0.301
	Two siblings	5/40	1.04 (0.33-3.21)	0.944
	>Two siblings	0/7	1.00 (1.00-1.00)	.
Place of main meal	With their parents	25/261	1(ref.)	.
	At school	14/156	0.71 (0.34-1.53)	0.393
	Other	1/34	0.27 (0.03-2.09)	0.210
Use of screens per day	<90min	34/316	1(ref.)	.
	>90 min	6/135	0.38 (0.15-0.95)	0.039
Breastfeeding at 6 months	Breastfeeding	17/123	1(ref.)	.
	Mixed (breastfeeding and infant formula)	11/92	0.70 (0.26-1.87)	0.476
	Infant formula only	12/209	0.29 (0.10-0.80)	0.016

Adjusted for: child's age, birth weight, maternal age, breastfeeding type, and kindergarten attendance

Table 3. Factors associated with fruit intake

VARIABLE	CATEGORY	a/n	OR adjusted (95% CI)	p
Mother's age mean(DE)			1.00 (0.95-1.05)	0.943
Children´s sex	Female	150/218	1(ref.)	
	Male	152/237	0.67 (0.43-1.05)	0.085
Mother's BMI	Normal weight	161/224	1(ref.)	.
	Overweight	46/80	0.55 (0.30-1.01)	0.057
	Obesity	41/68	0.56 (0.30-1.06)	0.076
Father's BMI	Normal weight	101/157	1(ref.)	.
	Overweight	92/139	1.17 (0.67-2.05)	0.573
	Obesity	45/65	1.08 (0.54-2.17)	0.822
Mother's educational level	Basic studies	20/41	1(ref.)	*p trend: 0.015*
	Secondary studies	111/183	1.12 (0.49- 2.57)	0.782
	University studies	166/225	2.02 (0.87-4.70)	0.103
Father's educational level	Basic studies	60/110	1(ref.)	.
	Secondary studies	129/190	1.56 (0.90-2.78)	0.126
	University studies	97/133	1.47 (0.77-2.82)	0.247
Mother's income	Low economic level(<1300euros)	138/223	1(ref.)	.
	Medium economic level (1300 to <2700euros)	133/184	1.38 (0.84-2.23)	0.199
	Hight economic level (>2700euros)	13/19	0.94 (0.31-2.84)	0.916
	Doesn't know/ doesn't answer	8/13	0.92 (0.27-3.10)	0.895
Father's income	Low economic level(<1300euros)	60/107	1(ref.)	*p trend: 0.021*
	Medium economic level (1300 to <2700euros)	179/266	1.39 (0.82-2.35)	0.224
	Hight economic level (>2700euros)	32/38	3.55 (1.20-10.48)	0.022
	Doesn't know/ doesn't answer	18/27	0.82 (0.27-3.09)	0.895
Global family income	Low economic level(<1300euros)	43/79	1(ref.)	*p trend: 0.098*
	Medium economic level (1300 to <2700euros)	197/291	1.39 (0.78-2.49)	0.265
	Hight economic level (>2700euros)	38/48	2.07 (0.78-2.49)	0.120
	Doesn't know/ doesn't answer	22/35	1.04 (0.41-2.65)	0.927
Family's pharmaceutical contribution	TSI1- TSI2	26/46	1(ref.)	.
	TSI3	118/191	1.04 (0.49-2.20)	0.916
	TSI4	136/195	1.35 (0.63-2.90)	0.431
	TSI5-NOFAR	0/5	1.00 (1.00-1.00)	
	TSI6	15/16	6.39 (0.74-55.18)	0.092

Table 3. Factors associated with fruit intake (cont).

VARIABLE	CATEGORY	a/n	OR adjusted (95% CI)	p
Family structure	Biparental	237/359	1(ref.)	.
	Single parent	10/14	1.39 (0.40-4.88)	0.608
	Divorced/separated	28/41	1.06(0.49-2.30)	0.869
Birth order	First born	73/101	1(ref.)	.
	Second born	117/185	0.81 (0.43-1.51)	0.509
	Third born or later	16/25	0.54 (0.19-1.52)	0.241
Number of siblings	No siblings	69/102	1(ref.)	
	One sibling	175/264	0.95 (0.56-1.61)	0.850
	Two siblings	25/40	0.86 (0.37-1.98)	0.728
	>Two siblings	5/7	0.35 (0.04-2.81)	0.324
Place of main meal	With their parents	175/261	1(ref.)	.
	At school	107/156	0.91 (0.54-1.51)	0.702
	Other	19/34	0.52 (0.23-1.16)	0.110
Use of screens per day	<90min	219/316	1(ref.)	.
	>90 min	80/135	0.65 (0.40-1.04)	0.075
Breastfeeding at 6 months	Breastfeeding	101/123	1(ref.)	.
	Mixed (breastfeeding and infant formula)	55/92	0.29 (0.13-0.62)	0.002
	Infant formula only	130/209	0.27 (0.14-0.53)	<0.001

Adjusted for: child's age, birth weight, maternal age, breastfeeding type, and kindergarten attendance

Table 4. Factors associated with o Ultra-processed Food (UPF) Consumption

VARIABLE	CATEGORY	a/n	OR adjusted (95% CI)	p
Mother's age mean (DE)			1.04 (0.98-1.09)	0.175
Children's sex	Female	65/219	1(ref.)	
	Male	87/237	1.38 (0.89-2.14)	0.156
Mother's BMI	Normal weight	68/224	1(ref.)	.
	Overweight	25/80	0.78 (0.42-1.48)	0.460
	Obesity	29/69	1.24 (0.67-2.31)	0.499
Father's BMI	Normal weight	45/157	1(ref.)	*ptrend: 0.236*
	Overweight	43/140	1.11 (0.63-1.95)	0.725
	Obesity	29/65	1.78 (0.91-3.51)	0.096
Mother's educational level	Basic studies	17/41	1(ref.)	.
	Secondary studies	72/183	1.24 (0.53-2.89)	0.614
	University studies	62/226	0.82 (035-1.93)	0.646
Father's educational level	Basic studies	37/110	1(ref.)	.
	Secondary studies	68/190	1.30 (0.72-2.32)	0.382
	University studies	40/134	1.07 (0.55-2.07)	0.850
Mother's income	Low economic level(<1300euros)	85/223	1(ref.)	.
	Medium economic level (1300 to <2700euros)	48/184	0.57(0.35-0.92)	0.021
	Hight economic level (>2700euros)	5/19	0.72(0.23-2.23)	0.571
	Doesn't know/ doesn't answer	4/13	0.76 (0.21-2.76)	0.679
Father's income	Low economic level(<1300euros)	35/107	1(ref.)	.
	Medium economic level (1300 to <2700euros)	89/266	1.05(0.61-1.79)	0.870
	Hight economic level (>2700euros)	11/38	0.85(0.34-2.14)	0.733
	Doesn't know/ doesn't answer	11/27	1.84(0.34-2.14)	0.260
Global family income	Low economic level(<1300euros)	85/223	1(ref.)	.
	Medium economic level (1300 to <2700euros)	48/184	0.95(0.53-1.73)	0.873
	Hight economic level (>2700euros)	5/19	1.01 (0.42-2.39))	0.988
	Doesn't know/ doesn't answer	4/13	1.50 (0.58-3.88)	0.404
Family's pharmaceutical contribution	TSI1- TSI2	18/46	1(ref.)	.
	TSI3	72/192	0.94 (0.45-1.99)	0.881
	TSI4	58/195	0.73 (0.34-1.56)	0.416
	TSI5-NOFAR	0/5	1.00 (1.00-1.00)	.
	TSI6	4/16	0.75 (0.19-2.92)	0.675

Table 4. Factors associated with o Ultra-processed Food (UPF) Consumption (cont)

VARIABLE	CATEGORY	a/n	OR adjusted (95% CI)	p
Family structure	Biparental	121/359	1(ref.)	
	Single parent	4/14	0.64 (0.19-2.20)	0.477
	Divorced/separated	13/41	0.93 (0.44-2.01)	0.863
Birth order	First born	30/101	1(ref.)	
	Second born	68/185	1.39(0.76-2.52)	0.287
	Third born or later	10/25	2.13(0.77-5.88)	0.146
Number of siblings	No siblings	28/102	1(ref.)	p *trend:* 0.030
	One sibling	92/264	1.60 (0.94-2.74)	0.084
	Two siblings	15/40	2.18(0.94-5.05)	0.068
	>Two siblings	3/7	3.27(0.39-27.40)	0.275
Place of main meal	With their parents	88/261	1(ref.)	
	At school	47/156	0.80(0.49-1.32)	0.391
	Other	17/35	1.84 (0.82-4.10)	0.138
Use of screens per day	<90min	87/316	1(ref.)	
	>90 min	62/135	2.49 (1.55-4.01)	<0.001
Breastfeeding at 6 months	Brestfeeding	31/123	1(ref.)	
	Mixed (breastfeeding and infant formula)	27/92	1.33(0.87-2.41)	0.443
	Infant formula only	89/210	2.57 (1.41-4.67)	0.002

Adjusted for: child's age, birth weight, maternal age, breastfeeding type, and kindergarten attendance

Table 5: Association Between Parental BMI and Child's BMI Status

		Child BMI Status		
		BMI<p95	BMI >=p95	p
Mother's BMI (mean (DE))		24.73(4.86)	26.66(5.86)	0.01
Mother's BMI	Normal weight	109(64.12)	28(48.28)	0.07
	Overweight	34(20.00)	14(24.14)	
	Obesity	27(15.88)	16(27.59)	
Father's BMI (mean (DE))		26.30(4.02)	27.34(4.34)	0.09
Father's BMI	Normal weight	80(48.19)	19(33.93)	0.176
	Overweight	57(34.34)	25(44.64)	
	Obesity	29(17.47)	12(21.43)	

DISCUSSION

The main objective of this study was to assess how individual and socioeconomic factors affect children's diet quality. Our results showed that higher socioeconomic status was associated with greater adherence to the Mediterranean diet and higher daily fruit consumption Regarding individual factors, it was found that breastfeeding at 6 months of age was associated with higher adherence to Mediterranean diet, higher fruit consumption and lower intake of ultra-processed- foods. In contrast, sedentary behavior (defined as more than 90min of screens per day) was associated with higher ultra-processed food consumption and less adherence to Mediterranean diet and fruit consumption.

Although existing research have shown the positive impact of family meals on diet quality, we have not found any association between family-related characteristics (family structure and where meals are eaten) and any of the three factors analyzed (Mediterranean diet, fruit intake, and UPFs). Gillman et al. found that children who ate with their families more often had higher intakes of fruits and vegetables, and therefore more fiber, calcium, folate, iron, and vitamins B6, B12, and E. They also consumed less fat—especially trans and saturated fats—fewer soft drinks, and had a lower glycemic load(18).

MEDITERRANEAN DIET ADHERENCE

The Mediterranean diet is globally recognized and extensively studied for its health benefits. It is defined by a diverse range of foods, including extra-virgin olive oil, legumes, grains, nuts, fruits, vegetables, dairy, fish, and, for adults, moderate wine consumption(19).

Previous research, supported by more recent studies, has provided strong evidence of the Mediterranean diet's positive impact on health. If acquired from the earliest stage of life, this food model contributes, together with a correct lifestyle, to maintain an optimal health status even in adulthood(20). Mediterranean diet adherence is associated with a lower ADHD diagnosis(21), lower obesity (22), better sleep quality (23) and less inflammatory mediators of asthma in children(24).

Moreover, acquiring this diet in early childhood contributes to a decrease in the occurrence of cardiovascular events and related risk factors such as obesity, high blood pressure, metabolic syndrome, unhealthy lipid levels and development of diabetes. In long-term studies, following the Mediterranean diet was associated with a reduction in mortality, particularly from cardiovascular causes, leading to increased lifespan. Additionally, it has been connected to a lower risk of age-related cognitive decline and a reduced incidence of neurodegenerative diseases, especially Alzheimer's disease(25).

Despite its benefits, in Spain and other Mediterranean countries, there is a decline in adherence to this diet among both young and adult population(26).

Adherence to the Mediterranean diet can be influenced by a variety of factors, with demographic, social and economic aspects playing a significant role. Family dynamics, in particular, can affect children's dietary habits and nutritional well-being. Children are considered a vulnerable and often under-researched group

in relation to this subject, highlighting the importance of studying how these factors influence their adherence to the Mediterranean Diet(27).

In our study it was found that socioeconomic factors including paternal education, paternal and maternal income and global household income played an important role in children optimal adherence to Mediterranean diet. This may be explained by the fact that some of the food which is included in the Mediterranean diet such us olive oil, fish and lean meat are quite expensive and make it less affordable for families with lower income. In a study performed in Brazil it was found that among the food subgroups, the highest prices were found in vegetables, fresh fish, and alcoholic beverages, followed by sugar-sweetened beverages, canned foods, and fresh meats(28).

In a study performed in children living in small Southern Italian villages it was also found that the adherence to Mediterranean diet was associated with the educational level of the mother and the occupational status of both parents (29). Similarly, in a study performed in Logroño(Spain) in order to evaluate different factors influencing Mediterranean diet adherence in children from northern Spain it was found that children who attended state schools, immigrants and those from families with a medium-to-low socio-economic status were less likely to follow the diet(30).

Further evidence comes from a Portuguese study demonstrating that lower income levels were associated with a low adherence to the Mediterranean Diet. After adjusting for sex, age, education, employment status, and NUTS II region, participants reporting greater financial difficulty were less likely to consume at least 4 tablespoons of olive oil per day, to consume 2 or more servings of vegetables per day, to consume 3 or more servings of fish/seafood per week and to consume 3 or more servings of nuts per week(31).

Although these studies do not report identical findings (we found association with the father's educational level but not with the mother's), they all concluded that socioeconomic disadvantage is a risk factor for poor adherence to the Mediterranean diet in both children and adults.

When considering individual factors, breastfeeding and sedentary behavior (measured by screens use) were also found to influence this adherence.

The PASOS Study highlights that greater screen time is linked to lower intake of healthy foods like vegetables, legumes, fish, and nuts, while promoting higher consumption of sweets and fast food. This shift in eating habits often results in poor adherence to the Mediterranean Diet. (32).

When talking about breastfeeding, the SENDO project concluded that children who were breastfed for more than 6 months showed nearly 1 point higher on the KIDMED index at age 5 compared to those who were not breastfed. Additionally, they were almost three times more likely to exhibit high adherence to the Mediterranean Diet pattern, with a 9.8% higher proportion of 5-year-olds meeting this dietary pattern among those who were breastfed for at least 6 months compared to those who were not. They also explained that unlike formula milk, the composition of breast milk changes naturally over the months, and both its composition and flavor are influenced by the mother's diet. These characteristics

may help explain why breastfed children tend to be more willing to try new foods and have a higher intake of fruits and vegetables(33).

FRUIT CONSUMPTION

Early childhood is a key stage for forming dietary habits that persist into adulthood(34). Fruits contribute to children's growth and development as they are a good source of energy, protein, iron, calcium, and other essential nutrients. They help strengthen the immune system due to their high content of vitamins and minerals, protecting children from illnesses. Additionally, fruits are low in calories and fat, and high in fiber, which helps prevent childhood obesity. Their regular consumption also reduces the risk of chronic diseases such as heart disease, cancer, and diabetes later in life(35).

In our study, only the father´s income was found to be associated with a daily fruit consumption. Although parental educational attainment did not reach statistical significance, a significant trend was observed between the mother's educational level and fruit intake. Specifically, as the mother's level of education increased, so did the likelihood that the child would consume one or more pieces of fruit per day.

The association between maternal educational level and the children fruit consumption was previously found in a USA study examining dietary patterns in infants at 6-and 12-months of age (36). In Portugal, a cross-sectional study also stated that the higher the maternal education, the higher the children's fruit and vegetables consumption in ages 3 to 17(37). Moreover, a study that included 2750 children evaluated at 7 and 10 years old in the Portuguese birth cohort Generation XXI found that higher maternal education level was associated with higher odds of consuming fruit and vegetables at age 10 (38).

Regarding the impact of economic factors on dietary choices, a Brazilian study found that the proportion of fruit and vegetable purchases in total food spending increased when the prices of these items decreased or when household income rose. Specifically, a 1% drop in the price of fruits and vegetables would lead to a 0.79% increase in their share of total food purchases, while a 1% rise in family income would boost their participation by 0.27%. The income effect was less pronounced in higher-income groups. Therefore, they concluded that reducing the cost of fruits and vegetables, could be an effective public policy strategy to promote greater consumption of these foods within the Brazilian population's diet(39).

In our study it was also found an association between breastfeeding and consumption of fruit. These results are in consistent with previous research, including a Brazilian study that examined the relationship between exclusive breastfeeding duration and the consumption of ultra-processed foods, fruit and vegetables in children. That study found that exclusive breastfeeding for less than 4 months was associated with children being in the lowest tercile of fruit and vegetables consumption (40). This association has been observed in several other studies, such as the one from Jane A. Scott et al., which also showed

that breastfeeding duration was associated with intake of fruits and vegetables(41).

In our study, children with more than 90 minutes of daily screen time were 45% less likely to consume fruit each day with the association showing borderline statistical significance. In line with these findings, the Aladino project performed in Spain in children (6-9-year-old), showed that one additional hour of screen time per day was associated with a significantly lower consumption of: “fresh fruit”, “vegetables” and “fish”(42). The lower consumption of fruits and vegetables, which correlates with more screen time, might be due to a substitution effect, as the promotion and availability of high-energy foods compete for attention. This happens despite evidence that shows greater exposure to fruit and vegetable ads is linked to increased consumption of these healthier options(42).

ULTRA-PROCESED FOOD CONSUMPTION

In high-income countries (HICs), ultra-processed foods (UPFs), make up over 60% of daily energy intake. In low- and middle-income countries (LMICs), sales of these products have increased by more than 30% in the past 20 years (43). In the SENDO project, performed in Spain, it was found that the mean consumption of UPF of the 513 children studied was 446.76 g/day, representing 39.9% of the total calories ingested per day(44).

Evidence shows that UPFs negatively affect the diet and health of children and adolescents by replacing breastfeeding, fruits, and vegetables, while increasing the intake of salt, saturated fats, sugars, and simple starches. This leads to unfavorable changes in blood lipid levels and body fat, and an increased risk of overweight, obesity, diabetes, heart disease, stroke, cancer, depression, and overall mortality in adulthood(43).

Our study did not find a linear association between UPF consumption and socioeconomic factors such as family income and parental education. In contrast, several studies show that both lower maternal schooling level and lower income are associated with higher UPF consumption(5)(45). These results may be explained by the fact that people with higher levels of education are more likely to choose healthier foods and have better access to information on nutrition, particularly regarding which foods are best for their children. Moreover, higher household incomes are often linked to higher education levels, which in turn provide more knowledge about healthy eating, better access to nutritional information, and the ability to afford unprocessed foods(46) (47) (5).

When evaluating sedentary behaviors, we found an association with the children screen time and UPF consumption. This relationship might be explained by the exposure to this kind of food advertisement while watching tv, or playing games, as well as by the tendency of children to pay less attention to their food intake when engaged in other activities simultaneously(48) (49) (50).

In a Brazilian study whose aim was to find associations between maternal diet quality and diet quality of preschool children (3-6-year-old) it was found significant differences in the average frequency of food consumption according to household income, mothers schooling level and time of exposure of children to television

and smartphones. When mothers had higher schooling level, more beans and oilseeds children consumed. The consumption of UPFs was higher among children with lower household incomes. Children whose time of exposure to screens was longer or equal to 240 minutes per day presented the highest consumption of UPFs compared with less than 120 minutes per day(5).

Moreover, the Aladino project found that the consumption frequencies of “potato chips and other salty snacks”, “candy bars or chocolate”, “biscuits, cakes, etc.”, “pizza”, “French fries”, hamburgers”, “milkshakes”, “soft drinks containing sugar” and “diet/light soft drinks” were significantly higher in children with high screen time(>2hours per day) (42).

Finally, formula feeding was associated with higher UPF consumption. This finding aligns with results from the SENDO project conducted by the University of Navarra (Spain), which observed that children breastfed for 12 months or more consumed, on average, 59 grams less of ultra-processed foods per day at 4–5 years of age. This represented approximately 5% less of their daily energy intake(33). Other example comes a European study by Lauzon-Guillain et al which came to the conclusion that a longer breastfeeding duration was related to a higher fruit and particularly vegetable intake in young children consistently across 4 European cohorts(51).

ASSOCIATION BETWEEN PARENTS AND CHILDREN ANTHROPOMETRY

In our study, higher maternal BMI was significantly associated with a child’s BMI at or above the 95th percentile, whereas no such association was observed for paternal BMI.

This is consistent with prior research that have reported a significant association between maternal BMI and childhood obesity. One study performed in Chile showed that the BMI of both parents was positively and significantly associated with the BMI of their children. This association was greater in the case of the mother’s BMI. They explained this could be related to the fact that parents serve as role models and transmit behaviors to their children. They also tried to explain the stronger association with the mother’s BMI by the direct effect of the maternal uterine environment on the offspring(52). Moreover, a systematic review and meta-analysis by Wang et al. examining the association between parental and child obesity across countries concluded that children with overweight or obese parents are more than twice likely to be overweight compared to those with normal-weight parents(53).

The importance of all of this lies in the fact that childhood obesity, is becoming more common and severe(54). Childhood and adolescent overweight and obesity can lead to immediate health issues such as high blood pressure, obstructive sleep apnea, and severe COVID-19, as well as long-term problems like adult obesity and an increased risk of early death. Children with obesity are three times more likely to die prematurely compared to those with a healthy weight(55).

LIMITATIONS AND STRENGTHS

Our study has several limitations that should be acknowledged. Firstly, socioeconomic status is measured differently across studies, with various indicators and composite variables used, making cross-study comparisons somewhat limited. Acknowledging this variability, we opted not to create a single composite measure. Rather, we examined parents´ educational level and income separately to explore their associations with their children´s diet quality.

Secondly, several variables in our study, such as - parental weight, screen time, UPF consumption and fruit consumption, as well as adherence to the Mediterranean diet- were obtained through self-reported questionaries. Although self-assessed data can introduce classification bias due to several factors such as social desirability or recall inaccuracies, this potential limitation may have a minimal impact on our findings for several reasons. On the one hand, this type of questionnaire is frequently used in epidemiological research and have been validated in similar populations, providing a reasonable degree of reliability(56). On the other hand, the inclusion of multiple indicators and consistency in administration across participants helps to mitigate the effects of individual inaccuracies, allowing us to draw meaningful conclusions from the observed patterns.

Finally, our study did not account for parental dietary habits when assessing children's diet, which could be considered a potential confounding factor. Previous studies have indicated that parents´ eating behaviors can influence their children's diets. For instance, one study performed in the USA showed a positive association between parents' and children's fruit and vegetable intake among African American families (57). However, the impact on our study's findings may be limited. A meta-analysis performed at Johns Hopkins University reviewed 24 studies and concluded that the overall resemblance between parents´ and their children's diet was weak, with average correlation coefficients around 0,2(58).

Despite the limitations discussed above, this study has several strengths. A major strength lies in the identification and adjustment for key potential confounding factors, including child's age and birth weight, maternal age, breastfeeding duration and kindergarten attendance. These factors have been previously associated with children dietary behaviors such as the adherence to Mediterranean diet, UPF and fruit consumption. By adjusting these covariates, we aimed to isolate the independent associations of interest, thereby increasing the internal validity of our findings.

Furthermore, while parents' weight was obtained through self-reported questionaries, children's anthropometric data were collected through direct, in-person measurements by trained personnel. This methodological choice enhances the reliability of the data on children's weight and height, minimizing measurement error and reducing the potential classification bias. As a result, the associations involving children's BMI in our study are based on objective measurement, strengthening the validity of our findings.

Additionally, attending to the previously mentioned limitations regarding the socioeconomic status variable, we adopted an alternative approach that enhances the study's robustness. We separately examined parental educational

level, work status and income. This allowed us to identify which individual socioeconomic indicator showed the strongest relationship with the dietary outcomes. Thus, our approach provides a more refined understanding of how different socioeconomic dimensions contribute to differences in children's diet.

Moreover, as highlighted in the introduction, there is a notable scarcity of research examining the interaction between various socioeconomic factors and the dietary habits of first-grade children in northern Spain. Consequently, our study contributes to expanding the understanding of the factors that affect children's diet and by extension, the overall health status within this population. Finally, it is important to highlight that this study is based on a cross-sectional analysis drawn from a cohort that has been tracked since birth. Ongoing follow-up and data collection may improve our ability to detect temporal patterns and offer deeper insights into how socioeconomic factors influence children's dietary habits over time.

CONCLUSION

This study main objective was to explore the influence of various socioeconomic and individual factors on the diet quality among first-grade children in northern Spain. The findings reveal that higher levels of parental education and higher household income are associated with a greater adherence to the Mediterranean diet and a higher daily fruit consumption and lower UPF consumption. Additionally, when talking about individual factors, breastfeeding was positively linked to healthier children dietary patterns, while increased screen time was associated with poorer diet quality.

These results have important implications for public health strategies in order to improve childhood nutrition, particularly in socioeconomically disadvantaged populations. Moreover, this study provides an opportunity for continued follow-up and future data collection which will provide the opportunity to enhance understanding of how dietary patterns evolve and what factors tend to influence them over time and also how these dietary patterns impact on their health in a long term, contributing to the development of more effective prevention and early intervention strategies.

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REFERENCES

1. Tarro S, Lahdenperä M, Vahtera J, Pentti J, Lagström H. Diet quality in preschool children and associations with individual eating behavior and neighborhood socioeconomic disadvantage. The STEPS Study. Appetite. 1 de mayo de 2022;172:105950.

2. Silva GAP, Costa KAO, Giugliani ERJ. Infant feeding: beyond the nutritional aspects. Jornal de Pediatria. mayo de 2016;92(3):S2-7.

3. Granziera F, Guzzardi MA, Iozzo P. Associations between the Mediterranean Diet Pattern and Weight Status and Cognitive Development in Preschool Children. Nutrients. noviembre de 2021;13(11):3723.

4. Longo-Silva G, Silveira JAC, Menezes RCE de, Toloni MH de A. Age at introduction of ultra-processed food among preschool children attending day-care centers. J Pediatr (Rio J). 2017;93(5):508-16.

5. de Bona Coradi F, Anele CR, Goldani MZ, da Silva CH, Bernardi JR. Maternal diet quality and associations with body composition and diet quality of preschool children: A longitudinal study. PLoS One. 2023;18(5):e0284575.

6. Williams AS, Ge B, Petroski G, Kruse R, McElroy JA, Koopman RJ. Socioeconomic Status and Other Factors Associated with Childhood Obesity. J Am Board Fam Med. 2018;31(4):514-21.

7. Cunningham SA, Kramer MR, Venkat Narayan KM. Incidence of Childhood Obesity in the United States. N Engl J Med. 30 de enero de 2014;370(5):403-11.

8. Liang J, Matheson BE, Kaye WH, Boutelle KN. Neurocognitive correlates of obesity and obesity-related behaviors in children and adolescents. Int J Obes (Lond). abril de 2014;38(4):494-506.

9. Bjornstad P, Chao LC, Cree-Green M, Dart A, King M, Looker HC, et al. Youth-onset type 2 diabetes mellitus: an urgent challenge. Nat Rev Nephrol. marzo de 2023;19(3):168-84.

10. Shah AS, Nadeau KJ, Dabelea D, Redondo MJ. Spectrum of Phenotypes and Causes of Type 2 Diabetes in Children. Annu Rev Med. 27 de enero de 2022;73:501-15.

11. Scaglioni S, De Cosmi V, Ciappolino V, Parazzini F, Brambilla P, Agostoni C. Factors Influencing Children's Eating Behaviours. Nutrients. junio de 2018;10(6):706.

12. Darmon N, Drewnowski A. Does social class predict diet quality?1. The American Journal of Clinical Nutrition. 1 de mayo de 2008;87(5):1107-17.

13. Tarro S, Lahdenperä M, Vahtera J, Pentti J, Lagström H. Parental feeding practices and child eating behavior in different socioeconomic neighborhoods and their association with childhood weight. The STEPS study. Health & Place. 1 de marzo de 2022;74:102745.

14. Pereira-da-Silva L, Rêgo C, Pietrobelli A. The Diet of Preschool Children in the Mediterranean Countries of the European Union: A Systematic Review. International Journal of Environmental Research and Public Health. junio de 2016;13(6):572.

15. development_content_validity_physical_activity_questionnaire_young_children_paq_

yc_assess_physical_activity_children_between_5_and_7_years_2021_material_suplementari.pdf [Internet]. [citado 4 de mayo de 2025]. Disponible en: https://scientiasalut.gencat.cat/bitstream/handle/11351/6854/development_content_validity_physical_activity_questionnaire_young_children_paq_yc_assess_physical_activity_children_between_5_and_7_years_2021_material_suplementari.pdf

16. Monteiro CA, Cannon G, Levy RB, Moubarac JC, Louzada ML, Rauber F, et al. Ultra-processed foods: what they are and how to identify them. Public Health Nutr. abril de 2019;22(5):936-41.

17. Altavilla C, Caballero-Pérez P. An update of the KIDMED questionnaire, a Mediterranean Diet Quality Index in children and adolescents. Public Health Nutr. octubre de 2019;22(14):2543-7.

18. Gillman MW, Rifas-Shiman SL, Frazier AL, Rockett HR, Camargo CA, Field AE, et al. Family dinner and diet quality among older children and adolescents. Arch Fam Med. marzo de 2000;9(3):235-40.

19. KIANI AK, MEDORI MC, BONETTI G, AQUILANTI B, VELLUTI V, MATERA G, et al. Modern vision of the Mediterranean diet. J Prev Med Hyg. 17 de octubre de 2022;63(2 Suppl 3):E36-43.

20. Grassi T, Bagordo ,Francesco, Panico ,Alessandra, De Giorgi ,Mattia, Idolo ,Adele, Serio ,Francesca, et al. Adherence to Mediterranean diet of children living in small Southern Italian villages. International Journal of Food Sciences and Nutrition. 18 de mayo de 2020;71(4):490-9.

21. Ríos-Hernández A, Alda JA, Farran-Codina A, Ferreira-García E, Izquierdo-Pulido M. The Mediterranean Diet and ADHD in Children and Adolescents. Pediatrics. febrero de 2017;139(2):e20162027.

22. López-Gil JF, García-Hermoso A, Sotos-Prieto M, Cavero-Redondo I, Martínez-Vizcaíno V, Kales SN. Mediterranean Diet-Based Interventions to Improve Anthropometric and Obesity Indicators in Children and Adolescents: A Systematic Review with Meta-Analysis of Randomized Controlled Trials. Adv Nutr. julio de 2023;14(4):858-69.

23. Scoditti E, Tumolo MR, Garbarino S. Mediterranean Diet on Sleep: A Health Alliance. Nutrients. 21 de julio de 2022;14(14):2998.

24. Douros K, Thanopoulou MI, Boutopoulou B, Papadopoulou A, Papadimitriou A, Fretzayas A, et al. Adherence to the Mediterranean diet and inflammatory markers in children with asthma. Allergol Immunopathol (Madr). 2019;47(3):209-13.

25. Guasch-Ferré M, Willett WC. The Mediterranean diet and health: a comprehensive overview. Journal of Internal Medicine. 2021;290(3):549-66.

26. Iaccarino Idelson P, Scalfi L, Valerio G. Adherence to the Mediterranean Diet in children and adolescents: A systematic review. Nutrition, Metabolism and Cardiovascular Diseases. abril de 2017;27(4):283-99.

27. Acito M, Valentino R, Rondini T, Fatigoni C, Moretti M, Villarini M. Mediterranean Diet Adherence in Italian Children: How much do Demographic Factors and Socio-Economic Status Matter? Matern Child Health J. 1 de noviembre de 2024;28(11):1861-9.

28. Claro RM, Maia EG, Costa BV de L, Diniz DP. Preço dos alimentos no Brasil: prefira preparações culinárias a alimentos ultraprocessados. Cad Saúde Pública. 29 de agosto de 2016;32:e00104715.

29. Grassi T, Bagordo ,Francesco, Panico ,Alessandra, De Giorgi ,Mattia, Idolo ,Adele, Serio ,Francesca, et al. Adherence to Mediterranean diet of children living in small Southern Italian villages. International Journal of Food Sciences and Nutrition. 18 de mayo de 2020;71(4):490-9.

30. Arriscado D, Muros JJ, Zabala M, Dalmau JM. Factors associated with low adherence to a Mediterranean diet in healthy children in northern Spain. Appetite. 1 de septiembre de 2014;80:28-34.

31. Mendonça N, Gregório MJ, Salvador C, Henriques AR, Canhão H, Rodrigues AM. Low Adherence to the Mediterranean Diet Is Associated with Poor Socioeconomic Status and Younger Age: A Cross-Sectional Analysis of the EpiDoC Cohort. Nutrients. 15 de marzo de 2022;14(6):1239.

32. Wärnberg J, Pérez-Farinós N, Benavente-Marín JC, Gómez SF, Labayen I, G. Zapico A, et al. Screen Time and Parents' Education Level Are Associated with Poor Adherence to the Mediterranean Diet in Spanish Children and Adolescents: The PASOS Study. J Clin Med. 16 de febrero de 2021;10(4):795.

33. Oliver A. Estudio de la asociación entre la duración de la lactancia materna y la calidad de la dieta en la edad preescolar [Internet]. Universidad de Navarra; 2023 [citado 12 de abril de 2025]. Disponible en: https://hdl.handle.net/10171/69220

34. Hodder RK, O'Brien KM, Tzelepis F, Wyse RJ, Wolfenden L. Interventions for increasing fruit and vegetable consumption in children aged five years and under. Cochrane Database Syst Rev. 25 de mayo de 2020;2020(5):CD008552.

35. Madrid Productores [Internet]. [citado 12 de abril de 2025]. Nutrición infantil y la importancia de la verdura y fruta fresca. Disponible en: https://mercadoproductores.es/nutricion-infantil-consejos-del-nutricionista-infantil/

36. Wen X, Kong KL, Eiden RD, Sharma NN, Xie C. Sociodemographic differences and infant dietary patterns. Pediatrics. noviembre de 2014;134(5):e1387-1398.

37. Vilela S, Muresan I, Correia D, Severo M, Lopes C. The role of socio-economic factors in food consumption of Portuguese children and adolescents: results from the National Food, Nutrition and Physical Activity Survey 2015–2016. British Journal of Nutrition. septiembre de 2020;124(6):591-601.

38. dos Santos Leal K, Pinto da Costa M, Vilela S. Socioeconomic and household framework influences in school-aged children's eating habits: Understanding the parental roles. Appetite. 1 de octubre de 2024;201:107605.

39. Claro RM, Monteiro CA. Family income, food prices, and household purchases of fruits and vegetables in Brazil. Rev Saúde Pública. diciembre de 2010;44:1014-20.

40. Fonseca PC de A, Ribeiro SAV, Andreoli CS, de Carvalho CA, Pessoa MC, de Novaes JF, et al. Association of exclusive breastfeeding duration with consumption of ultra-processed

foods, fruit and vegetables in Brazilian children. Eur J Nutr. 1 de octubre de 2019;58(7):2887-94.

41. Scott JA, Chih TY, Oddy WH. Food Variety at 2 Years of Age is Related to Duration of Breastfeeding. Nutrients. octubre de 2012;4(10):1464-74.

42. Pérez-Farinós N, Villar-Villalba C, López Sobaler AM, Dal Re Saavedra MÁ, Aparicio A, Santos Sanz S, et al. The relationship between hours of sleep, screen time and frequency of food and drink consumption in Spain in the 2011 and 2013 ALADINO: a cross-sectional study. BMC Public Health. 6 de enero de 2017;17:33.

43. Kroker-Lobos MF, Mazariegos M, Guamuch M, Ramirez-Zea M. Ultraprocessed Products as Food Fortification Alternatives: A Critical Appraisal from Latin America. Nutrients. 29 de marzo de 2022;14(7):1413.

44. García-Blanco L, de la O V, Santiago S, Pouso A, Martínez-González MÁ, Martín-Calvo N. High consumption of ultra-processed foods is associated with increased risk of micronutrient inadequacy in children: The SENDO project. Eur J Pediatr. 2023;182(8):3537-47.

45. Drouillet-Pinard P, Dubuisson C, Bordes I, Margaritis I, Lioret S, Volatier JL. Socio-economic disparities in the diet of French children and adolescents: a multidimensional issue. Public Health Nutr. abril de 2017;20(5):870-82.

46. Batalha MA, França AKT da C, Conceição SIO da, Santos AM dos, Silva F de S, Padilha LL, et al. Processed and ultra-processed food consumption among children aged 13 to 35 months and associated factors. Cad Saúde Pública. 21 de noviembre de 2017;33:e00152016.

47. Al-buobayd AA, Al-Otaibi HH, Farag HAS. Association of Maternal Feeding Style with Fruit and Vegetable Consumption in Saudi Preschoolers: A Nationwide Cross-Sectional Study. Nutrients. 9 de noviembre de 2023;15(22):4735.

48. Television Food Advertising to Children: A Global Perspective | AJPH | Vol. 100 Issue 9 [Internet]. [citado 12 de abril de 2025]. Disponible en: https://ajph.aphapublications.org/doi/full/10.2105/AJPH.2009.179267

49. Kelly B, Halford JCG, Boyland EJ, Chapman K, Bautista-Castaño I, Berg C, et al. Television Food Advertising to Children: A Global Perspective. Am J Public Health. septiembre de 2010;100(9):1730-6.

50. Kelly B, Freeman B, King L, Chapman K, Baur LA, Gill T. Television advertising, not viewing, is associated with negative dietary patterns in children. Pediatr Obes. abril de 2016;11(2):158-60.

51. de Lauzon-Guillain B, Jones L, Oliveira A, Moschonis G, Betoko A, Lopes C, et al. The influence of early feeding practices on fruit and vegetable intake among preschool children in 4 European birth cohorts123. The American Journal of Clinical Nutrition. 1 de septiembre de 2013;98(3):804-12.

52. (PDF) Asociación entre índice de masa corporal de padres e hijos (Association between body mass index of parents and children). ResearchGate [Internet]. 22 de octubre de 2024 [citado 1 de abril de 2025]; Disponible en: https://www.researchgate.net/publication/345496001_Asociacion_entre_indice_de_masa

_corporal_de_padres_e_hijos_Association_between_body_mass_index_of_parents_and_children

53. Wang Y, Min J, Khuri J, Li M. A Systematic Examination of the Association between Parental and Child Obesity across Countries123. Adv Nutr. 5 de mayo de 2017;8(3):436-48.

54. Schratz LM, Larkin O, Dos Santos N, Martin C. Caregiver Influences on Eating Behaviors in Children: An Opportunity for Preventing Obesity. Curr Atheroscler Rep. 1 de diciembre de 2023;25(12):1035-45.

55. Oktaviani S, Mizutani M, Nishide R, Tanimura S. Factors associated with overweight/obesity of children aged 6-12 years in Indonesia. BMC Pediatr. 25 de septiembre de 2023;23(1):484.

56. Ranganathan P, Caduff C. Designing and validating a research questionnaire - Part 1. Perspect Clin Res. 2023;14(3):152-5.

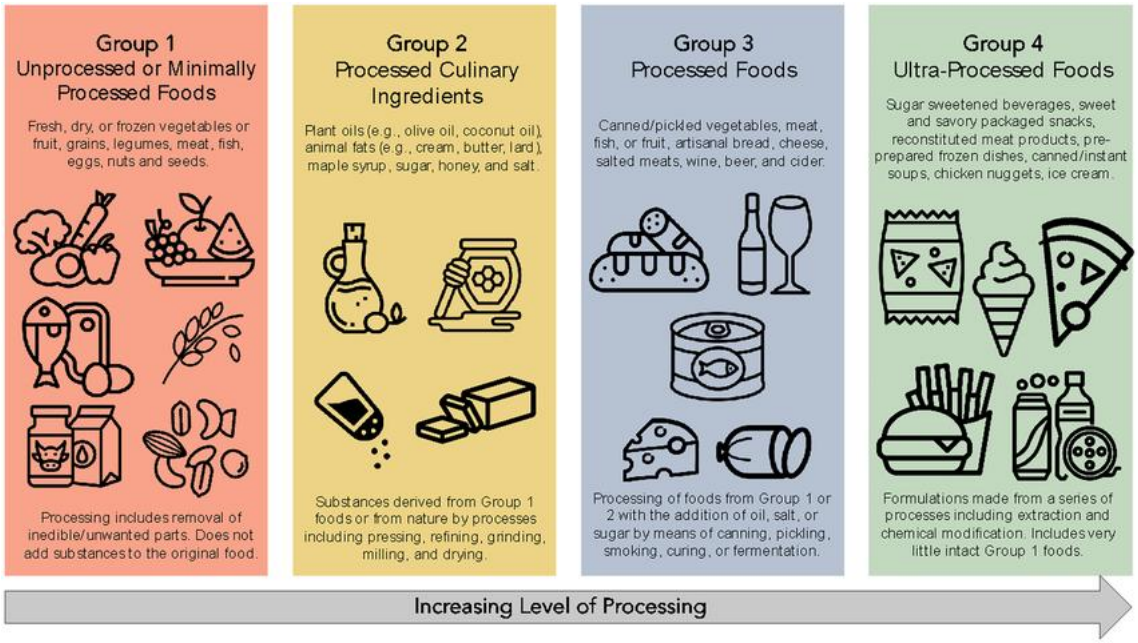
57. Naylor Metoyer B, Chuang RJ, Lee M, Markham C, Brown EL, Almohamad M, et al. Fruit and Vegetable Intake and Home Nutrition Environment among Low-Income Minority Households with Elementary-Aged Children. Nutrients. 10 de abril de 2023;15(8):1819.

58. Wang Y, Beydoun MA, Li J, Liu Y, Moreno LA. Do children and their parents eat a similar diet? Resemblance in child and parental dietary intake: systematic review and meta-analysis. Journal of Epidemiology & Community Health. 1 de febrero de 2011;65(2):177-89.

59. What are ultra-processed foods? What are their effects? [Internet]. [citado 27 de marzo de 2025]. Disponible en: https://prolifehc.com/post/What-are-ultra-processed-foods-What-are-their-effects

ANNEX

ANNEX 1:



NOVA CLASSIFICATION(59)

ANNEX 2:

Update of the KIDMED questionnaire to assess quality of the Mediterranean diet in children and adolescents

Score	Criterion
+1	Takes a fruit every day
+1	Has a second fruit every day
+1	Has fresh or cooked vegetables regularly once per day
+1	Has fresh or cooked vegetables more than once per day
+1	Consumes fish regularly (at least 2–3 times per week)
−1	Goes to a fast-food (hamburger) restaurant more than once per week
+1	Likes pulses and eats them more than once per week
+1	Consumes whole-grain pasta or whole-grain rice almost every day (5 or more times per week)
+1	Has whole cereals or whole-grains (whole-meal bread, etc.) for breakfast
+1	Consumes nuts regularly (at least 2–3 times per week)
+1	Uses olive oil at home
−1	Skips breakfast
+1	Has a dairy product for breakfast (yoghurt, milk, etc.)
−1	Has commercially baked goods or pastries for breakfast
+1	Takes two yoghurts and/or some cheese (40 g) daily
−1	Takes sweets and candy several times every day

KIDMED QUESTIONNAIRE(17)