Is greater adherence to the Mediterranean diet related to higher health-related quality of life among children and adolescents? A systematic review and meta-analysis

Mediterranean diet and health-related quality of life

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ABSTRACT

Background: Adherence to the Mediterranean diet (MedDiet) has been linked to better physical and mental health outcomes. However, its relationship with health-related quality of life (HRQoL) in children and adolescents has not been quantitatively assessed. To examine the association between adherence to the MedDiet and HRQoL in children and adolescents through a systematic review and meta-analysis of observational studies.

Methods: PubMed, Scopus, Web of Science, and Cochrane Library were searched from inception through November 1, 2024. Observational studies assessing the association between MedDiet adherence and HRQoL in participants aged ≤19 years. Only studies using validated tools for both exposure and outcome were included. Two reviewers independently extracted data and assessed study quality using the NHLBI tool. A random-effects model with a restricted maximum likelihood estimator was applied. PRISMA guidelines were followed. The primary outcome was the correlation (r) between MedDiet adherence and HRQoL. **Results:** Twenty-four studies (n = 28,692; mean age = 12.6 years) from ten countries were included. Higher adherence to the MedDiet was associated with better HRQoL (r = 0.22; 95% CI, 0.13 to 0.30; p < 0.001), although effect sizes were modest and heterogeneity was high (I^2 = 99.8%). Subgroup and sensitivity analyses confirmed the robustness of findings across HRQoL domains (e.g., physical, emotional, school-related). Studies with unadjusted models reported stronger associations than those with covariate-adjusted models. **Conclusions:** Greater adherence to the MedDiet is modestly associated with higher HRQoL in children and adolescents. These findings support dietary interventions as a component of youth well-being strategies, although further longitudinal and interventional research is needed.

Keywords: dietary patterns; diet; eating healthy; well-being; quality of life; preschoolers.

1. Introduction

Childhood and adolescence are periods of swift physical, psychological, and social changes in human development[1]. This stage is crucial for forming habits and experiencing vulnerabilities that can influence an individual's health status[2] and health-related quality of life (HRQoL)[3]. HRQoL is a complex, self-perceived measure of well-being and functioning, encompassing physical, emotional, and social aspects of an individual's existence[4, 5]. HRQoL is recognized as more than just an indicator of youth health[6] and is a significant outcome in public health research[7]. Studies have shown that higher HRQoL levels are correlated with increased life satisfaction[8], whereas lower scores are associated with a greater likelihood of suicide-related behaviors in adolescents[9]. Consequently, exploring the connections between modifiable factors and HRQoL in adolescents is highly important for developing targeted interventions aimed at enhancing overall health and well-being[8, 9].

The Mediterranean diet (MedDiet) stands out for its multiple recognized health benefits[10–14]. The MedDiet is based on a high intake of fruits, vegetables, whole grains and legumes; a significant intake of unsaturated fats, mainly from olive oil and nuts; a moderate intake of dairy products, mainly cheese and yogurt; a moderate to low intake of fish and poultry; and a low intake of red meat[15]. Research has indicated that children and adolescents with greater adherence to the MedDiet are more likely to have better physical and mental health outcomes, including lower rates of obesity[13], superior academic performance[16], and better mental health[17] and well-being[18], than those with lower adherence. Similarly, a previous systematic review analyzing 11 studies (10 cross-sectional studies and one longitudinal study) highlighted a connection between greater adherence to the MedDiet and improved HRQoL in children and adolescents[19]. Specifically, five of the examined studies revealed a statistically significant positive relationship between MedDiet adherence and HRQoL in at least one of its dimensions. One study demonstrated this association across all HRQoL dimensions[20], whereas another observed it particularly in adolescents[21].

Several biological pathways may explain the relationship between adherence to the MedDiet and improved HRQoL. The MedDiet is characterized by a high intake of antioxidant-rich foods (fruits, vegetables, olive oil, nuts), anti-inflammatory properties (due to polyphenols, omega-3 fatty acids, and unsaturated fats), and gut microbiota modulation (through fiber-rich foods and fermented dairy)[22]. These dietary components are associated with reduced oxidative stress and systemic inflammation[23], which are known contributors to poor mental health[24]. Furthermore, improved metabolic health[25] (e.g., better glycemic control and a lower risk of obesity) and enhanced neurotransmitter synthesis (via omega-3 fatty acids[26] and B vitamins[27]) may play a role in psychological well-being, which is a key dimension of HRQoL[7]. These mechanisms suggest that adherence to the MedDiet could positively influence various aspects of health, ultimately leading to improved HRQoL.

Recently, multiple new studies have been published highlighting the need to update the evidence on the relationship between adherence to the MedDiet and HRQoL in children and adolescents. While a previous review qualitatively examined this association[19], there is still a lack of quantitative analyses addressing this topic comprehensively. To our knowledge, no previous meta-analysis has investigated the relationship between adherence to the MedDiet and HRQoL in children and adolescents. Therefore, the objective of the present study was to synthetize the evidence concerning the association between adherence to the MedDiet and HRQoL in children and adolescents. By integrating newly available data, this systematic review and meta-analysis provides a comprehensive and up-to-date summary of the most current research on the topic.

2. Materials and methods

The protocol was registered in PROSPERO with the registration number CRD42024573705 and carried out in accordance with the PRISMA 2021 checklist[28].

2.1. Information sources and search strategy

Four electronic databases (PubMed, Scopus, Web of Science, and The Cochrane Library), from inception to November 1st, 2024, were examined by two independent researchers (DV-M and JFL-G). The research strategy was based on the following groups of search terms: (a) preschool*, early*, child*, young*, adolescen*, student*, youth, and teena*; (b) “Mediterranean diet”, “Mediterranean eating pattern”, and “Mediterranean dietary pattern”; and (c) “health-related quality of life”, “quality of life”, “quality of life”, and “HRQoL”. The search terms utilized for each of the mentioned databases can be found in **Supplementary Table 1**, which outlines the specific terms employed during the search process. In addition, a manual search of the reference lists of the included studies and relevant review studies was conducted to guarantee that no eligible studies were overlooked.

2.2. Selection criteria

To be considered eligible for inclusion in this meta-analysis, each study was required to meet the following criteria: (a) population: children and adolescents up to 19 years of age; (b) exposure: adherence to the MedDiet; (c) outcome: HRQoL; and (d) study design: observational studies were included, whereas editorials, abstracts, or congress communications, systematic reviews and/or meta-analyses, narrative reviews, and experimental and qualitative studies were excluded. Studies were also excluded if they considered children and adolescents living with a disability, which could influence the estimated effects.

No restrictions were applied regarding the specific MedDiet adherence or HRQoL assessment tool provided that the instrument was validated. The most commonly used tool for MedDiet adherence was the KIDMED questionnaire, although we also included studies that used the Krece Plus test and Food Frequency Questionnaires (FFQs). For HRQoL, validated instruments such as the KIDSCREEN (versions 10, 27, and 52), PedsQL, SF-36, EQ-5D-L, and EQ-5D-Y were used.

EndNote (version 21.0.1) was utilized to remove duplicate studies after identifying eligible studies in each database. Two researchers (JFL-G and DV-M) evaluated the titles and abstracts of the studies to identify potentially pertinent articles. The complete texts of the final studies selected by both authors were independently assessed for eligibility. In the case of any disagreements, a consensus was reached between the two researchers, or a third researcher (AG-H) served as a tiebreaker.

For two studies in which data of interest were not available, the corresponding authors were contacted. A 100% response rate was achieved in obtaining the requested information[29, 30].

2.3. Data collection process and data items

Data extraction was conducted independently by two researchers (DV-M and JFL-G) to ensure accuracy and reliability. Any discrepancies were discussed between the two, and if a consensus was not reached, a third researcher (AG-H) acted as a tiebreaker. Two researchers (DV-M and JFL-G) extracted the data separately, and the results were then compared via a double-check process.

The extracted data were recorded in a structured database via Microsoft Excel. The selection of variables for extraction followed an iterative process, where key variables (e.g., study design, population characteristics, MedDiet adherence tool, HRQoL measurement tool, effect sizes) were initially identified on the basis of the study objectives. As the extraction progressed, the framework was refined to ensure completeness and consistency across studies. Any modifications to the data extraction strategy were discussed and agreed upon by the research team.

One researcher (DV-M) performed the data extraction process, and a second researcher (JFL-G) verified its accuracy. In cases of disagreement, the two investigators reached a consensus, or a third researcher (AG-H) intervened as above. A librarian reviewed and assessed the accuracy of the search. The data presented below were derived from studies that satisfied the specified selection criteria: author(s), year of publication, country, sample size, mean age, age range, study design, adherence measurement method for the MedDiet, HRQoL indicators, type of respondent, type of adjustment in the analyses, and type of effect size reported. **Supplementary Table 2** displays the excluded studies and reasons for exclusion.

2.4. Outcome measures

HRQoL was evaluated through standardized and validated instruments that assess multiple dimensions, including physical, psychological, and social well-being (among others). Among the most commonly used questionnaires are the Pediatric Quality of Life Inventory (PedsQL) and the KIDSCREEN questionnaire, which are available in 10-, 27-, and 52-item versions and are frequently used to measure HRQoL in children and adolescents. The 36-Item Short Form Survey (SF-36) has also been utilized in some studies of adolescents. Additionally, other instruments, such as the EQ-5D-5L and EQ-5D-Y, have been employed in specific studies, particularly to evaluate younger populations.

Additionally, secondary analyses were conducted to examine the associations between adherence to the MedDiet and specific HRQoL dimensions. These analyses focused on physical, emotional, social, parental, and school-related domains. To ensure consistency across different HRQoL assessment tools, the subdomains from various instruments were systematically recategorized into these five dimensions. A detailed description of this categorization process is provided in **Supplementary Table 3**.

2.5. Assessment of the quality of individual studies

The quality of the studies was evaluated via the Quality Assessment Tool for Observational Cohort and Cross-sectional Studies developed by the National Heart, Lung, and Blood Institute (NHLBI)[31]. This tool consists of 14 items that are classified as "yes", "no", or "not reported", with higher scores indicating greater rigor and higher methodological quality. Two authors (DV-M and JFL-G) independently assessed all the studies, and if needed, a third author (AG-H) was consulted.

2.6. Meta-analysis

All analyses were conducted via R (Version 4.3.0) (R Core Team, Vienna, Austria) and RStudio (Version 2023.03.1) (Posit, Boston, MA, USA) software. For this meta-analysis, Pearson's correlation coefficient (r) was used as the primary measure of effect size.

For cross-sectional studies, the data reported by the original authors were used as provided. For longitudinal studies, we prioritized the use of data from the latest available follow-up assessment. If follow-up data were not available in an extractable format, baseline data were used instead. Whenever studies reported both adjusted and unadjusted results, we prioritized the adjusted estimates to ensure comparability across studies. The specific variables included in the adjustments were recorded in an additional column in the extracted dataset.

We applied standardized formulas[32–34] to convert other statistical measures (e.g., unstandardized regression coefficients [B], standardized regression coefficients (β), mean differences (Δ), odds ratios (ORs), or categorical variable distributions (i.e., chi-square [χ^2] tests) into *r values*. A random-effects inverse variance model with a restricted maximum likelihood estimator was applied to calculate the overall effect size estimate and its corresponding 95% confidence intervals (CIs).

To address the expected variability among studies, we considered the total variance (Q) and the inconsistency index (I^2)[35]. The I^2 values were classified into three groups: 0% to 40% (might not be important), 30% to 60% (may represent moderate inconsistency), 50% to 90% (may represent substantial inconsistency), and 75% to 100% (considerable inconsistency)[36].

To evaluate small-study effects and publication bias, we utilized funnel plots and conducted Egger's regression test, considering significant bias if $p < 0.05$. Additionally, we performed an influence analysis by recalculating pooled estimates while omitting one study at a time. To assess the impact of potential publication bias, we identified studies classified as potential outliers in the funnel plot. Outliers were defined as studies with effect sizes falling outside the pseudoconfidence limits of the funnel plot, determined as $r \pm 1.96 \times$ standard error. These studies were removed from the sensitivity analysis, and the pooled effect size was recalculated via a random effects model to evaluate their influence on the overall findings. Additionally, pooled estimates were recalculated, omitting one study at a time (i.e., influence analysis) to analyze how individual studies influenced the overall combined correlation coefficients.

Furthermore, stratified analyses were performed to explore variability on the basis of specific factors, including the measurement tools used to assess both MedDiet adherence and HRQoL, country, study design, respondent type, adjustment type, and type of association reported. This approach helped determine whether the observed associations were consistent across different instruments. However, following Cochrane's recommendation to avoid direct comparisons when fewer than 10 studies are available[36], the results are presented only descriptively without statistical comparisons between groups. Finally, mixed-effects meta-regression analyses were conducted to assess whether mean age, mean body mass index, percentage of females in the study, or study publication date influenced the estimates.

3. Results

3.1. Study selection

The PRISMA flow diagram in **Figure 1** shows the number of studies excluded at each stage of the systematic review and meta-analysis. The initial search of the databases yielded 874 studies. Following the process of identifying and removing duplicate entries, as well as considering other relevant factors during screening, 527 studies remained. After the titles and abstracts were reviewed, 473 papers were excluded, and 54 full-text articles were assessed for eligibility. Finally, 24 studies were included in the current systematic review (**Table 1**), and all 24 were also included in the meta-analysis, as they met the inclusion and exclusion criteria. **Supplementary Table 2** provides a list of the reasons for excluding certain items or elements from consideration during the full-text screening.

Figure 1** near here

3.2. Study characteristics

The main characteristics of the 24 studies included in this systematic review[20, 21, 37–58] are shown in **Table 1**. Eleven studies were conducted in Spain[20, 21, 38, 41–43, 46, 49, 51–53, 56], six in Greece[40, 47, 48, 50, 55, 57], one in Portugal[58], one in Turkey[37], one in Chile[39], one in Italy[45], one in Iran[54], one in Lebanon[44], and one in two countries (Spain and Brazil)[56]. Regarding the measurement of adherence to the MedDiet, the Mediterranean Diet Quality Index in children and adolescents (KIDMED) was used in 22 out of the 24 studies[20, 21, 37, 39–53, 55–58]. Only two studies used tools other than KIDMED (i.e., the Krece Plus test in one study[39] and a food frequency questionnaire [FFQ] in another[54]). With respect to quality of life indicators, most studies have employed standardized tools to assess this aspect. Eight studies used the KIDSCREEN-27[38, 46–48, 52, 53, 55, 57], a shorter version of the original KIDSCREEN-52 that retains core dimensions such as physical and psychological well-being. Six studies used the KIDSCREEN-10[21, 39, 41, 42, 53, 58], which provides a global index of HRQoL. Five studies utilized the PedsQL[37, 40, 45, 50, 54], with one specifically using the PedsQL 4.0 to assess physical, emotional, social, and school functioning[54]. Three studies used the EQ-5D-Y[49, 51, 56] to evaluate dimensions such as mobility and anxiety/depression. Additionally, one study used the KIDSCREEN-52[20], the comprehensive original version that covers ten dimensions, and one study used the SF-36[43], a general health survey offering broader quality of life insights. With respect to the study design, all studies were cross-sectional, with the exception of three longitudinal studies (with 12[40] and 24[21, 42] months of follow-up). With respect to sex, all the studies included both boys and girls. With respect to respondent type, HRQoL assessments were primarily self-reported by children or adolescents (20 studies)[20, 21, 38–49, 51–54, 57, 58], whereas in four studies[37, 50, 55, 56], parents or caregivers provided responses. Finally, 16 adjustments were applied for potential confounders[21, 39–43, 45–48, 51, 54–56, 58, 59], whereas eight remained unadjusted[20, 37, 38, 44, 49, 50, 52, 57]. The most common adjustments were for sociodemographic factors (15 studies)[21, 39–43, 45, 47, 48, 51, 54–56, 58, 59], lifestyle behaviors (13 studies)[39–43, 45–48, 54–56, 58], anthropometric variables (12 studies)[21, 40–42, 45, 46, 48, 51, 55, 56, 58, 59], and other psychological factors (two studies)[39, 42]. Details on the specific adjustments applied in each study are provided in **Supplementary Table 4**.

Table 1** near here

For the meta-analysis, a total of twenty-four studies (28,692 children and adolescents from Spain, Greece, Portugal, Italy, Turkey, Chile, Iran, Lebanon, and Brazil) were included. The mean age of the participants was 12.59 ± 1.64 years (range: 2-18 years), with a mean BMI of 24.98 ± 3.62 kg/m² (range: 18.6-31.37 kg/m²) (when reported). Sample sizes across studies ranged from 114 to 5188 participants. Twenty-one of the 24 studies reported results adjusted for other covariates[20, 21, 37, 40–42, 44–58], whereas three studies presented unadjusted results[38, 39, 43].

3.3. Assessment of the quality of individual studies

The results of the quality assessment are presented in **Supplementary Table 5**. All studies met the criteria for questions one (i.e., research question), two (i.e., study population), four (i.e., groups recruited from the same population and uniform eligibility criteria), seven (i.e., sufficient timeframe to see an effect), eight (i.e., different levels of the exposure of interest), nine (i.e., exposure measures and assessment), and eleven. None of the studies met the criteria for question twelve (i.e., blinding of outcome assessors). Additionally, 22 out of 24 studies[20, 37–39, 41–58] (91.7%) did not meet the criteria for question ten (i.e., repeated exposure assessment), and 15 out of 24 studies[20, 21, 39–45, 49, 52, 53, 55, 56, 58] (62.5%) did not meet the criteria for question five (i.e., sample size justification). Criteria six (i.e., exposure assessed prior to outcome measurement) and thirteen (i.e., loss to follow-up of 20% or less) were applicable only to longitudinal studies[21, 40]. Furthermore, three studies[38, 39, 43] (12.5%) did not meet the criteria for question fourteen (i.e., adjustment for key potential confounders), and one study[55] (4.2%) did not meet the criteria for question three (i.e., participation rate of at least 50%).

3.4. Synthesis of results of the meta-analysis

The associations between adherence to the MedDiet and HRQoL are shown in **Figure 2**. Higher adherence to the MedDiet was modestly associated with higher HRQoL among children and adolescents ($r = 0.22$, 95% confidence interval [CI] 0.13 to 0.30, $p < 0.001$), although with considerable heterogeneity ($I^2 = 99.8\%$, $p < 0.001$). Egger's test indicated funnel plot asymmetry ($p < 0.001$) (**Supplementary Figure S1**). A sensitivity analysis excluding studies outside the pseudoconfidence limits ($n = 15$) revealed that the recalculated pooled effect size remained statistically significant ($r = 0.20$, 95% CI 0.17 to 0.24, $p < 0.001$), with minimal change (**Supplementary Figure S2**). Heterogeneity was reduced after these studies were excluded ($I^2 = 63.4\%$, $p < 0.001$). In addition, Egger's test no longer indicated significant asymmetry ($p = 0.549$), suggesting that there was no strong evidence of publication bias (**Supplementary Figure S3**). Given the robustness of the findings, all studies were retained to ensure a comprehensive synthesis of the available evidence. Finally, influence analysis confirmed that omitting individual studies did not alter the overall results ($p < 0.001$ in all cases) (**Supplementary Figure S4**).

*****Figure 2** near here***

Table 2 presents the results of the meta-analyses conducted for each HRQoL domain. The analysis included between seven and nine studies per domain. The highest correlation was observed in the parental relations domain (r = 0.20; 95% CI 0.10 to 0.31; p = 0.002). The association with the school environment was also notable (r = 0.23; 95% CI 0.09 to 0.37; p = 0.001). Physical well-being was significantly associated (r = 0.21; 95% CI 0.09 to 0.33; p = 0.001), whereas emotional well-being (r = 0.19; 95% CI 0.06 to 0.32; p = 0.004) and social well-being (r = 0.19; 95% CI 0.05 to 0.33; p = 0.009) also demonstrated positive associations. All the domains exhibited substantial heterogeneity, as indicated by high I^2 values, ranging from 91.6% (parental relations) to 98.7% (social well-being).

Table 2** near here

Furthermore, meta-regression analyses did not reveal a moderating effect as a function of mean age (B = –0.003, p = 0.859), mean body mass index (B = –0.011, p = 0.061), percentage of females included in the study (B = 0.018, p = 0.224), or publication date (B = 0.001, p = 0.959) (**Table 3**).

Table 3** near here

Table 4 presents the stratified analyses based on the MedDiet adherence tool, HRQoL assessment tool, country, study design, respondent type, adjustment type, and type of association reported. Studies using the KIDMED tool revealed an association of r = 0.21 (95% CI 0.12--0.30), whereas the PedsQL tool reported r = 0.26 (95% CI 0.02--0.50) and the KIDSCREEN-27 tool reported r = 0.17 (95% CI 0.13--0.22). Country-specific analyses revealed similar associations of r = 0.25 (95% CI 0.11--0.39) in Spain and r = 0.21 (95% CI 0.04--0.37) in Greece, with both indicating a positive relationship between MedDiet adherence and HRQoL. In terms of study design, cross-sectional studies had an association of r = 0.23 (95% CI 0.14--0.33), whereas longitudinal studies had an association of r = 0.08 (95% CI 0.004--0.15). Stratified results by respondent type indicated that studies with child-reported HRQoL had an association of r = 0.23 (95% CI 0.04 to 0.55), whereas those with parent-reported outcomes had r = 0.08 (95% CI 0.004 to 0.31). When stratified by adjustment type, unadjusted studies showed a stronger association (r = 0.35, 95% CI 0.15 to 0.55) than did adjusted studies (r = 0.15, 95% CI 0.09 to 0.22). Regarding the type of effect size reported, associations ranged from r = 0.12 (95% CI 0.07--0.18) for unstandardized beta coefficients to r = 0.45 (95% CI 0.25--0.66) for mean differences. Across all analyses, substantial inconsistency was observed, with I^2 values ranging from 35.0% to 99.8%.

Table 4 near here

4. Discussion

This review supports the association between higher MedDiet adherence and greater HRQoL, suggesting that dietary quality and specific eating habits may serve as modifiable factors that promote well-being across physical and psychological domains. These findings align with those of Romero-Robles et al.[19], who reported a positive relationship between MedDiet adherence and HRQoL in children and adolescents. Our study builds upon previous research by incorporating a larger number of studies (24 vs. 11 in the previous systematic review[19]) and, for the first time, quantifies this association through meta-analysis, as that review did not include such an analysis. However, most of the included studies were conducted in Mediterranean countries (primarily Spain and Greece). Therefore, this association has been observed mainly within populations where dietary habits, food availability, and cultural factors strongly align with the MedDiet pattern. Given the scarcity of studies in non-Mediterranean regions, we cannot assume that these findings are generalizable to populations where the MedDiet is not a traditional dietary pattern.

In general, the MedDiet encompasses a unique set of dietary patterns (e.g., high consumption of fruits and vegetables, emphasis on whole grains and legumes, and regular consumption of olive oil) that distinguish it from other dietary approaches[10]. These distinctive patterns likely contributed to the results observed in our study. Although the exact mechanisms through which the MedDiet enhances HRQoL remain unclear, the consumption of foods rich in antioxidant compounds, such as polyphenols and fiber—hallmarks of the MedDiet—may confer benefits by mitigating oxidative stress and inflammation[60, 61].

The observed effect sizes for the association between adherence to the MedDiet and HRQoL were small, with considerable inconsistency among the results. Although the effect size observed in this meta-analysis is modest, it aligns with findings in nutritional epidemiology[16, 62], where small associations can still have meaningful public health implications. Moreover, this finding is consistent with previous meta-analyses reporting associations between lifestyle factors (e.g., physical activity, physical fitness) and HRQoL in children and adolescents[63, 64]. Given that HRQoL is a multifactorial construct influenced by numerous variables, even a modest contribution from diet suggests that adherence to the MedDiet may play a role in improving well-being in children and adolescents. Future studies should explore potential synergistic effects with other lifestyle factors and investigate whether long-term adherence to the MedDiet leads to greater cumulative benefits over time.

To obtain deeper insights into the relationship between MedDiet adherence and HRQoL, we conducted secondary analyses focusing on specific HRQoL domains, including physical, emotional, social, parental, and school-related well-being. Our findings indicate that adherence to the MedDiet is positively associated with multiple HRQoL domains[19], with similar effect sizes observed across physical well-being, emotional well-being, social well-being, the school environment, and parental relationships. The observed correlations, although significant, exhibited substantial inconsistency across studies, suggesting that factors such as variations in measurement tools, population differences, and adjustment methods may influence effect sizes. Notably, the high heterogeneity underscores the complexity of HRQoL determinants and the potential role of additional factors beyond dietary adherence. Future research should aim to refine the methodological approaches used to evaluate HRQoL subdomains, ensuring greater consistency in measurement and accounting for key confounders that may drive these associations.

A key methodological consideration in this meta-analysis is the variability in tools used to assess both adherence to the MedDiet and HRQoL, which may contribute to the observed inconsistency. The vast majority of the included studies employed the KIDMED questionnaire, a structured and validated tool specifically designed for children and adolescents. While KIDMED is widely used owing to its ease of administration and ability to classify adherence levels, it relies on yes/no responses, potentially oversimplifying dietary behaviors and failing to capture the quantity and frequency of food intake. Other tools, such as the Krece Plus Test and Food Frequency Questionnaire (FFQ), offer different methodological approaches. The Krece Plus Test, used in one study, is a simpler screening tool that evaluates adherence to dietary recommendations but lacks specificity for Mediterranean dietary patterns, whereas the FFQ provides a more detailed assessment of dietary intake over time but requires extensive food recall, which can be challenging for younger participants. Similarly, HRQoL assessment tools, including the PedsQL, KIDSCREEN-10, KIDSCREEN-27, KIDSCREEN-52, SF-36, EQ-5D-5 L, and EQ-5D-Y, which capture different HRQoL dimensions, vary considerably across studies, potentially leading to variations in reported associations. This methodological diversity complicates direct comparisons and may introduce measurement biases that influence the robustness of the results. Future research should prioritize greater standardization in dietary and HRQoL assessment tools, employing validated instruments to increase comparability across studies and adopting rigorous designs that account for potential biases and confounding variables.

In addition to the variability introduced by different measurement tools, our findings suggest that covariate adjustment may also influence the observed associations. The included studies varied considerably in how they reported associations (e.g., crude estimates vs. adjustments for sociodemographic, lifestyle, or anthropometric factors), which may have influenced the pooled estimates. Other relevant factors related to MedDiet adherence, such as socioeconomic status and parental practices, were also inconsistently considered, potentially affecting the validity of the observed associations. Although we did not conduct formal statistical comparisons due to the limited number of studies per subgroup, we observed a trend where studies that did not adjust for confounders reported stronger correlations, whereas adjusted studies showed more modest associations—a common pattern in epidemiological research[16, 62–64]. This finding reinforces the idea that HRQoL is a multifactorial construct influenced by a range of factors beyond diet alone, including sociodemographic characteristics, lifestyle behaviors, and anthropometric variables, among others. These results highlight the importance of considering adjustment methods in future research to ensure more precise estimations of the relationship between MedDiet adherence and HRQoL while also acknowledging the complexity of factors contributing to overall well-being.

Furthermore, the type of respondent completing the questionnaire may have influenced the results. In most studies, younger children's dietary adherence and HRQoL were assessed through parent-reported questionnaires, whereas older children and adolescents provided self-reports. However, our stratified analyses revealed an association between MedDiet adherence and HRQoL in both reporting groups, with comparable effect sizes. Nevertheless, studies did not always specify whether one or both parents completed the questionnaire, introducing potential variability. The accuracy of dietary and HRQoL reports can vary depending on the respondent. In preschool-aged children, parental reports are generally considered reliable for capturing overall dietary intake, although estimations of portion sizes may be less precise[65]. Among older children, reporting accuracy may be influenced by factors such as age, body mass index, and cognitive ability[66]. Additionally, discrepancies between parent- and child-reported dietary and lifestyle behaviors have been found to range from poor to good agreement, depending on the behavior assessed[67]. Future studies should aim to standardize reporting practices, explore ways to improve measurement consistency, and consider validated assessment methods to minimize potential biases introduced by different respondent types.

Although some degree of publication bias was observed, our sensitivity analyses excluding studies outside the pseudoconfidence limits in the funnel plot confirmed that the pooled effect size remained statistically significant. Additionally, heterogeneity was markedly reduced after their exclusion, and Egger's test no longer indicated significant asymmetry. While we retained these studies to ensure a comprehensive synthesis, future research should incorporate unpublished data and gray literature to better assess and mitigate potential biases in this field. A possible explanation for the observed asymmetry in the funnel plot and Egger's test is sample heterogeneity in adherence to the MedDiet.

Differences in dietary patterns across population subgroups may lead to clustering of effect sizes, particularly if certain groups exhibit either markedly lower or higher adherence, skewing the overall distribution of reported associations. Moreover, sociodemographic factors (e.g., age, socioeconomic status, geographic location) may influence both dietary adherence and study participation, affecting the generalizability of the findings. For example, adolescents in urban areas with greater access to fresh and nutritious foods may report higher adherence, whereas those in regions with food insecurity or limited availability of MedDiet components may show lower adherence[68], contributing to asymmetry. Additionally, cultural influences and individual preferences may lead some children and adolescents to adopt only specific elements of the diet[69]. If adherence varies substantially across key dietary components (e.g., consuming olive oil but avoiding fish), this may result in inconsistent scoring across studies, further influencing the shape of the funnel plot. Beyond sample heterogeneity, other sources of publication bias—such as the selective reporting of positive findings or the tendency for smaller studies with significant results to be published more frequently—could also contribute to asymmetry[70, 71]. Future research should aim to control for these factors, ensuring a more standardized assessment of MedDiet adherence across diverse populations.

The results of this study should be interpreted in light of certain limitations. First, the cross-sectional design of most included studies precludes causal inferences regarding the association between MedDiet adherence and HRQoL. Second, the conversion of diverse effect measures into r may introduce biases and inaccuracies, affecting the precision and interpretability of the meta-analysis results. Third, the high heterogeneity observed likely stems from differences in study populations, MedDiet adherence assessment tools, and HRQoL measurement instruments. Although our stratified analyses identified some contributors to heterogeneity, a portion of the variability remains unexplained, underscoring the need for more standardized methodologies and research on potential moderating factors. Additionally, the limited number of studies in certain categories prevented formal subgroup comparisons, restricting the ability to assess potential effect modifiers. The possibility of publication bias was also noted, but sensitivity analyses confirmed that the pooled effect size remained statistically significant and stable even after excluding outlier studies, with a notable reduction in heterogeneity.

In conclusion, this systematic review and meta-analysis suggests a modest positive association between adherence to the MedDiet and HRQoL in children and adolescents. However, given the observational nature of the included studies and the high heterogeneity observed, the strength of this association remains uncertain. Although our findings provide relevant insights, the inherent limitations of cross-sectional data restrict causal inferences. Given the weak effect sizes and inconsistencies observed, future research should prioritize well-controlled longitudinal and interventional studies, particularly randomized controlled trials, to better understand the directionality of this association, elucidate the underlying mechanisms, and strengthen the evidence base. Additionally, methodological limitations—such as variability in measurement tools and potential publication bias—highlight the need for more rigorous study designs to increase the reliability of findings. Given the psychological implications of HRQoL during childhood and adolescence, promoting adherence to the MedDiet through comprehensive, multifaceted strategies—including educational programs, family involvement, and public health policies—may be beneficial for this population.

Statements and declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Competing interests

All the authors disclose no conflicts of interest related to this work.

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Authors' contributions

JFL-G and DV-M designed the study. JFL-G contributed to the interpretation and analysis of the data. JFL-G wrote of the initial draft. DV-M, YE, SNK and AG-H contributed to the revision of the manuscript. All authors approved the final version of the manuscript.

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Tables

Table 1. Main characteristics of the studies included in the systematic review (N=24).

Authors (year)	Country	Sample (n)	Sex n (% girls)	Mean age (years)	Age range	BMI (kg/m^2)	HRQOL tool	MedDiet indicator	Respondent type	Adjustment type	Effect size reported
Bakırhan et al. (2023)[37]	Turkey	1991	949 (47.7)	12.0	5-18 years	19.4	PedsQL	KIDMED	Parents	Unadjusted	r
Boraita et al. (2020)[38]	Spain	761	378 (49.7)	14.5	12-17 years	21.0	KIDSCREEN-27	KIDMED	Children	Unadjusted	r
Caamaño-Navarrete et al. (2022)[39]	Chile	634	282 (44.5)	12.0	13-16 years	21.6	KIDSCREEN-10	Krece Plus test	Children	Adjusted	β
Costarelli et al. (2013)[55]	Greece	359	193 (53.8)	13.1	13-16 years	19.9	KIDSCREEN-27	KIDMED	Parents	Adjusted	β
Diamantis et al. (2023)[40]	Greece	3153	1539 (48.8)	7.8	6-11 years	NA	PedsQL	KIDMED	Children	Adjusted	OR
Esteban-Gonzalo et al. (2019)[21]	Spain	1233	601 (48.7)	8.5	12-18 years	NA	KIDSCREEN-10	KIDMED	Children	Adjusted	B
Evaristo et al. (2019)[58]	Portugal	956	446 (46.7)	14.5	12-17 years	21.1	KIDSCREEN-10	KIDMED	Children	Adjusted	B
Ferrer-Cascales et al. (2019)[20]	Spain	527	287 (54.5)	14.4	12-17 years	NA	KIDSCREEN-52	KIDMED	Children	Unadjusted	r
Jiménez-López et al. (2023)[41]	Spain	634	361 (56.9)	14.0	12-17 years	22.7	KIDSCREEN-10	KIDMED	Children	Adjusted	B
Juton et al. (2022)[42]	Spain	1371	681 (49.7)	10.1	11-17 years	NA	KIDSCREEN-10	KIDMED	Children	Adjusted	B
Melguizo-Ibáñez et al. (2023)[43]	Spain	1057	510 (48.2)	14.2	11-18 years	NA	SF-36	KIDMED	Children	Adjusted	β
Mitri et al. (2022)[44]	Lebanon	798	376 (47.1)	15	11-14 years	NA	KIDSCREEN-27	KIDMED	Children	Unadjusted	Δ
Mozzillo et al. (2021)[45]	Italy	420	233 (55.5)	14.2	11-13 years	31.4	PedsQL	KIDMED	Children	Adjusted	OR
Muros et al. (2017)[46]	Spain	456	235 (51.5)	12.6	13-17 years	19.8	KIDSCREEN-27	KIDMED	Children	Adjusted	β
Papadaki et al. (2022)[48]	Greece	2081	1052 (50.6)	15.1	12-18 years	21.2	KIDSCREEN-27	KIDMED	Children	Adjusted	B
Papadaki et al. (2022)[47]	Greece	459	232 (50.5)	13.7	12-16 years	20.5	KIDSCREEN-27	KIDMED	Children	Adjusted	β
Pastor et al. (2022)[49]	Spain	305	144 (47.2)	10.6	8-16 years	NA	EQ-5D-5 L	KIDMED	Children	Unadjusted	χ^2
Pavlidou et al. (2023)[50]	Greece	5188	2642 (50.9)	4.1	2-5 years	NA	PedsQL	KIDMED	Parents	Unadjusted	Δ
Ródenas-Munar et al. (2023)[51]	Spain	3534	1829 (51.8)	12.6	8-16 years	20.4	EQ-5D-Y	KIDMED	Children	Adjusted	OR
Rodríguez-Rosado et al. (2020)[52]	Spain	114	57 (50.0)	9.5	8-10 years	18.6	KIDSCREEN-27	KIDMED	Children	Unadjusted	β
Shariati-Bafghi et al. (2022)[54]	Iran	900	477 (53.0)	15.3	13-18 years	NA	PedsQL 4.0	FFQ	Children	Adjusted	Δ
Solera-Sánchez et al. (2021)[59]	Spain	262	125 (47.7)	15.8	15-16 years	NA	KIDSCREEN-10	KIDMED	Children	Adjusted	β
Victoria-Montesinos et al. (2023)[56]	Brazil, Spain	1099	523 (47.6)	11.5	3-18 years	19.1	EQ-5D-Y	KIDMED	Parents	Adjusted	r
Zervaki et al. (2017)[57]	Greece	400	202 (50.5)	15.8	14-17 years	21.7	KIDSCREEN-27	KIDMED	Children	Unadjusted	r

B, unstandardized beta coefficient; β, standardized beta coefficient; Δ, mean difference; r, Pearson's correlation coefficient; χ^2, chi-square test; BMI, body mass index; EQ-5D-5 L, EuroQol-5 Dimension-5 Level; EQ-5D-Y, EuroQol-5 Dimension-Youth; FFQ, Food Frequency Questionnaire; HRQoL, health-related quality of life; KIDMED, Mediterranean Diet Quality Index for children and adolescents; KIDSCREEN-10, KIDSCREEN-10 Questionnaire; KIDSCREEN-27, KIDSCREEN-27 Questionnaire; KIDSCREEN-52, KIDSCREEN-52 Questionnaire; NA, not available; OR, odds ratio; PedsQL, Pediatric Quality of Life Inventory; SF-36, 36-Item Short Form Survey.

Table 2. Meta-analysis of the associations between adherence to the Mediterranean diet and different subdomains of health-related quality of life in children and adolescents.

HRQoL Domain				**95% CI**			
	k	***n***	***r***	**LLCI**	**ULCI**	***p***	I^2
Physical well-being	9	8601	0.21	0.09	0.33	0.001	97.5%
Psychological well-being	9	8601	0.19	0.06	0.32	0.004	98.3%
Social well-being	9	8601	0.19	0.05	0.33	0.009	98.7%
Parents & autonomy	7	3457	0.20	0.10	0.31	<0.001	91.6%
School environment	8	8201	0.23	0.09	0.37	0.001	98.2%

CI, confidence interval; HRQoL, health-related quality of life; *k*, number of observations; LLCI, lower limit confidence interval; *n*, number of participants; SE, standard error; ULCI, upper limit confidence interval.

Table 3. Meta-regression analyses by mean age, mean body mass index, and percentage of girls.

Variable			95% CI		
	k	***B***	**LLCI**	**ULCI**	***p***
Mean age (years)	28	–0.003	–0.036	0.030	0.859
Mean body mass index (kg/m^2)	14	–0.011	–0.022	0.001	0.061
Number of girls (%)	29	0.018	–0.011	0.047	0.224
Publication date (year)	24	0.001	–0.034	0.035	0.959

k, number of observations; LLCI, lower limit confidence interval; MedDiet, Mediterranean diet; SE, standard error; ULCI, upper limit confidence interval.

Table 4. Stratified analysis by adherence to the Mediterranean diet tool, health-related quality of life tool, or type of association reported.

Variable	*k*	***n***	***r***	**LLCI**	**ULCI**	I^2
MedDiet tool						
KIDMED	22	27,158	0.21	0.12	0.30	99.8
Krece Plus Test	1	900	0.05	-0.03	0.13	-
FFQ	1	634	0.54	0.49	0.58	-
HRQoL tool						
KIDSCREEN-27	8	5428	0.17	0.13	0.22	52.9
KIDSCREEN-10	6	5090	0.10	0.06	0.13	35.0
PedsQL	5	11,652	0.26	0.02	0.50	99.6
EQ-5D-5 L	2	3839	0.29	0.01	0.53	96.4
KIDSCREEN-52	1	527	0.94	0.93	0.95	-
SF-36	1	1057	0.27	0.21	0.32	-
EQ-5D-Y	1	1099	0.10	0.04	0.15	-
Country						
Spain	12	10,858	0.25	0.11	0.39	99.8
Greece	6	11,640	0.21	0.04	0.37	99.5
Italy	1	420	0.04	-0.06	0.13	-
Portugal	1	956	0.10	0.03	0.16	-
Turkey	1	1991	0.12	0.08	0.16	-
Chile	1	634	0.05	-0.03	0.13	-
Brazil	1	495	0.14	0.06	0.23	-
Lebanon	1	798	0.24	0.17	0.31	-
Iran	1	900	0.54	0.49	0.58	-
Study design						
Cross-sectional	21	22,935	0.23	0.14	0.33	99.7
Longitudinal	3	5757	0.08	0.004	0.15	85.7
Respondent type						
Children	20	20,055	0.21	0.11	0.30	99.4
Parents	4	8637	0.28	0.08	0.39	99.8
Adjustment type						
Unadjusted	8	11,183	0.35	0.15	0.55	99.8
Adjusted	16	17,509	0.15	0.09	0.22	96.1
Effect size reported						
β	7	3341	0.15	0.08	0.21	79.2
B	5	6275	0.12	0.07	0.18	91.6
r	5	4778	0.30	-0.02	0.62	99.8
Δ	3	6886	0.45	0.25	0.66	97.9
OR	3	7107	0.07	-0.01	0.15	91.6
χ^2	1	305	0.41	0.31	0.50	-

B, unstandardized beta coefficient; β, standardized beta coefficient; Δ, mean differences; χ^2; chi-square test; EQ-5D-5 L, EuroQol-5 Dimensions-5 Levels; EQ-5D-Y, EuroQol-5 Dimensions-Youth; FFQ, Food Frequency Questionnaire; HRQOL, health-related quality of life; *k*, number of observations; KIDMED, Mediterranean Diet Quality Index for children and adolescents; KIDSCREEN-10, KIDSCREEN-10 Questionnaire; KIDSCREEN-27, KIDSCREEN-27 Questionnaire; KIDSCREEN-52, KIDSCREEN-52 Questionnaire; LLCI, lower limit confidence interval; MDS, Mediterranean Diet Score; MedDiet, Mediterranean diet; *n*, number of participants; OR, odds ratio; PedsQL, Pediatric Quality of Life Inventory; *r*, Pearson's correlation coefficient; SF-36, 36-Item Short Form Survey; SE, standard error; ULCI, upper limit confidence interval.

Figure caption

Figure 1. PRISMA 2020 flow chart for systematic reviews that included database searches. HRQoL, health-related quality of life; MedDiet, Mediterranean diet.

Figure 2. Meta-analysis of the association between adherence to the Mediterranean diet and health-related quality of life in children and adolescents. CI, confidence intervals; EQ-5D-5 L, EuroQol-5 Dimensions-5 Levels; EQ-5D-Y, EuroQol-5 Dimensions-Youth; FFQ, Food Frequency Questionnaire; HRQOL, Health-Related Quality of Life; I^2, inconsistency index; KIDMED, Mediterranean Diet Quality Index for children and adolescents; KIDSCREEN-10, KIDSCREEN-27 Questionnaire; KIDSCREEN-52, KIDSCREEN-52 Questionnaire; MedDiet, Mediterranean diet; PedsQL, Pediatric Quality of Life Inventory; r, Pearson's correlation coefficient; SF-36, 36-Item Short Form Survey.

Supplementary Figure S1. Funnel plot showing the relationship between the correlation coefficient (r) and the standard error. Egger's regression test indicates significant asymmetry ($p < 0.001$), which is consistent with the presence of publication bias.

Supplementary Figure S2. Meta-analysis of the associations between adherence to the Mediterranean diet and health-related quality of life in children and adolescents after sensitivity analysis. CI, confidence intervals; EQ-5D-5 L, EuroQol-5 Dimensions-5 Levels; EQ-5D-Y, EuroQol-5 Dimensions-Youth; HRQOL, health-related quality of life; I^2, inconsistency index; KIDMED, Mediterranean Diet Quality Index for children and adolescents; KIDSCREEN-10, KIDSCREEN-10 Questionnaire; KIDSCREEN-27, KIDSCREEN-27 Questionnaire; MedDiet, Mediterranean diet; r, Pearson's correlation coefficient; SF-36, 36-Item Short Form Survey.

Supplementary Figure S3. Funnel plot depicting the relationship between the correlation coefficient (r) and the standard error after sensitivity analysis. Egger's regression test does not indicate significant asymmetry ($p = 0.549$), suggesting no evidence of publication bias.

Supplementary Figure S4. Influence analysis showing the pooled estimates omitting one study at a time. CI, confidence interval; I^2, inconsistency index; r, Pearson's correlation coefficient.

Supplementary material

Supplementary Table S1. Search strategy.

Databases searched until 1st November2024.
Strategy for Web of Science: ALL=((preschool* OR early* OR child* OR young* OR adolesc* OR student* OR youth OR teena*) AND ("Mediterranean diet" OR "Mediterranean eating pattern" OR "Mediterranean dietary pattern") AND ("health-related quality of life" OR "quality of life" OR "life quality" OR "HRQoL")) (All Fields) (No limitations were used).
Results: 316
Strategy for PubMed: ("preschool*"[All Fields] OR "early*"[All Fields] OR "child*"[All Fields] OR "young*"[All Fields] OR "adolesc*"[All Fields] OR "student*"[All Fields] OR ("adolescent"[MeSH Terms] OR "adolescent"[All Fields] OR "youth"[All Fields] OR "youths"[All Fields] OR "youth s"[All Fields]) OR "teena*"[All Fields]) AND ("Mediterranean diet"[All Fields] OR "Mediterranean eating pattern"[All Fields] OR "Mediterranean dietary pattern"[All Fields]) AND ("health-related quality of life"[All Fields] OR "quality of life"[All Fields] OR "life quality"[All Fields] OR "HRQoL"[All Fields]) (No limitations were used).
Results: 188
Strategy for SCOPUS: TITLE-ABS-KEY((preschool* OR early* OR child* OR young* OR adolesc* OR student* OR youth OR teena*) AND ("Mediterranean diet" OR "Mediterranean eating pattern" OR "Mediterranean dietary pattern") AND ("health-related quality of life" OR "quality of life" OR "life quality" OR "HRQoL"))
Results: 288
Strategy for Cochrane: ((preschool* OR early* OR child* OR young* OR adolesc* OR student* OR youth OR teena*) AND ("Mediterranean diet" OR "Mediterranean eating pattern" OR "Mediterranean dietary pattern") AND ("health-related quality of life" OR "quality of life" OR "life quality" OR "HRQoL")):ti, ab, kw
Results: 82

Supplementary Table S2. Excluded studies and reasons for exclusion.

Albaladejo-Blázquez, N., Ferrer-Cascales, R., Ruiz-Robledillo, N., Sánchez-Sansegundo, M., Clement-Carbonell, V., & Zaragoza-Martí, A. (2018). Poor Dietary Habits in Bullied Adolescents: The Moderating Effects of Diet on Depression. International Journal of Environmental Research and Public Health, 15, 1569. https://doi.org/10.3390/ijerph15081569
Reason for exclusion: No comparison between MedDiet and HRQOL.
Andueza, N., Martin-Calvo, N., & Navas-Carretero, S. (2023). The ALINFA Intervention Improves Diet Quality and Nutritional Status in Children 6 to 12 Years Old. Nutrients, 15(10), 2375. https://doi.org/10.3390/nu15102375
Reason for exclusion: No comparison between MedDiet and HRQOL.
Bekelman, T. A., Ringham, B. M., & Sauder, K. A. (2021). Adherence to Index-Based Dietary Patterns in Childhood and BMI Trajectory During the Transition to Adolescence: The EPOCH Study. International Journal of Obesity, 45, 2439–2446. https://doi.org/10.1038/s41366-021-00917-z
Reason for exclusion: No comparison between MedDiet and HRQOL.
Bibiloni, M. D. M., Gallardo-Alfaro, L., Gómez, S. F., Wärnberg, J., Osés-Recalde, M., González-Gross, M., et al. (2022). Determinants of Adherence to the Mediterranean Diet in Spanish Children and Adolescents: The PASOS Study. Nutrients, 14(4), 738. https://doi.org/10.3390/nu14040738
Reason for exclusion: No HRQOL data provided.
Cadenhead, J. W., Martínez-Steele, E., Contento, I., Kushi, L. H., Lee, A. R., Nguyen, T. T. T., et al. (2023). Diet Quality, Ultra-Processed Food Consumption, and Quality of Life in a Cross-Sectional Cohort of Adults and Teens with Celiac Disease. *Journal of Human Nutrition and Dietetics, 36*(4), 1144–1158. https://doi.org/10.1111/jhn.13137
Reason for exclusion: No comparison between MedDiet and HRQOL.
Carpena Lucas, P. J., Jiménez Candel, M. I., Sánchez-Cubo, F., Ceballos-Santamaría, G., Vargas Vargas, M., & Mondéjar Jiménez, J. (2022). Gender Differences in the Development of Childhood Obesity in Young Teenagers in Murcia, Spain. *Pediatrics International, 64*(1), e15065. https://doi.org/10.1111/ped.15065
Reason for exclusion: No comparison between MedDiet and HRQOL.
Delgado-Floody, P., Caamaño-Navarrete, F., Bustos-Barahona, R., González-Rivera, J., & Jerez-Mayorga, D. (2021). The Social and Psychological Health of Children Is Associated with Mediterranean Diet Adherence Items, Cardiorespiratory Fitness, and Lifestyle. *Nutrición Hospitalaria, 38*(5), 954–960. https://doi.org/10.20960/nh.03629.
Reason for exclusion: Duplicated study.
Delgado-Floody, P., Caamaño-Navarrete, F., Carter-Thuillier, B., & Guzmán-Guzmán, I. P. (2022). Negative Physical Self-Concept Is Associated to Low Cardiorespiratory Fitness, Negative Lifestyle, and Poor Mental Health in Chilean Schoolchildren. *Nutrients, 14*(13), 2771. https://doi.org/10.3390/nu14132771
Reason for exclusion: No comparison between MedDiet and HRQOL.
Delgado-Floody, P., Caamaño-Navarrete, F., & Guzmán-Guzmán, I. P. (2019). Food Habits and Screen Time Play a Major Role in the Low Health-Related Quality of Life of Ethnic Ascendant Schoolchildren. *Nutrients, 12*(11), 3489. https://doi.org/10.3390/nu12113489
Reason for exclusion: No comparison between MedDiet and HRQOL.
Diamantis, D. V., Shalit, A., Katsas, K., Zioga, E., Zota, D., Kastorini, C. M., Veloudaki, A., Kouvari, M., & Linos, A. (2023). Improving Children's Lifestyle and Quality of Life through Synchronous Online Education: The Nutritional Adventures School-Based Program. Nutrients, 15, 5124. https://doi.org/10.3390/nu15245124
Reason for exclusion: No comparison between MedDiet and HRQOL.
Ferdous, M. Z., Islam, M. S., Kundu, L. R., Islam, U. S., Banik, R., & Pardhan, S. (2024). Patterns of Eating Behaviors, Physical Activity, and Lifestyle Modifications among Bangladeshi Adolescents during the COVID-19 Pandemic. *PLoS One, 19*(5), e0302571. https://doi.org/10.1371/journal.pone.0302571
Reason for exclusion: No comparison between MedDiet and HRQOL.
Galan-Lopez, P., Domínguez, R., Pihu, M., Gísladóttir, T., Sánchez-Oliver, A. J., & Ries, F. (2019). Evaluation of Physical Fitness, Body Composition, and Adherence to Mediterranean Diet in Adolescents from Estonia: The AdolesHealth Study. *International Journal of Environmental Research and Public Health, 16*(22), 4479. https://doi.org/10.3390/ijerph16224479
Reason for exclusion: No HRQOL data provided.

Galan-Lopez, P., Sánchez-Oliver, A. J., Ries, F., & González-Jurado, J. A. (2019). Mediterranean Diet, Physical Fitness, and Body Composition in Sevillian Adolescents: A Healthy Lifestyle. *Nutrients, 11*(9), 2009. https://doi.org/10.3390/nu11092009
Reason for exclusion: No comparison between MedDiet and HRQOL.
Gürbüz, M., Bayram, H. M., Kabayel, N., Türker, Z. S., & Şahin, Ş. (2024). Association between Breakfast Consumption, Breakfast Quality, Mental Health, and Quality of Life in Turkish Adolescents: A High School-Based Cross-Sectional Study. Nutrition Bulletin, 49(2), 157-167. https://doi.org/10.1111/nbu.12668
Reason for exclusion: Not assessed using MedDiet indicators.
Hahnraths, M. T. H., Winkens, B., & van Schayck, O. C. P. (2023). Effects of School-Based Health-Promoting Activities on Children's Health: A Pragmatic Real-World Study. *Nutrients, 15*(15), 3349. https://doi.org/10.3390/nu15153349
Reason for exclusion: No comparison between MedDiet and HRQOL.
Jiménez Boraita, R., Arriscado Alsina, D., Dalmau Torres, J. M., & Gargallo Ibort, E. (2020). Calidad de Vida Relacionada con la Salud y Hábitos de Vida: Diferencias entre Adolescentes Migrantes y Autóctonos. *Revista Española de Salud Pública, 94*, e202004023.
Reason for exclusion: No comparison between MedDiet and HRQOL.
Jiménez Boraita, R., Gargallo Ibort, E., & Dalmau Torres, J. M. (2022). Quality of Life Related to Health and Habits: Differences Between Adolescents in Rural and Urban Environments. Anales de Pediatría, 96(3), 196-202. https://doi.org/10.1016/j.anpede.2020.11.016
Reason for exclusion: No comparison between MedDiet and HRQOL.
Jiménez Boraita, R., Gargallo Ibort, E., Dalmau Torres, J. M., & Arriscado Alsina, D. (2024). Lifestyle Habits, Health Indicators, and Sociodemographic Factors Associated with Health-Related Quality of Life and Self-Esteem in Adolescents. Clinical Child Psychology and Psychiatry, 29(2), 493-512. https://doi.org/10.1177/13591045231200661
Reason for exclusion: Duplicated study.
Knox, E., & Muros, J. J. (2017). Association of Lifestyle Behaviors with Self-Esteem through Health-Related Quality of Life in Spanish Adolescents. European Journal of Pediatrics, 176(5), 621-628. https://doi.org/10.1007/s00431-017-2886-z
Reason for exclusion: No comparison between MedDiet and HRQOL.
López-Gil, J. F., & García-Hermoso, A. (2022). Adherence to the Mediterranean Diet and Subjective Well-Being among Chilean Children. *Appetite, 172*, 105974. https://doi.org/10.1016/j.appet.2022.105974
Reason for exclusion: No comparison between MedDiet and HRQOL.
Miguel-Berges, M. L., De Miguel-Etayo, P., Larruy-García, A., Jimeno-Martínez, A., & Pellicer, C. (2022). Lifestyle Risk Factors for Overweight/Obesity in Spanish Children. *Children (Basel), 9*(12), 1947. https://doi.org/10.3390/children9121947
Reason for exclusion: No comparison between MedDiet and HRQOL.
Mitri, R. N., Boulos, C., & Ziade, F. (2022). Mediterranean Diet Adherence Among Adolescents in North Lebanon: The Role of Skipping Meals, Meals with the Family, Physical Activity and Physical Well-Being. *British Journal of Nutrition, 128*(7), 1349-1356. https://doi.org/10.1017/S0007114521002269
Reason for exclusion: Duplicated study.
Sangouni, A. A., Vasmehjani, A. A., Ghayour-Mobarhan, M., Ferns, G. A., & Khayyatzadeh, S. S. (2022). The Association Between Dietary Phytochemical Index with Depression and Quality of Life in Iranian Adolescent Girls. Biopsychosocial Medicine, 16(1), 5. https://doi.org/10.1186/s13030-022-00234-5
Reason for exclusion: Not assessed using MedDiet indicators.
Sangouni, A. A., Vasmehjani, A. A., Ghayour-Mobarhan, M., Ferns, G. A., & Khayyatzadeh, S. S. (2024). The Association Between Lifelines Diet Score (LLDS) with Depression and Quality of Life in Iranian Adolescent Girls. *Nutrition Journal, 23*(1), 19. https://doi.org/10.1186/s12937-024-00913-9
Reason for exclusion: Not assessed using MedDiet indicators.
Silva, A. L., Teles, J., & Fragoso, I. (2020). Health-Related Quality of Life of Portuguese Children and Adolescents According to Diet Quality and Food Intake. *Quality of Life Research, 29*(8), 2197-2207. https://doi.org/10.1007/s11136-020-02475-9
Reason for exclusion: Not assessed using MedDiet indicators.
Solera-Sánchez, A., Adelantado-Renau, M., Moliner-Urdiales, D., & Beltran-Valls, M. R. (2021). Health-Related Quality of Life in Adolescents: Individual and Combined Impact of Health-Related

Behaviors (DADOS Study). *Quality of Life Research, 30*(4), 1093-1101. https://doi.org/10.1007/s11136-020-02699-9
Reason for exclusion: No comparison between MedDiet and HRQOL.
Sørensen, L. M. N., Aamodt, G., Brantsæter, A. L., & Meltzer, H. M. (2022). Diet Quality of Norwegian Children at 3 and 7 Years: Changes, Predictors, and Longitudinal Association with Weight. *International Journal of Obesity, 46*(1), 10-20. https://doi.org/10.1038/s41366-021-00951-x
Reason for exclusion: No HRQOL data provided.
Vázquez-Bolea, N., Andueza, N., & Cuervo, M. (2024). A Higher Adherence to the ALINFA Nutritional Intervention Is Effective for Improving Dietary Patterns in Children. *Children (Basel), 11*(5), 559. https://doi.org/10.3390/children11050559
Reason for exclusion: No comparison between MedDiet and HRQOL.
Zapico, A. G., Aparicio-Ugarriza, R., Quesada-González, C., Gómez, S. F., Wärnberg, J., Medrano, M., Gusi, N., Aznar, S., Marín-Cascales, E., González-Valeiro, M. A., et al. (2023). Lifestyle Behaviors Clusters in a Nationwide Sample of Spanish Children and Adolescents: PASOS Study. *Pediatrics Research, 94*(6), 2077-2084. https://doi.org/10.1038/s41390-023-02710-2
Reason for exclusion: No comparison between MedDiet and HRQOL.

Supplementary Table S3. Mapping of health-related quality of life domains and subdomains across different assessment tools.

HRQoL tool	Original subdomain	Post hoc domain
KIDSCREEN-52		
	Physical well-being	Physical well-being
	Psychological well-being	Psychological well-being
	Mood & Emotions	Psychological well-being
	Self-perception	Psychological well-being
	Social support & peers	Social well-being
	Social acceptance	Social well-being
	Parent relations & home life	Parents & autonomy
	Autonomy	Parents & autonomy
	School environment	School environment
KIDSCREEN-27		
	Physical well-being	Physical well-being
	Psychological well-being	Psychological well-being
	Autonomy & parents	Parents & autonomy
	Social support & peers	Social well-being
	School environment	School environment
PedsQL		
	Physical functioning	Physical well-being
	Emotional functioning	Psychological well-being
	Social functioning	Social well-being
	School functioning	School environment
EQ-5D-Y		
	Mobility	Physical well-being
	Pain/discomfort	Psychological well-being
	Anxiety/depression	Psychological well-being
	Self-care	Social well-being
	Usual activities	Social well-being
SF-36		
	Physical functioning	Physical well-being
	Role-physical	Physical well-being
	Mental health	Psychological well-being
	Vitality	Psychological well-being
	Role-emotional	Psychological well-being
	Social functioning	Social well-being
	General health perceptions	Parents & autonomy

EQ-5D-5 L, EuroQol-5 Dimensions-5 Levels; EQ-5D-Y, EuroQol-5 Dimensions-Youth; HRQoL, Health-Related Quality of Life; KIDSCREEN-27, KIDSCREEN-27 Questionnaire; KIDSCREEN-52, KIDSCREEN-52 Questionnaire; PedsQL, Pediatric Quality of Life Inventory; SF-36, 36-Item Short Form Survey.

Supplementary Table S4. Types of adjustment of the studies included in the systematic review (*N*=24).

Authors (year)	Type of adjustment
Bakırhan et al. (2023)[37]	Unadjusted
Boraita et al. (2020)[38]	Unadjusted
Caamaño-Navarrete et al. (2022)[39]	Age, sex, physical activity, sedentary behavior, and self-esteem
Costarelli et al. (2013)[55]	Sex, parental education, body mass index, and family meals
Diamantis et al. (2023)[40]	Age, sex, socioeconomic status, body mass index, and physical activity
Esteban-Gonzalo et al. (2019)[21]	Age, sex, socioeconomic status, and body mass index
Evaristo et al. (2019)[58]	Age, sex, pubertal stage, socioeconomic status, body mass index, sleep duration, and physical fitness
Ferrer-Cascales et al. (2019)[20]	Unadjusted
Jiménez-López et al. (2023)[41]	Age, sex, socioeconomic status, waist circumference, physical activity, sedentary behavior, sleep duration, and energy intake
Juton et al. (2022)[42]	Age, sex, allocation to intervention group, school, parental education, body mass index, physical activity, and baseline HRQoL
Melguizo-Ibáñez et al. (2023)[43]	Sex, alcohol consumption, and tobacco consumption
Mitri et al. (2022)[44]	Unadjusted
Mozzillo et al. (2021)[45]	Parental education, physical activity, and body mass index
Muros et al. (2017)[46]	Physical activity, and body mass index
Papadaki et al. (2022)[48]	Age, sex, parental education, family structure, body mass index, sedentary behavior, and sleep duration
Papadaki et al. (2022)[47]	Sex, socioeconomic status, living with parents, sedentary behavior, and sleep duration
Pastor et al. (2022)[49]	Unadjusted
Pavlidou et al. (2023)[50]	Unadjusted
Ródenas-Munar et al. (2023)[51]	Age, sex, and body mass index
Rodríguez-Rosado et al. (2020)[52]	Unadjusetd
Shariati-Bafghi et al. (2022)[54]	Age, sex, ethnicity, socioeconomic status, physical activity, sedentary behavior, sleep duration, supplement intake, and energy intake
Solera-Sánchez et al. (2021)[59]	Sex, pubertal stage, socioeconomic status, parental educational, and waist circumference
Victoria-Montesinos et al. (2023)[56]	Age, sex, socioeconomic status, body mass index, physical activity, sedentary behavior, and sleep duration
Zervaki et al. (2017)[57]	Unadjusted

HRQoL, health-related quality of life.

Supplementary Table S5. Quality Assessment Tool for Observational Cohort and Cross-sectional Studies developed by the National Heart, Lung, and Blood Institute (NHLBI).

Study	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Overall Bias
Bakırhan et al. (2023)[37]	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Boraita et al. (2020)[38]	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Caamaño-Navarrete et al. (2022)[39]	Yes	Yes	No	Yes	No	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Fair
Costarelli et al. (2013)[55]	Yes	Yes	Yes	Yes	No	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Diamantis et al. (2023)[40]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Fair
Esteban-Gonzalo et al. (2019)[21]	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Good
Evaristo et al. (2019)[58]	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Fair
Ferrer-Cascales et al. (2019)[20]	Yes	Yes	Yes	Yes	No	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Jiménez-López et al. (2023)[41]	Yes	Yes	Yes	Yes	No	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Juton et al. (2022)[42]	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Melguizo-Ibáñez et al. (2023)[43]	Yes	Yes	Yes	Yes	No	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Mitri et al. (2022)[44]	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Mozzillo et al. (2021)[45]	Yes	Yes	Yes	Yes	No	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Muros et al. (2017)[46]	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Papadaki et al. (2022)[48]	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Papadaki et al. (2022)[47]	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Pastor et al. (2022)[49]	Yes	Yes	Yes	Yes	No	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Pavlidou et al. (2023)[50]	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Ródenas-Munar et al. (2023)[51]	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Rodríguez-Rosado et al. (2020)[52]	Yes	Yes	Yes	Yes	No	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Shariati-Bafghi et al. (2022)[54]	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Solera-Sánchez et al. (2021)[59]	Yes	Yes	Yes	Yes	No	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Victoria-Montesinos et al. (2023)[56]	Yes	Yes	Yes	Yes	No	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good
Zervaki et al. (2017)[57]	Yes	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	Yes	No	N/A	Yes	Good

1. **Was the research question or objective in this paper clearly stated?**
2. **Was the study population clearly specified and defined?**
3. **Was the participation rate of eligible persons at least 50%?**
4. **Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?**
5. **Was a sample size justification, power description, or variance and effect estimates provided?**
6. **For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured?**
7. **Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?**
8. **For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)?**
9. **Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?**
10. **Was the exposure(s) assessed more than once over time?**
11. **Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?**
12. **Were the outcome assessors blinded to the exposure status of participants?**
13. **Was loss to follow-up after baseline 20% or less?**
14. **Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?**