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Associations between complementary feeding methods, dietary patterns, and Mediterranean diet adherence in preschool children: the CORALS cohort

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Abstract

Purpose

This study aimed to examine the association between complementary feeding (CF) initiation method and both food group intake and adherence to the MedDiet in preschool children.

Methods

This is a cross-sectional analysis from the Childhood Obesity Risk Assessment Longitudinal Study (CORALS) project. A total of 1296 children aged 3–6 years were included. CF method at the initiation of introduction of solids was classified as traditional spoon-feeding, baby-led weaning (BLW) and mixed method. Dietary intake of food groups was assessed using the COME-Kids Food and Beverage Frequency Questionnaire (F&B-FQ). For the assessment of adherence to the MedDiet, the MED4CHILD questionnaire was used. Principal component analysis (PCA) was performed to derive dietary patterns based on food group intake and linear and logistic regression models were fitted to assess the association between the variables.

Results

Compared with traditional spoon-feeding, both BLW and the mixed method were associated with significantly higher scores in the healthy foods pattern for boys (β: 0.57, 95% CI: 0.24 – 0.91 and β: 0.14, 95% CI: 0.04-0.23, respectively) and girls (β: 0.34, 95% CI: 0.06 – 0.63 and β: 0.09, 95% CI: 0.00 – 0.18, respectively). Sex-specific associations were observed for other dietary patters and intake of foods and beverages. Overall, 65.7% of participants were classified as having adherence to the MedDiet, and no associations were found between CF groups and adherence to the MedDiet.

Conclusion

Compared with traditional spoon-feeding, both BLW and mixed methods were associated with more favourable dietary pattern profiles.

Introduction

Early-life nutrition is considered a key determinant in shaping dietary preferences and eating behaviours later in life. During this critical period, key exposures contribute to the programming of these patterns [1–3]. Although childhood eating behaviours have been associated with diet quality in later stages [4], evidence remains limited regarding whether early feeding practices associate with food intake beyond infancy.

Complementary feeding (CF), typically introduced around six months of age, involves not only the types of foods offered to infants but also the methods of introduction [[1,5,6]. Classification of CF methods is based on the caregiver's role and the texture of the food provided. Traditional spoon-feeding is a

caregiver or parental-led approach in which infants are fed purees and smooth-textured foods [1,7]. In contrast, Baby-Led Weaning (BLW) emerged as a CF approach that emphasizes infant self-feeding and an active role in family meals by allowing them to self-feed whole pieces of food [1,8,9]. Both the BLW method and its modification, Baby-led introduction to solids (BLISS), have gained increasing popularity in recent years [1,7–10].

While some studies have explored how these different CF approaches might relate to oral-motor development or eating behaviours [1,10–12, their longer-term nutritional impact remains unclear. Most research assessing energy and nutrient intake across CF methods has focused on infants aged 6 to 24 months, yielding inconsistent results [10,11,13–16. Evidence on food group consumption, including fruit and vegetable is even more limited and primarily focused on the first two years of life as well [13,17], leaving the mid-term effects of these CF methods on dietary patterns largely unexplored.

The Mediterranean diet (MedDiet) is widely regarded as one of the healthiest dietary patterns [18,19. It is characterized by a high intake of vegetables, fruits, whole grains, legumes, nuts, and seeds; a moderate consumption of dairy products; and a low intake of red meat [20]. This dietary pattern can be promoted from infancy, and evidence suggests that exposure to these food groups during CF may be associated with greater adherence to the MedDiet later in childhood[21]. Early adherence to MedDiet is associated with lower adiposity deposition in children[22].

To date, it remains unknown whether the initial CF method is associated with food group intake beyond infancy and how these practices relate to adherence to overall dietary patterns, including the MedDiet. Therefore, the aim of this study was to examine the association between CF initiation method (traditional spoon-feeding, BLW and mixed method) and food group intake and adherence to the MedDiet in children aged 3–6 years.

Methods

Study design

This cross-sectional analysis utilized baseline data from the Childhood Obesity Risk Assessment Longitudinal Study (CORALS), an ongoing prospective multi-center cohort study involving preschool-aged children (3–6 years old) from seven cities across Spain (Barcelona, Cordoba, Pamplona, Reus, Santiago de Compostela, Valencia, and Zaragoza). The CORALS study, with an expected follow-up of 10 years, aims to identify factors associated with the development of childhood obesity (https://corals.es/). Approval for the protocol was secured from the ethics committees of all seven participating cities (reference nos. 051/2019, 4155/2019, 2019/18, 9/19, 19/162, 19/27, and 2019/131). All questionnaires were completed by parents/legal guardians who gave written informed consent. The study protocol was conducted in accordance with the statements of the Declaration of Helsinki.

Study Sample and Eligibility Criteria

For the present analyses, children enrolled in the CORALS study between March 2019 and June 2022 were included. The full CORALS cohort comprises 1,509 children; however, only those who attended the baseline visit, completed all required questionnaires, and had available data on the Food and Beverage Frequency Questionnaire (COME-Kids F&B-FQ)[23], CF initiation method, breastfeeding duration, maternal education, maternal age, child age and adherence to the MedDiet were considered eligible. Children were excluded if they had food allergies, any medical condition affecting food intake, or missing data on key study variables. As a result, a total of 1,296 children aged 3 to 6 years were included in the analysis.

Data collection

Parental questionnaire

A set of self-administered questionnaires completed at home by parents or caregivers of children aged between 3 and 6 years were used to collect general information including child's sex and age in years, maternal data like maternal age in years and maternal education categorized according to the years of education as basic (< 7–12 years), middle (13–16 years) and high (> 16 years). Early feeding practices, including breastfeeding duration and the method of CF initiation, were recorded retrospectively. Breastfeeding duration was considered as a continuous variable (months). CF method at initiation of introduction of solids was classified as traditional spoon-feeding (mashed food or porridge, fed by an adult), baby-led weaning (BLW) (baby-fist or hand-held size pieces of food, infant eating autonomously), and mixed method (approximately 50% mashed food and 50% hand-held size pieces of food) [5,7,8].

Dietary intake of food groups was assessed using the COME-Kids Food and Beverage Frequency Questionnaire (F&B-FQ). This 125-item is a validated semi-quantitative and retrospective questionnaire that evaluates habitual dietary intake over the previous 12 months [[23].

The COME-Kids F&B-FQ was administered in person by a trained dietitian-nutritionist during the baseline visit and was completed by the parents or legal guardians. To improve the accuracy of responses, visual aids, such as portion size images and household measurement guides, were used. Reported frequencies were converted to daily intakes.

Adherence to the Mediterranean Diet

Adherence to the MedDiet, was assessed using the MED4CHILD questionnaire, a validated 18-item questionnaire designed for use in clinical and epidemiological settings [[22]. Affirmative answers awarded 1 point to the total score, while negative answers were worth 0 points, the total score ranged from 0 to 18 (minimum to maximum adherence). To classify adherence to the MedDiet, participants were categorized as adherent (≥ 10 points) or non-adherent (≤ 9 points)[24]

Statistical analysis

All statistical analyses were performed using the Statistical Package for the Social Sciences, version 25.0 (SPSS Inc., Chicago, IL, USA). Data are presented as means ± standard deviation (SD) for quantitative variables and as frequencies and percentages for qualitative variables. Principal component analysis (PCA) with varimax rotation was performed to derive dietary patterns based on food group intake. The number of factors retained was determined based on eigenvalues > 1.0, visual inspection of the scree plot, and the conceptual interpretability of the patterns. Collectively, the retained factors accounted for approximately 39% of the total variance. Factor loadings greater than 0.40 were considered significant to identify the food groups characterizing each pattern.

To examine the association between the CF initiation method and dietary outcomes, both linear and logistic regression models were employed. Linear regression was used to examine the association between the CF method (traditional spoon-feeding, BLW, and mixed method) and food group intake in grams and dietary pattern scores derived from PCA, the results were expressed as β coefficients and 95% confidence intervals (95% CI). Logistic regression was used to assess the association between CF method and adherence to the MedDiet, estimating odds ratios (OR) and 95% CI. Both, linear and logistic regression models were adjusted for the same potential confounders (child age, maternal age, maternal education, and breastfeeding duration) and stratified by sex. For all analyses, a p-value < 0.05 was considered statistically significant.

Results

A total of 1,296 children (50.5% girls) were included in the final analysis. The mean age of the children at study inclusion was 4.7 ± 1.0 years. The predominant CF method was traditional spoon-feeding (69.7%). Overall, 65.7% of children were classified as adherent to the MedDiet at preschool age. Further descriptive characteristics of the sample are presented in Table 1.

Table 1
Descriptive characteristics of the sample

	N (%) or Mean ± SD
Child's sex	
Boys	642 (49.5)
Girls	654 (50.5)
Child age at inclusion in the study (years)	4.7 ± 1.0
Maternal age at childbirth (years)	33.0 ± 4.8
Maternal education [a]	
Basic	235 (18.1)
Middle	401 (30.9)
High	660 (51.0)
Breastfeeding duration (months)	7.8 ± 9.5
Age at introduction of solid foods (months)	6.0 ± 2.8
Complementary feeding method	
Traditional/Spoon-feeding	905 (69.8)
Baby Led Weaning (BLW)	101 (7.8)
Mixed	290 (22.4)
Mediterranean Diet Adherence[b] (n = 1354)	
Adherent	889 (65.7)
Non-adherent	465 (34.3)
Data are shown as N and % for categorical variables and for continuous variables as mean ± Standard Deviation.	
[a]:Maternal education was categorized as basic: <7–12 years, middle: 13–16 years and high: ≥16 years.	
[b]: Mediterranean Diet Adherence was categorized into two groups according to the MED4CHILD score: adherent (≥ 10) and non-adherent (≤ 9)	

Dietary patterns components

In total, five components were identified. For boys, component 1 represented a processed foods pattern (processed meats, dairy products, snacks, prepared meals, and sugar-sweetened beverages (SSBs));

component 2 reflected a healthy foods pattern (vegetables, fruits, whole grains, oilseeds and legumes); component 3 represented an animal proteins and refined cereals pattern (meats, fish and seafood, and refined cereals); component 4 reflected a fats and flavourings pattern (oils and fats, sauces, and condiments); and component 5 represented a breakfast staples and beverages pattern (dairy, dairy products, tubers, and coffee, tea, and herbal infusions) (Fig. 1).

For girls, component 1 reflected a healthy foods pattern (vegetables, fruits, legumes, fish and seafood); component 2 represented a high sugar and sodium foods pattern (snacks, sugar, cocoa and candies, SSBs, coffee, tea, herbal infusions, and oilseeds); component 3 corresponded to a high-carbohydrate pattern (high intake of tubers and refined cereals, and low intake of whole grains and nuts); component 4 included a Western food pattern (dairy products, processed meats, meats, prepared foods, and eggs); and component 5 reflected a fats, and flavourings pattern (fats and oils, sauces, and condiments) (Fig. 2).

Food group intake by complementary feeding method

Compared with traditional spoon-feeding, boys who followed BLW had a statistically significant higher intake of vegetables and whole grains, and a lower intake of dairy products, pastries and sweets, and convenience foods. Boys who followed the mixed method also showed higher intake of vegetables, fruits, and SSBs compared with those who followed traditional spoon-feeding (Fig. 3 **and Supplementary Table 1**).

Similarly, girls who followed BLW showed significantly lower intake of dairy products, pastries and sweets, tubers, and sugars, cocoa and candies compared with those who followed traditional spoon-feeding. Girls who followed the mixed method showed higher intake of oilseeds and water, and lower intake of dairy products compared with those who followed traditional spoon-feeding (Fig. 4 **and Supplementary Table 2**).

Dietary pattern scores by complementary feeding method

When analysing dietary patterns, both BLW and the mixed method were associated with higher scores in the healthy foods pattern in both boys (β: 0.57, 95% CI: 0.24–0.91, $p < 0.01$) and girls (β: 0.34, 95% CI: 0.06–0.63, $p = 0.016$) compared with traditional spoon-feeding (Tables 2 and 3).

Table 2
Association between complementary feeding method (traditional spoon-feeding, BLW and mixed method) and dietary pattern scores in boys.

Dietary pattern	**Mixed method**		**BLW**	
	β (95% CI)	**p**	**β (95% CI)**	**p**
Processed foods pattern (processed meats, dairy products, snacks, prepared meals, and SSBs)	-0.02 (-0.11– 0.06)	0.622	-0.39 (-0.71 – -0.07)	**0.016**
Healthy foods pattern (vegetables, fruits, whole grains, oilseeds and legumes)	0.14 (0.04– 0.23)	**0.003**	0.57 (0.24– 0.91)	**< 0.001**
Animal proteins and refined cereals pattern (meats, fish and seafood, and refined cereals)	0.18 (-0.07– 0.11)	0.707	-0.08 (-0.42- 0.25)	0.611
Fats and flavourings pattern (oils and fats, sauces, and condiments)	0.00 (-0.09– 0.10)	0.901	-0.02 (-0.36– 0.31)	0.874
Breakfast staples and beverages pattern (dairy, dairy products, tubers, and coffee, tea, and herbal infusions).	0.08 (-0.01– 0.17)	0.083	-0.24 (-0.57– 0.09)	0.157

Values are presented as β coefficients with 95% confidence intervals and p-values obtained from multivariable linear regression models adjusted for child age, maternal age, maternal education, and breastfeeding duration. Traditional spoon-feeding was used as the reference category.

BLW = Baby led weaning; CI= confidence intervals

Table 3
Association between complementary feeding method (traditional spoon-feeding, BLW and mixed method) and dietary pattern scores in girls.

Dietary patterns	Mixed method		BLW	
	β (95% CI)	p	β (95% CI)	p
Healthy foods pattern (vegetables, fruits, legumes, fish and seafood)	0.09 (0.00–0.18)	**0.034**	0.34 (0.06–0.63)	**0.016**
High sugar and sodium foods pattern (snacks, sugar, cocoa and sweets, SSBs, coffee, tea, herbal infusions, and oliseeds)	0.02 (-0.06–0.10)	0.645	-0.00 (-0.29–0.27)	0.948
High-carbohydrate pattern (high intake of tubers and refined cereals, low intake of whole grains and nuts)	-0.02 (-0.11–0.06)	0.589	-0.43 (-0.71 – -0.14)	**0.003**
Western food pattern (dairy products, processed meats, meats, prepared foods and eggs)	-0.00 (-0.09–0.08)	0.878	-0.24 (-0.52–0.04)	0.099
Fats and flavourings pattern (oils and fats, sauces, and condiments).	0.10 (0.01–0.19)	**0.018**	0.33 (0.04–0.61)	**0.023**

Values are presented as β coefficients with 95% confidence intervals and p-values obtained from multivariable linear regression models adjusted for child age, maternal age, maternal education, and breastfeeding duration. Traditional spoon-feeding was used as the reference category.

BLW = Baby led weaning; CI= confidence intervals

In boys, BLW was associated with significantly lower scores in the processed foods pattern compared with traditional spoon-feeding, whereas no statistically significant differences were observed between the mixed method and traditional spoon-feeding for this pattern. Furthermore, no statistically significant associations were observed between CF method and the animal proteins pattern, fats and flavourings pattern, or breakfast staples and beverages pattern (Table 2).

In girls, both BLW and the mixed method were associated with higher scores in the fats and flavourings pattern compared with traditional spoon-feeding. Additionally, BLW was associated with lower scores in the high-carbohydrate pattern compared with traditional spoon-feeding (Table 3).

Adherence to the Mediterranean diet

Overall, 65.7% of participants were classified as adherent to the MedDiet. As shown in Table 4, multivariable logistic regression models revealed no statistically significant associations between the initial CF method and adherence to the MedDiet at preschool age, for both boys and girls, after adjusting for potential confounders.

Table 4
Association between complementary feeding method and adherence to the Mediterranean diet

	Adherence to Mediterranean Diet		OR* (95% CI)	p-value
	Adherent n (%)	Non-adherent n (%)		
Boys				
Traditional Spoon-feeding (Ref.)	307 (67.4)	185 (37.6)	-	-
BLW	32 (76.2)	10 (23.8)	1.23 (0.56–2.69)	0.596
Mixed	94 (70.1)	40 (29.9)	1.25 (0.82–1.93)	0.293
Girls				
Traditional Spoon-feeding (Ref.)	304 (65.1)	163 (34.9)	-	-
BLW	40 (71.4)	16 (28.6)	1.19 (0.62–2.34)	0.587
Mixed	112 (68.7)	51 (31.3)	1.14 (0.76–1.70)	0.516

Descriptive data are presented as N and %. Results are presented as odds ratios (ORs) with 95% confidence intervals and p-values from adjusted multivariable logistic regression models. Traditional spoon-feeding was the reference category.

*P-values obtained from multivariable logistic regression models adjusted for child age, maternal age, maternal education, and breastfeeding duration.

BLW= Baby led weaning

Discussion

In recent years, research on baby-led CF methods has grown considerably. Reviews have increasingly highlighted their benefits and addressed initial concerns held by parents and health professionals regarding choking risks and potential deficits in energy and iron intake [1,2,7]. Current evidence suggests that when implemented with appropriate guidance and supervision, there are no significant differences in these risks compared to traditional methods[7,9]. However, research beyond nutrient intake during infancy, specifically regarding the impact of exposure to diverse textures, food variety, and the family socialization promoted by these methods, has largely been confined to this early stage. Few studies have investigated whether these potential benefits persist into later childhood, such as the preschool age, which is often characterized by heightened food selectivity and the rejection of previously accepted foods[25].

Proponents of BLW posit that infants following this method accept a wider variety of foods in later childhood, owing to repeated exposure to diverse textures and foods[8,9]. Furthermore, infants following BLW reportedly exhibit better breastfeeding practices and healthier eating patterns [[1,10,26].

Comparing our findings with previous research on food group consumption by CF method is challenging, as most studies were conducted during the CF period (6 to 24 months) rather than in later childhood. To our knowledge, the only study comparing food group consumption in children older than two years relative to their initial feeding method is the study by Townsend conducted in 2012[27]. This study assessed food preferences in children aged 20 to 78 months, comparing BLW and traditional spoon-feeding, Townsend found that the BLW group exhibited a greater preference for carbohydrates compared to the traditional spoon-feeding group, despite the latter having more frequent exposure to this group. However, the type of carbohydrates was not specified, although a separate “sweet foods” group was considered. Our results, while not assessing food preferences, showed that boys in the BLW group had a higher intake of whole grains, while girls who followed the BLW method, had a higher consumption of the 'high-carbohydrate' dietary pattern (refined grains and tubers), compared to girls who started with the traditional/spoon-feeding method. These findings may align with the results reported by Townsend [[27]. Furthermore, both boys and girls who followed the BLW method showed lower consumption of pastries and sweets than those who started with the traditional spoon-feeding method, which is consistent with Townsend’s report of more frequent exposure to sweets in the spoon-feeding group.

Findings by Morison et al.[13] showed a slight increase in fruit and vegetable consumption at 24 months of age in infants following the BLISS method (a BLW adaptation) compared to the traditional feeding group. Similarly, Rowan et al.[28] and Guenetxea-Gonostiza et al[17]. found greater exposure to vegetables among infants practicing BLW compared to those following traditional or parent-led methods. Our results suggest that in addition to the higher frequency of vegetable exposure and offering reported during the CF period in BLW infants, this higher intake was also observed during the preschool stage. Specifically, boys aged 3 to 6 years who started with the mixed or BLW methods had a higher vegetable intake compared to those in the traditional/spoon-feeding group. This difference was not statistically significant in girls when vegetables were assessed alone. However, when vegetables were evaluated as part of a healthy dietary pattern, significantly higher scores to this pattern were found for both boys and girls who followed the mixed and BLW methods. It is important to note, however, that the food groups constituting this pattern differed between sexes. Both patterns included vegetables, fruits and legumes; however, the pattern for boys also included whole grains and oilseeds, whereas the pattern for girls included fish and seafood.

Both boys and girls who initiated CF with the BLW method showed lower consumption of dairy products compared to those who started with the traditional/spoon-feeding method. Two other studies[16,29] also reported these differences in the consumption of dairy and dairy-based desserts, although their cohorts consisted of infants aged 9 to 12 months. In our study, dairy products were included in the “processed diet” pattern for boys, and in a “Western” pattern for girls. For boys, the pattern also comprised prepared

foods, processed meats, snacks, and soft drinks, while for girls, the pattern included processed meats, meats, prepared foods and eggs. A decreased score in the processed diet pattern was found in boys from the BLW group, but no significant differences were found for the Western dietary pattern between CF groups in girls.

The food groups that constitute the healthy dietary pattern for boys and girls include core components of the MedDiet (e.g., vegetables, fruits, fish and seafood, whole grains, and legumes). In addition, within the healthy pattern identified for girls (vegetables, fruits, legumes, fish, and seafood), those in the BLW group also exhibited a higher intake of nuts, which are also key components of the MedDiet. Although no statistically significant differences were found between CF method and adherence to the MedDiet, more than half of the sample (65.7%) had a high adherence to this diet.

To date, no study has directly associated the initial CF method with subsequent adherence to the MedDiet. However, existing literature has linked other early feeding practices, such as breastfeeding duration and the timing of CF initiation, with greater MedDiet adherence. A study also conducted in Spain found that children breastfed for at least 6 months had 2.9 times higher odds of adhering to the MedDiet in the preschool stage than those who were never breastfed, while those breastfed for less than 6 months had lower adherence [[30]. Another study by Gómez-Martín et al. [[31] also found that breastfed children had better MedDiet Scores at 24 months than those who were formula-fed, although these differences were borderline significant.

A recent systematic review on factors correlating with MedDiet adherence in preschoolers found a significant positive association with parental education, were higher education levels correlated with greater adherence[20]. Both breastfeeding and parental education are known to be strongly associated with the parental choice to follow a baby-led feeding method like BLW[7,8,26,32]. Studies have shown that parents with higher educational levels may have greater access to information and a better understanding of the method's risks and benefits, as well as the benefits of breastfeeding. Consequently, infants starting with BLW typically have a longer breastfeeding duration. In our study, these variables (maternal education and breastfeeding duration) were included in the analysis as covariates. Although no association was found between the BLW method and adherence to the MedDiet, the adjusted models indicated that, among boys, a higher maternal education (OR:1.8, 95% CI: 1.1–2.9, p = 0.01) and longer duration of breastfeeding (OR: 1.039, 95% CI: 1.01–1.06, p = 0.001) were significantly associated with higher adherence to the MedDiet.

This study suggests that children whose families reported initiating CF with a method that allows for repeated exposure to diverse textures and a variety of foods, such as BLW or a mixed approach, is associated with more favourable dietary patterns in preschool-aged children, including a higher consumption of core healthy foods such as vegetables, fruits, whole grains and legumes.

It is important to note that this study is not without its limitations. A primary limitation is the retrospective collection of the independent variable (CF method). The unequal number of participants

across the CF groups constitutes a further limitation, which may reduce the precision of comparisons and potentially preclude finding statistical significance for other variables. Additionally, given the large number of comparisons, some findings may be due to chance. Furthermore, information on key variables that could influence both the choice of CD method and subsequent adherence to the MedDiet, such as parenting styles and parental dietary habits, were unavailable, which may introduce residual confounding. Finally, due to the cross-sectional nature of this analysis, our findings strictly highlight associations rather than causality. Therefore, future longitudinal studies are required to track these dietary trajectories over time and confirm our results. Notwithstanding the limitations mentioned above, the study possesses significant strengths, including its large sample size and the use of new and validated assessment tools specific to this population.

Conclusions

In this cohort of Spanish preschool children, the CF initiation method was associated with later dietary intake and dietary pattern adherence at 3–6 years of age. Compared with traditional spoon-feeding, both BLW and mixed methods were associated with modest differences in dietary patterns. These findings suggest that early CF practices may be related to subsequent dietary behaviours beyond infancy. However, given the observational and retrospective nature of the CF assessment, causality cannot be established. Further longitudinal research within the CORALS cohort is warranted to confirm these associations and elucidate the role of CF methods in shaping sustained dietary habits.

Declarations

Conflict of interest:

The authors declare they have no conflict of interest.

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Author Contribution

ADO-R, MLM-B, LM participated in the conceptualization, formal analysis, visualization and writing of the original draft. PM-E, IB-T, NG-L and AL-G contributed to the investigation, formal analysis and writing of the original draft. MG-C, RL, NB, SN-C, DC, HS, CC-C, RP-L, IV, JA-M, JJ-C, RV-C, NF, MJT-A, KF-R, and JS-S participated in writing, review and editing of the manuscript. All authors have revised and approved the final version of the manuscript.

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Data Availability

The datasets generated and analysed during the current study are not publicly available due to data regulations and for ethical reasons, considering that this information might compromise research participants' acceptance because our participants only gave their consent for the use of their data by the original team of investigators. However, collaborations for data analyses can be requested by sending a letter to the CORALS Steering Committee (estudiocoral@corals.es). The request will then be passed to all the members of the CORALS Steering Committee for deliberation.

References

1. Capra ME, Decarolis NM, Monopoli D et al (2024) Complementary Feeding: Tradition, Innovation and Pitfalls. Nutrients 16737. 10.3390/nu16050737
2. Nantel A, Gingras V Are Complementary Feeding Practices Aligned with Current Recommendations? A Narrative Review. Published online 2023. 10.3390/children10050794
3. Pietrobelli A, Agosti M, Palmer C et al (2017) Nutrition in the first 1000 days: Ten practices to minimize obesity emerging from published science. Int J Environ Res Public Health 14(12). 10.3390/ijerph14121491
4. Maneschy I, Jimeno-Martínez A, Miguel-Berges ML et al (2024) Eating Behaviours and Dietary Intake in Children and Adolescents: A Systematic Review. Curr Nutr Rep Springer 13(3):363–376. 10.1007/s13668-024-00544-w
5. Fewtrell M, Bronsky J, Campoy C et al (2017) Complementary feeding: A position paper by the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) committee on nutrition. J Pediatr Gastroenterol Nutr 64(1):119–132. 10.1097/MPG.0000000000001454

6. Moreno LA, Moreno L (2024) Complementary Food and Obesity. Hum Nutrition: Rev Article Ann Nutr Metab 0(0):1–12. 10.1159/000542373
7. Boswell N (2021) Complementary Feeding Methods—A Review of the Benefits and Risks. Int J Environ Res Public Health 18:7165. 10.3390/ijerph18137165
8. D'Auria E, Bergamini M, Staiano A et al (2018) Baby-led weaning: What a systematic review of the literature adds on. Ital J Pediatr BioMed Cent Ltd 44(1). 10.1186/s13052-018-0487-8
9. Bocquet A, Brancato S, Turck D et al (2022) Baby-led weaning – Progress in infant feeding or risky trend? *Archives de Pediatrie*. Elsevier Masson s r l 29(7):516–525. 10.1016/j.arcped.2022.08.012
10. Matzeller KL, Krebs NF, Tang M Current Evidence on Nutrient Intakes and Infant Growth: A Narrative Review of Baby-Led Weaning vs. Conventional Weaning. *Nutrients*. Published online 2024. 10.3390/nu16172828
11. Cox AM, Taylor RW, Haszard JJ et al (2024) Baby food pouches and Baby-Led Weaning: Associations with energy intake, eating behaviour and infant weight status. Appetite 192. 10.1016/j.appet.2023.107121
12. Ortega-Ramírez AD, Reis Maneschy I, Miguel-Berges ML et al Early feeding practices and eating behaviour in preschool children: the CORALS cohort. Matern Child Nutr Published online 2024:16. 10.1111/mcn.13672
13. Morison BJ, Heath ALM, Haszard JJ et al (2018) Impact of a Modified Version of Baby-Led Weaning on Dietary Variety and Food Preferences in Infants. Nutrients 101092. 10.3390/nu10081092
14. Moreira PR, Silveira B, Oliveira Neves R, Nunes LM, Bernardi JR (2024) Estimated energy and nutrient intake in complementary feeding methods in Brazilian infants: randomized clinical trial. Sci Rep 1413. 10.1038/s41598-023-50415-7
15. Rowan H, Lee M Brown | Amy. Estimated energy and nutrient intake for infants following baby-led and traditional weaning approaches. Published online 2021. 10.1111/jhn.12981
16. Pearce J, Langley-Evans SC (2022) Comparison of food and nutrient intake in infants aged 6–12 months, following baby-led or traditional weaning: A cross-sectional study. J Hum Nutr Dietetics 35(2):310–324. 10.1111/jhn.12947
17. Guenetxea-Gorostiza J, Rada Fernández de Jáuregui D, Apraiz-Sanchez I et al (2025) Nutrient intake and fruit and vegetable offering in baby-led weaning compared with parent-led weaning in healthy 6- to 13-month-old infants: A systematic review and meta-analysis. Nutrition Elsevier Inc 137. 10.1016/j.nut.2025.112812
18. Srambikkal Vinesh D, Syed Altaf RR, Mohan A et al (2026) The Mediterranean diet as a metabolic strategy for healthy aging and non-communicable disease prevention. J Nutritional Physiol 5:100015. 10.1016/j.jnphys.2026.100015
19. Trajkovska Petkoska A, Ognenoska V, Trajkovska-Broach A (2025) Mediterranean Diet: From Ancient Traditions to Modern Science—A Sustainable Way Towards Better Health, Wellness, Longevity, and Personalized Nutrition. *Sustainability (Switzerland)*. Multidisciplinary Digit Publishing Inst (MDPI) 17(9). 10.3390/su17094187

20. Trezia N, Obeid C, Abou Jaoude M et al (2025) Correlates of adherence to the Mediterranean diet among preschool-age and school-age children living in Mediterranean countries: a systematic review. Eur J Nutr Springer Sci Bus Media Deutschland GmbH 64(6). 10.1007/s00394-025-03769-9
21. de Franchis R, Bozza L, Canale P et al (2022) The Effect of Weaning with Adult Food Typical of the Mediterranean Diet on Taste Development and Eating Habits of Children: A Randomized Trial. Nutrients 14(12). 10.3390/nu14122486
22. Larruy-García A, Miguel-Berges ML, Torre IR et al (2025) Cross-sectional associations between Mediterranean diet and body composition in preschool children. CORAL study. Pediatr Obes 20(7). 10.1111/ijpo.70014
23. Babio N, de Las Heras-Delgado S, De Miguel-Etayo P et al (2023) Reproducibility and relative validity of a semi-quantitative food and beverage frequency questionnaire for Spanish children aged 3 to 11 years: the COME-Kids F&B-FQ. Eur J Pediatr 182(12):5577–5589. 10.1007/s00431-023-05220-9
24. Larruy-García A, Miguel-Berges ML, Torre IR, De et al (2025) Cross-sectional associations between Mediterranean diet and body composition in preschool children. CORAL study. Pediatr Obes 20(7). 10.1111/ijpo.70014
25. Bettocchi S, D'Oria V, De Cosmi V et al (2025) Preschool Children's Eating Habits and Parental Nutritional Status. Nutrients 17(3). 10.3390/nu17030575
26. Białek-Dratwa A, Dawid K, Staskiewicz-Bartecka W, Kiciak A, Kowalski O (2025) Baby-Led Weaning vs. Traditional Complementary Feeding-Differences in Feeding Practices Among Polish Children Aged 6–36 Months-A Cross-Sectional Study. Nutrients 17:899. 10.3390/nu17050899
27. Townsend E, Pitchford NJ (2012) Baby knows best? The impact of weaning style on food preferences and body mass index in early childhood in a case-controlled sample. BMJ Open 2:e000298. 10.1136/bmjopen-2011-000298
28. Rowan H, Lee M, Brown A (2019) Differences in dietary composition between infants introduced to complementary foods using Baby-led weaning and traditional spoon feeding. J Hum Nutr Dietetics 32(1):11–20. 10.1111/jhn.12616
29. Alpers B, Blackwell V, Clegg ME (2019) Standard v. baby-led complementary feeding: A comparison of food and nutrient intakes in 6-12-month-old infants in the UK. Public Health Nutr 22(15):2813–2822. 10.1017/S136898001900082X
30. Oliver Olid A, Moreno-Galarraga L, Moreno-Villares JM et al (2023) Breastfeeding Is Associated with Higher Adherence to the Mediterranean Diet in a Spanish Population of Preschoolers: The SENDO Project. Nutrients 15(5). 10.3390/nu15051278
31. Gómez-Martín M, Herrero-Morín D, Arboleya S, Gueimonde M, González S (2022) Early Life Nutrition and the Role of Complementary Feeding on Later Adherence to the Mediterranean Diet in Children up to 3 Years of Age. Nutrients 14(8). 10.3390/nu14081664
32. Pérez-Ríos M, Santiago-Pérez MI, Butler H, Mourino N, Malvar A, Hervada X (2020) Baby-led weaning: prevalence and associated factors in Spain. Eur J Pediatr 179(6):849–853. 10.1007/s00431-020-03579-7

Figures

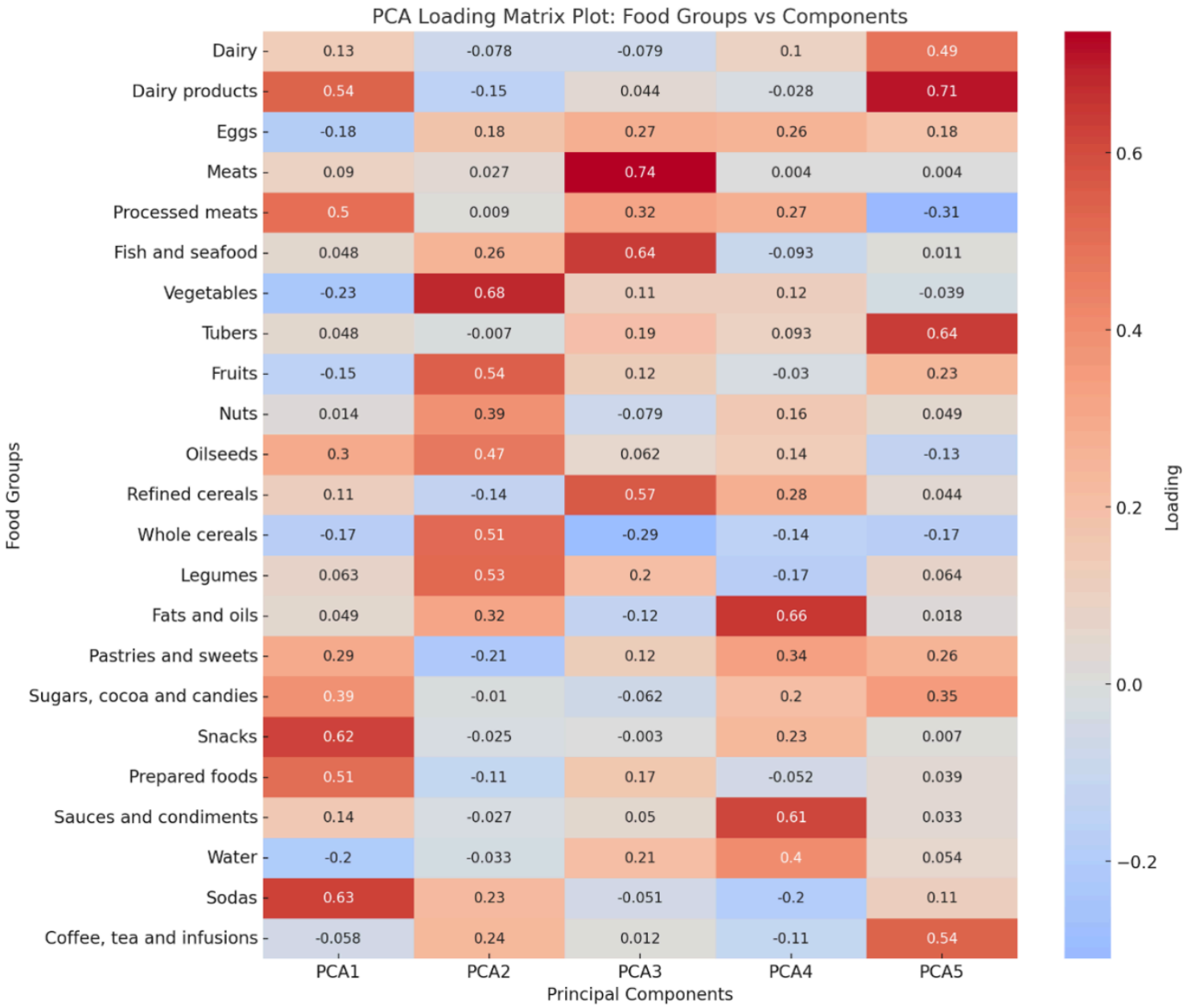


Figure 1

Matrix plot for food groups PCA loading in boys

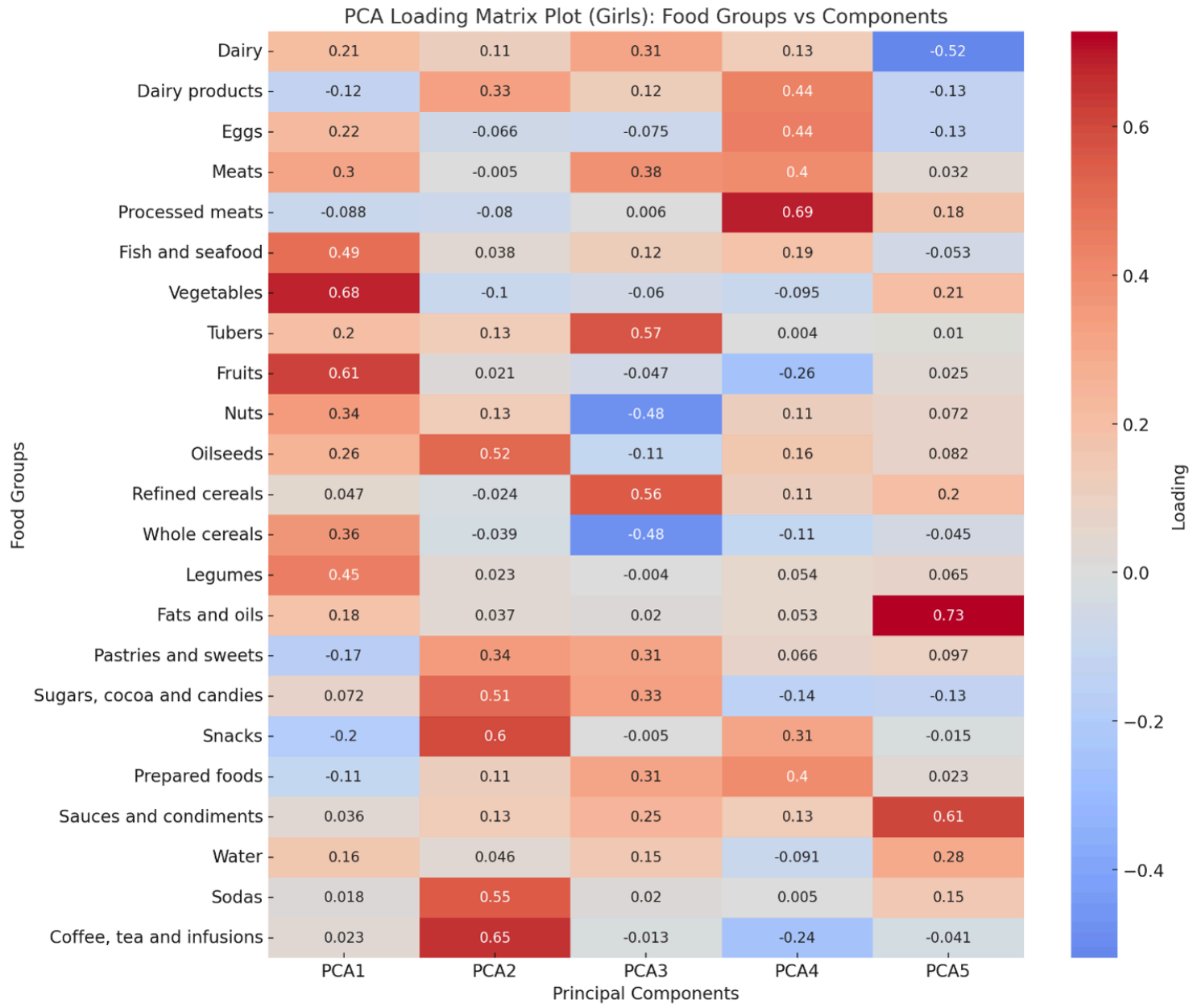


Figure 2

Matrix plot for food groups PCA loading in girls

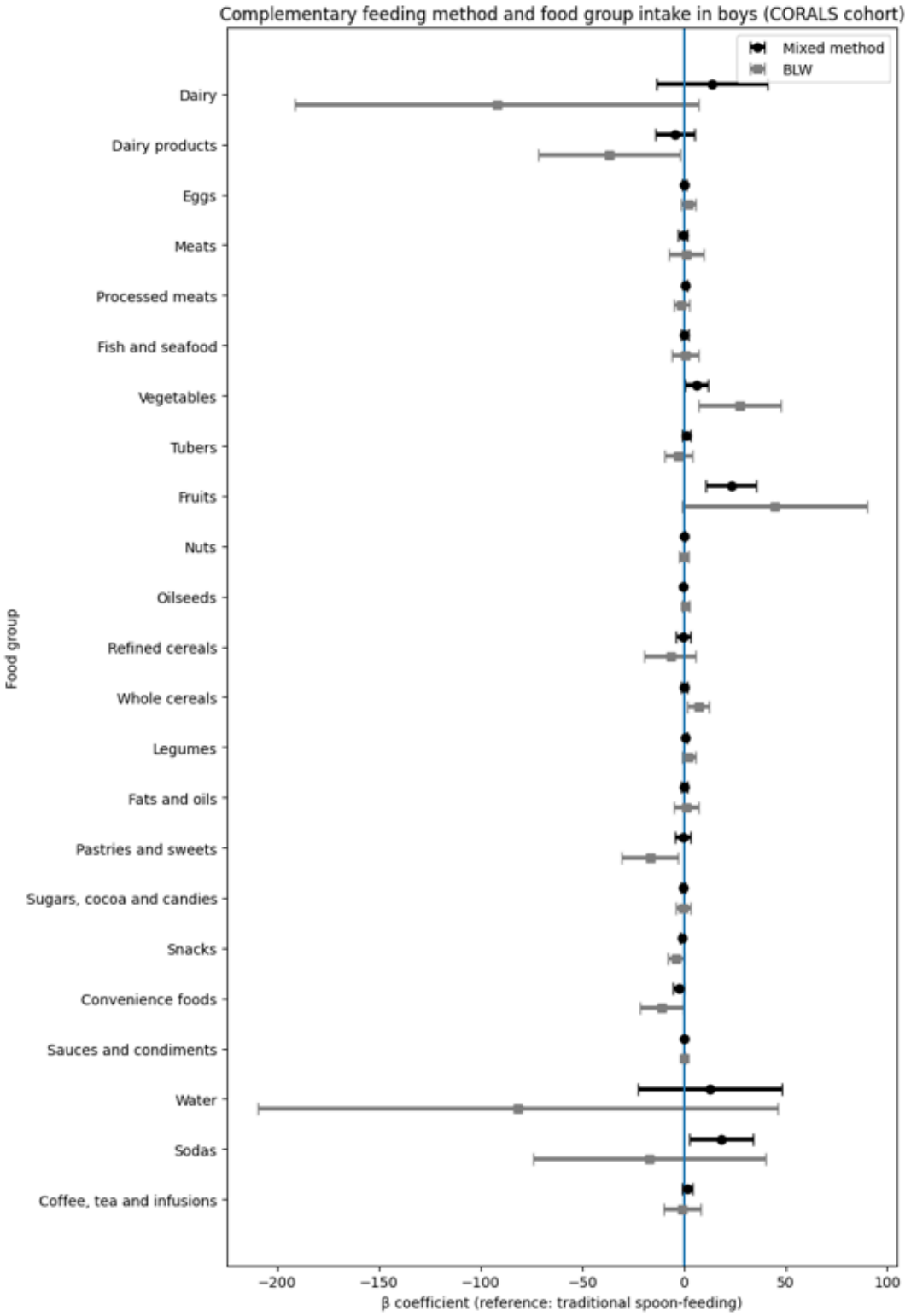


Figure 3

Forest plot showing associations between complementary feeding method (traditional spoon-feeding, BLW and mixed method) and food and beverage intake in boys from the CORALS cohort. Values represent β coefficients and 95% confidence intervals.

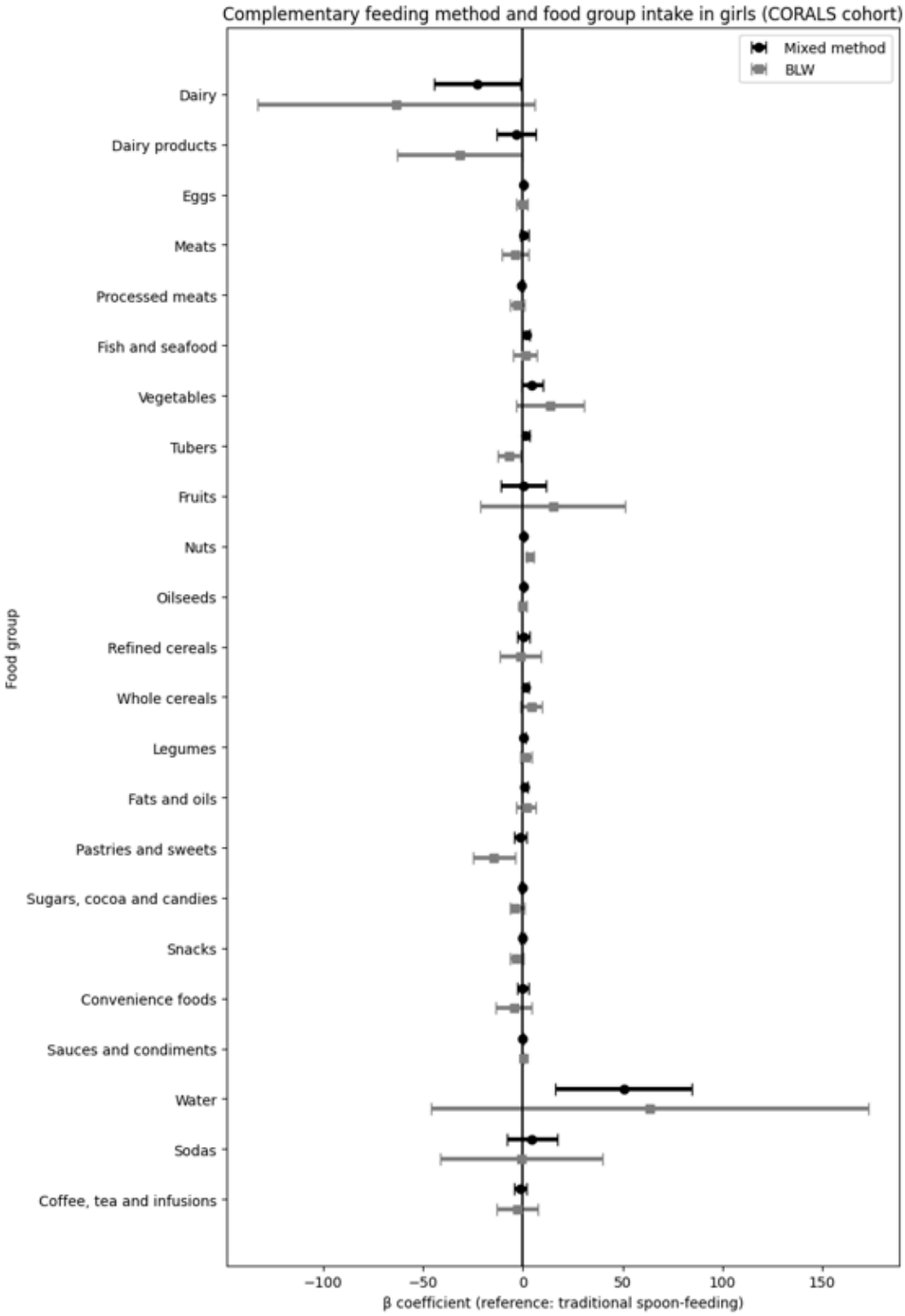


Figure 4

Forest plot showing associations between complementary feeding method (traditional spoon-feeding, BLW and mixed method) and food and beverage intake in girls from the CORALS cohort. Values represent β coefficients and 95% confidence intervals.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryTable1and2.docx