CLINICAL SCIENCE OF NUTRITION
Clin Sci Nutr. 2026;8(1):40-50
Research Article
DOI: 10.62210/ClinSciNutr.2026.131

Comparative analysis of nutrient contents of multi-micronutrient supplements marketed for children in Türkiye

Derşan Onur[1], Irmak Onur[2]

[1]İzmir Tepecik Training and Research Hospital, University of Health Sciences, İzmir, Türkiye
[2]İzmir Dr. Behçet Uz Children's Hospital, İzmir, Türkiye

Cite this article as: Onur D, Onur I. Comparative analysis of nutrient contents of multi-micronutrient supplements marketed for children in Türkiye. *Clin Sci Nutr*. 2026;8(1):40-50.

ABSTRACT

Objective: The market for multi-micronutrient supplements for children is expanding rapidly in Türkiye, despite national guidelines not recommending routine supplementation for healthy, well-nourished children. A critical knowledge gap exists regarding the composition of these commercially available products and their alignment with national nutritional standards. This study aimed to analyze the contents of multi-micronutrient supplements marketed for children in Türkiye and compare them with national dietary reference values (DRV) and daily maximum limits (DML).

Methods: This observational, cross-sectional study was conducted between April and May 2025. A total of 89 multi-micronutrient supplements from 27 different brands, all with specific dosage recommendations for children under 18 years old, were analyzed.. Data were collected from pharmacies in İzmir and Manisa. The declared micronutrient contents on product labels were compared with the age-specific DRVs and DMLs established by the Turkish Food Codex.

Results: The most frequently included micronutrients were Vitamin C (71.9%), Vitamin D (70.8%), and Zinc (61.8%). A significant heterogeneity was observed in the micronutrient content of the products. For the 4-10 age group, essential minerals such as calcium, magnesium, and iron were often supplied at subtherapeutic doses, meeting only 22.8%, 20.6%, and 42.0% of the mean DRV, respectively. Conversely, the maximum doses in some products for the same age group significantly exceeded safety limits, reaching 467% of the DML for Vitamin A, 300% for Vitamin D, and 200% for Zinc.

Conclusion: The Turkish market for pediatric multi-micronutrient supplements is characterized by a lack of standardization, which poses a dual risk to children: potential inefficacy due to subtherapeutic doses of key minerals and a risk of chronic toxicity from excessive intake of vitamins A, D, and zinc. These findings contradict national health guidelines and highlight an urgent need for stricter regulatory oversight of supplement composition and labeling, alongside stronger clinical guidance for parents to prevent both inadequate and excessive micronutrient intake.

Keywords: dietary supplements, pediatric, micronutrients, vitamins, nutrition policy

Corresponding author: Derşan Onur
Email: drdersanonur@gmail.com

Received: August 26, 2025 **Accepted:** February 16, 2026
Published online: March 8, 2026

Introduction

Background

The popularity of dietary supplements for children, particularly those in the form of flavored gummies and chewables, is on the rise on a global scale. The revenue of the vitamin and mineral market in Türkiye is projected to attain US$29.72 million by the year 2025, exhibiting a compound annual growth rate that is anticipated to exceed both the global rate of 6.7% and the US rate of 7.52% between the years 2025 and 2029, with a projected growth rate of 10.49%.[1,2] This increase in market growth reflects parents' growing awareness of their children's nutritional needs and the increasing importance placed on preventive health approaches. Parents commonly regard these supplements as a means of protecting their children against infections and supporting their physical and cognitive development.[3-5]

Adequate intake (AI) of micronutrients, including vitamins, minerals, and trace elements, is essential for children's optimal growth, physical and cognitive development, immune function, and overall health.[6,7] Deficiencies and excesses in these essential nutrients can result in a variety of adverse health consequences, which may have long-term consequences.[7-10] Therefore, nutritional supplements intended for children must provide these essential components within appropriate amounts.[11]

Main Points

- The composition of pediatric multi-micronutrient supplements in the Turkish market is characterized by significant heterogeneity and a lack of standardization.
- This market poses a dual risk: subtherapeutic doses of essential minerals, such as calcium and magnesium, which can lead to inefficacy, and excessive doses of vitamins A, D, and zinc that exceed daily maximum limits, potentially leading to chronic toxicity.
- The widespread availability and marketing of these products contradict national health guidelines, which do not recommend routine supplementation for healthy, well-nourished children.
- Stricter regulatory oversight of supplement composition and stronger clinical guidance for parents are urgently needed to prevent both inadequate and excessive micronutrient intake.

In Türkiye, the Ministry of Health has established a national policy that stipulates the administration of vitamin K at birth, vitamin D in the first year of life, and iron supplementation between 4-12 months of age (2-12 months in cases of prematurity).[12,13] However, beyond these national recommendations, additional vitamin and mineral supplementation for healthy children who consume a normal and balanced diet is not recommended.[12-15]

Aim

Given the expanding market and its potential effects on child health, there is a clear need for data specific to the Turkish context to understand the characteristics of available supplements and their alignment with relevant nutritional guidelines. This study aims to address this gap by analyzing the multi-micronutrient content of dietary supplements marketed for children in Türkiye and comparing it with established national daily nutritional reference values.

Material and Methods

Study design and settings

This was an observational, cross-sectional, descriptive study conducted between April and May 2025. The study was reported in accordance with The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement guidelines (Supplementary Material).[16]

The study was conducted in the provinces of Manisa and İzmir to reflect the demographic and socioeconomic diversity of the Aegean Region. These locations were selected based on logistical feasibility and resource constraints. In each province, three districts representing low, middle, and high socioeconomic levels were selected via purposive sampling. Within these selected districts, convenience sampling was utilized to access centrally located pharmacies with high foot traffic. A total of 18 different pharmacies were visited, comprising a minimum of one and a maximum of five pharmacies from each district. This sampling strategy was chosen for its practicality in reaching the maximum number of products within a limited time frame. Since manufacturer formulations are standardized nationally, data from locations were pooled to analyze the widest possible range of unique product brands available in the Turkish market.

The study included all multi-micronutrient supplements that were sold with or without a prescription in the visited pharmacies and had a specific dosage recommendation for children under 18 years of age on their packaging. Products sold online were excluded from the scope of the study due to the difficulty of price standardization and the inability to verify regional availability. Products containing a single micronutrient were excluded from the study. For the purpose of this analysis, multi-micronutrient supplements were defined as any product containing at least two distinct micronutrients or active ingredients in a single formulation, regardless of the total count.

Dietary reference intakes and values

In this field, two main reference value systems stand out globally: the Dietary Reference Intakes (DRI) framework [17], developed by the Food and Nutrition Board (FNB) of the National Academies of Sciences, Engineering, and Medicine for the United States (US) and Canada, and the Dietary Reference Values (DRV) framework[18], established by the European Food Safety Authority (EFSA) for the European Union. In Türkiye, two different frameworks are used: the Turkish Food Codex (TFC)[19] and the Turkey Dietary Guidelines (TDG).[15] A comparative summary of the dietary reference value terminologies, definitions, and primary areas of application used by the FNB, EFSA, and Türkiye is presented in Table S2 (Supplementary Material). A comparison of the TFC and international DRV is presented as an interactive website at https://onurdersan.github.io/micronutrients/.[20]

Variables, measurement and procedure

For each product, the name, brand, supplement type, pharmaceutical form (e.g., syrup, capsule, chewable), flavor, the presence of a figure and a child figure on the packaging, the total package quantity, the recommended daily dosages according to age, and the content and amounts of micronutrients (vitamins, minerals) and other active ingredients (e.g., fish oil/fatty acids, herbal extracts) in these dosages were recorded. The products and their contents were verified using the official lists of the Republic of Türkiye Ministry of Agriculture and Forestry and the Ministry of Health, as well as the manufacturers' official websites. To ensure a homogeneous market analysis, the study specifically included products legally classified as dietary supplements, which are regulated and licensed by the Ministry of Agriculture and Forestry. Products registered as pharmaceuticals under the Ministry of Health were used for exclusion verification and were not included in the final analysis, as they are subject to different regulatory standards regarding labeling and composition.

The number of days a product would last was calculated as [total quantity ÷ daily dose], and the cost per day of use was calculated as [product price ÷ (total quantity × daily dose)]. To ensure international comparability given currency fluctuations of Turkish Liras (TRY), all cost data were also converted to Euros (EUR) based on the average exchange rate during the study period (1 EUR = 43.28 TRY), obtained from the Central Bank of the Republic of Türkiye.

For each micronutrient, product contents were compared with the age- and gender-specific DRVs[21] and Daily Maximum Limits (DMLs)[22] as reported by the TFC[19] (Supplementary Table S2).

Statistical analysis and data visualization

Data analysis and visualizations were performed using the jamovi software (The jamovi project. Sydney, Australia. version 2.3) and IBM SPSS Statistics for Windows (IBM Corp. Released 2021. Version 28.0. Armonk, NY).

The distribution of the data was assessed using histograms, Q-Q plots, and the Kolmogorov-Smirnov test. Continuous variables were summarized as mean ± standard deviation (SD) or median and interquartile range (IQR). Categorical variables were presented as absolute numbers and percentages (n [%]).

Ethical considerations

This study did not require institutional ethics committee approval, as all data was compiled from publicly available sources and it did not involve any human or animal subjects.

Results

A total of 93 products from 28 brands were included in the study. Four products were excluded due to content discrepancies and missing data. Analyses were performed on a total of 89 products from 27 brands (mean, 3.3±3.6; range, 1-13).

Of the products, 48.3% (n=43) were in syrup form, 14.6% (n=13) were chewable tablets, and 12.4% (n=11) were chewable gels. In terms of flavor, 35.96% (n=32) of the products contained orange, 13.48% (n=12) contained mixed fruit, and 13.48% (n=12) contained lemon.

A total of 51.7% (n=46) of the products featured at least one figure on the packaging. Of the 17 different figures, the most common type was an animal (n=33, 37.1%). The most frequently used figure was fish (17 products from 6 brands, 19.1%). A child figure or picture was included on 25.9% (n=23) of the products.

The products contained a supply sufficient for an average of 25.9±12.7 days (range, 10-70) for the 4-10 age group and 23.6±10.2 days (range, 10-60) for the 11-18 age group. The average retail price of the products was 491±216 TRY (11.3±4.99 EUR) (range, 101-1149 TRY, 2.33-26.5 EUR). The average daily cost was 23.3±17.7 TRY (0.54±0.4 EUR) (range, 5.0-100 TRY, 0.12-2.3 EUR) for children aged 4-10 years and 26.6±12.9 TRY (0.61±0.3 EUR) (range, 5.5-53.3 TRY, 0.13-1.23 EUR) for those aged 11-18 years.

The three most common micronutrients found in the products were vitamin C (n=64, 71.91%), vitamin D (n=63, 70.79%), and zinc (n=55, 61.8%). The micronutrient contents and their proportions are presented in Table 1.

The micronutrient amounts in the products were compared with the DRVs established by the TFC for various age groups, and the results are presented as a percentage of the DRV in Table 2, Table 3, and Table 4. The mean ratios of micronutrient levels to the DRV varied widely, ranging from 15% to 1250% for vitamin C, 50% to 750% for vitamin D, and 28% to 40000% for vitamin B12. For the 4-10 age group, the mean daily dose met only 22.8% (±9.9) of the DRV for calcium, 20.6% (±9.1) for magnesium, 41.6% (±10.6) for iodine, and 42.0% (±31.2) for iron. For the 11-18 age group, the mean daily dose met only 24.1% (±4.0) of the DRV for magnesium and 37.1% (±22.5) for vitamin K.

For the 4-10 age group, the mean DRV ratio was less than 100% for 21 micronutrients, whereas the mean DRV ratio for vitamin D was 196%. For the 11-18 age group, the mean DRV ratio was below 100% for 8 micronutrients and above 100% for 14 micronutrients. Regarding other active ingredients, the mean DRV ratio for DHA (Docosahexaenoic acid) was above 100% in all age groups. The mean daily dose of DHA met 326.8% (±206.1) of the DRV for children aged 4-8 years, 245.1% (±154.5) for those aged 9-11 years, and 297.0% (±172.4) for those aged 12-13 years.

A comparison of the ratios of product contents to the DMLs established by the TFC and UL (Upper level of intake) for EFSA is presented in Table 4. In the 4-10 age group, the maximum dose was found to correspond to 467% of the DML for vitamin A, 300% of the DML for vitamin D, 200% of the DML for iron, and 200% of the DML for zinc. In the 11-18 age group, the maximum dose was found to correspond to 125% of the DML for vitamin A and 100% of the DML for both zinc and iodine.

Discussion

To our knowledge, this is the first study to analyze the contents and marketing features of multi-micronutrient supplements for children in Türkiye. The primary finding of the study is the notable heterogeneity in the multi-micronutrient content of food supplements marketed for children in Türkiye. This heterogeneity raises serious concerns regarding the consistency and predictability of nutrient intake when these products are used, as some supplements provide adequate amounts of micronutrients while others fall below or significantly exceed reference values.

National and international guidelines clearly state that healthy children who consume a balanced and varied diet do not require additional multi-micronutrient supplementation. In contrast, our study reveals the existence of a market aimed at the general pediatric population, offering a wide range of products that go beyond the principle of *complementing, not replacing, a diet*. The significant variation in nutrient content, even among products targeting the same age group, poses a challenge for parents and caregivers attempting to make informed choices. The absence of standardized formulations complicates the selection of an appropriate supplement and may lead to either insufficient or excessive intake, depending on the chosen product. This underscores the need for stronger clinical guidance to bridge the gap between parental purchasing behaviors and the actual health requirements of children.

Table 1. Content and distribution of micronutrients and other active ingredients in the products

Micronutrient	Unit	n (%)	Mean±SD (95% CI mean lower-upper)	Median (IQR, 25th-75th p)	Minimum-Maximum
Vitamin C	mg/d	64 (71.91%)	102±183 (55.8-147)	60 (45, 35-80)	12-1000
Vitamin D	U/d	63 (70.79%)	375±194 (326-424)	400 (200, 200-400)	100-1000
Zinc	mg/d	55 (61.8%)	5.9±3.21 (5.03-6.76)	5 (3.62, 3.88-7.5)	2-15
Vitamin B6	mg/d	50 (56.18%)	1.48±1.83 (0.96-2)	1 (0.837, 0.563-1.4)	0.25-8.23
Vitamin A	µg/d	47 (52.81%)	514±413 (393-635)	400 (200, 300-500)	125-2333
Niacin	mg/d	44 (49.44%)	10.9±7.62 (8.58-13.2)	10 (4.25, 8-12.3)	0.6-50
Vitamin B12	µg/d	43 (48.31%)	29.7±152 (17.2-76.6)	2.5 (2.75, 1.25-4)	0.7-1000
Folate	µg/d	42 (47.19%)	176±93.4 (147-206)	155 (100, 100-200)	50-400
Riboflavin	mg/d	42 (47.19%)	1.5±2.22 (0.80-2.2)	1 (0.6, 0.8-1.4)	0.3-15
Vitamin E	mg/d	41 (46.06%)	7.74±4.61 (6.28-9.19)	6 (5, 5-10)	1.5-24
Thiamin	mg/d	40 (44.94%)	1.46±2.04 (0.80-2.11)	1 (0.4, 0.7-1.1)	0.25-11.8
Pantothenic Acid	mg/d	39 (43.82%)	4.62±3.47 (3.49-5.74)	4 (3, 3-6)	1-23
Iodine	µg/d	31 (34.83%)	67.0±25.7 (57.6-76.4)	75 (25, 50-75)	25-150
Selenium	µg/d	31 (34.83%)	35.6±23.6 (26.9-44.2)	45 (37.5, 17.5-55)	0.1-100
Omega3	mg/d	27 (30.34%)	617±612 (375-859)	444 (480, 255-735)	33.2-2931
DHA	mg/d	22 (24.72%)	266±172 (189-342)	245 (185, 116-302)	80-740
EPA	mg/d	21 (23.6%)	275±247 (162-387)	180 (300, 90-390)	24-873
Manganese	mg/d	18 (20.22%)	0.91±0.46 (0.68-1.15)	0.92 (0.41, 0.59-1)	0.3-2
Chromium	µg/d	17 (19.1%)	35.2±27.7 (20.9-49.4)	15 (50, 10-60)	6-80
Vitamin K	µg/d	14 (15.73%)	26.4±9.3 (21-31.7)	30 (10, 20-30)	20-37.5
Iron	mg/d	14 (15.73%)	6.7±3.74 (4.54-8.86)	6.13 (3.13, 5-8.13)	1.05-14
Molybdenum	µg/d	12 (13.48%)	42.7±20.3 (29.8-55.6)	42.5 (15, 35-50)	10-75
Copper	µg/d	11 (12.36%)	458±316 (246-670)	300 (350, 275-625)	150-1000
L-Arginine	mg/d	11 (12.36%)	205±128 (119-290)	250 (163, 87.5-250)	25-450
Magnesium	mg/d	10 (11.24%)	95.7±43.5 (64.6-127)	94 (33.3, 66.8-100)	45-200
Phosphatidylserine	mg/d	7 (7.87%)	48.6±48.1 (4.08-93.1)	10 (90, 10-100)	10-100
Sambucus nigra	mg/d	7 (7.87%)	116±72.3 (48.8-183)	100 (100, 75-175)	10-200
Beta Glucan	mg/d	6 (6.74%)	60±34.6 (23.6-96.4)	50 (37.5, 50-87.5)	10-100
Choline	mg/d	6 (6.74%)	252±420 (269-773)	100 (59, 41-100)	20-1000
Calcium	mg/d	5 (5.62%)	176±70.2 (88.4-263)	150 (0, 150-150)	128-300
Citrus Bioflavonoids	mg/d	5 (5.62%)	274±546 (-404-952)	46 (33, 17-50)	6.9-1250

* Micronutrients and other active ingredients found in at least five products are presented in the table.
/d: per recommended daily dose (represents the amount of nutrient consumed when the product is taken at the daily dosage recommended by the manufacturer on the label).
Basil Extract: Ocimum basilicum L, CI: Confidence interval, IQR: Interquartile range, NC: Not Calculated, SD: Standard Deviation, 25th - 75th p: 25th - 75th percentile.
IQR=[75th percentile-25th percentile]

Table 2. Distribution of DRV percentages for micronutrient content for the 4-10 age group according to the TFC

Micronutrient	Mean (±SD)	Median (IQR)	Minimum-Maximum
Biotin, %	71.5 (±67.7)	40.0 (70.0)	18.8 - 300
Calcium, %	22.8 (±9.92)	18.8 (5.38)	16.0 - 37.5
Vitamin B12, %	97.5 (±72.9)	80.0 (50.0)	28.0 - 400
Copper, %	33.8 (±18.7)	30 (9.00)	15 - 75
Folate, %	83.6 (±38.9)	75.0 (50.0)	25.0 - 209
Iodine, %	41.6 (±10.6)	46.7 (16.7)	20.0 - 50.0
Iron, %	42.0 (±31.2)	39.3 (19.6)	7.50 - 121
Magnesium, %	20.6 (±9.11)	18.5 (7.53)	12.0 - 33.3
Manganese, %	39.1 (±13.1)	42.5 (25.0)	15.0 - 50.0
Niacin, %	63.6 (±33.4)	62.5 (15.6)	18.8 - 200
Pantothenic Acid, %	71.2 (±35.3)	66.7 (33.3)	16.7 - 200
Phosphorus, %	17.1 (±NC)	17.1 (0.00)	17.1 - 17.1
Riboflavin, %	76.5 (±35.0)	64.3 (42.9)	21.4 - 200
Selenium, %	83.4 (±48.7)	90.9 (50.0)	9.09 - 200
Thiamin, %	89.8 (±39.5)	90.9 (36.4)	22.7 - 200
Vitamin A, %	69.2 (±55.2)	50.0 (56.3)	11.4 - 292
Vitamin B6, %	71.5 (±35.7)	71.4 (48.2)	17.9 - 200
Vitamin C, %	87.8 (±88.0)	75.0 (50.0)	15.0 - 625
Vitamin D, %	196 (±108)	200 (100)	50 - 750
Vitamin E, %	63.8 (±32.0)	50.0 (41.7)	16.7 - 167
Vitamin K, %	35.1 (±12.4)	40.0 (13.3)	13.3 - 50.0
Zinc, %	56.5 (±29.7)	50.0 (35.0)	20.0 - 150

Values represent the percentage of the DRV met by the product when consumed at the manufacturer's recommended daily dosage.
DRV: Dietary Reference Values, IQR: Interquartile Range, NC: Not Calculated, SD: Standard Deviation, TFC: Turkish Food Codex

Table 3. Distribution of DRV percentages for micronutrient content for the 11-17 age group according to the TFC

Micronutrient	Mean (±SD)	Median (IQR)	Minimum-Maximum
Biotin, %	154 (±194)	100 (110)	20 - 800
Calcium, %	16.0 (±NC)	16 (0.00)	16 - 16
Vitamin B12, %	2318 (±8676)	120 (300)	40 - 40000
Copper, %	106 (±31.5)	100 (18.8)	75 - 150
Folate, %	135 (±45.4)	150 (50.0)	75 - 200
Iodine, %	64.4 (±24.7)	50.0 (43.3)	30.0 - 100
Iron, %	67.0 (±31.5)	78.6 (53.6)	31.4 - 100
Magnesium, %	24.1 (±4.02)	25.1 (1.60)	17.1 - 26.7
Manganese, %	64.4 (±25.0)	50.0 (35.0)	25.0 - 100
Niacin, %	103 (±58.4)	100 (56.3)	37.5 - 313
Pantothenic Acid, %	116 (±78.2)	100 (66.7)	41.7 - 383
Riboflavin, %	173 (±229)	111 (28.6)	64.3 - 1071
Selenium, %	113 (±53.4)	100 (100)	9.09 - 200
Thiamin, %	234 (±268)	132 (81.8)	72.7 - 1073
Vitamin A, %	68.4 (±34.7)	60.0 (39.6)	31.3 - 156
Vitamin B6, %	157 (±175)	100 (64.3)	35.7 - 588
Vitamin C, %	214 (±304)	106 (87.5)	31.3 - 1250
Vitamin D, %	295 (±135)	225 (200)	60.0 - 500
Vitamin E, %	107 (±62.3)	100 (33.3)	25.0 - 250
Vitamin K, %	37.1 (±22.5)	30.0 (11.7)	16.0 - 80.0
Zinc, %	86.1 (±36.4)	75.0 (50.0)	30 - 150

Values represent the percentage of the DRV met by the product when consumed at the manufacturer's recommended daily dosage.
DRV: Dietary Reference Values, NC: Not Calculated, SD: Standard Deviation, TFC: Turkish Food Codex

Table 4. Distribution of DRV percentages for DHA content according to the TFC

	Mean	SD	Median	25th p	75th p	Minimum	Maximum
DHA, for 4-8 years, %	326.83	206.05	272.22	133.33	510.46	88.89	822.22
DHA, for 9-11 years, %	245.12	154.54	204.17	100.0	382.84	66.67	616.67
DHA, for 12-13 years, %	297.03	172.40	212.50	166.43	425.0	95.83	645.83

DHA: Docosahexaenoic acid, DRV: Dietary Reference Values, SD: Standard Deviation , TFC: Turkish Food Codex, 25th p: 25th percentile, 75th p: 75th percentile.

Parental anxiety and the power of persuasion in marketing

Our study revealed that more than half of the products (51.7%) featured a character or figure on their packaging, and a quarter (25.9%) included a child figure. The fact that the most commonly used figure was a fish (19.1%) is likely a marketing strategy to associate the products with the perceived cognitive benefits of omega-3 fatty acids. Research has shown that cartoon characters on packaging significantly influence children's taste perceptions and product preferences, creating *pester power*.[23]

This trend is not unique to Türkiye. Studies conducted in the US, China, and other developed countries show that approximately one-third of children use dietary supplements and that multivitamins are the most common type. [24,25] Parents' reasons for using dietary supplements are to improve general health, strengthen immunity, and support appetite and diet.[3,4,24,26] Consistent with the parental perception of immune support, the most frequent micronutrients in the products in our study included popular ones such as zinc and vitamins C and D. Similarly, studies analyzing the content of multivitamins and multiminerals in Peru and the US reported that the most common ingredients were vitamins C, D, A, and zinc.[27,28]

This marketing approach medicalizes normal dietary diversity and replaces nuanced clinical judgment with a simple consumer choice, which shifts the burden of risk assessment onto parents who lack the necessary tools (such as UL information on labels) to make an informed decision.

The double-edged sword of dosage: Risks of insufficiency and excess

The most central finding of this study is the variability in micronutrient content among the products. This variability creates a dual-risk profile for the consumer: on one hand, the risk of receiving subtherapeutic doses that provide a false sense of security, and on the other, the more concerning risk of chronic exposure to excessive doses that approach or exceed established safety limits.

Our analysis showed that in products formulated for the 4-11 age group, the average content of 21 different micronutrients fell below the TFC DRV. Essential minerals critical for child development, such as calcium, magnesium, and iron for bone health and neurological development, were offered at levels meeting approximately 20-40% of the DRV. While these amounts align with the regulatory definition of a supplement intended to complement a varied diet, they may be considered subtherapeutic in the context of parental reliance. Parents often use these products to address perceived dietary inadequacies, yet these dosages may be insufficient to correct actual deficits, creating a gap between consumer expectation and physiological impact. This finding of our study was consistent with other research. A study in the US found that while many vitamins were provided at or above the Recommended Dietary Allowance (RDA), calcium, magnesium, and phosphorus were consistently labeled below the RDA.[29] A market analysis in Canada revealed that the median doses of calcium and iron in pediatric supplements were similarly low.[30]

Although product labels technically declare these amounts in compliance with regulations, the marketing of these products as comprehensive 'multivitamin/multimineral' formulations can create a paradox. Parents who purchase these supplements may believe they are meeting their children's nutritional needs under the perceived illusion of *comprehensive nutritional support*, while in reality, the subtherapeutic doses of essential minerals mean their children may still be at risk for essential mineral deficiencies. This false assurance can deter parents from seeking dietary solutions or using appropriate, single-ingredient supplements when clinically indicated.

Conversely, the prolonged use of such supplements, especially when combined with dietary intake, may lead to exceeding safe upper limits and potentially result in adverse health effects.[31,32] Table 5 illustrates the potential risk by comparing it with the safety thresholds established by the TFC. Our findings align with research from Canada, where median doses of vitamins A, B6, B12, and C, as well as other B vitamins, were found to significantly exceed the AI recommendations.[30] Another study in Danish children found that a significant proportion of those using multivitamin and mineral supplements exceeded the ULs for micronutrients such as vitamin A, zinc, iodine, and iron.[33] Similarly, Saavedra-Garcia et al. reported that vitamin A and folate most frequently exceeded the recommended UL.[27] In their study evaluating the micronutrient content for children aged 1-3 years, Samuel et al. reported that more than one-third of the products contained Vitamin A that exceeded the UL, and one-fifth contained niacin that also exceeded the UL.[34]

Table 5. Distribution of DML percentages for micronutrient content according to the TFC

	4-10 Years			11-18 Years		
	Mean (SD)	**Median (IQR)**	**Min (Max)**	**Mean (SD)**	**Median (IQR)**	**Min (Max)**
Biotin	2.86 (2.71)	1.60 (2.80)	0.75 (12.0)	1.54 (1.94)	1.00 (1.10)	0.20 (8.0)
Calcium	24.3 (10.6)	20.0 (5.73)	17.1 (40.0)	8.53 (NC)	8.53 (0.00)	8.53 (8.53)
Choline	82.5 (138)	36.4 (16.0)	7.27 (364)	60.1 (82.1)	25.7 (59.7)	7.27 (182)
Vitamin B12	0.16 (0.12)	0.13 (0.08)	0.05 (0.67)	18.33 (21.2)	18.33 (15)	3.33 (33.3)
Copper	33.8 (18.7)	30 (9.0)	15 (75)	53.1 (15.7)	50.0 (9.38)	37.5 (75.0)
Folate	55.7 (25.9)	50.0 (33.3)	16.7(139)	44.9 (15.1)	50.0 (16.7)	25.0 (66.7)
Iodine	83.2 (21.1)	93.3 (33.3)	40.0 (100)	64.4 (24.7)	50.0 (43.3)	30.0 (100)
Iron	69.1 (51.4)	64.7 (32.4)	12.3 (200)	55.2 (25.9)	64.7 (44.1)	25.9 (82.4)
Magnesium	61.8 (27.3)	55.6 (22.6)	36.0 (100)	36.2 (6.02)	37.6 (2.40)	25.6 (40.0)
Manganese	78.1 (26.3)	85.0 (50.0)	30 (100)	64.4 (25.0)	50.0 (35.0)	25.0 (100)
Molybdenum	24.4 (11.6)	24.3 (8.57)	5.71 (42.9)	17.3 (4.13)	20.0 (5.71)	10.0 (21.4)
Niacin	4.07 (2.14)	4.00 (1.0)	1.20 (12.8)	3.28 (1.87)	3.20 (1.80)	1.20 (10.0)
Pantothenic Acid	0.85 (0.42)	0.80 (0.40)	0.20 (2.40)	0.69 (0.46)	0.60 (0.40)	0.25 (2.30)
Phosphorus	34.3 (NC)	34.3 (0.00)	34.3 (34.3)			
Riboflavin	1.07 (0.49)	0.9 (0.60)	0.30 (2.80)	1.21 (1.60)	0.775 (0.20)	0.45 (7.50)
Selenium	46.3 (26.3)	50.0 (27.5)	5.00 (110)	31.1 (14.7)	27.5 (27.5)	2.50 (55.0)
Thiamin	1.98 (870)	2.00 (800)	500 (4.40)	2.58 (2.95)	1.45 (0.900)	0.80 (11.8)
Vitamin A	111 (88.2)	80.0 (90.0)	18.3 (467)	54.8 (27.8)	48.0 (31.7)	25.0 (125)
Vitamin B6	20.0 (9.99)	20.0 (13.5)	5.0 (56.0)	22.0 (24.5)	14.0 (9.00)	5.00 (82.3)
Vitamin C	14.0 (14.1)	12.0 (8.00)	2.4 (100)	17.1 (24.3)	8.50 (7.00)	2.50 (100)
Vitamin D	78.5 (43.1)	80.0 (40.0)	20.0 (300)	59.0 (27.0)	45.0 (40.0)	12.0 (100)
Vitamin E	5.67 (2.84)	4.44 (3.70)	1.48 (14.8)	4.76 (2.77)	4.44 (1.48)	1.11 (11.1)
Vitamin K	26.4 (9.30)	30.0 (10.0)	10.0 (37.5)	13.9 (8.43)	11.3 (4.38)	6.00 (30.0)
Zinc	75.3 (39.6)	66.7 (46.7)	26.7 (200)	57.4 (24.3)	50.0 (33.3)	20.0 (100)
Beta Glucan	7.50 (4.33)	6.25 (4.69)	1.25 (12.5)	15.0 (7.13)	12.5 (6.25)	6.25 (25.0)
L-Arginine	17.0 (10.7)	20.8(13.5)	2.08 (37.5)	7.67 (3.61)	9.50 (3.25)	1 (10)
Chromium	19.4 (16.3)	8.33 (27.6)	3.33 (44.4)	19.3 (11.8)	19.4 (16.7)	1.67 (33.3)
L-Carnitine	10.0 (NC)	10 (0.00)	10 (10)	5.00 (4.33)	2.50 (3.75)	2.50 (10.0)
Caffeine				24.3 (NC)	24.3 (0.00)	24.3 (24.3)
Coenzyme Q10				1.00 (0.00)	1.00 (0.00)	1 (1)
L-Tyrosine	10.0 (NC)	10 (0.00)	10 (10)			
Citicoline	12.0 (NC)	12 (0.00)	12 (12)	18.7 (11.0)	25 (9.50)	6 (25)
Uridine				28.6 (NC)	28.6 (0.00)	28.6 (28.6)

DML: Daily Maximum Limits, IQR: Interquartile Range, NC: Not Calculated, SD: Standard Deviation, TFC: Turkish Food Codex

Therefore, the study's findings have important implications for clinicians. Clinicians should proactively inquire about all supplement use and document brand names and dosages. As physicians are the most frequent source of information, they have a critical role in educating parents about the lack of evidence for routine multivitamins, specific national recommendations for vitamin D and iron, and the dangers of toxicity from over-the-counter products.[5] This critical role is further reinforced by the finding in the study by Koç et al. that "72% of families believe that excessive use of nutritional supplements is not harmful".[5]

Study Limitations

This study has several limitations. First, it was conducted within a specific time frame and a limited geographical area using a convenience sampling method; therefore, while it captures nationally distributed brands, the findings may not be generalizable to the entire national market. The study provides a snapshot of the market, a limitation that should guide future research, as formulations and product availability can change rapidly. This cross-sectional design may introduce seasonality bias, as certain formulations predominantly marketed for winter use (e.g., specific immune boosters) might be underrepresented compared to peak-season availability. Licensed products that were unavailable on the market could not be included in the study. The exclusion of online marketplaces restricts our findings to the traditional retail pharmacy sector, where parents typically seek professional face-to-face guidance, potentially missing online-exclusive brands. Furthermore, the analyses are based solely on the nutritional content declared on product labels and manufacturers' official websites and do not include independent chemical analysis. However, significant research shows that the actual content of nutritional supplements often deviates from label declarations.[29,35,36] We acknowledge that web-based data may lag behind physical labeling updates. Therefore, our findings reflect the declared safety profile presented to the consumer rather than the analytically confirmed composition. A major limitation of our study is the lack of separate DRV data for age and gender in the TFC.

In light of these findings, future research could focus on conducting laboratory analyses to verify label claims, investigating the impact of pediatric nutritional supplement use on children's overall nutrient intake and micronutrient status, examining the knowledge and attitudes of parents in Türkiye regarding these products, and evaluating the long-term health outcomes associated with their use.

Conclusion

The market for multi-micronutrient supplements marketed for children in Türkiye is characterized by remarkable heterogeneity and a lack of standardization in product content. This situation creates a dual-risk profile for children. On one hand, the provision of subtherapeutic doses of essential minerals such as calcium, magnesium, and iron may create a false sense of security in parents, thereby failing to address existing nutritional deficiencies. On the other hand, the presence of micronutrients, particularly vitamins A and D and zinc, in doses exceeding the nationally established DML, carries a risk of chronic toxicity and excessive intake.

The current market structure contradicts national and international health guidelines that do not recommend such supplements for healthy, well-nourished children. Marketing strategies, such as figures on packaging, create a market shaped by consumer demand, targeting parental anxiety rather than evidence-based medical necessity. In light of these findings, clinicians should counsel families on the non-necessity of routine use of these supplements, actively inquire about the products and dosages being used, and educate them on the potential risks of toxicity. Policymakers should more strictly regulate the content and labeling standards of supplements for children, incorporate safety limits such as the UL into legislation, and oversee misleading marketing practices. Future research should verify label claims with chemical analyses and evaluate the long-term health outcomes of these products.

In conclusion, the multi-micronutrient supplement market for children in Türkiye presents a picture that carries risks of both insufficient and excessive dosages and requires public health regulation. Urgent regulatory measures and strong clinical guidance are imperative to protect children's health.

Ethical approval

This study did not require institutional ethics committee approval, as all data were compiled from publicly available sources and it did not involve any human or animal subjects.

Author contribution

The authors declare contribution to the paper as follows: Study conception and design: DO; data collection: DO, IO; analysis and interpretation of results: DO; draft manuscript preparation: DO, IO. All authors reviewed the results and approved the final version of the article.

Source of funding

The authors declare the study received no funding.

Conflict of interest

The authors declare that there is no conflict of interest.

Data availability statement

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

References

1. Statista. Vitamins & Minerals - Turkey. Statista. Available at: https://www.statista.com/outlook/emo/otc-pharmaceuticals/vitamins-minerals/turkey (Accessed on April 30, 2025).
2. Research and Markets. U.S. Pediatric Supplements Market - Focused Insights 2024-2029. Available at: https://www.researchandmarkets.com/reports/5982848/u-s-pediatric-supplements-market-focused (Accessed on April 30, 2025).
3. Barretto JR, Gouveia MADC, Alves C. Use of dietary supplements by children and adolescents. *J Pediatr (Rio J)*. 2024;100(Suppl 1):S31-S39. **[Crossref]**
4. Koç A, Erdoğan K, Arslan N, Öztürk SB, Ayşakar A, Koparal B. Assessment for the use of nutritional support in Turkey. *J Med - Clin Res Amp Rev*. 2018;2:1-5. **[Crossref]**
5. Koç O, Tosyalı M, Gökçe Ş, Koç F. Use of dietary supplements and influencing factors in children. *Int J Environ Res Public Health*. 2024;21:734. **[Crossref]**
6. Yakoob MY, Lo CW. Nutrition (micronutrients) in child growth and development: a systematic review on current evidence, recommendations and opportunities for further research. *J Dev Behav Pediatr*. 2017;38:665-679. **[Crossref]**
7. Shenkin A. The key role of micronutrients. *Clin Nutr*. 2006;25:1-13. **[Crossref]**
8. Black RE, Allen LH, Bhutta ZA, et al. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet*. 2008;371:243-260. **[Crossref]**
9. Black RE, Victora CG, Walker SP, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. *Lancet*. 2013;382:427-451. **[Crossref]**
10. Pike V, Zlotkin S. Excess micronutrient intake: defining toxic effects and upper limits in vulnerable populations. *Ann N Y Acad Sci*. 2019;1446:21-43. **[Crossref]**
11. Tam E, Keats EC, Rind F, Das JK, Bhutta AZA. Micronutrient supplementation and fortification interventions on health and development outcomes among children under-five in low- and middle-income countries: a systematic review and meta-analysis. *Nutrients*. 2020;12:289. **[Crossref]**
12. Ilgaz Ş, Yardım N, Çimen MYB, et al. Food fortification with vitamin D, folic acid and iron in Turkey: ministry of health recommendation. *Turk J Public Health*. 2020;18:226-248.
13. Republic of Türkiye Ministry of Health. Ministry of health, general directorate of public health. infant, child, and adolescent monitoring protocols. 2018.
14. Altmann TR, Hill DL, editors. Caring for your baby and young child: birth to age 5. 8th ed. Bantam Books; 2024. **[Crossref]**
15. Public Health Agency of the Ministry of Health of Türkiye. Türkiye dietary guidelines 2022. Head of department of obesity, Diabetes and Metabolic Diseases of the Public Health Agency of the Ministry of Health of Türkiye; 2022.
16. von Elm E, Altman DG, Egger M, et al. The Strengthening the Reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *J Clin Epidemiol*. 2008;61:344-349. **[Crossref]**
17. Institute of Medicine. Dietary reference intakes: the essential guide to nutrient requirements. The National Academies Press; 2006. **[Crossref]**
18. European Food Safety Authority (EFSA). Dietary reference values for nutrients summary report. EFSA Support Publ. 2017;14, e15121E. **[Crossref]**
19. Ministry of Agriculture and Forestry. Turkish Food Codex Nutrition and Health Claims; 2023. https://mevzuat.gov.tr/mevzuat?MevzuatNo=40154&MevzuatTur=7&MevzuatTertip=5
20. Onur D. onurdersan/micronutrients: A comparative analysis and interactive visualization tool for micronutrient reference values. **[Crossref]**
21. Ministry of Agriculture and Forestry. Turkish Food Codex Regulation on Labelling and Food Information to Consumers; 2024. Available at: https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=23282&MevzuatTur=7&MevzuatTertip=5 (Accessed on August 17, 2025).
22. Ministry of Agriculture and Forestry. Turkish Food Codex Communiqué on Food Supplements; 2017. Available at: https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=18729&MevzuatTur=9&MevzuatTertip=5 (Accessed on August 17, 2025).

23. Ogba I, Johnson R. How packaging affects the product preferences of children and the buyer behaviour of their parents in the food industry. *Young Consum*. 2010;11:77-89. **[Crossref]**

24. Bailey RL, Gahche JJ, Thomas PR, Dwyer JT. Why US children use dietary supplements. *Pediatr Res*. 2013;74:737-741. **[Crossref]**

25. Picciano MF, Dwyer JT, Radimer KL, et al. Dietary supplement use among infants, children, and adolescents in the United States, 1999-2002. *Arch Pediatr Adolesc Med*. 2007;161:978-985. **[Crossref]**

26. Stierman B, Mishra S, Gahche JJ, Potischman N, Hales CM. Dietary supplement use in children and adolescents Aged ≤19 Years - United States, 2017-2018. *MMWR Morb Mortal Wkly Rep*. 2020;69:1557-1562. **[Crossref]**

27. Saavedra-Garcia L, Gawlas AM, Quiroz-Macukachi A, Donayre-Huamán HG, Basurco-Olazabal RI, Guerra Valencia J. Nutritional content of vitamin and mineral supplements aimed at children in the peruvian market: analysis of compliance with recommendations. *Rev Peru Med Exp Salud Publica*. 2025;42:82-87. **[Crossref]**

28. Dwyer JT, Saldanha LG, Bailen RA, et al. Do Multivitamin/mineral dietary supplements for young children fill critical nutrient gaps? *J Acad Nutr Diet*. 2022;122:525-532. **[Crossref]**

29. Gusev P, Andrews K, Tey PT, et al. Children's multivitamin/mineral supplements: label claims and measured content compared to recommended dietary allowances and tolerable upper intake levels. *Curr Dev Nutr*. 2020;4:nzaa061_037. **[Crossref]**

30. Elliott C. Assessing vitamins, minerals and supplements marketed to children in Canada. *Int J Environ Res Public Health*. 2019;16:4326. **[Crossref]**

31. Zhang FF, Barr SI, McNulty H, Li D, Blumberg JB. Health effects of vitamin and mineral supplements. *BMJ*. 2020;369:m2511. **[Crossref]**

32. Aljohani A, Alharbi S, Althobaiti R, Aljohani R, Alnemari R, Arida H. Micronutrients' toxicity from causes to adverse effects: a review. *Int J Med Dev Ctries*. 2023;7:711-715. **[Crossref]**

33. Christensen C, Matthiessen J, Fagt S, Biltoft-Jensen A. Dietary supplements increase the risk of excessive micronutrient intakes in Danish children. *Eur J Nutr*. 2023;62:2449-2462. **[Crossref]**

34. Samuel L, Ethan D, Basch C, Dunne S, Quinn C. An analysis of nutrient facts labels of pediatric multi-vitamin and mineral supplements: is there a risk of overexposure? *Nutr Health*. 2023;29:715-720. **[Crossref]**

35. Lentjes MAH. The balance between food and dietary supplements in the general population. *Proc Nutr Soc*. 2019;78:97-109. **[Crossref]**

36. Andrews KW, Roseland JM, Gusev PA, et al. Analytical ingredient content and variability of adult multivitamin/mineral products: national estimates for the Dietary Supplement Ingredient Database. *Am J Clin Nutr*. 2017;105:526-539. **[Crossref]**