Journal of Food Composition and Analysis 155 (2026) 109224

Contents lists available at ScienceDirect

Journal of Food Composition and Analysis

journal homepage: www.elsevier.com/locate/jfca

Hidden sodium in effervescent food supplements: Labelling practices and product composition

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ARTICLE INFO

Dataset link: Sodium Content in Effervescent Food Supplements: Dataset of Products Sampled in Slovenia

Keywords:
Food supplements
Dietary supplements
Food labelling
Sodium
Effervescent tablets
Salt

ABSTRACT

Effervescent food supplements contain mineral carbonates and organic acids that enable carbon dioxide release. While sodium content is well established for effervescent medicines, data for food supplements remain limited. Sodium labelling is not mandatory for food supplements in the European Union. Effervescent tablets are consumed as beverages and may be used daily, potentially contributing to total sodium intake relevant for cardiovascular health. The aim of this study was to examine the sodium content and labelling practices of the effervescent food supplements available in Slovenia. A cross-sectional representative sample of 71 effervescent supplements containing vitamins and/or minerals was analysed. Sodium content was quantified using an accredited inductively coupled plasma atomic emission spectroscopy method. The mean sodium content per dose unit was 253 ± 108 mg. The highest mean levels were observed in products containing vitamins&minerals ($N = 18$; 314 ± 109 mg), and the lowest in calcium containing products ($N = 9$; 136 ± 59 mg). With recommended intakes of up to three dose units per day, sodium exposure may reach 740 mg, corresponding to up to 37% of the EFSA reference intake of 2000 mg/day. Effervescent food supplements can represent a notable and often overlooked source of dietary sodium.

1. Introduction

Food supplements in the form of effervescent tablets are popular and widely available. This formulation typically contains an ingredient capable of releasing carbon dioxide (e.g. sodium hydrogen carbonate, $NaHCO_3$), and an acid that induces CO_2 release (e.g. citric, malic, tartaric, or ascorbic acid), resulting in rapid dissolution and a characteristic effervescence (Advankar et al., 2019).

Sodium hydrogen carbonate can be a major component of effervescent tablets, and represents a significant source of sodium. The adverse effects of high sodium intake on blood pressure are well established (Filippini et al., 2022; He et al., 2013). While sodium-containing medicines have been extensively studied in relation to cardiovascular and blood pressure-related outcomes (Benitez-Camps et al., 2015; Douglas & Akil, 2006; George et al., 2014; George et al., 2013; Perrin et al., 2018; Perrin et al., 2017), food supplements have received considerably less research attention. To our knowledge, only De Keyzer et al. included food supplements in their sodium intake estimations (De Keyzer et al., 2015), although the sodium content of effervescent food supplements was specifically highlighted by Kunz et al. (Kunz et al., 2023). Food supplements are commonly perceived as harmless (Pajor et al., 2017); effervescent tablets are consumed as beverages and may be treated similarly to ordinary foods, thereby increasing the potential for chronic daily use with potential negative implications for cardiovascular health.

Regulatory frameworks within the European Union (EU) may contribute to this oversight. Regulation (EU) No. 1169/2011, on the provision of food information to consumers, mandates nutrition declaration for foods, including energy value, fat, saturated fat, carbohydrate, sugars, protein, and salt/sodium (EC, 2011). However, food supplements are exempt from mandatory nutrition declaration under this regulation; their labelling is harmonised with Directive 2002/46/EC, which requires the labelling of ingredients and the amounts of nutrients

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https://doi.org/10.1016/j.jfca.2026.109224
Received 13 February 2026; Received in revised form 4 May 2026; Accepted 5 May 2026
Available online 7 May 2026

or substances with a nutritional or physiological effect, but does not mandate the declaration of salt or sodium content (EC, 2002). In practice, this means that nutrition information is only mandatory for effervescent tablets classified as traditional foods. However, if effervescent tablets contain vitamins and are marketed as a food supplement, only the amount of the vitamins is required to be declared in the nutrition information, while sodium content may remain unlabelled.

1.1. Sodium intake, blood pressure, and health implications

The World Health Organization recommends that daily sodium intake should not exceed 2.0 g (WHO, 2012). The European Food Safety Authority (EFSA) highlighted that insufficient data are available to establish an average requirement (AR) or population reference intake (PRI) for sodium; however, it also identified a sodium intake of 2.0 g/day as a level associated with a reduced risk of cardiovascular disease, and it considers this intake adequate to maintain the sodium balance of the general adult population (Turck et al., 2019).

Despite sodium being an essential electrolyte, the majority of the adult population worldwide exceed these recommended levels (Powles et al., 2013). Multiple meta-analyses have demonstrated that reducing sodium intake from these higher habitual levels lowers blood pressure in both hypertensive and normotensive individuals, with an apparent linear dose-response relationship (He et al., 2013; Mozaffarian et al., 2014). Elevated sodium intake is also associated with increased cardiovascular disease risk, particularly when combined with low potassium intake (Ma et al., 2022). Consequently, reducing sodium consumption is recognised as one of the most cost-effective strategies for lowering blood pressure and reducing the burden of cardiovascular disease (Bibbins-Domingo et al., 2010; Webb et al., 2017).

1.2. Composition of effervescent food supplements

Sodium hydrogen carbonate ($NaHCO_3$) is widely used in effervescent formulations. In an aqueous solution, the mildly alkaline hydrogen carbonate anion undergoes an acid-base reaction with an organic acid, such as citric or malic acid (Advankar et al., 2019). This reaction releases carbon dioxide, resulting in effervescence, when the tablet dissolves in water: $HCO_3^- + H_3O^+ \rightarrow 2\,H_2O + CO_2$

The generation of CO_2 bubbles promotes rapid tablet disintegration and enhances the dissolution and dispersion of the active ingredients. In addition, the effervescence produces a carbonation sensation that is often perceived as pleasant by consumers (Advankar et al., 2019). Sodium hydrogen carbonate also serves as a pH-regulating agent in effervescent formulations (Bühler, 2001), while the mildly salty-acidic taste of the resulting products contributes to flavour modulation. From a formulation perspective, sodium hydrogen carbonate can be partially or fully replaced by alternative carbonate or hydrogen carbonate salts which also generate CO_2 when combined with citric or other organic acids in an aqueous solution (Beres et al., 1998; Negre et al., 2022). Potassium hydrogen carbonate ($KHCO_3$) can substitute for sodium hydrogen carbonate; issues related to hygroscopicity, stability, compressibility, and bitterness were addressed by combining potassium hydrogen carbonate with malic acid, mannitol, and aspartame (Beres et al., 1998). Calcium carbonate ($CaCO_3$) reacts with citric acid; while formed citrate has a neutral taste, its low solubility may result in visible sediment formation. However, combining calcium carbonate with citric and malic acids can yield metastable calcium citrate malate, which has substantially higher solubility (Fox Mary et al., 1995). A recent patent also describes sodium-free effervescent formulations based on calcium carbonate, magnesium carbonate, or their combinations, used together with mixtures of organic acids (citric acid, malic acid etc.) (Negre et al., 2022).

1.3. Study objectives

The primary objective of this study was to assess the sodium content of the effervescent food supplements available on the Slovenian market. Additionally, the study aimed to compare the sodium content across different categories of effervescent tablets, and to assess sodium content labelling practices. The study also provides a basis for the future evaluation of sodium intake derived from effervescent food supplements and their potential public health implications.

2. Materials and methods

2.1. Samples and declared (labelled) composition

The point of departure was a cross-sectional sample of food supplements in the form of effervescent tablets in Slovenia. The sample was originally compiled to verify the quality of these products, focusing on the verification of the declared content of the selected vitamins and minerals with the actual composition (laboratory analyses), which has been previously described (Hribar et al., 2026). In brief, the national Composition and Labelling Information System (CLAS) database (Pravst et al., 2022) was updated in 2023 with all the food supplements available in the major food retailers, specialised stores and pharmacies in Slovenia. This database was used to identify all the effervescent tablets containing selected vitamins and minerals. When multiple flavours or package sizes of the same product were available, a single flavour in the smallest available package size was selected to minimise redundancy. This selection process resulted in a total of 71 products, of which the majority were international brands (87%), and only a small proportion were national brands (13%). One production series of each product was purchased in July-August 2023, followed by data extraction from the label (Hribar et al., 2026) and laboratory analyses.

2.2. Quantification of the sodium content

The laboratory analyses were carried out by an independent accredited laboratory (Mérieux NutriSciences, Resana, Italy) using an analytical method compliant with the standards applied by food control authorities; the sodium content was quantified using inductively coupled plasma atomic emission spectroscopy (ICP–AES) (AOAC International, 2019) [Accreditation ref. MP1289 rev. 18/2023], with a declared limit of detection (LOD) of 1 mg/kg, a limit of quantification (LOQ) of 5 mg/kg, and a coefficient of variation (CV) of 5.5%. The laboratory also reported extended measurement uncertainty, accounting the accuracy of the method, together with uncertainty components related to systematic effects on mass measurements, the calibration curve, and point curve control. Considering coverage factor $k = 2$, corresponding to a probability interval of 95%, the extended uncertainty for the matrix used was $< 19\%$. The effervescent tablets were handled as solid matrices; multiple tablets from one product package (one batch) were combined and homogenised to account for variability between units. The pooled sample was finely ground to obtain a uniform powder. An accurately weighed portion of the homogenised sample was subjected to acid digestion with HNO_3 in a microwave oven; the obtained solution was nebulised and the resulting aerosol transported to the plasma torch. The results of the laboratory quantification were reported per single measurement in mg/kg, with the corresponding extended measurement uncertainty. The sodium content per effervescent tablet was calculated based on the average tablet weight and recalculated to Salt/NaCl-equivalent using a conversion factor of 2.54, derived from the ratio of the molecular weights of sodium and sodium chloride.

2.3. Data analysis

Statistical analyses were carried out to address the study objectives with regard to the assessment of sodium content and the labelling

accuracy of effervescent food supplements. The data were collected and managed using Microsoft® Excel® for Microsoft 365 MSO (Version 2511, Build 16.0; Redmond, WA, USA), with statistical analyses conducted using IBM SPSS Statistics (Version 30.0.0.0; IBM Corp., Armonk, NY, USA). Prior to the analysis, data distribution was assessed using the Shapiro-Wilk test, which confirmed normality and supported the use of parametric statistical methods throughout. The statistical significance was defined as $p < 0.05$ for all analyses.

Descriptive statistics, including median, mean, and range, were calculated for the entire sample and at subgroup levels. Product categorisation followed the classification system used by Kunz et al. [11], enabling systematic comparison across different types of effervescent food supplements. The differences in sodium content between product categories were evaluated using one-way analysis of variance (ANOVA), with post hoc pairwise comparisons carried out using Bonferroni adjustment to control for multiple testing. The effect sizes for statistically significant pairwise comparisons were expressed as standardised mean differences (Cohen's d), calculated using pooled standard deviations and interpreted according to conventional benchmarks (small: $d = 0.2$, medium: $d = 0.5$, large: $d \geq 0.8$) (Lakens, 2013).

Where the samples declared their salt/sodium content on labels, these values were compared to the analytical results. While labelling of salt/sodium content is not mandatory on food supplements in the EU, such voluntary information (if labelled) must reflect the actual composition of the product, within the permitted tolerances, as defined by the European Commission for the labelling of minerals in food supplements (−20% to +45%, including measurement uncertainty and already accounting for batch-to-batch variability) (EC, 2012). Differences between the declared and measured concentrations were evaluated using a paired sample *t*-test.

To evaluate the contribution of effervescent tablets to daily sodium intake, the measured sodium amounts per tablet were compared to the recommended daily sodium intake limit of 2 g (Turck et al., 2019). This comparison enabled an assessment of the potential public health implications of the regular consumption of these products. The figures were prepared using GraphPad Prism (Version 10.0; GraphPad Software, San Diego, CA, USA).

3. Results

3.1. Sodium content by product category and intake estimates

Notable differences in sodium content were observed between product categories (Table 1; Fig. 1). Levene's test confirmed the homogeneity of variances ($p = 0.508$), satisfying the assumption for the one-way ANOVA, which revealed a significant effect of product category on sodium content per tablet, $F(4, 66) = 6.47$, $p < 0.001$. Effervescent tablets containing combinations of vitamins and minerals exhibited the highest mean sodium content (314 ± 109 mg per tablet), followed by products containing vitamins only (285 ± 108 mg) and products classified as 'other' supplements (275 ± 85 mg). Magnesium and calcium-containing effervescent tablets had the lowest mean sodium content: 219 ± 88 and 136 ± 59 mg per tablet, respectively. Although the calcium and magnesium-containing effervescent tablets did not differ significantly from each other, both categories showed significantly lower sodium content than category of vitamins and minerals (calcium: $p < 0.01$, $d = 1.85$; magnesium: $p = 0.03$, $d = 0.96$), with both differences representing large effect sizes (Fig. 1). Similar trends can be observed when these categories are compared based on the proportion of products with high sodium content, which we defined as exceeding the overall median of 256 mg/tablet. A higher proportion of such high sodium products was observed in vitamins and minerals (72%), followed by other products (64%) and vitamins (62%).

When expressed as salt equivalents, these values ranged from a mean of 0.35 g per tablet in calcium supplements, to 0.80 g per tablet in vitamin-mineral combinations. The corresponding contribution to the EFSA established AR ranged up to 15.7% per tablet (for vitamin-mineral effervescent tablets; see Table 1).

The wide distribution of sodium content across the products is also reflected by interquartile ranges (IQR) within all categories (Table 1). The median sodium content in the overall sample was 256 mg per tablet (IQR: 178–324 mg).

The majority of the products (88.7%) recommended a daily intake of one effervescent tablet. However, a proportion of the products recommended higher intakes. For products with a recommended daily intake of more than one tablet, the sodium intake from effervescent supplements alone could reach substantially higher levels. In products allowing up to three tablets per day, the measured sodium content corresponded to potential daily intakes of up to approximately 740 mg of sodium, equivalent to about 37% of the EFSA AR.

3.2. Declared versus analytically determined sodium content

Only a small subset of products (N = 16, 23%) declared their sodium or salt content on the label. In these products, the analytically determined sodium content showed some variability in comparison with the labelled values (Fig. 2, Supplementary Figure S1). In the overall sample, the difference between the mean labelled and measured sodium values was not significant (246 vs 241 mg/tablet; $p = 0.38$), while the limited number of labelled products precluded robust statistical subgroup analysis. The differences in the labelled and measured sodium levels were therefore compared at the product level, using the EC threshold for the labelling of minerals in food supplements (-20% to +45%) (EC, 2012). Only one sample (N = 1; 6%) was outside this interval, and even in that one the actual sodium content was lower than labelled (-28%). This observation was also confirmed after applying stricter criteria of

Table 1
Laboratory determined sodium content of effervescent food supplement tablets available in Slovenia, by product category.

(Sub)sample	N (%)	Sodium content mg/tablet					Salt-equivalent content* mg/tablet				% of the EFSA AR (2 g) (Turck et al., 2019)			
		Mean	SD	Median	IQR	High sodium N (%)	Mean	SD	Median	IQR	Mean	SD	Median	IQR
All	71 (100)	253	108	256	178–324	34 (50)	644	275	650	452–822	12.7	5.4	12.8	8.9–16.1
Vitamins	13 (18)	285	108	319	216–356	8 (62)	725	274	812	550–906	14.3	5.4	16.0	10.8–17.8
Vitamins and Minerals	18 (25)	314	109	309	256–394	13 (72)	797	277	786	650–1003	15.7	5.5	15.5	12.8–19.7
Magnesium	20 (28)	219	88	246	133–269	7 (35)	556	223	626	338–683	11.0	4.4	12.3	6.6–13.4
Calcium	9 (13)	136	59	149	114–164	0 (0)	346	150	379	290–417	6.8	3.0	7.5	5.7–8.2
Other products	11 (16)	275	85	279	196–336	7 (64)	699	217	708	497–853	13.8	4.3	13.9	9.8–16.8

Notes: SD = Standard deviation; IQR = Interquartile range; High sodium: N (%): the proportion of products with sodium content above the overall median of 256 mg per tablet. The salt-equivalent content was calculated as described in the Methods section.

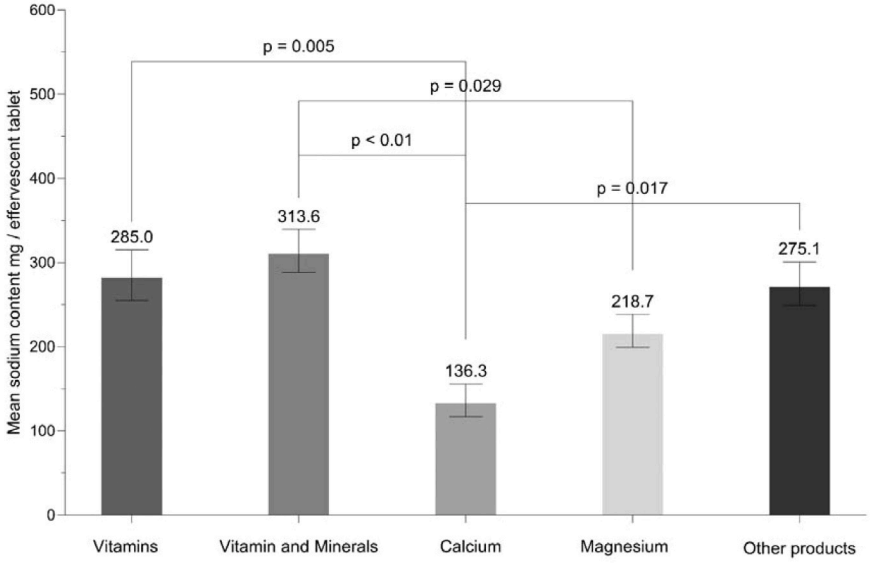

Fig. 1. Mean sodium content of effervescent food supplements by category (ANOVA, Analysis of variance) (N = 71).

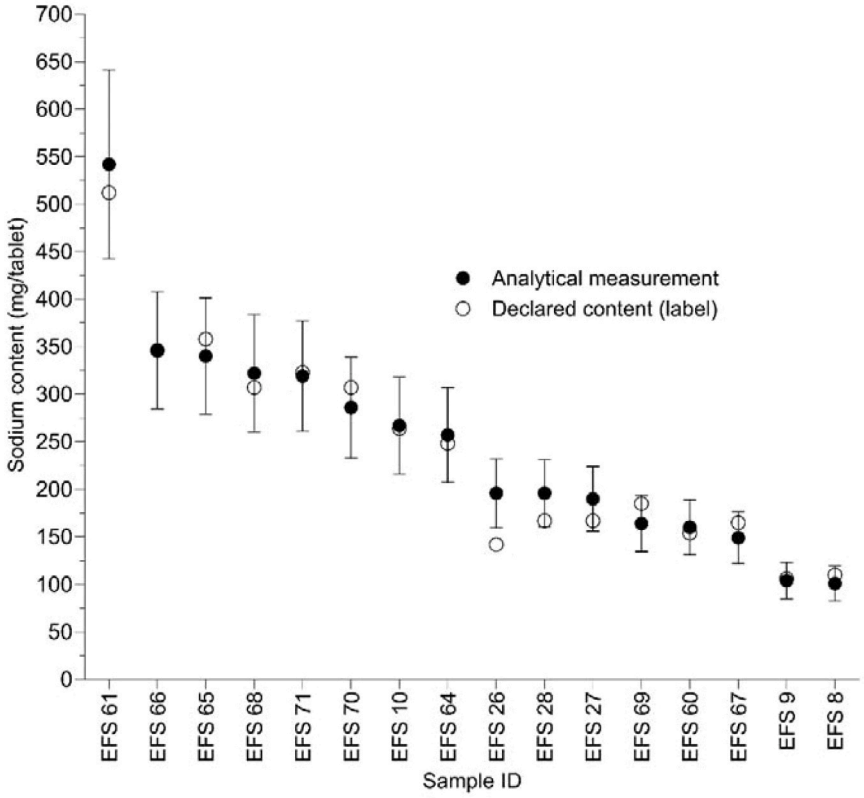

Fig. 2. Plot of the declared (labelled) sodium content values in individual samples of effervescent food supplements (N = 16) and the corresponding analytically determined values with corresponding measurement uncertainty.

extended uncertainty of the laboratory measurement (Fig. 1), which only showed notable deviation for one sample (ID EFS26). These results confirm that almost all the products with declared sodium content showed good agreement with the laboratory measurement. However, the study findings indicate inconsistency in sodium labelling practices in effervescent food supplements – such voluntary data was labelled very rarely.

4. Discussion

In the EU, the declaration of salt (sodium) content is mandatory on most prepacked foods; however, food supplements are exempt from this requirement (EC, 2002), despite being regulated as foods. At the same time, the declaration of added nutrients, including minerals, is mandatory for food supplements, with the exception of sodium. In a recent study, we reported that the actual content of declared nutrients in effervescent food supplements can deviate notably from the labelled

values (Hribar et al., 2026). However, it remained unclear whether such products may also represent a notable source of sodium that is not declared on the label. The present study demonstrates that the effervescent food supplements examined contain substantial amounts of sodium, with considerable variability between product categories. The mean sodium content of approximately 250 mg per effervescent tablet indicates that these products can represent a non-negligible source of dietary sodium, particularly in the context of repeated or daily use. In our sample, the majority of products (88.7%) recommended a daily intake of one tablet, suggesting regular use, while some products recommended higher daily intakes. For products with recommended intakes of up to three tablets per day, sodium intake may reach nearly 40% of the EFSA reference intake of 2 g/day, which is particularly relevant given that most European populations already exceed the recommended sodium intakes. In Slovenia, for example, the estimated average sodium intake in adults exceeds 4 g/day (Kugler et al., 2024), which is more than double the EFSA reference intake.

4.1. Sodium content and formulation-related differences

The observed differences between product categories likely reflect formulation choices rather than the presence of sodium as a nutrient with a physiological role. The products combining vitamins and minerals showed the highest sodium content, while effervescent tablets containing calcium and magnesium had the lowest. This pattern is consistent with the use of sodium hydrogen carbonate primarily as a technological excipient rather than as a declared nutrient. Calcium or magnesium-based effervescent products more frequently rely on calcium carbonate or magnesium carbonate as a partial source of the effervescence, which reduces the need for sodium-containing effervescent agents. The median sodium content in magnesium food supplements is only slightly lower than in other food supplements; however, certain magnesium-containing products have low sodium content (IQR 133–269 mg). This demonstrates that sodium hydrogen carbonate can be partially substituted by calcium or magnesium carbonates.

These findings align with previous work by Kunz et al. [11], who reported comparable sodium levels in effervescent food supplements and highlighted the wide variability between products. The present study expands on this evidence by providing detailed category-level data from a comprehensive and nationally representative sample, and by linking sodium content more explicitly to potential daily intake scenarios.

From a formulation perspective, the results underscore the fact that high sodium content in effervescent food supplements is not inevitable. Alternative carbonate systems based on potassium, calcium, or magnesium salts can achieve comparable effervescence with substantially lower sodium content. While such substitutions may involve technological trade-offs related to taste, solubility, or cost, they represent feasible reformulation strategies, particularly for products intended for long-term or frequent use.

4.2. Public health relevance of sodium from effervescent supplements

Effervescent food supplements are typically consumed as beverages and may be perceived by consumers as equivalent to ordinary drinks or functional beverages. Unlike medicines, which are often used episodically, food supplements are frequently consumed daily and over extended periods. This consumption pattern increases the relevance of their sodium content from a public health perspective. Although the sodium intake from a single effervescent tablet may appear modest, cumulative exposure from multiple tablets and concurrent dietary sources can meaningfully contribute to total daily sodium intake. This is particularly concerning for individuals with hypertension, older adults, or consumers who are actively seeking to reduce their salt intake (De Keyzer et al., 2015). The absence of sodium or salt labelling on food supplements under current EU legislation may further exacerbate this issue, as consumers are generally unable to make informed comparisons between products. As a comparison, in the USA the 'Supplement Facts' panel need to list sodium content when present in measurable amounts (FDA, 2005). It would make sense for mandatory sodium labelling on food supplements to also be introduced in Europe, to support consumers in informed consumption choices.

4.3. Labelling practices and regulatory considerations

Only a minority of the products in this study voluntarily declared their sodium/salt content. While the discrepancies between the labelled and analytically determined values were mostly small, the study findings highlighted the inconsistent labelling practices and the lack of harmonised regulatory requirements for sodium declaration in food supplements (Niedzielski et al., 2016; Poniedziałek et al., 2018; Puścion-Jakubik et al., 2021). Current EU legislation distinguishes between foods and food supplements with regard to mandatory nutrition declaration, resulting in a regulatory gap for effervescent supplements which are technologically similar to effervescent foods and medicines. Given the demonstrated sodium levels and the potential for regular consumption, consideration should be given to extending mandatory sodium/salt labelling to effervescent food supplements, particularly where sodium serves only a technological function.

4.4. Implications for consumers and manufacturers

Improved transparency of sodium content would enable consumers to make more informed choices, and could incentivise manufacturers to pursue lower-sodium formulations. For manufacturers, reformulation strategies which reduce sodium without compromising product performance may represent an opportunity to align products with public health objectives and evolving consumer expectations. From a public health perspective, effervescent food supplements should be recognised as a potential hidden source of sodium, analogous to effervescent medicines. Their contribution to total sodium intake should be considered in dietary assessments and, where relevant, in the clinical counselling of individuals advised to limit salt consumption. However, possible approaches to consumer education and awareness remain very limited when sodium content is not declared on product labels. Under the current framework in the EU, only generalized advice – such as indicating that effervescent food supplements are often high in sodium – can be provided, potentially alongside the identification of at-risk product categories. Such guidance, however, may be unfair to products whose formulations have already been optimised to reduce sodium content. Mandatory declaration of sodium content would enable the provision of product-specific information to consumers, thereby avoiding overgeneralisations.

4.5. Study strengths and limitations

An important strength of this study is that it was conducted on a very large and representative sample of effervescent food supplements available in the Slovenian food supply; these were mostly products of international brands (87%), with a small proportion of national brands (13%). Whereas market surveillance studies often rely on predefined sampling schemes which restrict the number of products tested, we aimed for complete coverage, and analysed all the pertinent products identified within the national food supply. Another strength was in the use of an accredited laboratory for the quantification of the sodium content, using the same standards which apply for food control authorities.

Some limitations should nevertheless be acknowledged. Only one production batch (single lot/series) per product was tested. As food supplements may exhibit batch-to-batch variability in sodium content due to differences in raw materials and manufacturing conditions, the reported values may not fully capture this variability. While the results

are considered to provide a reasonable estimate of the typical sodium content of the products available on the market, and the potential impact of measurement uncertainty and batch variability is likely smaller than the differences observed between the investigated categories of the effervescent food supplements, these effects should be further investigated in more detail in future studies.

5. Conclusions

The effervescent food supplements available on the Slovenian market contain notable amounts of sodium, with some products contributing substantially to daily sodium intake levels when consumed according to the label instructions. Despite this, the sodium/salt content is rarely declared on product labels. Given the widespread availability, frequent use, and beverage-like mode of consumption of these products, effervescent food supplements could represent a relevant but largely overlooked source of dietary sodium. Only the introduction of mandatory sodium labelling on food supplements (at least for products high in sodium content) would enable consumers to make informed consumption choices. Furthermore, reformulation strategies aimed at reducing the sodium used solely for technological purposes should be considered to avoid excess sodium consumption in regular use of effervescent food supplements.

CRediT authorship contribution statement

Vid Vičič: Writing – review & editing, Writing – original draft, Conceptualization. **Igor Pravst:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Funding acquisition, Conceptualization. **Katja Žmitek:** Writing – original draft, Investigation. **Maša Hribar:** Writing – review & editing, Investigation, Data curation. **Hristo Hristov:** Writing – review & editing, Visualization, Formal analysis, Data curation.

Declaration of Generative AI and AI-assisted technologies in the manuscript preparation process

During the preparation of this work the author(s) used ChatGPT (OpenAI, San Francisco, CA, USA) in order to improve the clarity and quality of the English language. After using this tool, the author(s) reviewed and edited the content as required, and take(s) full responsibility for the content of the published article.

Funding

This research was conducted within the national research programme "Nutrition and Public Health" (ARIS P3–0395), financed by the Slovenian Research and Innovation Agency.

Declaration of Competing Interest

The authors report no conflicts of interest. The funding body had no involvement in the study design; data collection, analysis, or interpretation; manuscript preparation; or the decision to submit the work for publication. Igor Pravst and Katja Žmitek have led or contributed to several other projects in the fields of nutrition, public health, and food technology, which were funded or co-funded by the Slovenian Research and Innovation Agency, the Ministry of Health of the Republic of Slovenia, the Ministry of Agriculture, Forestry and Food of the Republic of Slovenia, and, in the case of selected applied research projects, by food industry partners. Vid Vičič was previously employed at company Jata Emona d.o.o. (until July 2024), which was also a producer of food supplements.

Acknowledgments

The authors sincerely thank Špela Goljuf for her contribution to data collection and data curation. We are also grateful to Justi Carey for support with English language editing.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.jfca.2026.109224.

Data Availability

The raw data that support the findings of this study are available in the DiRROS repository at URL: http://hdl.handle.net/20.500.12556/DiRROS-28687.

Sodium Content in Effervescent Food Supplements: Dataset of Products Sampled in Slovenia (Dirros)

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