

Nutrition and dietary habits

Nutrient Content in Energy Drinks



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Ernæring og kostvaner

Næringsstofindhold i energidrikke

February 2026

Report by:

Marija Langwagen

Anders Poulsen

Pauline Sall

Jette Jakobsen

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Preface

On behalf of the Danish Veterinary and Food, Agriculture and Fisheries Agency, the DTU Food Institute conducted a study on the nutrient content of energy drinks available in Danish supermarkets from May to June 2024.

The analytical data from this project will be included in the Danish Food Composition Database and published in Frida, version 5.5 (www.frida.fooddata.dk).

The project was planned and carried out by Marija Langwagen, Anders Poulsen and Jette Jakobsen. The sampling plan, as well as the collection of samples, was carried out by Marija Langwagen, while the sample analyses were performed by Eurofins Steins Laboratorium A/S in Vejen, Denmark.

The report was produced through a collaboration between Marija Langwagen, Anders Poulsen, Pauline Sall and Jette Jakobsen.

Kongens Lyngby, February 2026

Marija Langwagen
Project Manager

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Summary

This study provides an updated overview of the nutrient content of energy drinks on the Danish market. The purpose was to expand and modernise the data in the Danish Food Composition Database, since previous information did not reflect the current diversity of products, including the increasing share of sugar-free variants. Twelve widely sold energy drinks were collected from supermarkets in the Greater Copenhagen area in May and June 2024. The samples represented energy drinks with added sugars, energy drinks with non-sugar sweeteners, and energy drinks containing both sugars and sweeteners. All analyses were carried out as accredited testing in accordance with ISO 17025 at Eurofins Steins Laboratorium A/S.

Products with added sugars showed energy levels similar to sugar-sweetened soft drinks. Sugar-free energy drinks had very low energy content, and products combining sugars and sweeteners showed substantial variation due to diverse formulations. Taurine influenced nitrogen levels, and amino acids were present below the quantification limit. Sodium levels were higher in energy drinks than in soft drinks. Ten of the twelve samples contained added vitamins, with large variations between products. In a single can, the content of individual vitamins varied between 35-361 percent of the recommended intake for adult males. For one product, one can provided half of the tolerable upper intake level for pyridoxine (vitamin B₆). Caffeine contents ranged from 16 to 35 mg per 100 ml, and the average levels corresponded to those typically found in coffee or tea when consuming a 500 ml can.

The study shows that energy drinks on the Danish market vary widely in composition and that some products do not fit neatly into the simple categories of sugar-containing or sugar-free.

Future monitoring should include private-label products to strengthen market representativeness. Continued attention to caffeine, vitamin and sodium levels is recommended, along with monitoring of formulation trends.

The analytical results and estimated nutrient values from this project have been included in the Danish Food Composition Database and are published in Frida version 5.5 (www.frida.fooddata.dk).

Resumé (Danish)

Denne undersøgelse har til formål at opdatere informationerne om næringsindholdet i energidrikke på det danske marked, da de eksisterende data i fødevederedatabasen, Frida, ikke afspejlede den nuværende produktvariation, herunder den stigende andel af sukkerfri varianter.

I alt tolv udbredte energidrikke blev indsamlet i supermarkeder i Hovedstadsområdet i maj og juni 2024. Udvalget omfattede energidrikke med tilsat sukker, energidrikke med sødestoffer og energidrikke, der indeholdt både sukker og sødestoffer. Alle analyser blev udført som akkrediterede test i overensstemmelse med ISO 17025 hos Eurofins Steins Laboratorium A/S.

Energidrikke med tilsat sukker havde energiniveauer, svarende til dem i sukkersødede læskedrikke, mens sukkerfrie varianter havde et meget lavt energiindhold. Produkter, der kombinerede sukker og sødestoffer, viste betydelig variation i energiindhold, som følge af forskelle i ingredienssammensætningen. Taurin bidrog væsentligt til variationer i nitrogenindholdet, og aminosyrer lå under detektionsgrænsen. Natriumindholdet var generelt højere end i andre læskedrikke. Ti ud af tolv energidrikke indeholdt tilsatte vitaminer, med stor variation mellem produkterne. Indholdet af de enkelte vitaminer i én dåse varierede mellem 35 og 361 procent af det anbefalede daglige indtag for voksne mænd. En af energidrikkene indeholdt i én dåse halvdelen af den øvre tolerable indtagsgrænse for pyridoxin (B₆-vitamin). Koffeinindholdet varierede fra 16 til 35 mg pr. 100 ml, og de fleste energidrikke bidrager til et koffeinindtag svarende til kaffe eller te ved indtag af en 500 ml dåse.

Undersøgelsen viser, at energidrikke på det danske marked varierer betydeligt i deres næringsstofindhold, og flere produkter passer ikke entydigt ind i kategorierne sukkerholdig eller sukkerfri.

Det anbefales, at fremtidige undersøgelser også inkluderer private label-produkter, som udgør en væsentlig del af markedet. Der bør fortsat være fokus på variationen i koffein-, vitamin- og natriumindhold samt på udviklingen i produktformuleringer.

De analytiske resultater og de tilhørende estimerede værdier er nu inkluderet i den danske fødevederedatabase og offentliggjort i Frida version 5.5 (www.frida.fooddata.dk).

1. Introduction

According to *The Danish Dictionary*, energy drinks are defined as energizing soft drinks that, in addition to sugar and carbon dioxide, contain caffeine and possibly other substances (Den Danske Ordbog).

In this study, energy drinks are defined as non-alcoholic soft drinks based on carbonated flavoured water, containing added sugars and/or non-sugar sweeteners, and a high caffeine content (over 150 mg/L). This growing market is reflected in sales trends: according to Euromonitor International (2025), a total of 72 million litres of energy drinks were sold in Denmark in 2025, more than ten times the 6.5 million litres sold in 2010.

The Danish Veterinary, Food, Agriculture and Fisheries Agency (DVFAFA) advises that adults should limit their caffeine intake to a maximum of 400 mg per day, and pregnant and breastfeeding women to no more than 200 mg per day, in order to minimise potential health risks (DVFAFA, n.d.-b). The agency does not issue an official recommendation for maximum caffeine intake in children. However, it advises that children should avoid energy drinks entirely, and that adolescents aged 15–17 should consume no more than one small can (25 cl) per day, provided that no other sources of caffeine are consumed (DVFAFA, n.d.-b). The agency further recommends that children under the age of three should not be given coffee, as it contains caffeine and reduces the absorption of iron from the diet (DVFAFA, n.d.-c). In line with the Official Dietary Guidelines, water should be the primary beverage, and the intake of sweetened beverages, including energy drinks with or without added sugars, should be limited (De Officielle Kostråd, 2021).

The previous version of the Danish Food Composition Database, Frida version 5.4, includes combined data for ten sugar-sweetened energy drinks collected in 2010 and 2011. However, these data do not capture the full range of products available on the Danish market, and the rapid changes in the market necessitate an update. In particular, sugar-free energy drinks are not represented in Frida, despite their increasing market share.

Euromonitor International reports that sugar-free energy drinks accounted for 37% of Denmark's total off-trade energy drink volume in 2024, up from 19% in 2014 (Euromonitor, 2024a). This significant growth underlines the importance of ensuring that nutritional data for these variants are included in the database.

This study aimed to update and expand the nutrient composition data for the two main types of energy drinks on the Danish market: those with added sugars and those without. The most popular products from each category were selected based on a market survey and information from manufacturers and distributors and were collected from supermarkets in the Greater Copenhagen area during spring 2024.

Due to the considerable variation in vitamins and other ingredients with nutritional and physiological effects, each sample was analyzed individually to capture differences in caffeine and nutrient content across brands. During the sampling process, an additional category was identified, comprising

products containing both added sugar and non-sugar sweeteners. Consequently, the analyses encompassed five energy drink variants with added sugar only (no sweetener), five variants with non-sugar sweetener only (no added sugar), and two variants containing both added sugar and non-sugar sweeteners.

In total, the 12 samples were analyzed for macro- and micronutrient content through accredited testing in accordance with ISO 17025. The analytical data from this project are included in the Danish Food Composition Database and published in Frida, version 5.5 (www.frida.fooddata.dk).

This report describes the sampling strategy and analytical methods used, as well as the resulting nutrient data.

2. Sample Materials

2.1 Market Analysis and Sampling Plan

To ensure a representative selection of the best-selling and most widely available energy drinks on the Danish market, 12 samples were selected based on brand share data from Euromonitor International (2024b), a product survey conducted in supermarkets across the Greater Copenhagen area in April 2024, and information provided by manufacturers and distributors of market-leading brands. The aim was to include both energy drinks with added sugars (Regular) and sugar-free energy drinks with non-sugar sweeteners, labelled as “sukkerfri”, “sugar-free” or “zero sugar”.

Top-selling brands were identified using Euromonitor data (2024b). These included Royal Unibrew (Faxe Kondi Booster, Cult, and Rockstar) with a 29% market share, Carlsberg Danmark (Monster Energy) with 24%, Red Bull with 20%, Harboe’s Brewery (X-Ray) with 5%, and State Drinks with 2% (Euromonitor, 2024b).

Royal Unibrew and Carlsberg provided insights into their best-selling variants, leading to the inclusion of the most popular Regular (with added sugars) and sugar-free variants of Faxe Kondi Booster and Monster Energy. Royal Unibrew also identified the most popular Cult and Rockstar Energy Drinks, which included the *No Sugar* variant of Rockstar and the *Original* Cult Energy Drink. The original sugar-free version of Cult was also included, along with the longest-standing Red Bull variants on the market: *Original* and *Sugar-free*. Furthermore, Harboe’s budget-friendly energy drink X-Ray was included in both its Regular (with added sugars) and sugar-free variant.

State was represented by one variant containing added sugars, primarily marketed for its palatinose (isomaltulose) content (State Energy, n.d.). According to Euromonitor International, State has increased its sales volume by 2.5 times since 2020 (Euromonitor, 2024b).

The product survey covered all major grocery retail chains in Zealand with over 5% market share, representing 92% of the modern grocery retailers’ market in Denmark in 2024 (Euromonitor, 2024c).

The survey recorded all relevant energy drinks available at the time, including product name, brand, store availability, nutrition declaration, and ingredient list.

This strategy ensured coverage of both market-leading brands and diverse formulations, capturing variation in sugar content, caffeine levels, and consumer segments. Private-label energy drinks, accounting for 14% of total retail volume in 2024, were excluded due to the many smaller-selling brands (Euromonitor, 2024b). The 12 selected samples thus represent the primary types of energy drinks on the Danish market.

2.2 Collection of Samples

In total, 12 different energy drink samples (83 individual units) were purchased from supermarkets in the Greater Copenhagen area during May and June 2024. Each sample consisted of 4–9 individual units, providing a minimum total volume of 2,000 ml to ensure sufficient material for all analyses.

The initial sampling plan aimed to include two groups of six energy drinks each: one group with added sugars and one group labelled as sugar-free. During the collection process, however, it became evident that some products, including several best-selling variants such as Monster Original and Cult Sugar-free, contained both added sugars and non-sugar sweeteners. Although these products were categorised according to their labelling (e.g., “sugar-free”) or lacked explicit reference to sweetener content, their actual composition warranted the establishment of an additional category.













Consequently, the final grouping comprised five samples containing added sugars only (no sweeteners), five samples containing non-sugar sweeteners only (no added sugars), and two samples containing both added sugars and sweeteners. An overview of the 12 energy drinks, including their energy content, caffeine levels, sugar and sweetener composition, as well as vitamins and other ingredients with physiological effects, is presented in Table 1. The products are organised according to the three categories described above.

More detailed information on the 12 samples is provided in Appendix A1 (Danish) and Appendix A2 (English).

2.3 Sample Preparation

After collection, the samples were stored at room temperature. At the DTU National Food Institute, the samples were placed in plastic bags while remaining in their original packaging. The samples were then transported to Eurofins Steins Laboratorium A/S in Vejen, Denmark. Within 72 hours, each of the 12 samples was prepared by combining the individual subsamples to produce one homogeneous sample for analysis.

Table 1. Overview of the 12 selected energy drinks categorised into three groups, detailing brand, product name, energy content, sugar content, sweeteners, caffeine level, vitamins, and other ingredients with physiological effects.

Brand Name		Energy, kJ	Caffeine, mg	Sugars, g	Sweeteners	Vitamins	Other Ingredients
		pr. 100 ml					
ENERGY DRINKS, WITH ADDED SUGAR (NO SWEETENER)							
	CULT ENERGY DRINK THE REAL ORIGINAL	175	32	9,8	None	Niacin, B6, B12	Taurine Inositol Guarana
	FAXE KONDI Booster ORIGINAL	204	32	12	None	Pantothenic Acid, B6, Biotin, B12	None
	Red Bull ENERGY DRINK	195	32	11	None	Niacin, Pantothenic Acid, B6, B12	Taurine
	STATE ENERGY LEMON/LIME	170	32	9,8	None	Niacin, Pantothenic Acid, B6, B12	Taurine Green Tea
	X RAY ENERGY DRINK ORIGINAL	210	16	12	None	None	Guarana
ENERGY DRINKS, WITH ADDED SUGAR AND SWEETENER							
	CULT ENERGY DRINK SUGAR FREE ORIGINAL	19	32	0	E 950 E 952 E 954	Niacin, B6, B12	Taurine Guarana
	MONSTER ENERGY	201	32	11	E 955	Riboflavin, Niacin, B6, B12	Taurine Inositol Ginseng
ENERGY DRINKS, WITH SWEETENER (NO ADDED SUGAR)							
	FAXE KONDI Booster Original 0 kcal	0	32	0	E 950 E 951	Pantothenic Acid, B6, Biotin, B12	None
	MONSTER ENERGY ULTRA ZERO SUGAR	10	30	0	E 950 E 955	Niacin, Pantothenic Acid, B6, B12	Taurine Inositol Ginseng
	Red Bull SUGARFREE	13	32	0	E 950 E 955	Niacin, Pantothenic Acid, B6, B12	Taurine
	ROCKSTAR ENERGY DRINK ZERO SUGAR	22	31	0	E 950 E 955	Niacin, B6, Vitamin C	Taurine Inositol Ginseng
	X RAY ENERGY DRINK ZERO SUGAR	5	16	0	E 950 E 951 E 952	None	Guarana

*acesulfame-K (E 950), aspartame (E 951), cyclamate (E 952), saccharin (E 954), sucralose (E 955)

3. Analytical Methods

Each of the 12 samples was analyzed for nutrients such as nitrogen, ash, dry matter, sugars (fructose, glucose, lactose, maltose, sucrose), and minerals. In addition, the samples were analyzed for relevant ingredients such as caffeine, taurine, acids (lactic, acetic, and citric), and sugar alcohols (mannitol, isomalt, lactitol, maltitol, xylitol, and sorbitol). If a vitamin was listed in the ingredient list, the corresponding analysis was included for that specific sample.

All analyses were performed as single determinations and conducted as accredited tests under ISO 17025:2017 at Eurofins Steins Laboratorium A/S (DANAK TEST Reg. No. 222). A brief overview of the methods is provided in Appendix B.

4. Results

The analytical results are presented in Appendices C–F:

- Appendix C: Macronutrients, including sugars, sugar alcohols, and amino acids
- Appendix D: Vitamins
- Appendix E: Minerals
- Appendix F: Caffeine, taurine, acids, and pH

Additionally, estimated energy values based on analyses of individual components (nitrogen, sugars, and acids) and on estimated available carbohydrate (dry matter – (protein + ash)) are shown in Appendix G.

In this section, **Table 2** presents the contents of sugars, acids, and energy in samples from the three categories of energy drinks (those with added sugar, those with added sugar and sweeteners, and those with added sweeteners), as well as in a soft drink with added sugars. **Table 3** shows the contents of sodium and potassium in the same samples. **Table 4** provides the minimum, maximum, and average contents of vitamins per 100 g in energy drinks with added vitamins, including the number of products containing each vitamin.

The dataset consists of 10 energy drinks with added vitamins. All calculations presented in Table 4 and Table 5 are based exclusively on the products that contain the specific vitamin in question (meaning that the number of samples included in each calculation varies between vitamins). **Table 5** presents the estimated dietary intake of vitamins from a can of energy drink, expressed as % of the recommended intake (RI) for adult males (NNR, 2023). Calculations are based on the specific products and can sizes that were sampled for laboratory analysis.

The products represented in the dataset include two Cult Energy products (330 ml), two Faxe Kondi Booster products (500 ml), two Monster Energy products (500 ml), and two Red Bull products (250 ml), as well as one energy drink from Rockstar (330 ml) and one from State Energy (355 ml). Although

several of these energy drinks are available on the market in additional can sizes¹; only the sizes collected for analysis are used in the calculations. The results in Table 5 therefore do not represent brand-specific vitamin contents but reflect the combined minimum, maximum, and average estimated intakes across all sampled products containing each respective vitamin.

Table 6 highlights the caffeine and taurine contents per 100 g in samples of the three energy drink categories, compared with coffee and tea.

Table 2. Contents of sugars, acids, and energy in samples from three energy drink (ED) categories and in a soft drink, including number of samples in each category. Data for soft drinks with added sugars are based on 26 samples (Jakobsen, Danielsen, Poulsen, & Trolle, 2023).

Drink	Number of Samples	Content (selected)				Energy ¹	
		Fructose	Glucose	Sucrose	Citric Acid	Individual Analyses	Available Carbohydrate ²
		g/100 g	g/100 g	g/100 g	g/100 g	kJ/100 g	kJ/100 g
ED, added sugar	5	2.1	2.0	5.8	0.5	174	171
ED, added sugar and sweetener	2	0.9	1.6	3.3	0.7	108	98
ED, added sweetener	5	0.0	0.0	0.0	0.6	7	12
Soft Drink, added sugar	26	1.9	1.9	5.9	na	na	175

¹ Factors applied: 17 kJ/100 g of protein (nitrogen × 6.25), fructose, glucose, sucrose, and 13 kJ/100 g for citric acid.

² Available carbohydrates: Dry matter – (Protein + Ash). Factor applied: 17 kJ/100 g. See Appendix C for nitrogen content.

³ na = not analyzed

Table 3. Contents of sodium and potassium in samples from three energy drink (ED) categories analyzed in this study and in soft drinks with added sugars. Data are based on 26 samples (Jakobsen, Danielsen, Poulsen, & Trolle, 2023).

Drink	Number of Samples	Sodium			Potassium		
		mg/100 g			mg/100 g		
		Min	Max	Average	Min	Max	Average
ED, added sugar	5	2.4	65	27	0.3	6.1	3.3
ED, added sugar and sweetener	2	69	82	76	0.3	6.2	3.2
ED, added sweetener	5	5.9	72	43	1.8	8.9	5.1
Soft Drink, added sugar	26	<0.2	20	4.7	<0.3	26.6	9.0

¹According to a survey of available energy drink products (Langwagen, 2025), Red Bull is available in cans of 250, 355, and 473 ml; Cult Energy is available in cans of 330 and 570 ml; Faxe Kondi Booster is available in cans of 250, 330, 500, and 568 ml; Monster Energy is available in cans of 500 and 568 ml; State is available in cans of 355 ml; Rockstar is available in cans of 330 ml.

Table 4. Contents of vitamins (minimum, maximum, and average) per 100 g in samples from all energy drinks with added vitamins (n= 10), including the number of products containing the vitamin.

Energy Drinks (all products with added vitamins)	Riboflavin	Niacin	Pyridoxine	Pantothenic acid	Biotin	Cobalamin	Vitamin C
	mg	mg	mg	mg	µg	µg	mg
Minimum, per 100 g	-	3.9	0.2	1.2	3.4	0.5	-
Maximum, per 100 g	-	9.3	2.2	2.4	6.1	4.0	-
Average, per 100 g	0.7	7.6	0.9	1.8	4.8	2.1	20.7
<i>Number of products containing the vitamin</i>	<i>1</i>	<i>8</i>	<i>10</i>	<i>6</i>	<i>2</i>	<i>9</i>	<i>1</i>

Table 5. Estimated intake of vitamins from a can of energy drink, expressed as % of recommended intake (RI) for adult males (NNR, 2023), based on the specific products and can sizes sampled for laboratory analysis (250–500 ml).

Energy Drinks (all products with added vitamins)	Riboflavin	Niacin	Pyridoxine	Pantothenic acid	Biotin	Cobalamin	Vitamin C
	mg	mg	mg	mg	µg	µg	mg
Minimum % of RI*	-	72	35	86	43	42	-
Maximum % of RI*	-	258	361	206	76	335	-
Average % of RI*	233	151	159	134	59	193	62

*Recommended intake (RI) for adult males ≥18 years: 1.6 mg riboflavin, 18 mg niacin, 1.8 mg pyridoxine, 5 mg pantothenic acid, 40 µg biotin, 4 µg cobalamin, 110 mg vitamin C (NNR, 2023).

Table 6. Caffeine and taurine contents in samples from the three energy drink (ED) categories, as well as in coffee, tea, and dark chocolate.

Drink	Number of Samples	Caffeine mg/100 g			Taurine mg/100 g		
		Min	Max	Average	Min	Max	Average
		ED, added sugar	5	16.3	34.8	30	<2
ED, added sugar and sweetener	2	32.6	34.4	34	451	474	463
ED, added sweetener	5	17.6	35.2	30	<2	458	177
Coffee, drink ¹	13 ²	32	69	49			0 ³
Tea, green ¹	11 ²	10	24	19			0 ³

¹Typical natural content values, summarised in EFSA (2023) ; ²Number of studies; ³Natural content.

5. Discussion

5.1 Sampling and Representativeness

The selection of 12 energy drink samples, although limited to the Greater Copenhagen area, is considered broadly representative of the Danish market. However, the exclusion of private-label

energy drinks represents a limitation, as these products may differ in sugar, sweetener, caffeine, or other ingredient composition. Private-label products accounted for 14% of retail volume in 2024 (Euromonitor, 2024b) and included three brands with a total of 14 variants (Langwagen, 2025), indicating that this segment is both sizeable and diverse. Consequently, their absence may reduce the completeness of the present analysis.

5.2 Nutrient Content and Energy Contribution

The market analysis highlights the rapid growth and increasing diversification within the energy drink segment. Over the past decade, sales of products sweetened with non-sugar sweeteners have risen markedly, while sugar-containing beverages continue to account for a substantial share of total sales (Langwagen, 2025). To capture the full range of products available on the Danish market, both sugar-containing and sugar-free categories were included in the analysis. Within these categories, two energy drinks containing both sugars and non-sugar sweeteners formed an additional group, reflecting the expanding complexity of formulations in the segment.

The sugar content is central to interpreting the nutrient composition of the sampled products. Analyses of the 12 sampled energy drinks confirmed that, in products with added sugars, sugar is the primary contributor to energy content, while citric acid contributes only marginally. These products typically contain approximately 175 kJ/100 g, comparable to sugar sweetened soft drinks (Table 2). In contrast, drinks sweetened exclusively with non-sugar sweeteners have a very low energy content, around 10 kJ/100 g, primarily due to citric acid.

For the two analyzed energy drinks containing both sugars and non-sugar sweeteners, energy content varied considerably from 17–179 kJ/100 g (Appendix G). This finding aligns with a previous Danish market survey (Langwagen, 2025), which showed that products combining sugars and sweeteners span the widest declared energy range among the three categories (17–201 kJ/100 ml). Such variability reflects the absence of uniform formulation patterns in energy drink products, resulting in substantial differences in energy contribution.

Analyses of 18 amino acids showed that their concentrations in all energy drinks were below the limit of quantification (0.006–0.035 g/100 g). Nitrogen levels ranged from <0.02 g/100 g to 0.06 g/100 g. The four energy drinks with nitrogen levels below the limit of quantification contained no added taurine, and nitrogen content correlated with the concentrations of taurine and caffeine. Because taurine is not used for protein synthesis like other amino acids, it is excluded from energy estimation based on amino acid analysis. In contrast, estimating protein from nitrogen content leads to an overestimation. The estimation of available carbohydrate includes analyses of nitrogen content, resulting in minor differences (Table 2). Overall, the energy level is similar to that of soft drinks. A 500 ml can of energy drink with added sugar contributes approximately 9% of a daily energy intake of 10 MJ, making it an energy-dense product without contributing protein, fat, or essential micronutrients.

5.3 Micronutrients

None of the analyzed energy drinks had minerals explicitly added, but two contained added salt. The levels of sodium and potassium differed from those in soft drinks, with energy drinks showing higher sodium and lower potassium contents (Table 3). The content of these minerals derives from food additives such as acidity regulators, sweeteners, and preservatives. Two of the 12 analyzed varieties contained 2–6 mg sodium per 100 g, while the maximum values in each of the three categories were 65–82 mg sodium per 100 g (Table 3). The maximum recommended daily intake of sodium is 2.3 g (NNR, 2023). In a 500 ml serving of energy drink, the sodium content corresponds on average to 6% of the recommended maximum daily intake for varieties with added sugar, 16% for varieties with added sugar and sweetener, and 9% for varieties with added sweetener. In comparison, a 500 ml serving of soft drink with added sugar corresponds to about 1% of the maximum recommended daily sodium intake.

Two of the twelve varieties from the same brand contained no added vitamins. Among the remaining ten, pyridoxine (vitamin B₆) was present in all, cobalamin (vitamin B₁₂) in most, and pantothenic acid and niacin were also commonly added. A few varieties contained riboflavin, biotin, or vitamin C (see Appendix D). In products with added vitamins, the maximum difference between the lowest and highest vitamin contents was a factor of eight for cobalamin, ranging from 0.5 µg/100 g to 4 µg/100 g (Table 4). In a can of energy drink with added vitamins, the vitamin content, compared to the recommended intake for adult males (NNR, 2023), ranged from 35% to 361%, with average values between 59% and 193% for the five vitamins added to more than one product (Table 5). One product provided 50% of the tolerable upper intake level (UL) for pyridoxine (12.5 mg per day) in a single can (NNR, 2023).

Denmark maintains some of the strictest national regulations on food fortification in the EU, including requirements for pre-approval of voluntarily fortified products (DVFAFA, n.d.-a). The levels of vitamins and minerals in energy drinks sold on the Danish market could therefore be expected to be lower than those in comparable products sold in other countries. However, this is not supported by comparisons with vitamin contents in energy drinks listed in food composition databases from Sweden (Livsmedelsverket), Norway (Matvaretabellen), Finland (Fineli), United Kingdom (CoFID), France (Ciqal), Switzerland (Nährwertdaten) and the Netherlands (NEVO).

5.4 Caffeine Content

Caffeine content in the analyzed energy drinks ranged from 16–35 mg/100 ml, which is in line with the maximum permitted level of 320 mg/L for added caffeine in soft drinks under Danish legislation. EFSA has evaluated the safety of caffeine intake (EFSA, 2015), but does not set regulatory limits. Two varieties from the same manufacturer contained 16–17 mg/100 ml, while the remaining ten products were within the range of 32–35 mg/100 ml (Appendix F). A 2025 market survey of energy drinks in Denmark showed that these two varieties are the only products on the market with a caffeine level below 30 mg/100 ml (Langwagen, 2025).

Caffeine content was independent of whether the drinks contained added sugar or non-sugar sweeteners, and the average levels corresponded to those found in coffee and tea (Table 6). The Danish Veterinary, Food, Agriculture and Fisheries Agency advises that adults should limit their caffeine intake to a maximum of 400 mg per day, and pregnant and breastfeeding women to no more than 200 mg per day, in order to minimise potential health risks (DVFAFA, n.d.-b). Consumption of a 500 ml can of energy drink results in an intake of either 85 mg or 170 mg caffeine.

In Denmark, no legislation specifies a minimum age for purchasing energy drinks. However, the Danish Veterinary, Food, Agriculture and Fisheries Agency advises that children should avoid energy drinks entirely, and that adolescents aged 15–17 should consume no more than one small can (250 ml) per day, provided that no other sources of caffeine are consumed (DVFAFA, n.d.-b). The Agency further recommends that children under the age of three should not be given coffee, as it contains caffeine and reduces the absorption of iron from the diet (DVFAFA, n.d.-c).

As described in Section 5.2, taurine was added to eight of the analyzed energy drinks (Appendix F). Its presence also explains some of the observed variation in nitrogen content, as nitrogen levels were strongly influenced by taurine concentrations.

In addition to caffeine and taurine, several other ingredients with physiological effects, including inositol, guarana, ginseng, and green tea extract, were listed among the ingredients of selected products (Table 1), although these constituents were not included in the analytical program.

6. Perspectives

Future surveys could consider including private-label energy drinks to capture a broader representation of the market and its formulation diversity. The current findings indicate that some popular products do not fit neatly into the conventional categories of “regular” and “sugar-free”, since several varieties contain both added sugars and non-sugar sweeteners. Continued monitoring of how these formulations evolve would therefore be relevant.

Although consumer interest in sugar-reduced beverages appears to be increasing, sugar-sweetened soft drinks still maintain a strong presence on the Danish market. Understanding how these parallel trends develop over time may help clarify future shifts in consumer behaviour and product reformulation.

It is advisable to monitor dietary intake of energy drinks not only in relation to caffeine but also with respect to vitamins, since one can contains up to 50% of the tolerable upper intake level (UL) for pyridoxine.

Furthermore, some products contain unexpectedly high levels of sodium, contributing to a notably salt content. Engaging with manufacturers could help clarify the reasons for such formulations and assess whether these nutrient concentrations align with consumer expectations.

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Appendix A1 – Prøveinformationer (Danish)

ID nummer	Brand, Navn	Producent	GTIN	Ingredienser	Vægt, ml	Antal enheder	Dato for indsamling	Bedst før dato
ENERGIDRIK, MED SØDESTOFFER (UDEN TILSAT SUKKER)								
2401-01-04	CULT ENERGY DRINK, THE REAL ORIGINAL	Cult A/S	5741000228265	Vand, sukker, syre (E330), kuldioxid, taurin, surhedsregulerende middel (E331), koffein (0,03%), konserveringsmidler (E202, E211), guaranaekstrakt, farvestoffer (E150d, E101), aroma, vitaminer (niacin (B3), B6, B12), inositol.	330	7	24-05-24	09-04-25
2401-01-02	FAXE KONDI Booster, Original	Royal Unibrew A/S	5741000134894	Vand, sukker, druesukker (4%), syre (E330), kuldioxid, salt, koffein (0,03%), konserveringsmidler (E202, E211), surhedsregulerende midler (E339, E500, E331, E501), naturlig farve (ekstrakt af saflor), aroma (bl.a. quinin), vitaminer (pantothensyre, vitamin B6, biotin, vitamin B12).	500	4	24-05-24	08-04-25
2401-01-01	Red Bull, ENERGY DRINK	Red Bull GmbH	9002490216016	Vand, saccherose, glukose, syre (citronsyre), kuldioxid, taurin (0,4%), surhedsregulerende midler (natriumcarbonater, magnesiumcarbonater), koffein (0,03%), vitaminer (niacin, pantothensyre, B6, B12), aromaer, farver (karamel, riboflavin).	250	9	24-05-24	02-02-26 09-02-26
2401-01-06	STATE ENERGY, LEMON/LIME	N/A	5745000038596	Kulsyreholdigt vand, fruktose, isomaltulose (3%), syre (citronsyre), taurin (0,2%), aromaer, surhedsregulerende middel (natriumcitrat), koffein (0,03%), konserveringsmidler (kaliumsorbat, natriumbenzoat), grøn te-ekstrakt, farvestof (brilliant blue FCF), vitaminer (niacin, pantothensyre, B6, B12).	355	7	06-06-24	15-02-25
2401-01-05	X RAY ENERGY DRINK, ORIGINAL	Harboes Bryggeri A/S	5701598024427	Vand, sukker, kuldioxid, surhedsregulerende middel (citronsyre), aroma, karamelsukkersirup, guarana ekstrakt, aroma (koffein), farve (E150d)	250	9	06-06-24	27-02-25
ENERGIDRIK, MED SØDESTOFFER & TILSAT SUKKER								
2401-02-04	CULT ENERGY DRINK, SUGAR FREE ORIGINAL	Cult A/S	5741000226407	Vand, fruktosesirup, kuldioxid, syre (E330), taurin, surhedsregulerende middel (E331), aroma, sødestoffer (E952, acesulfam-K, E954), koffein (0,03%), konserveringsmidler (E202, E211), guaranaekstrakt, farvestoffer (E150d, E101), vitaminer (niacin (B3), vitamin B6, vitamin B12), stabilisator (E466).	330	7	24-05-24	23-01-25
2401-01-03	MONSTER ENERGY	Monster Energy Company	5060337502948	Kulsyreholdigt vand, saccharose, glucosesirup, syre (citronsyre), aromaer, taurin (0,4%), surhedsregulerende middel (natriumcitrat), panax ginseng rodekstrakt (0,08%), konserveringsmidler (sorbinsyre, benzoesyre), koffein (0,03%), farve (anthocyaner), vitaminer (niacin, riboflavin, B6, B12), sødestof (sucralose), inositol (0,002%), maltodextrin.	500	5	24-05-24	30-09-25 10/2025

ID nummer	Brand, Navn	Producent	GTIN	Ingredienser	Vægt, ml	Antal enheder	Dato for indsamling	Bedst før dato
ENERGIDRIK, MED TILSAT SUKKER (UDEN SØDESTOFFER)								
2401-02-02	FAXE KONDI Booster, Original 0 kcal	Royal Unibrew A/S	5741000142899	Vand, aroma, syre (E330), kuldioxid, salt, konserveringsmidler (E202, E211), sødestoffer (aspartam, acesulfam-K), koffein (0,03%), surhedsregulerende midler (E331, E500, E339, E501), stabilisator (E415), aroma (bl.a. quinin), vitaminer (pantothensyre, vitamin B6, biotin, vitamin B12).	500	6	24-05-24	24-09-24
2401-02-03	MONSTER ENERGY, ULTRA ZERO SUGAR	Monster Energy Company	5060337502290	Kulsyreholdigt vand, syre (citronsyre), taurin (0,4%), surhedsregulerende middel (natriumcitrater), aromaer, panax ginseng rodekstrakt (0,08%), sødestoffer (sucralose, acesulfamkalium), konserveringsmidler (sorbinsyre, benzoesyre), koffein (0,03%), vitaminer (niacin (B3), pantotensyre (B5), B6, B12), inositol (0,002%).	500	5	24-05-24	01/2026 03/2026
2401-02-01	Red Bull, SUGARFREE	Red Bull GmbH	9002490216030	Vand, syre (citronsyre), kuldioxid, taurin (0,4%), surhedsregulerende midler (natriumcarbonater, magnesiumcarbonater), koffein (0,03%), sødestoffer (sucralose, acesulfamkalium), vitaminer (niacin, pantothensyre, B6, B12), aromaer, fortykningsmiddel (xanthangummi), farver (karamel, riboflavin).	250	9	24-05-24	28-11-24 28-02-25
2401-02-06	ROCKSTAR ENERGY DRINK, ZERO SUGAR	Royal Unibrew A/S	5741000228227	Vand, kuldioxid, smagsforstærker (E968), syre (E330), surhedsregulerende middel (E331), aromaer, fortykningsmiddel (E440), koffein (0,03%), vitaminer (C, B3, B6), sødestoffer (E955, E950), farvestof (E150d), taurin (0,02%), inositol, ginsengekstrakt (0,0004%).	330	7	24-05-24	11-01-24 01-02-25
05-02-2401	X RAY ENERGY DRINK, ZERO SUGAR	Harboes Bryggeri A/S	5701598029514	Vand, kuldioxid, syre (citronsyre), sødestoffer (cyclamater, aspartam, acesulfamkalium), aroma, farvestoffer (E 150a, E 150d), koffein, konserveringsmiddel (kaliumsorbit), guarana ekstrakt.	250	9	06-06-24	26-03-25

Appendix A2 – Sample Information

ID number	Brand, Name	Manufacturer	GTIN	Ingredients	Weight, ml	Number of samples	Sample Date	BBD
ENERGY DRINKS, WITH SWEETENER (NO ADDED SUGAR)								
2401-01-04	CULT ENERGY DRINK, THE REAL ORIGINAL	Cult A/S	5741000228265	Water, sugar, acid (E330), carbon dioxide, taurine, acidity regulator (E331), caffeine (0.03%), preservatives (E202, E211), guarana extract, colorings (E150d, E101), flavoring, vitamins (niacin (B3), B6, B12), inositol.	330	7	24-05-24	09-04-25
2401-01-02	FAXE KONDI Booster, Original	Royal Unibrew A/S	5741000134894	Water, sugar, dextrose (4%), acid (E330), carbon dioxide, salt, caffeine (0.03%), preservatives (E202, E211), acidity regulators (E339, E500, E331, E501), natural color (safflower extract), flavoring (including quinine), vitamins (pantothenic acid, vitamin B6, biotin, vitamin B12).	500	4	24-05-24	08-04-25
2401-01-01	Red Bull, ENERGY DRINK	Red Bull GmbH	9002490216016	Water, sucrose, glucose, acid (citric acid), carbon dioxide, taurine (0.4%), acidity regulators (sodium carbonates, magnesium carbonates), caffeine (0.03%), vitamins (niacin, pantothenic acid, B6, B12), flavorings, colors (caramel, riboflavin).	250	9	24-05-24	02-02-26 09-02-26
2401-01-06	STATE ENERGY, LEMON/LIME	N/A	5745000038596	Carbonated water, fructose, isomaltulose (3%), acid (citric acid), taurine (0.2%), flavorings, acidity regulator (sodium citrate), caffeine (0.03%), preservatives (potassium sorbate, sodium benzoate), green tea extract, coloring (brilliant blue FCF), vitamins (niacin, pantothenic acid, B6, B12).	355	7	06-06-24	15-02-25
2401-01-05	X RAY ENERGY DRINK, ORIGINAL	Harboes Bryggeri A/S	5701598024427	Water, sugar, carbon dioxide, acidity regulator (citric acid), flavoring, caramel sugar syrup, guarana extract, flavoring (caffeine), coloring (E150d).	250	9	06-06-24	27-02-25
ENERGY DRINKS, WITH ADDED SUGAR AND SWEETENER								
2401-02-04	CULT ENERGY DRINK, SUGAR FREE ORIGINAL	Cult A/S	5741000226407	Water, fructose syrup, carbon dioxide, acid (E330), taurine, acidity regulator (E331), flavoring, sweeteners (E952, acesulfame-K, E954), caffeine (0.03%), preservatives (E202, E211), guarana extract, colorings (E150d, E101), vitamins (niacin (B3), vitamin B6, vitamin B12), stabilizer (E466).	330	7	24-05-24	23-01-25
2401-01-03	MONSTER ENERGY	Monster Energy Company	5060337502948	Carbonated water, sucrose, glucose syrup, acid (citric acid), flavorings, taurine (0.4%), acidity regulator (sodium citrates), Panax ginseng root extract (0.08%), preservatives (sorbic acid, benzoic acid), caffeine (0.03%), coloring (anthocyanins), vitamins (niacin, riboflavin, B6, B12), sweetener (sucralose), inositol (0.002%), maltodextrin.	500	5	24-05-24	30-09-25 10/2025

ID number	Brand, Name	Manufacturer	GTIN	Ingredients	Weight, ml	Number of samples	Sample Date	BBD
ENERGY DRINKS, WITH ADDED SUGAR (NO SWEETENER)								
2401-02-02	FAXE KONDI Booster, Original 0 kcal	Royal Unibrew A/S	5741000142899	Water, flavoring, acid (E330), carbon dioxide, salt, preservatives (E202, E211), sweeteners (aspartame, acesulfame-K), caffeine (0.03%), acidity regulators (E331, E500, E339, E501), stabilizer (E415), flavoring (including quinine), vitamins (pantothenic acid, vitamin B6, biotin, vitamin B12).	500	6	24-05-24	24-09-24
2401-02-03	MONSTER ENERGY, ULTRA ZERO SUGAR	Monster Energy Company	5060337502290	Carbonated water, acid (citric acid), taurine (0.4%), acidity regulator (sodium citrates), flavorings, Panax ginseng root extract (0.08%), sweeteners (sucralose, acesulfame potassium), preservatives (sorbic acid, benzoic acid), caffeine (0.03%), vitamins (niacin (B3), pantothenic acid (B5), B6, B12), inositol (0.002%).	500	5	24-05-24	01/2026 03/2026
2401-02-01	Red Bull, SUGARFREE	Red Bull GmbH	9002490216030	Water, acid (citric acid), carbon dioxide, taurine (0.4%), acidity regulators (sodium carbonates, magnesium carbonates), caffeine (0.03%), sweeteners (sucralose, acesulfame potassium), vitamins (niacin, pantothenic acid, B6, B12), flavorings, thickener (xanthan gum), colors (caramel, riboflavin).	250	9	24-05-24	28-11-24 28-02-25
2401-02-06	ROCKSTAR ENERGY DRINK, ZERO SUGAR	Royal Unibrew A/S	5741000228227	Water, carbon dioxide, flavor enhancer (E968), acid (E330), acidity regulator (E331), flavorings, thickener (E440), caffeine (0.03%), vitamins (C, B3, B6), sweeteners (E955, E950), coloring (E150d), taurine (0.02%), inositol, ginseng extract (0.0004%).	330	7	24-05-24	11-01-24 01-02-25
05-02-2401	X RAY ENERGY DRINK, ZERO SUGAR	Harboes Bryggeri A/S	5701598029514	Water, carbon dioxide, acid (citric acid), sweeteners (cyclamates, aspartame, acesulfame potassium), flavoring, colorings (E150a, E150d), caffeine, preservative (potassium sorbate), guarana extract.	250	9	06-06-24	26-03-25

Appendix B – Analytical Methods

Nitrogen: NMKL 6:2003. The total amount of organic nitrogen is measured according to the Kjeldahl principle. Test code: DHN10; expanded uncertainty: 5%; LOQ: 0.1 g/100g.

Amino acids: ISO 13903:2005; EU 152/2009.

- Tryptophane: Alkaline hydrolysis, quantification by HPLC. Test code: DJ009; expanded uncertainty: 10%; LOQ: 0.01 g tryptophan/100 g.
- Methionine and cysteine: Oxidized with hydrogen peroxide and formic acid at low temperature, followed by acid hydrolysis using aqueous hydrochloric acid. Amino acids are separated in an amino acid analyzer and detection using post-column derivatization with ninhydrin reagent at 440 and 570 nm. Test code: DJ011; expanded uncertainty: 15%; LOQ: 0.024 g methionine/100 g and 0.006 g cysteine/100 g.
- All other amino acids such as isoleucine, leucine, lysine, phenylalanine, tyrosine, threonine, valine, arginine, histidine, alanine, aspartic acid, glutamic acid, glycine, proline, serine: Hydrolyzed in aqueous hydrochloric acid and separated by an amino acid analyzer. Spectrophotometric detection is carried out using post-column derivatization with ninhydrin reagent at 440 nm and 570 nm. Test code: DI004; expanded uncertainty: 14%; LOQ: 0.014-0.035 g/100 g.
- Hydroxyproline not accredited according to ISO17025.

Dry matter: NMKL 23:1991. The total dry matter content is determined by evaporating all water from the sample by means of heating at a constant temperature. Test code: DHD11; expanded uncertainty: 5%.

Ash: NMKL 173:2005. The sample is treated at 525-550°C, and the ash is weighed. Test code: DHA13; expanded uncertainty: 4%; LOQ: 0,05 g/100 g

Sugars (Glucose, fructose, lactose, maltose, sucrose). Single laboratory validated method. The sugars are separated by ion chromatography with NaOH eluant and detected by pulsed amperometry. Notes: Maltodextrin might not be separated from glucose and maltose. Stevia might not be separated from glucose. Maltitol might not be separated from fructose. Test code: AA480; expanded uncertainty: 12% for total sugars; LOQ: 0.2 g/100 g for each individual sugar.

Riboflavin (Vitamin B₂): EN 14152:2003. Acid hydrolysis, enzymatic treatment, separation by RP-HPLC, and quantification by fluorescence detection (Ex/Em: 468 nm/520 nm). External standard. Adapted to quantify riboflavin-5-phosphate and riboflavin separately. Test code: DJB33; expanded uncertainty: 16%; LOQ: 0.01 mg/100 g.

Pyridoxine (Vitamin B₆): EN 14164. Acid extraction, followed by treatment with phosphatase. In the presence of Fe(II) as a catalyst, pyridoxamine (PM) reacts with glyoxylic acid and is transformed into pyridoxal (PL), which is then reduced to pyridoxine (PN) by the action of sodium borohydride in an alkaline medium. Pyridoxine is quantified by RP-HPLC with fluorescence detection (Ex/Em: 290 nm/395 nm). External standard. The sum of PM, PL, PN, and phosphorylated PM, PL, PN is quantified, excluding glycosidic-bound pyridoxine. Molecular weight reported: 169.18 g/mol. Test code: A7251; expanded uncertainty: 14%. LOQ: 0.01 mg/100 g.

Niacin: EN 15652:2009. Nicotinic acid and nicotinamide are extracted from samples in a weak hydrochloric acid solution at 100°C, separated by RP-HPLC, and quantified by fluorescence detection (Ex/Em: 322 nm/380 nm) after a post-column reaction with hydrogen peroxide catalyzed by Cu(II) ions under UV radiation (365 nm). External standard. Niacin is calculated as the sum of nicotinic acid and nicotinamide. Molecular weight reported: 123.11 g/mol. Test code: DJB05; expanded uncertainty: 14%; LOQ: 0.1 mg/100g.

Biotin: Biotin is extracted using papain (60°C, 1.5 h). After pH adjustment and filtration, biotin is determined by liquid chromatography with MS detection (single ion mode, high resolution). A deuterated internal standard is used for quantification. Reference: J AOAC vol 93 no. 5, 2010. Test code: DJ8B7; expanded uncertainty: 20%; LOQ: 1 µg/100 g. Not performed accredited.

Pantothenic acid (Vitamin B₅): AOAC 2012.16. LC/MS/MS with isotope dilution. Test code: DJ5BG; expanded uncertainty: 20%; LOQ: 0.007 mg/100 g.

Cobalamin (vitamin B₁₂): AOAC 952.20. The sample is treated by a buffer solution in an autoclave. After dilution with basal medium containing all required growth nutrients except cobalamins the growth response of *Lactobacillus leichmanii* (ATCC 7830) to extracted cobalamins is measured turbidimetrically and is compared to calibration solutions. Test code: A7289; expanded uncertainty: 30%; LOQ: 0.01 µg/100 g.

Vitamin C (sum of ascorbic acid and dehydroascorbic acid): The sample are extracted in an aqueous solution containing trichloroacetic acid and the antioxidant tris(2-carboxyethyl)phosphine (TCEP). TCEP reduces dehydroascorbic acid to ascorbic acid. The final extract is analyzed by HPLC with UV detection at 265 nm. The Iso-ascorbic acid will be seen as a peak after the ascorbic acid peak. Reference: Food Chemistry, 94 (2006) 626-631. Test code: A7291; expanded uncertainty: 10%; LOQ: 0.5 mg/100 g.

Sodium, potassium, calcium, magnesium, phosphorus, iron, copper, zinc: NEN-EN-ISO 21424, AOAC 2015.06, and in-house modified. Pressure digestion and inductively coupled plasma with mass spectrometry (ICP-MS).

- Sodium: Test code: FF1SM; expanded uncertainty: 17.7%; LOQ: 2 mg/100g
- Potassium: Test code: FF1SI; expanded uncertainty: 18.4%; LOQ: 2 mg/100g
- Calcium: Test code: FF1S6; expanded uncertainty: 13.8%; LOQ: 2 mg/100g
- Magnesium: Test code: FF1SC; expanded uncertainty: 16.2%; LOQ: <0.01 mg/100 g
- Phosphorus: Test code: FF1SH; expanded uncertainty: 20.2%; LOQ: 0,1 mg/100 g
- Iron: Test code: FF1SA; expanded uncertainty: 13.9%; LOQ: 0.08 mg/100 g.
- Copper: Test code: FF1S9; expanded uncertainty: 10.7%; LOQ: 0,0001 mg/100 g
- Zinc: Test code: FF1SU; expanded uncertainty: 9.5%; LOQ: <0.001 mg/100 g.

Selenium, chromium, manganese: EN 13805:2014/EN ISO 17294:2016. Pressure digestion. Analysis of liquid samples by inductively coupled plasma mass spectroscopy (ICP-MS).

- Selenium: Test code: FF1SK; expanded uncertainty: 14.2%; LOQ: 0,04 µg/100 g.
- Chromium: Test code: FF1S7; expanded uncertainty: 14.8%; LOQ: 0,08 µg/100 g.
- Manganese: Test code: FF1SD; expanded uncertainty 12.6%; LOQ: 0.02 mg/100 g
- *Molybdenum*: EN 13805:2014/EN 15763:2010. Pressure digestion. Analysis of liquid samples by inductively coupled plasma mass spectrometry (ICP-MS). Test code: FF1SF; expanded uncertainty:14.2%; LOQ: 4 µg/100 g.

Iodine: DS EN ISO 15111:2007. Following a thermal extraction with tetramethylammonium hydroxide, detected and quantified by ICP-MS. Test code: DH9A3; expanded uncertainty: 20%; LOQ: 0.05 µg/100 g.

Sugar alcohols: GC-FID method of SLMB Nr. 501.2:200. The sample is dissolved in water, clarified according to Carrez if necessary, mixed with methanol and filtered. An aliquot of the filtrate is evaporated to dryness. The sugar oxime-silyl derivatives are then prepared and analyzed by gas chromatography. Test code: LG3Z8. Expanded uncertainty: 15% for Isomalt, 10% for mannitol, sorbitol, lactitol, maltitol and 7% for Xylitol; LOQ: 0.1 g/100 g for xylitol, mannitol, sorbitol, lactitol, maltitol, isomalt.

Caffein: Reference § 64 LFGB L 46.00-3:2013-08. Extraction with water. Finally, determination by HPLC with UV detection (265 nm). Test code JK08K; expanded uncertainty: 4%; LOQ: 1 mg/100 ml

Acids: Reference§ 64 LFGB L 46.00-3:2013-08. The sample is grinded, suspended and cleared if necessary. After filtration, the sample is analyzed by HPLC-UV. Test code HEG7M; Expanded uncertainty: Expanded uncertainty: Citric acid (2.9%), lactic acid (9.1%), acetic acid (5.2%). LOQ: citric acid (2 mg/100 g), lactic acid (4 mg/100 g), acetic acid (5 mg/100 g), Not accredited.

Taurin: Reference GB 5009.169-2016 First method. Extraction of free taurine with metaphosphoric acid and protein precipitation with centrifugation. Separation on AAA by sodium cation exchange column, post column derivatisation with O-Phthalic aldehyde (OPA) and detection by fluorescence at 338/425 nm. Test code DJK00; Expanded uncertainty: 10%, LOQ: 2 mg/100 g.

pH: NMKL 179:2005. Test code: DHP34. Not performed accredited.

Appendix C – Macronutrients Including Sugars, Sugar Alcohols, and Amino Acids

Energy Drink (ED)	Nitrogen g/100g	Ash g/100g	Dry matter g/100g	Fructose g/100 ml	Glucose g/100 ml	Sucrose g/100 ml
ED with added sugar						
CULT, THE REAL ORIGINAL	0.04	0.17	9.92	0.31	0.3	8.6
FAXE KONDI Booster, Original	<0.02	<0.05	11.33	0.39	4.2	7.0
Red Bull, ENERGY DRINK	0.06	0.18	10.31	0.65	2.6	7.1
STATE, LEMON/LIME	0.03	<0.05	8.84	6.6	<0.2	<0.2
X RAY, ORIGINAL	<0.02	0.20	11.31	2.6	2.7	6.5
ED with added sugar and non-sugar sweetener						
CULT, SUGAR FREE ORIGINAL*	0.04	0.24	1.47	0.5	<0.2	<0.2
MONSTER, ENERGY	0.05	0.19	11.06	1.32	3.2	6.7
ED with non-sugar sweetener						
FAXE KONDI Booster, Original 0 kcal	<0.02	<0.05	0.32	<0.2	<0.2	<0.2
MONSTER, ULTRA ZERO SUGAR	0.06	0.20	1.27	<0.2	<0.2	<0.2
Red Bull, SUGARFREE	0.06	0.20	1.37	<0.2	<0.2	<0.2
ROCKSTAR, ZERO SUGAR	<0.02	0.11	1.45	<0.2	<0.2	<0.2
X RAY, ZERO SUGAR	<0.02	<0.05	0.41	<0.2	<0.2	<0.2

*The ingredient list includes fructose syrup; therefore, it is not categorized as a sugar-free energy drink.

All samples were analyzed and found to have a content of the amino acids below the limit of quantification (LOQ). LOQ values (g/100 g) for each amino acid are provided in parentheses: Isoleucine (0.035), Leucine (0.015), Lysine (0.014), Methionine (0.024), Cysteine (0.006), Phenylalanine (0.031), Tyrosine (0.023), Threonine (0.006), Tryptophan (0.010), Valine (0.016), Arginine (0.010), Histidine (0.020), Alanine (0.015), Aspartic acid (0.017), Glutamic acid (0.021), Glycine (0.019), Proline (0.020), Serine (0.016), as well as Ornithine (<0.05 g/100 g) and Hydroxyproline (<0.2 g/100 g).

Appendix D – Vitamins

Energy Drink (ED)*	Riboflavin	Niacin	Pyridoxine	Pantothenic acid	Biotin	Cobalamin	Vitamin C
Content per 100 g	mg	mg	mg	mg	µg	µg	mg
ED with added sugar							
CULT, THE REAL ORIGINAL		7.7	1.97			3.62	
FAXE KONDI Booster, Original			0.20	1.2	6.1	0.52	
Red Bull, ENERGY DRINK		7.2	2.08	1.83		1.92	
STATE, LEMON/LIME		7.8	0.25	2.43		0.47	
ED with added sugar and non-sugar sweetener							
CULT, SUGAR FREE ORIGINAL **		8.2	0.19			4.04	
MONSTER, ENERGY	0.75	7.7	0.64			2.68	
ED with non-sugar sweetener							
FAXE KONDI Booster, Original 0 kcal			0.22	1.26	3.4	0.57	
MONSTER, ULTRA ZERO SUGAR		9.3	0.65	2.06		2.66	
Red Bull, SUGARFREE		8.9	2.22	1.72		2.19	
ROCKSTAR, ZERO SUGAR		3.9	0.37				20.7

*Ingredient list with added vitamins included in the analytical program.

**The ingredient list includes fructose syrup; therefore, it is not categorized as a sugar-free energy drink.

Empty cell: no values declared or analyzed.

Appendix E – Minerals

Energy Drink (ED)	Sodium	Potas- sium	Calcium	Magnesium	Phospho- rus	Iron	Copper	Zinc	Iodine	Mangan- ese	Chro- mium	Molyb- denum
Content per 100 g	mg	mg	mg	mg	Mg	mg	mg	mg	µg	mg	µg	µg
ED with added sugar												
CULT, THE REAL ORIGINAL	65	4.4	0.36	0.22	<0.1	0.006	0.0009	<0.001	0.72	0.00085	<0.2	<0.1
FAXE KONDI Booster, Original	19	6.1	0.45	0.24	1.1	0.004	0.0007	<0.001	1.00	<0.0005	<0.2	<0.1
Red Bull, ENERGY DRINK	37	0.3	9.6	21	0.17	0.007	0.0006	<0.001	0.47	0.00066	<0.2	0.31
STATE, LEMON/LIME	13	5	0.30	<0.01	<0.1	0.003	<0.0001	<0.001	0.07	0.0018	<0.2	<0.1
X RAY, ORIGINAL	2.4	0.58	9.8	1.60	<0.1	0.005	0.0002	0.002	0.74	<0.0005	<0.2	<0.1
ED with added sugar and non-sugar sweetener												
CULT, SUGAR FREE ORIGINAL*	82	6.2	0.37	0.30	<0.1	0.005	0.0005	0.0021	0.87	<0.0005	<0.2	<0.1
MONSTER, ENERGY	69	0.28	0.12	0.02	0.16	0.004	0.0004	<0.001	0.47	<0.0005	<0.2	<0.1
ED with non-sugar sweetener												
FAXE KONDI Booster, Original 0 kcal	26	8.9	0.46	0.26	1.2	0.004	0.0002	<0.001	0.76	<0.0005	<0.2	<0.1
MONSTER, ULTRA ZERO SUGAR	72	3.2	0.38	0.04	<0.1	0.002	<0.0001	<0.001	0.26	<0.0005	<0.2	<0.1
Red Bull, SUGARFREE	42	1.8	6.10	19	<0.1	0.008	<0.0001	<0.001	0.32	0.00084	<0.2	0.13
ROCKSTAR, ZERO SUGAR	69	5	0.72	0.30	0.24	0.008	0.0006	<0.001	1.10	0.00061	<0.2	<0.1
X RAY, ZERO SUGAR	5.9	6.4	29	2.1	<0.1	0.044	0.0001	<0.001	1.10	0.0038	0.25	1.3

*The ingredient list includes fructose syrup; therefore, it is not categorized as a sugar-free energy drink.

Selenium: was <0.1 µg/100 g in all samples.

Appendix F – Caffeine, Taurine, Acids, and pH

Energy Drink (ED)	Caffeine mg/100 ml	Taurine mg/100 g	Lactic Acid mg/100 g	Acetic Acid mg/100 g	Citric Acid mg/100 g	pH
ED with added sugar						
CULT, THE REAL ORIGINAL	33.4	266	<4	<5	731	3.45
FAXE KONDI Booster, Original	32.4	<2	<4	<5	139	3.33
Red Bull, ENERGY DRINK	34.8	426	<4	<5	763	3.52
STATE, LEMON/LIME	33.2	187	<4	<5	273	3.18
X RAY, ORIGINAL	16.3	<2	<4	<5	333	2.78
ED with added sugar and non-sugar sweetener						
CULT, SUGAR FREE ORIGINAL*	32.6	474	<4	<5	671	3.76
MONSTER, ENERGY	34.4	451	<4	<5	705	3.58
ED with non-sugar sweetener						
FAXE KONDI Booster, Original 0 kcal	32.5	<2	<4	<5	187	3.42
MONSTER, ULTRA ZERO SUGAR	31.5	407	<4	<5	725	3.59
Red Bull, SUGARFREE	35.2	458	<4	<5	843	3.48
ROCKSTAR, ZERO SUGAR	33.1	20	<4	<5	786	3.41
X RAY, ZERO SUGAR	17.6	<2	<4	<5	321	2.94

*The ingredient list includes fructose syrup; therefore, it is not categorized as a sugar-free energy drink.

Appendix G – Estimated Energy

Energy drink (ED)	Energy, kJ/100 g						Energy, kJ/100 g	
	Estimated based on analyses of individual analytes*						Estimated based on available carbohydrate**	
	Protein	Fructose	Glucose	Sucrose	Citric Acid	Total	Carbohydrate, available	Total
ED with added sugar								
CULT, THE REAL ORIGINAL	-	5.3	5.1	147	9.5	167	10	162
FAXE KONDI Booster, Original		6.6	71	120	1.8	200	11	193
Red Bull, ENERGY DRINK	-	11	45	120	9.9	186	10	166
STATE, LEMON/LIME	-	112			3.5	115	9	147
X RAY, ORIGINAL	-	45	46	110	4.3	205	11	189
ED with added sugar and non-sugar sweetener								
CULT, SUGAR FREE ORIGINAL	-	8.5			8.7	17	1.0	17
MONSTER, ENERGY	-	22	54	113	9.2	199	11	179
ED with non-sugar sweetener								
FAXE KONDI Booster, Original 0 kcal					2.4	2	0,3	5
MONSTER, ULTRA ZERO SUGAR	-				9.4	9	0,7	12
Red Bull, SUGARFREE	-				11	11	0,8	14
ROCKSTAR, ZERO SUGAR					10	10	1,3	23
X RAY, ZERO SUGAR					4.2	4	0,4	7

*Factors applied: fructose, glucose, sucrose, and 13 kJ/100 g citric acid. Nitrogen (Appendix C) that was analyzed was assumed to originate from taurine and is not included in the energy estimation.

**Available carbohydrate: Dry matter - (Protein + ash). Factor applied: 17 kJ/100 g. Nitrogen was used to estimate the content of nitrogen for this estimation.



DTU National Food Institute

DTU Fødevareinstituttet

Henrik Dams Allé
2800 Kgs Lyngby

+45 35 88 70 00

food.dtu.dk