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# Energy drinks available in Ireland: a description of caffeine and sugar content

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## Abstract

*Objective:* To describe the caffeine and sugar content of all energy drinks available on the island of Ireland.

*Design:* Two retail outlets were selected from each of: multinational, convenience and discount stores in Northern Ireland and the Republic of Ireland, and all available single-serve energy drinks were purchased. The cross-sectional survey was conducted in February 2015 and brand name, price, volume, caffeine and sugar content were recorded for each product. Descriptive analysis was performed.

*Results:* Seventy-eight products were identified on the island of Ireland (regular, *n* 59; diet/sugar-free/light, *n* 19). Caffeine and sugar content was in the range of 14–35 mg and 2·9–15·6 g per 100 ml, respectively. Mean caffeine content of 102·2 mg per serving represents 25·6 % of the maximum intake advised for adults by the European Food Safety Authority. Per serving, mean sugar content of regular energy drinks was 37 g. This exceeds WHO recommendations for maximum daily sugar intake of <5 % of total energy intake (25 g for adults consuming 8368 kJ (2000 kcal) diet). If displaying front-of-pack labelling, fifty-seven of the fifty-nine regular energy drinks would receive a Food Standards Agency 'red' colour-coded label for sugar.

*Conclusions:* Energy drinks are freely available on the island of Ireland and all products surveyed can be defined as highly caffeinated products. This has potential health issues particularly for children and adolescents where safe limits of caffeine have not been determined. Energy drinks surveyed also contained high levels of sugar and could potentially contribute to weight gain and adverse dental health effects.

**Keywords**
Energy drinks
Sugar
Island of Ireland
Obesity

The annual consumption of energy drink products in 2013 exceeded 5·8 billion litres in over 160 countries[1]. Available nutrition surveillance surveys in Europe give a very wide range of consumption levels, 8–30 % in adults and 1·6–68 % in teenagers; and point to a young, mainly male consumer[1–4].

While no standard definition exists, energy drinks are commonly understood to be non-alcoholic drinks which contain caffeine as a main ingredient and which are marketed as a stimulant to improve energy levels and performance[5]. Adults tend to use this type of beverage as a mixer with alcohol but it is increasingly being consumed by children and adolescents[6]. A recent European review on energy drinks raised concerns about their caffeine and sugar content[6], with products typically containing a caffeine concentration of 80 mg per 250 ml can.

Excess caffeine consumption can lead to anxiety, insomnia and gastrointestinal upset in adults[7]. The effects have not been studied in children or adolescents for ethical reasons, despite these beverages' availability. While the European Food Safety Authority has set recommended safe limits for caffeine consumption in adults, it has not done so for children or adolescents. It has, however, raised concerns over the acute effects of caffeine consumption from energy drinks and the risk of adverse health effects in adolescents and adults involving the cardiovascular and central nervous systems, particularly when consumed over a short period, at high doses,

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and in combination with alcohol and/or physical exercise[2].

Energy drinks are classed as sugar-sweetened beverages, which have been linked to weight gain and obesity in both adults and children[3,4]. Currently one in four children and two in three adults in Ireland are overweight or obese[8,9]. In addition, the sugar content has also been linked to dental erosion[10,11], with energy drink consumption associated with a 2·4-fold increase in dental erosion[12].

The island of Ireland consists of two jurisdictions: the Republic of Ireland and Northern Ireland. The most recent review of energy drinks in the Republic of Ireland was conducted in 2002[13], where ten products were identified. As energy drinks have become more mainstreamed in the intervening decade, we considered it important to update that survey. The availability of energy drinks in Northern Ireland has not been explored previously. The aim of the present research was to: (i) assess the availability of energy drinks on the island of Ireland (both jurisdictions); (ii) document their caffeine content; (iii) document their sugar content; (iv) define what category of Food Standards Agency label each drink would receive for sugar content; and (v) determine how many of these products meet the EU criteria for highly caffeinated products.

## Methods

### *Energy drinks criteria*

For the purpose of the current study, energy drinks are defined as 'non-alcoholic drinks which contain caffeine as a main ingredient and which are marketed as a stimulant to improve energy levels and performance'[5]. Only products that met this definition were included. Where caffeine was included as flavouring these products were excluded from analysis. Sports drinks and other sugar-sweetened beverages were also excluded as they do not contain caffeine as a main ingredient.

### *Supermarkets*

Products were purchased from six supermarkets in the Republic of Ireland (Tesco, Dunnes Stores, Spar, Centra, Lidl and Aldi) and six supermarkets in Northern Ireland (Tesco, Sainsbury's, Spar, Mace, Lidl and Iceland).

### *Data collection*

All available energy drink products were purchased in February 2015. Brand name, price, volume, price promotion, health messages and caffeine content were recorded for each product. Where information on nutrient content could not be obtained from the label, this information was obtained from the official brand website. Only single-serve products, as sold, have been included in the analysis (e.g. a 330 ml can or a 500 ml bottle).

All information collected was electronically recorded and double-checked by two researchers.

### *Statistical analysis*

Descriptive analysis was carried out using the statistical software package IBM SPSS Statistics Version 22. Those drinks that did not report caffeine or sugar content were not included in the analysis. Mean values are reported for caffeine and sugar content. Regular and diet versions of products were analysed separately for sugar content.

### *Food Standards Agency front-of-pack labelling*

The Food Standards Agency[14] has issued guidelines on front-of-pack traffic light labelling for processed products. The categories are outlined below. All purchased products were categorised based on this.

| | Low (green) | Medium (orange) | High (red) |
|---|---|---|---|
| (Total) Sugars | ≤2·5 g/100 ml | >2·5 to ≤11·25 g/100 ml | >13·5 g/portion |

### *EU-defined highly caffeinated products*

The EU threshold for drinks to be considered highly caffeinated and to be labelled as such is ≥150 mg/l[15]. All purchased products were compared with this threshold.

## Results

### *Availability*

In total, seventy-eight energy drinks were identified. There were sixty-five products available in Northern Ireland and thirty-nine in the Republic of Ireland (twenty-six products in common). No energy drink 'shots' or alcohol and energy drink premixes were identified. There was a range of serving sizes from 250 to 500 ml with an average serving size of 353 ml. Table 1 details all products included in the analysis, along with the sugar and caffeine content per 100 ml and per serving of each.

### *Caffeine content*

All products purchased contained caffeine as an ingredient; however, only 80 % (*n* 67) of these noted the actual amount on the label. Mean values were calculated based on this group.

The mean caffeine content per 100 ml was 30·7 mg, with a range of 14 to 35 mg. The majority of products (88 %) had a caffeine content of between 30 and 32 mg per 100 ml. When looking at the caffeine content per serving size, the range of variation was large: 35 to 160 mg. The mean caffeine content per serving was 102·2 mg (Table 2).

**Table 1** Brands purchased and their sugar and caffeine content per 100 ml and per serving; cross-sectional survey of energy drinks (*n* 78) available from six supermarkets in Northern Ireland and six supermarkets in the Republic of Ireland, February 2015

| Product | Serving size (ml) | Energy per 100 ml | | Energy per serving | | Sugar content per 100 ml (g) | Sugar content per serving (g) |
|---|---|---|---|---|---|---|---|
| | | kcal | kJ | kcal | kJ | | |
| Blue Bear | 250 | 48 | 203 | 120 | 508 | 10·8 | 27 |
| Blue Bear Light | 250 | 4 | 17 | 13 | 54 | 0·3 | 0·8 |
| Blue Bear Sugarfree | 250 | 3·2 | 14 | 8·1 | 35 | <0·1 | <0·1 |
| Blue Bolt | 250 | 49 | 210 | 124 | 525 | 10·9 | 27·3 |
| Blue Bolt Cherry and Blackcurrant | 250 | 48 | 206 | 121 | 154 | 10·9 | 27·4 |
| Blue Bolt Mango and Passionfruit | 250 | 48 | 205 | 120 | 512 | 10·6 | 26·4 |
| Blue Bolt Original Zero | 250 | 5 | 20 | 12 | 51 | ˂0·5 | ˂0·5 |
| Boost | 250 | 47 | 200 | 118 | 500 | 10·6 | 26·5 |
| Boost Active | 500 | 70 | 294 | 350 | 1470 | 11·1 | 55·5 |
| Boost Citrus | 500 | 46 | 192 | 230 | 960 | 11 | 55 |
| Boost Original Sugarfree | 250 | 4 | 16 | 10 | 40 | <0·1 | <0·1 |
| Boost Pink Lemonade Sugarfree | 250 | 2 | 8 | 5 | 20 | 0 | 0 |
| BPM Energy* | 250 | 58 | 249 | 145 | 623 | 14·3 | 36 |
| Bulldog Power | 250 | 48·8 | 208 | 122 | 518 | 11·3 | 28 |
| Dart | 250 | 47 | 200 | 118 | 500 | 11 | 28 |
| Effect | 330 | 45 | 194 | 149 | 640 | 10·7 | 35·3 |
| Emerge | 250 | 44 | 185 | 110 | 462·5 | 9·8 | 24·5 |
| Energise Edge | 440 | 47 | 201 | 207 | 884 | 11 | 48 |
| Green-up Cranberry | 250 | 35 | 149 | 88 | 373 | 8·5 | 21 |
| Green-up Pomegranate | 250 | 44 | 187 | 110 | 468 | 11 | 27 |
| Green-up Tropical | 250 | 45·4 | 192·9 | 113·5 | 482·25 | 11 | 27·5 |
| Kx Cola | 330 | 45 | 190 | 148 | 628 | 11·1 | 36·7 |
| Kx Energy Drink | 250 | 46 | 194 | 114 | 484 | 9·8 | 24·5 |
| Kx Red Berry | 250 | 45 | 190 | 112 | 476 | 10·2 | 25·4 |
| Kx Tropical | 250 | 46 | 194 | 115 | 481 | 10·8 | 26·9 |
| Kx Cola Zero | 330 | 2 | 10 | 8 | 33 | 0·1 | 0·4 |
| Kx Sugar Free Citrus | 250 | 4 | 18 | 10 | 44 | <0·1 | <0·1 |
| Kx Sugar Free Energy Drink | 250 | 5 | 21 | 12 | 53 | <0·1 | <0·1 |
| Kx Sugar Free Red Berry | 250 | 4 | 17 | 10 | 42·5 | trace | trace |
| Lucozade Energy Brazilian | 380 | 62 | 263 | 236 | 999 | 12·4 | 47·1 |
| Lucozade Energy Caribbean Crush* | 250 | 57 | 241 | 143 | 603 | 14 | 34 |
| Lucozade Energy Citrus Clear | 380 | 63 | 267 | 239 | 1015 | 13 | 48 |
| Lucozade Energy Cloudy Lemonade (Reduced Sugar) | 380 | 34 | 143 | 129 | 543 | 4·1 | 15·6 |
| Lucozade Energy Grafitti | 380 | 46 | 191 | 171 | 726 | 8·7 | 33·1 |
| Lucozade Energy Melonade | 380 | 62 | 263 | 235 | 999 | 12·4 | 47·1 |
| Lucozade Energy Orange | 380 | 62 | 264 | 236 | 1004 | 12 | 47 |
| Lucozade Energy Pink Lemonade | 380 | 57 | 243 | 217 | 923 | 14 | 52 |
| Lucozade Energy Revive | 380 | 13 | 55 | 50 | 210 | 2·9 | 10·9 |
| Lucozade Original | 380 | 70 | 297 | 266 | 1129 | 8·7 | 33·1 |
| Mixxed Up Classic | 250 | 45 | 190 | 112·5 | 475 | 10·1 | 25·3 |
| Mixxed Up Light | 250 | 4 | 16 | 10 | 40 | <0·1 | <0·1 |
| Monster Assault | 500 | 48 | 203 | 240 | 1015 | 11 | 55 |
| Monster Energy | 500 | 48 | 203 | 240 | 1015 | 11 | 55 |
| Monster Khaos | 500 | 34 | 146 | 172 | 731 | 7·8 | 39 |
| Monster Rehab | 500 | 10 | 44 | 50 | 220 | 2·1 | 11 |
| Monster Ripper | 500 | 47 | 199 | 235 | 995 | 10·6 | 53 |
| Monster the Doctor | 500 | 44 | 186 | 219 | 929 | 10 | 52 |
| Monster Absolutely Zero | 500 | 3 | 16 | 15 | 80 | 0 | 0 |
| Mountain Dew* | 250 | 48 | 200 | 120 | 500 | 13 | 32·5 |
| Mountain Dew Sugarfree | 250 | 1 | 3 | 3 | 8 | 0 | 0 |
| No Fear Extreme Energy | 485 | 45 | 190 | 218 | 922 | 10·1 | 49 |
| No Fear Motherload Apple | 485 | 49 | 206 | 238 | 999 | 11·2 | 54·3 |
| No Fear Motherload Cherry | 485 | 41 | 176 | 199 | 854 | 9·9 | 48 |
| Pink Bolt Strawberry and Kiwi Zero | 250 | 3 | 15 | 9 | 38 | ˂0·5 | <0·5 |
| Red Bull | 250 | 46 | 194 | 115 | 485 | 11 | 27·5 |
| Red Bull Blue Edition Blueberry | 250 | 46 | 194 | 115 | 485 | 11 | 27·5 |
| Red Bull Red Edition Cranberry | 250 | 46 | 194 | 115 | 485 | 11 | 27·5 |
| Red Bull Silver Edition Lime | 250 | 45 | 192 | 112·5 | 480 | 11 | 27·5 |
| Red Bull Sugar Free | 250 | 3 | 13 | 7·5 | 32·5 | 0 | 0 |
| Red Bull Zero Calories | 250 | 1·8 | 8 | 4·5 | 20 | 0 | 0 |
| Red Thunder | 250 | 49 | 209 | 123 | 521 | 11 | 26 |
| Red Thunder Diet | 250 | 4 | 20 | 11 | 51 | <0·5 | <0·5 |
| Relentless Apple and Kiwi | 500 | 46 | 198 | 230 | 990 | 11·1 | 56 |
| Relentless Cherry | 500 | 31 | 133 | 155 | 665 | 7·5 | 38 |
| Relentless Lemon Ice | 500 | 48 | 204 | 240 | 1020 | 11·6 | 58 |
| Relentless Origin | 250 | 43 | 182 | 108 | 455 | 10·1 | 25·3 |

**Table 1** *Continued*

| Product | Serving size (ml) | Energy per 100 ml | | Energy per serving | | Sugar content per 100 ml (g) | Sugar content per serving (g) |
|---|---|---|---|---|---|---|---|
| | | kcal | kJ | kcal | kJ | | |
| Relentless Tropical Juiced | 500 | 44 | 188 | 220 | 940 | 10·7 | 54 |
| Relentless Origin Ultra | 500 | 3 | 12 | 14 | 55 | 0 | 0 |
| Rockstar Punched | 500 | 67 | 285 | 335 | 1425 | 15·6 | 78 |
| Rockstar Supersours | 500 | 59 | 249 | 295 | 1245 | 13·8 | 69 |
| Rockstar Xdurance | 500 | 57 | 242 | 285 | 1210 | 13·8 | 69 |
| Rockstar Pure Zero | 500 | 4 | 17 | 20 | 85 | 0 | 0 |
| Scheckter's Organic Energy | 250 | 31 | 134 | 76 | 335 | 7 | 17·5 |
| SoBe Pure Rush | 250 | 54 | 231 | 135 | 565 | 12 | 30 |
| Spar Budget Energy Drink | 250 | 44 | 186 | 109 | 465 | 9·9 | 24·6 |
| Tesco Blue Spark | 250 | 44 | 188 | 110 | 470 | 9·8 | 24·5 |
| Tiger | 250 | 46 | 197 | 115 | 492·5 | 10·9 | 27·3 |
| Tesco Blue Spark Sugar Free | 250 | 4 | 17 | 10 | 44 | <0·1 | <0·1 |

*These drinks are sold as 500 ml bottles; however, the label states a serving as 250 ml.

**Table 2** Caffeine content of surveyed energy drinks (*n* 67) from six supermarkets in Northern Ireland and six supermarkets in the Republic of Ireland, February 2015

| Volume | Caffeine | | |
|---|---|---|---|
| | Mean (mg) | Minimum (mg) | Maximum (mg) |
| Per 100 ml | 30·7 | 14 | 35 |
| Per serving | 102·2 | 35 | 160 |

**Table 3** Sugar content of regular versions of surveyed energy drinks (*n* 59) from six supermarkets in Northern Ireland and six supermarkets in the Republic of Ireland, February 2015

| Volume | Sugar | | |
|---|---|---|---|
| | Mean (g) | Minimum (g) | Maximum (g) |
| Per 100 ml | 10·6 | 2·9 | 15·6 |
| Per serving | 37·0 | 10·9 | 55·5 |

### *Sugar content*

Of the seventy-eight products, fifty-nine were full sugar/regular and nineteen were diet/light/sugar-free. The average sugar content per 100 ml for regular energy drinks was 10·6 g, with a range of 2·9 to 15·6 g. Per serving there was a mean of 37 g of sugar (Table 3). The sugar and energy content of the diet versions was minimal (mean: 0·1 g sugar/100 ml and 0·17 g sugar/serving).

### *Front-of-pack labelling*

If displaying front-of-pack labelling, fifty-seven of the fifty-nine regular-version energy drinks would receive a Food Standards Agency[14] 'red' colour-coded label for sugars for a serving as sold, one out of the fifty-nine products would receive an 'amber' colour-coded label and one would merit a 'green' colour-coded label. All diet versions would receive a 'green' label.

### *Highly caffeinated products*

All sixty-seven of the products included met the EU criterion and can be defined as a highly caffeinated product.

## Discussion

Seventy-eight energy drinks were identified on the island of Ireland, a major increase from the ten products previously reported in the Republic of Ireland in 2002[13]. This reflects global trends towards an increase in products and market shares[1,16]. The package size ranged from 250 to 500 ml, and this, understandably, had a significant impact on the caffeine and sugar content.

All (*n* 67) of the energy drinks met the definition for highly caffeinated products (≥150 mg/l). The mean caffeine content per serving was 102·2 mg, some products contained as much as 160 mg per serving. For comparison, an average 200 ml cup of filtered coffee contains 90 mg, a 200 ml cup of black tea contains 50 mg and a 500 ml bottle of diet coke contains 64 mg[2]. There is a higher mean level of caffeine in the products documented in the current survey than in those available in 2002[13].

The European Food Safety Authority has advised that a single dose of up to 200 mg caffeine for an average 70 kg adult is unlikely to cause clinically harmful changes. It has also concluded that daily caffeine intake from all sources up to 400 mg is safe for adults (excluding pregnant women)[2]. However, it raised concerns about the quantity which is safe for children and adolescents and currently no limits are set due to insufficient data. Energy drinks are high-caffeine products and five 250 ml cans or two 500 ml cans can exceed these recommended safe limits. That does not count other caffeine sources such as tea or coffee consumed during the day. Due to the high availability of these products and the substantial increase in range since 2002 in Ireland, it is important that guidelines be developed to inform safe levels of caffeine intake for children and adolescents.

These energy drinks contained sugar levels comparable to other mainstream sugar-sweetened beverages, which have been linked to weight gain and obesity in children, adolescents and adults[4,9]. Due to the varying serving sizes of these products, sugar content ranged from 10·9 to 78 g. The sugar-containing drinks surveyed contained an average of 37 g of sugar per serving; this is more than 9 teaspoons of sugar per serving (calculated using 4 g per teaspoon). The WHO has recommended that free sugars contribute no more than 10 % of total energy to the diet, with a further reduction to below 5 % providing additional health benefits. The average energy drink surveyed here equated to 7·5 % of the total daily energy intake for the average adult (based on an intake of 8368 kJ (2000 kcal)), exceeding the 5 % ideal and nearing the 10 % recommended free sugars intake. This represents the mean sugar content; some products contained up to 78 g sugar per serving, equating to almost 20 teaspoons of sugar and representing almost 16 % of the total daily energy intake for a 8368 kJ (2000 kcal) diet.

The EU action plan on childhood obesity 2014–2020[17] aims to halt the rise in overweight and obesity in children and young people aged 0–18 years by 2020. All member states are working to achieve this by focusing on eight key areas including restricting marketing and advertising to children, promoting healthier environments and making the healthy option the easier option. Taxation on sugar-sweetened beverages has been agreed as part of a government programme ('A Healthy Weight for Ireland')[18] in the Republic of Ireland, which may help to decrease consumption and impact weight positively. Due to their popularity and unrestricted availability, energy drinks are easily accessible to younger children. Voluntary codes or legislation to decrease consumption in youth or restrict sale of these products could be an additional important step.

The current research generated considerable interest in the Irish media with twenty interviews, twenty additional broadcast media reports and 173 media alerts over a 3-month period. It is clear that there is an interest and awareness gap here that needs addressing. Interventions to highlight the health risks that energy drinks pose are recommended.

### *Limitations*

We acknowledge a number of limitations to the present study. Only energy drinks available in surveyed supermarket chains were recorded and there may be other products available to the public in smaller independent stores. Brands and products are changing constantly, with new varieties being introduced and products being reformulated or discontinued, therefore our survey findings apply only to the products available in the time period of sampling (February 2015). We relied on the accuracy of the data provided on the label in our analysis. In addition, the serving size of energy drinks differed grossly with minimum volumes of 250 ml and maximum values of 500 ml; this had an impact on all nutritional analyses per serving. However, having this range within one data set is realistic as energy drinks typically are consumed per can.

## Conclusion

The results of the present study serve to document the caffeine and sugar content of energy drinks sold on the island of Ireland. Findings show that energy drinks are freely available in supermarkets and other retail outlets. All products surveyed here can be defined as highly caffeinated products. The caffeine content has potential health issues, particularly in children and adolescents for whom safe limits have not been determined. The study findings support the policy recommendations made in Europe by Breda *et al.*[6] to establish an evidence-based, upper limit for the amount of caffeine allowed in a single serving of any drink and to restrict sales to children and adolescents due to the potentially harmful adverse and developmental effects. Further we recommend the development of guidelines regarding safe levels of caffeine consumption in children and adolescents.

Energy drinks also contribute substantial quantities of sugar to the diet, approximately 37 g per serving, with some products containing as much as 78 g per serving. In a country where rates of obesity are increasing, as they are globally, there is a need to highlight the contribution that these products could make to weight gain. The high sugar content found in the products available in Ireland also has implications for dental health, causing dental erosion and tooth decay. Interventions are required to highlight the dangers of energy drinks to consumers.

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