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Energy Drinks – a Real Danger or a Scapegoat? An Analysis of the Commercially Available Products in Romania

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Abstract. Energy drinks are beverages that contain caffeine, taurine, ginseng, guarana, vitamins, herbal supplements, and sugar. Their ingredients are generally regarded as safe for consumption, but some of them raise some concerns. Caffeine is especially regarded as problematic, especially for some categories of consumers. Nevertheless, energy drinks also offer some advantages. In this study, we aimed to analyze the ingredients found in the energy drinks that were commercially available on the Romanian market. We analyzed products gathered over one year (March 2018 – March 2019). We used the information found on the companies' websites and directly on the products. We included 120 energy drinks found on the market. Most of the inspected products (93.4 %) contained caffeine and/or taurine (75 %). Many other products contained herbal ingredients such as guarana and ginseng. Vitamins and minerals were also abundant in these products. The vitamin concentrations are mostly negligible. Finally, all the energy drinks contained preservatives, food colorants or stabilizers, ingredients that are safe and authorized for use. In conclusion, energy drinks' consumption is mostly safe and all their ingredients are approved. However, special attention should be dedicated to some particular classes of consumers. Energy drinks should not be used in large quantities and children should be discouraged to consume them. The population must be further informed in regards to their risk, the negative effects when consumed in combination with alcohol and the danger they represent for children.

Keywords. Energy drinks, caffeine, taurine, health concerns, Romanian market

1. Introduction

Since their introduction on the market, energy drinks were regarded as a cause of concern for consumers and authorities alike. The products have a rich history, being first launched in Asia and Europe during the 1960s, but for twenty years they were relatively unknown. Only after Red Bull appeared in 1987 in Austria and especially after its launch on the US market ten years later, energy drinks became widely used (Pennay & Lubman, 2012). Various studies reported negative consequences of the consumption of energy drinks (Harb, Taylor, Khullar, & Sattari, 2016; Usman & Jawaid, 2012), but the literature also presents a series of positive aspects derived from their consumption (Kennedy & Scholey, 2004; Rayner & Horne, 2002; Sankararaman, Syed, Medici, & Sferra, 2018; Scholey & Kennedy, 2004; Souza, del Coso, Casonatto, & Polito, 2016). Nowadays, the Romanian market hosts many well-known producers of energy drinks. Given that these products raise some unique health concern, it is

important to point out whether the potential damages come from the ingredients found in the energy drinks. As many studies found, most of the negative effects are derived from the overconsumption (Kregiel, 2015), but the analysis of the ingredients could reveal new insights about the energy drinks' effects.

Generally speaking, energy drinks are caffeinated beverages designed to provide a boost of energy or enhance alertness (Bigard, 2010; Pennay & Lubman, 2012; Rath, 2012). For the purpose of this study, we consider that energy drinks are those beverages that contain caffeine, taurine, ginseng, guarana, vitamins, herbal supplements, and sugar (Usman & Jawaid, 2012) and therefore, we chose to select those products that contain, at least in part, many of these ingredients.

In Europe, the contribution of energy drinks to total caffeine exposure was: 43% in children, 13% in adolescents, and 8 % in adults (Breda et al., 2014; Zuconni et al., 2013). Other studies found that 16 % of US consumers report excessive consumption, while in Europe the rates are higher, with 24% of adolescents and 19% of adult energy drink consumers that reported drinking more than two cans on a single occasion (Breda et al., 2014; Zuconni et al., 2013)

However, the most exposed age group remains the children with ages between 12 and 14 years. Previous studies report a variety of health risks for children, especially related to the intake of caffeine (Seifert, Schaechter, Hershorin, & Lipshultz, 2011). It is worth noting that among this age group, the rate of excessive consumption is lower, just over 7 %. Although there are advantages in the consumption of energy drinks, many producers overstate them (Clauson, Shields, McQueen, & Persand, 2008).

Reportedly, excessive consumption of energy drinks may lead to seizures, insomnia, cardiac arrest, and, on rare occasions, to death (Berger & Alford, 2009; Clauson et al., 2008; Svatikova et al., 2015). There are also some paradoxical negative effects. One study showed that bingeing energy drinks lead to lower sleep quality and greater next-day tiredness (Patrick, Griffin, Huntley, & Maggs, 2016). Also, energy drinks consumption is related to some behavioral effects, such as alcohol and drug use, smoking, sexual risk-taking or violence (Breda et al., 2014, Milicic & Leatherdale, 2017). However, many of these associations could be explained by the links between energy drinks consumption and sensation seeking (Breda et al., 2014). Energy drinks could be associated with diabetes and obesity (Seifert et al., 2011) It is important to note that many negative effects of energy drinks come from the amount of caffeine they contain (Clauson et al., 2008; Heckman, Sherry, & de Mejia, 2010; Milicic & Leatherdale, 2017). Mixing energy drinks with alcohol may result in some altered objective and subjective responses compared to when alcohol is consumed alone (Marczinski, Fillmore, Bardgett, & Howard, 2011). Some of the behavioral impairments caused by the alcohol (response activation) are countered, while others are not (response inhibition). Thus, mixing the two would result in riskier behaviors. For other ingredients, such as taurine, ginseng, and guarana, most studies did not find any health risks (Clauson et al., 2008).

Low or moderated consumption could lead to more energy and vigor or a better mood (Doepker et al., 2016). One analysis found that most of the effects are due to the caffeine intake and that the other ingredients had unclear benefits (Sankararaman et al., 2018). Taurine may have beneficial actions on heart function and may lead to more endurance and muscle strength (Sankararaman et al., 2018; Souza et al., 2016). Also, some studies reported that ginseng has some effects on memory, but these claims are generally not supported (Sankararaman et al., 2018). The placebo effect could also explain some of the energy drinks' benefits. One study showed that believing that one consumes an energy drink increased their motivation to perform and thus enhanced their performance (Schmidt, Chandon, Pessiglione, & Plassmann, 2017)

In this study, we aimed to analyze the ingredients found in the energy drinks that were commercially available on the Romanian market. There are a relatively lower number of studies conducted on the Romanian market and usually, these studies took into account small samples of energy drinks (Cretescu, Ropciuc, Ahmadi, Rada, & Ostan, 2015; Nour, Trandafir, & Ionica, 2010; Rada, 2016). Nevertheless, one study showed that energy drinks are popular among the Romanian population and especially among Romanian youth (Rada, 2016). Thus, we consider that knowing the precise nature of the ingredients and their effects is important and may lead to further discussion on this topic.

2. Materials and Methods

Information on the analyzed products was gathered over one year (March 2018 – March 2019). Company Web sites were used for gathering the relevant information. When the information was not posted on the respective web sites, the products were inspected and introduced in the databases. IBM SPSS 20 was used for the descriptive statistics provided in the following section.

3. Results and Discussions

We tested one hundred and twenty products. One hundred and two (85 %) had 250 ml, three (2.5 %) had 330 ml, one (0.8 %) had 355 ml, twelve (10 %) had 500 ml and two (1.7 %) had 1 000 ml. One hundred and nine (89.2 %) products came from the European Union. Seven (5.8 %) products were made outside of the European Union and six (5 %) did not specify the country of production. We have also included two milk-based energy drinks that had similar ingredients to some more classical types of energy drinks.

Caffeine was the most common active product, with only eight products (6.6 %) not containing it. Two drinks (1.7 %) had caffeine, although they did not specify how much. The others contained between 10 mg/100ml to 38 mg/100 ml of caffeine, which is lower than the recommended dose for both adolescents (100 mg per day) and adults (400 mg per day) (de Sanctis et al., 2016). Although caffeine has demonstrated positive effects, such as improved mental performance and decreased fatigue (Sankararaman et al., 2018), previous studies also present cases of caffeine overdose or dependence (Reissig, Strain, & Griffiths, 2009). Besides, many health hazards related to caffeine intake are due to acute intoxication or come after prolonged periods of overconsumption (Reissig, Strain, & Griffiths, 2009). Thus, the caffeine content may pose serious health risks when one person consumes more than the recommended dose of energy drinks per day (usually, the recommended dose for an adult is no more than two cans a day). However, some additional risks may arise for other populations. For adolescents and especially for children, drinking one can of energy drink account for nearly half (or more, in the case of children) of the daily recommended intake of caffeine (Seifert et al., 2011). Although we do not have any results regarding the consumption of energy drinks in the Romanian youth population, the studies from other countries report that around 70 % of youth consumed energy drinks containing caffeine (Reid et al., 2017). Thus, energy drinks might also pose a risk for the Romanian youth due to their high caffeine concentration, especially in the case of overconsumption. In addition, energy drinks become dangerous when consumed by individuals with cardio-vascular, mood and behavioral disorders (Seifert et al., 2011).

Taurine was present in 75 % of the investigated sample. Most products contained between 10 mg/100ml and 480 mg/100 ml of taurine. Twelve (10 %) drinks did not specify the taurine content while thirty (25 %) did not have taurine. Except for two products showing very low concentrations of taurine (10 mg/100ml), the others had between 200 and 480 mg/100 ml of

taurine. However, this concentration is lower than the recommended daily dosage (Seifert et al., 2013). The positive effect of taurine is controversial. While some studies found some benefits, others reported non-significant results and even the lowering of the facilitative effect of caffeine (Heckman et al., 2011; Peacock, Martin, & Carr, 2013). Thus, it remains unclear whether taurine has any benefits on the functioning of the body and which are the mechanisms that can explain these benefits.

Twenty-seven drinks (22.5 %) contained guarana, ten (8.3 %) contained ginseng and nine (7.5 %) contained L-carnitine L-tartrate. Fifty-six (46.7 %) products contained inositol. Other specific ingredients were mate tea and green tea. Many energy drinks contain herbal ingredients such as guarana, ginseng or tea. Although some reports say these have positive effects such as increasing memory and energy, the majority of previous studies show inconclusive results regarding their benefits (for more in-depth reviews on the effects of herbal ingredients contained in the energy drinks, see Heckman et al., 2011 and Sankararaman et al., 2018). However, there is some consensus that these products are not toxic, but the excessive consumption of ginseng may lead to diarrhea, insomnia or high blood pressure (Seifert et al., 2011). Finally, active substances such as L-carnitine L-tartrate and inositol were also present. Few manufacturers offered information regarding their concentration. While these ingredients can have an adverse effect in high doses, they are generally regarded as safe (Sankararaman et al., 2018). Also, they might have some benefits in offering enhanced muscle metabolism.

Most energy drinks contained vitamins and other minerals in various quantities. Niacin was present in one hundred and five drinks, pantothenic acid in 88 drinks, vitamin B6 in one hundred and nine drinks, and vitamin B12 in ninety-four drinks. Some energy drinks contained zinc gluconate, sodium selenite, potassium iodide, vitamins C, B5, B7, B9, B12, A, E, D, K, potassium, magnesium, zinc, and calcium.

A dose contained between 1 and 63 kcal/100 ml. One important selling point for energy drinks is the presence of vitamins and minerals. In our sample, virtually all the products contained some vitamins, and minerals. But it is worth noting that their concentration is very low, thus the vitamin intake coming from energy drinks consumption is negligible (Sankararaman et al., 2018).

Table 1 presents the frequency of artificial sweeteners, stabilizers, preservatives and artificial colorants in our sample. The majority of the investigated energy drinks used only sugar (66 products – 55 %). Thirty-five (29.2 %) products used both sugar and artificial sweeteners and nineteen (15.8 %) used only artificial sweeteners. Some products used only one artificial sweetener, while others used up to four. One additional health concern may be raised by the sugar concentration found in energy drinks. 84.2 % of the products from our sample contained sugar. Thus, energy drinks become a contributing factor to obesity or diabetes, especially among the youth (Clayson et al., 2008; Seifert et al., 2011; Brown, Dulloo, & Montani, 2008). Moreover, given their acidic nature, energy drinks may have erosive potential and thus may attack the enamel, becoming problematic for dental hygiene (Cretescu et al., 2015).

The most commonly used acidifier was citric acid. We also found acidifiers such as phosphoric acid, lactic acid, malic acid, and sodium citrate. Twenty-one (17.5 %) products contained from one to four stabilizers. The most commonly used ingredient was the gum arabic (acacia gum), which appeared ten times in the sample. Food preservatives were present in thirty-four (28.3 %) drinks. The most commonly used preservative was sodium benzoate, followed by potassium benzoate, sorbic acid, and benzoic acid. Eleven (9.2 %) drinks offered no information about food colorants. The others contained between one and five food coloring products. Caramel was the most frequently used food colorant, with eighty-four products. All

products contained salt. Twenty products specified that they contained less than 0.01 g/100 ml. The maximum salt concentration was 0.3 g/100 ml.

Table 1. List of non-specific ingredients, vitamins and mineral found in energy drinks.

Ingredient	Frequencies
<i>Sweetener</i>	
Acesulfame potassium	26
Fructose/Glucose/Dextrose syrup	25
Aspartame	19
Sucralose	12
Sodium cyclamate	9
Maltodextrin	7
Saccharin	5
Sucrose	1
<i>Stabilisers</i>	
Gum arabic/acacia gum	10
Glycerol ester of wood rosin	5
Carob gum	5
Pectin	4
Propylene glycol	4
Sucrose acetoisobutyrate	2
Carboxymethyl cellulose	2
Xanthan gum	1
<i>Preservatives</i>	
Sodium benzoate	29
Potassium benzoate	9
Scorbic acid	3
Benzoic acid	3
<i>Food Coloring</i>	
Caramel	84
Riboflavine	33
Black carrot extract	14
Brilliant Blue FCF	8
Anthocyanins	6
Carotens	5
Saffron	4
Carmine cosenile	2
Chlorophyllin	1
Quinoline Yellow	1
Apocarotenal	1

4. Conclusions

Our investigation showed that the energy drinks that are available on the Romanian market contain all the ingredients that were present in the products from other markets (Kennedy & Scholey, 2004). Although all of their ingredients are approved by the regulatory authorities, when consumed in high quantities can represent a risk factor for heart failure, insomnia or lower sleep quality, among others. Nevertheless, consuming energy drinks can bring some benefits (better memory functions or better physical results). It is worth noting that caffeine remains the most important active ingredient from the energy drinks and the one that is most well-studied. The research on other ingredients, such as taurine and herbal products, leads to contradictory results.

Most of the investigated products contain information and warnings regarding the dangers of consuming more than two doses a day. Also, energy drinks can be dangerous for children, given that their recommended daily dose of caffeine is much lower. Although most of the investigated products announce that children should not consume them, we consider that further actions are needed. These products could be sold under stronger guidelines or their commercialization to children could be banned. The population can benefit from further information in regards to the negative effects energy drinks have when consumed in combination with alcohol and the danger they represent for children.

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