

Press Kit

Assessment of the health risks associated with so-called energy drinks



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Press Release

So-called energy drinks: ANSES warns against dangerous consumption patterns

So-called energy drinks are sodas fortified with substances that are already present in food (caffeine, taurine, vitamins, etc.) and whose principal common factor is their caffeine content (on average the equivalent of two espresso coffees). Because of their composition, these beverages have a stimulating effect which, when associated with certain other behaviours (alcohol consumption, sport, etc.), can give rise to serious cardiac accidents in consumers with common genetic predispositions which frequently go undiagnosed (1 individual in 1000). ANSES therefore recommends avoiding the consumption of so-called energy drinks in association with alcohol or during physical exercise. Considering the consumption practices observed, it also calls for action to be taken to regulate the advertising of these beverages to vulnerable population groups (children and adolescents) and in contexts where consumption can be hazardous (festive and sporting events, for instance). The Agency also calls on the entire population to moderate its consumption of caffeinated beverages, especially in the case of children, adolescents, pregnant women and nursing mothers.

“Energy drink” is a commercial designation and is not defined by any specific regulations. So-called energy drinks (scEDs) are sodas fortified with various substances already present in food (caffeine, guarana, taurine, vitamins, ginseng, etc.). ANSES has catalogued over 100 of these drinks marketed in France. Their composition is relatively heterogeneous except as regards caffeine, which is found almost systematically in all of these beverages. A standard 250 ml can of so-called energy drink contains on average the same amount of caffeine as two espresso coffees (50 ml) or slightly more than two cans of cola (330 ml).

ANSES has been investigating the safety of so-called energy drinks for several years. In this context, the Agency is notified of cases collected as part of the nutriviigilance scheme of suspected adverse effects related to the consumption of these products. In a press release dated June 2012, ANSES requested health professionals to send in as many declarations of such cases as possible. More than 200 cases were reported, bringing the final total to 257, of which 212 were sufficiently well documented to allow analysis as a part of the risk assessment related to the consumption of so-called energy drinks that is being published today.

The implication of the consumption of so-called energy drinks in the onset of these adverse effects was judged, according to the nutriviigilance criteria for assessing causality, to be very likely or likely for **25 cases, i.e. 12% of those reported**. The principal symptoms observed in these cases are essentially: **cardiovascular** (chest tightness or pain, tachycardia, high blood pressure, arrhythmia leading even to cardiac arrest, etc.), and **psycho-behavioural or neurological** (irritability, nervousness, anxiety and even panic attacks, hallucinations, epileptic seizures, etc.).

ANSES considers that the cases of cardiac arrest reported under the nutriviigilance scheme and those reported in the literature arose very probably in genetically predisposed subjects. These frequent



predispositions (canalopathies) are mostly asymptomatic and generally undiagnosed. They may affect about one individual in 1000. Cardiac arrest in these subjects could occur as the result of drinking so-called energy drinks in association with certain supplementary risk factors such as physical exercise (sport, dancing, etc.), high alcohol consumption, hypokalaemia, certain medications or individual sensitivity to caffeine.

The other effects studied (cardiovascular, psycho-behavioural or neurological) correspond to adverse effects commonly observed after intake of large quantities of caffeine. After analysis of the nutriviigilance cases and the bibliographical data, the caffeine found in these drinks was considered to be the key explanatory factor.

Caffeine is found naturally in more than 60 plants (coffee, tea, kola, guarana, yerba maté, etc.) and is well known for its effects as a stimulant and its many adverse effects: anxiety, tachycardia, sleep disorders, and the risk in children of later developing addictive behaviour. In the population at large there is great variability in individual sensitivity to the effects of caffeine. On the basis of the different thresholds used as references internationally, it can be seen that a non-negligible fraction of the French population exceeds the recommended levels of caffeine:

- about **30% of the adult population** exceeds the threshold established as causing **anxiety** (which for an adult corresponds to about six espresso coffees);
- and almost **7% of the adult population** exceeds the threshold beyond which more general chronic toxicity is suspected (bone and cardiovascular health, cancer, male fertility, etc.);
- **11% of 3 to 10-year-olds** and 7% of 11 to 14-year-olds exceed the threshold for developing tolerance to caffeine and **triggering withdrawal symptoms** (which for a child weighing 35 kg corresponds to less than a half of a standard can of so-called energy drink or one can of cola).

Although caffeine has long been consumed throughout the world, its novel and increasingly popular presentation in the form of so-called energy drinks is changing consumption patterns:

- Use by consumers who until now had had little exposure to caffeine, including children and adolescents of whom, in Europe, 3% and 8% respectively consume so-called energy drinks more often than 4 to 5 times a week;
- Consumption of very high quantities: 25% of French consumers of so-called energy drinks sometimes consume more than 500 ml in a single day;
- Consumption in new contexts of exposure: in France, about 32% of consumers of so-called energy drinks drink them during festive occasions (bars, nightclubs, concerts, etc.), 41% in association with sporting activities, and 16% while also consuming alcohol.



ANSES considers that the multiplication of sources of caffeine, notably via so-called energy drinks, combined with current consumption patterns of these drinks, is capable of generating risk situations.

The Agency therefore recommends:

- 1) that consumers refrain from consuming so-called energy drinks in **association with alcohol** and **during physical exercise**;
- 2) that the following groups be particularly vigilant concerning their caffeine intake, especially via so-called energy drinks: pregnant women and nursing mothers, children and adolescents, and individuals sensitive to the effects of caffeine or presenting certain pathologies, especially: certain cardiovascular or psychiatric and neurological disorders, kidney failure or serious liver diseases.
- 3) that all consumers in general moderate their **consumption of caffeinated beverages**.

Furthermore, the Agency calls on health professionals, and especially doctors, to:

1. include questions about consumption of so-called energy drinks when interviewing patients with relevant symptoms (paroxysmal tachycardia, high blood pressure, convulsions, etc.) and to try and determine as early as possible the level of caffeine consumed;
2. continue to report to ANSES any new cases of adverse effects suspected of being related to the consumption of so-called energy drinks.

Lastly, ANSES also draws attention to the emergence in other countries (Canada, United States, Lithuania, etc.) of government policies to regulate the market for so-called energy drinks. Considering the divergence between the Agency's recommendations and current practice as reported in France, and also the lack of information available to the public, **ANSES calls for measures to be taken to inform vulnerable population groups and to regulate the advertising of so-called energy drinks to these groups and in contexts (festive, sporting, etc.) where consumption involves special risk.**

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1. How did ANSES proceed?

ANSES has investigated the safety of consuming energy drinks several times since 2000. Over the same period, several foreign and international health agencies such as the EU's Scientific Committee on Food, the *Institut National de Santé Publique du Québec*, and the BfR (Germany's Federal Institute for Risk Assessment) have also investigated this issue.

In 2008, when these beverages were first introduced for sale in France, the French Institute for Public Health Surveillance (InVS) set up a monitoring scheme at the request of the French Ministry of Health to identify any reports of adverse effects potentially related to so-called energy drinks, *via* the network of anti-poison and toxicovigilance centres. The Agency took over the running of the scheme in 2009, as a part of its nutriviigilance mission.

Within this framework, ANSES deemed it relevant to:

- launch a survey for the purpose of learning more about consumption practices involving these new products in France;
- encourage the reporting of as many adverse effects as possible that might be due to the consumption of so-called energy drinks (see Press Release of 6 June 2012);
- issue an internal request for an assessment of the risks related to the consumption of so-called energy drinks on the basis of these elements and a broad analysis of the scientific literature.

More than 200 cases were reported, bringing the final total to 257, of which 212 were sufficiently well documented to allow analysis as a part of the risk assessment related to the consumption of so-called energy drinks.

The assessment was carried out by 15 rapporteurs (neurologists, cardiologists, physiologists, paediatricians, etc.) whose work was discussed collectively by the "Nutriviigilance" Working Group and the Agency's "Human Nutrition" Expert Committee. The work focused on:

- an analysis of all the reported cases of adverse events associated with consumption of so-called energy drinks in line with the nutriviigilance scheme's own methods to determine the level of implication of the consumption of so-called energy drinks;
- an examination of more than 300 bibliographical references concerning the hazards and risks related to the consumption of so-called energy drinks, the cases reported in the literature or the mechanisms that could shed light on all these cases;
- an analysis of the available consumption data, from the survey carried out by ANSES and identification of potentially at-risk consumption conditions and vulnerable population groups.

Several stakeholders were also consulted by the Agency in the context of this investigation:

- the consumer association *Consommation, logement et cadre de vie* (CLCV);
- the French Society of Sports Nutrition (SFNS);
- representatives of so-called energy drink manufacturers: the National Refreshment Beverages Association (SNBR) and the Red Bull company;
- the National Public Health Institute of Quebec (INSPQ), which produced an assessment report on so-called energy drinks in 2010.

These organisations were invited to answer questions posed by ANSES and provide any information useful for the risk assessment of the consumption of so-called energy drinks. Accounts of these hearings can be found as an annex to the Opinion.



In addition, the anti-poison centres were requested to analyse the many cases received via this channel.

Lastly, health agencies from European countries and certain international partners were contacted and asked to provide insight gained from their surveys and assessments on the safety of so-called energy drinks.



2. What are so-called energy drinks?

"Energy drink" is a commercial designation and is not defined by any specific regulations. Manufacturers of these beverages claim that they possess stimulant properties that enhance physical and intellectual performance. These beverages should not be confused with those known as "sports drinks", whose nutritional composition is designed for consumption in conjunction with physical exercise, and for which there is a specific regulatory framework.

So-called energy drinks contain a mix of different constituents, most commonly caffeine, taurine, glucuronolactone, B group vitamins, sugars and sweeteners. They may also contain plant extracts, such as guarana and ginseng.

The market for so-called energy drinks

In France, sales of so-called energy drinks (scEDs) in hypermarkets, supermarkets and hard discount stores of more than 400 m² are **growing rapidly with an increase of 30% between 2009 and 2011**, taking the number of **litres sold in 2011 to above 30 million**, compared with 23 million in 2009.

The market is dominated by one brand which has a 40% share, followed by all distributor brands (25.4%). All other products account for 35% of the market with one new brand growing rapidly and taking a 13.8% share in 2011.

Between 8 and 9% of households, or slightly over 2 million, buy so-called energy drinks in supermarkets. **Only about 30% of actual purchases are taken home, as most consumption takes place outside the home.** So-called energy drinks are mainly packaged in individual formats (shots of 50-100 ml, cans of 250 ml or 500 ml) rather than in 1 litre bottles, so they can easily be consumed outside the home.

Composition of so-called energy drinks

ANSES identified about a hundred so-called energy drinks on the market in France, by comparing information available in various databases (the Oqali and Global New Products databases and Kantar Worldpanel) and looking for beverages containing the ingredients considered to be the most frequently used in these drinks: caffeine, taurine, glucuronolactone, guarana extract and ginseng extract.

Caffeine is the common denominator of all these drinks, with 96% of the beverages identified on the French market (99/103) containing them. The four caffeine-free products make up a very small share of the market.

Taurine and glucuronolactone are found in 52% (54/103) and 33% (34/103) of the identified beverages, respectively. Caffeine and taurine levels vary little, while levels of glucuronolactone can vary by a factor of 10, depending on the beverages considered.

Vitamins are found in 67% (69/103) of the identified beverages. Fifty-one beverages specify the vitamins they contain, with 44 containing vitamins from the B group, 11 containing vitamin C and two containing vitamin E. Extracts of ginseng are present in 20% of the beverages.



Substances (mg/100 ml)	Weighted mean based on market share	Minimum content	Maximum content
Caffeine	30	12	32
Taurine	396	250	410
Glucuronolactone	113	24	240

Table 1: Levels of caffeine, taurine and glucuronolactone in so-called energy drinks containing them

The constituents of so-called energy drinks

Caffeine

Caffeine belongs to the methylxanthine family. The substance is present naturally in more than 60 plants, including coffee, tea, kola nuts, guarana and yerba maté. Coffee and tea are the main dietary sources. Caffeine can also be produced by chemical synthesis. Once ingested, caffeine is rapidly and completely absorbed in the gastro-intestinal tract. The peak plasma concentration can be reached within 15 minutes to 2 hours after ingestion. Caffeine is distributed rapidly through the body. It crosses the blood-brain barrier and the placenta and passes into breast milk. It is known to be a stimulant and acts in particular by blocking the sedative effect related to the activation of certain receptors in the brain (adenosine receptors).

It is well-known as much for its stimulant effects as for its many other, often adverse effects: sleep disorders, anxiety, tachycardia, and diuretic effects; it also contributes, like other psycho-active substances, to the development in children of addictive behaviour in later life.

Taurine

Taurine is an amino acid that is abundant in the body, but it is not used in protein synthesis. In adults, it is synthesized from cysteine, particularly in the liver, and is also supplied through the diet from products of animal origin. Taurine is found in many body organs, such as the heart, muscles and the central nervous system, and also plays a role in several physiological functions (formation of bile salts, stabilisation of cell membranes, etc.). An energy drink can contain up to 5 times the average quantity provided by normal dietary intake.

Glucuronolactone

D-glucurono- γ -lactone is a derivative of glucose. Once ingested by humans, it is rapidly absorbed, metabolised and excreted. An energy drink can contain up to 500 times the average quantity provided by normal dietary intake.

B vitamins

This is a large group of water-soluble vitamins with multiple effects on cell metabolism and for which the French population is not generally thought to suffer from insufficient intake.



3. Who consumes so-called energy drinks, how and where?

Consumption of so-called energy drinks

In 2011, 17% of the French population over the age of 14 is said to have consumed so-called energy drinks (8.9 million consumers across the country). In a study by the European Food Safety Authority¹ carried out in 2012 in several Member States, 30% of respondents were consumers of so-called energy drinks.

Among these French consumers, **about a quarter were in the age group 14-25, and 60% were men.**

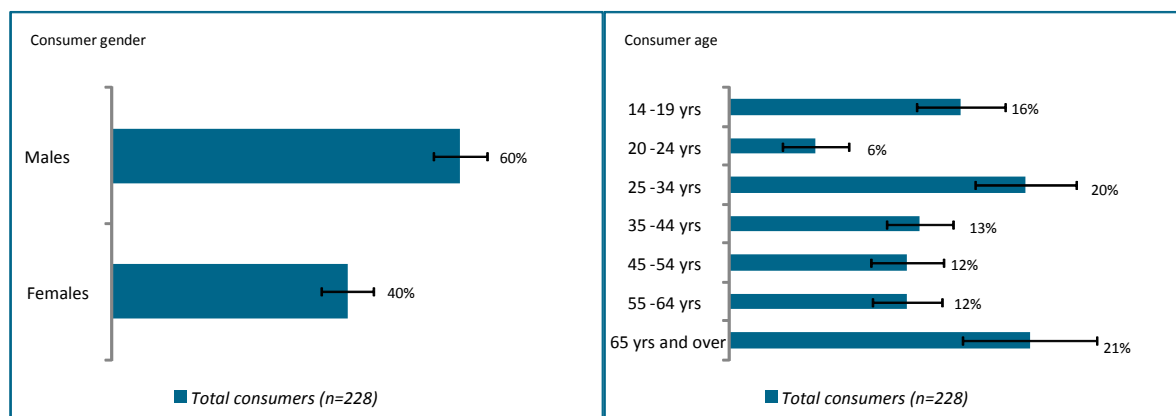


Figure 1: Age and gender of consumers of so-called energy drinks in France

32% of consumers state that they consume so-called energy drinks at least once a week.

¹ External scientific report "Gathering consumption data on specific consumer groups of energy drinks", European Food Safety Authority 2012. <http://www.efsa.europa.eu/en/supporting/doc/394e.pdf>

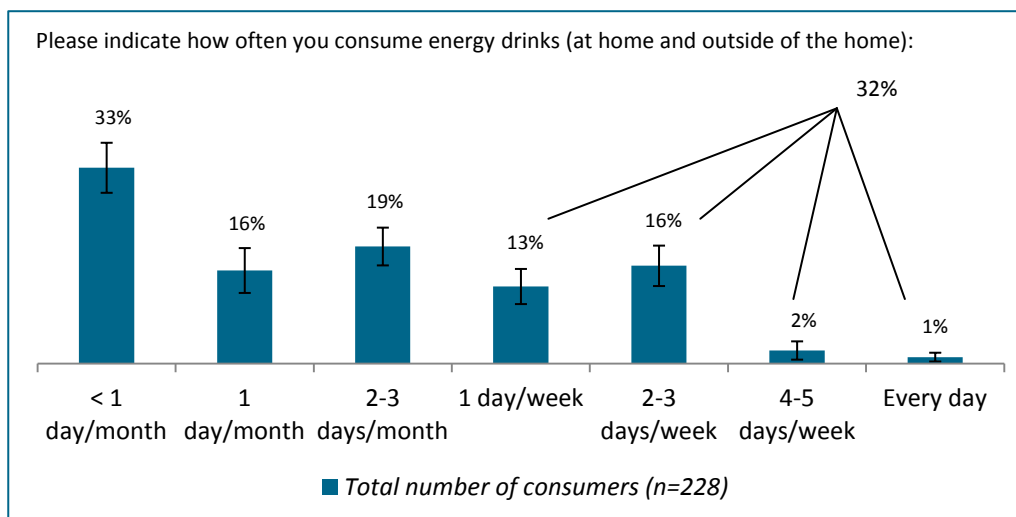


Figure 2: Frequency of so-called energy drink consumption

Two to three percent of consumers drink these products every day or almost every day. In 2011, average consumption in the course of a given day was 358 ml and a quarter of consumers consumed more than 500 ml (close to 2.1 million people over the age of 14 in France).

Consumption environments

Consumption is associated with relatively festive environments, as 32% of consumers of so-called energy drinks state that they drink them in bars, nightclubs, at concerts or parties, etc. Furthermore, 3% of consumers of so-called energy drinks drink them in cars, on motorways, or during travel; the sale of these drinks from vending machines (sports halls, service stations, etc.) and at motorway service stations makes them easily available. Consumption frequently occurs outside the home and mainly outside mealtimes.

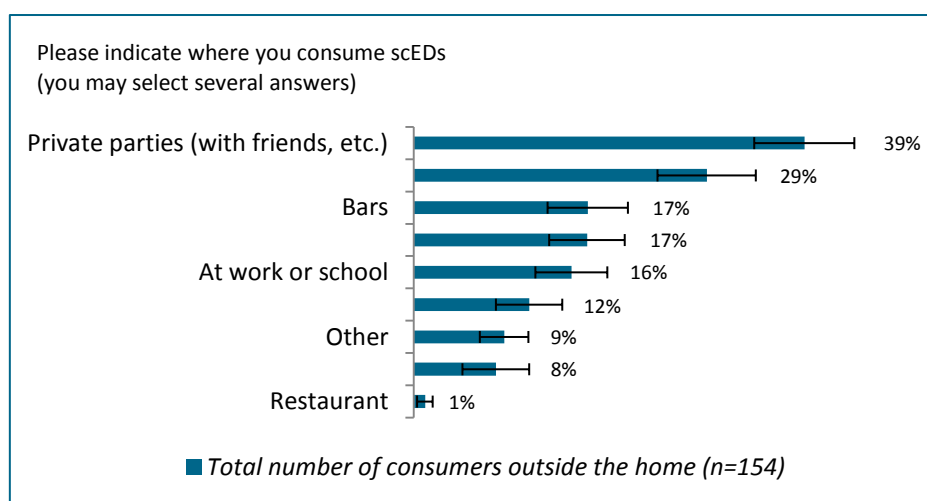


Figure 3: Locations where so-called energy drinks are consumed²

² Since this was a multiple-choice questionnaire, the values obtained for different items could not simply be summed together. Figures have been calculated from the raw data.



Among consumption patterns for these so-called energy drinks, **mixing with alcohol is widespread because 16% of consumers mix so-called energy drinks with alcoholic drinks** at least occasionally and 33% of these do so often or systematically. This means that 1.4 million people over the age of 14 in France mix so-called energy drinks with alcoholic beverages at least occasionally. To this should be added the fact that mixing is more frequent among young people.

Furthermore, **41% of so-called energy drink users** (i.e. 3.6 million people over the age of 14 in France) **consume these drinks in conjunction with a sporting activity**, 17% while actually practising a sport.

Lastly, 41% of so-called energy drink users are also coffee drinkers, meaning that this is an additional source of caffeine in their diet, even though partial substitution should not be ruled out.



4. The cases reported to ANSES

In all, ANSES collected **257 cases** and analysed them by applying the causality methodology developed specifically for nutravigilance (ANSES Opinion of 11 May 2011). The causality scores were determined on the basis of the conclusions of two rapporteurs who were qualified doctors and collective discussions within the Nutravigilance Working Group. The qualifiers associated with the scores used in the causality method are I4: very likely; I3: likely; I2: possible; I1: unlikely, I0: ruled out.

Of these cases, **45 were excluded** because of insufficient quality of the information (lack of clarity concerning the beverage that was consumed, drink past its sell-by date, absence of information on the patient, intake of multiple substances masking the effects potentially related to the so-called energy drink, or a context of malicious intent).

Of the **remaining 212 cases**, the most frequent types of effect represented ($n > 10$) were as follows: cardiovascular, psycho-behavioural, neurological, gastro-intestinal, respiratory and muscular or osteo-articular.

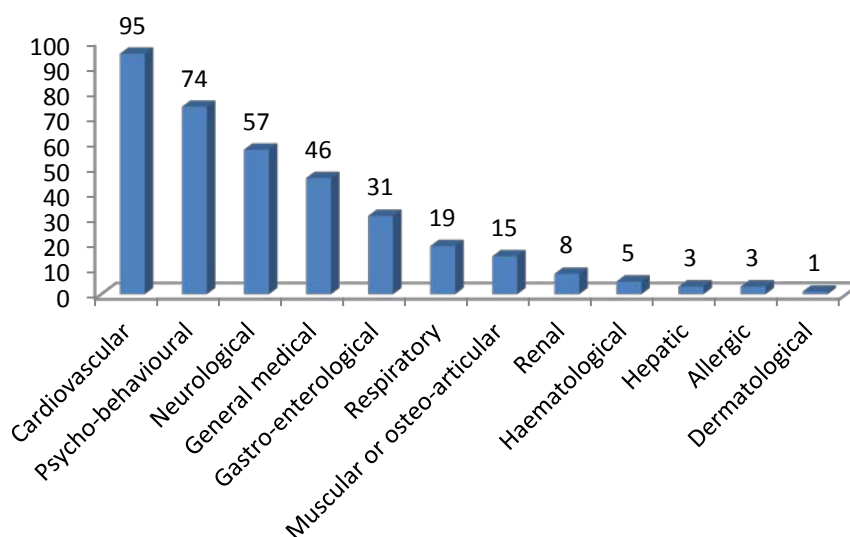


Figure 4: Breakdown of cases by type of effect

Concerning the implication analysis, causality was ruled out in 5 cases (I0: 2.4%), considered unlikely in 128 cases (I1: 60.4%), possible in 54 cases (I2: 25.5%), likely in 18 cases (I3: 8.5%) and very likely in 7 cases (I4: 3.3 %), according to the nutravigilance method.

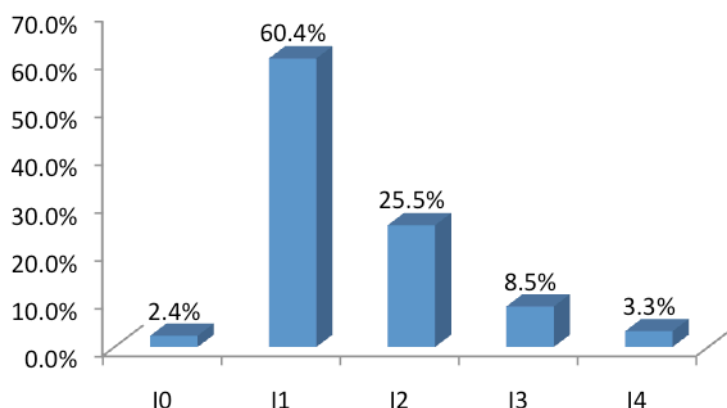


Figure 5: Breakdown of intrinsic causality scores

The causal relationship between the consumption of so-called energy drinks in the onset of these adverse events was judged, by the nutriviigilance criteria, **very likely or likely for 25 cases, i.e. 12% of those reported**. The principal symptoms observed in these cases were essentially: **cardiovascular** (cardiac arrest, feelings of tightness or pain in the chest, tachycardia, high blood pressure, etc.) and **psycho-behavioural or neurological** (irritability, nervousness, anxiety and even panic attacks, hallucinations, and epileptic seizures).

Serious cardiovascular effects

Eight cases of cardiac arrest were reported to the Agency in relation to consumption of so-called energy drinks. Two cases were considered inadmissible due to the impossibility of obtaining sufficient information. Since the cases were fatal, they were of course examined by a cardiologist but were not assigned a causality score.

For the six other cases, causality related to consumption of so-called energy drinks was considered unlikely in 3 cases, possible for 2 cases, and very likely for the last case.

The report for which the causality was considered very likely involved a case of sudden death in a young woman 16 years of age, occurring immediately after the subject stopped dancing in a nightclub. Her companions reported consumption of so-called energy drinks mixed with alcohol (though they were unable to specify any quantities), but no intake of other substances. The toxicological analysis revealed caffeine (2.4 mg/l) and alcohol (0.86 g/l) in the blood. The autopsy report indicated heart rhythm dysfunction.

ANSES considers that cases of cardiac arrest reported under the nutriviigilance system and those reported in the literature occur most probably in genetically predisposed individuals. These frequent predispositions (canalopathies) are generally asymptomatic and undiagnosed. Certain forms may affect about one individual in 1000. In these subjects, adrenergic stimulation, related for instance to physical exercise (sport, dancing), could be maintained and prolonged by the caffeine contained in so-called energy drinks, and thus precipitate the development of rhythm disorders. This risk can also be aggravated by various factors (tachycardia, bradycardia, hypokalaemia, intake of certain medications, etc.).



Cardiac arrest in these predisposed individuals may therefore result from the consumption of so-called energy drinks in association with certain supplementary risk factors such as physical exercise (sport, dancing, etc.), high alcohol intake, hypokalaemia, certain medications or individual sensitivity to caffeine.

The other adverse effects

The other cardiovascular effects reported after consumption of so-called energy drinks, such as tachycardia, tightness of the chest and chest pain, hypertension, and reflex bradycardia correspond to the adverse effects commonly observed after intake of large amounts of caffeine. Some data, however, suggest that taurine may have an additive effect on increased blood pressure and may promote the onset of coronary vasospasm.

The psycho-behavioural adverse effects (such as irritability, nervousness, anxiety, or even panic attacks), and neurological effects (epileptic seizures) in the cases analysed correspond to the frequently reported symptoms of caffeine intoxication.

Moreover, it is reported in the literature that the risk of psychiatric events following consumption of so-called energy drinks may be higher in subjects with chronic psychiatric disorders, particularly psychosis, bipolar disorder and anxiety disorders.

Individuals with epilepsy appear to be at greater risk of seizures following intake of so-called energy drinks, with higher risks related to higher consumption levels.



5. So-called energy drinks: at-risk population groups

Physiological conditions

Age

So-called energy drinks are a new source of caffeine intake in children and adolescents (accounting for up to 15% of caffeine intake in French children, according to the consumption data in the study published by EFSA in 2013). Children and adolescents are more sensitive to caffeine than adults. Consumption of caffeine in children and adolescents may lead to sleep disorders, resulting in fatigue and daytime drowsiness. This can lead to a vicious circle, in which caffeine is consumed to counter the drowsiness. Furthermore, poor sleep quality affects cognitive abilities and academic performance. Chronic sleep deficits have been associated with onset of somatic disorders (high blood pressure, cardiovascular disease, diabetes and obesity) and psychiatric conditions (such as anxiety and depression). Sleep deficits and early consumption of psychoactive substances such as caffeine may contribute to the development of addictive behaviour. Caffeine and caffeine-containing drinks should therefore be avoided in children and adolescents.

Maternity

Pregnant or breast-feeding women are another at-risk population in which caffeine consumption should be limited. **This recommendation stems primarily from the possible risk of intra-uterine growth retardation related to caffeine consumption during pregnancy and the sensitivity of infants to caffeine, which is excreted in breast milk.**

Presence of known disorders

In patients with certain diseases, caffeine metabolism is slowed (liver disease) or its adverse effects aggravated (high blood pressure, arrhythmias, psychiatric disorders, kidney failure, oesophagitis and gastro-oesophageal reflux).



6. So-called energy drinks: at-risk consumption situations

There are several situations where the consumption of these drinks is likely to involve risks.

Concomitant consumption of so-called energy drinks and alcohol

The intake of so-called energy drinks in combination with alcohol, is practised at least occasionally by 16% of so-called energy drink consumers in France, one third of whom report combining so-called energy drinks and alcohol often or systematically.

Consumption of so-called energy drinks or caffeine does not correct or only partially corrects cognitive disruptions induced by alcohol; it may however mitigate the perception of alcohol intoxication by reducing fatigue or increasing excitement. **Concomitant consumption of so-called energy drinks and alcohol thus carries a risk since the subjects may overestimate their abilities, which may lead them to continue consuming alcohol and increase risk-taking.**

In addition, alcohol can potentiate caffeine-induced heart rhythm disorders in predisposed individuals.

Finally, concomitant consumption of so-called energy drinks and alcohol increases the risk of dehydration.

Consumption of so-called energy drinks during physical exercise

In France, 41% of consumers of so-called energy drinks report intake before, during, or after physical activity. So-called energy drinks have no nutritional value concerning physical exercise. Unlike “sports drinks”, which have a nutritional composition suitable for physical exercise, so-called energy drinks do not maintain the water-electrolyte balance. On the contrary, the caffeine in so-called energy drinks has diuretic effects that accelerate water and electrolyte losses. The resulting dehydration is aggravated since these drinks are most often hyperosmolar. Moreover, caffeine alters thermoregulation processes when subjects exercise in warm conditions, resulting in increased body temperature and, consequently, a higher risk of heatstroke.

Consumption of so-called energy drinks in a festive context

The consumption of so-called energy drinks in a festive context may lead to accumulation of risk factors, in particular co-consumption with alcohol concomitant with physical exercise (dancing for example) and heat.



7. Caffeine content of the main dietary sources

The different so-called energy drinks on the market are relatively similar in their caffeine content. As regards hot drinks (coffee and tea), the literature review carried out by ANSES revealed considerable heterogeneity in the levels reported. The type of coffee, its processing, and the way the drink was produced (filter, espresso, etc.) all seem to play an important role in caffeine level variations.

Drink	Caffeine content in mg/100 g			Caffeine content (mg) for standard formats
	Minimum content	Maximum content	Average content	
				-
So-called energy drinks	12	32	30 ³	72.5 (250 ml can) <i>Several leading market brands sell shots in an 80 mg format</i>
Espresso coffee	25	214	71.3	35.7 (50 ml)
Filter coffee or large coffee from a pod or capsule	17.5	124.4	51.3	51.3 (100 ml)
Instant reconstituted coffee	20.1	85.6	48.4	48.4 (100 ml)
Decaffeinated coffee	1.5	12	2.1	2.1 (100 ml)
Brewed tea	9	50	27.2	54.2 (200 ml)
Soda containing cola	4.1	13.2	9.7	32 (330 ml can)

Table 2: Caffeine content of various beverages

According to the literature, a standard 250 ml can of so-called energy drink contains on average the same amount of caffeine as two espresso coffees (50 ml) or slightly more than two (2.3) cans of cola (330 ml).

To supplement these data, considering the lack of information concerning certain types of coffee and bearing in mind the variability found when analysing the data from the literature, the Agency

³ Weighted average based on market share



recently asked for the caffeine content of different coffees prepared in the home, using “espresso” machines, to be measured⁴. Overall, the data obtained concur with the literature. Levels of caffeine in “espresso” made from the pods or capsules of eight different brands sold in France fall between 68 and 184 mg of caffeine/100 ml, with an average of 131 mg/100 ml.

However, the caffeine concentration in “espressos” obtained with capsule technology is higher than that obtained using pods. If these particular forms of coffee are considered (capsules), a 50 ml cup of espresso would provide the same intake of caffeine as a can of so-called energy drink.

⁴ Research and development agreement with the French National Consumer Institute (INC). Pods or capsules used in “espresso” machines do not increase exposure to chemical contaminants:
<http://www.anses.fr/en/content/espresso-machine-coffee-pods-and-capsules-do-not-increase-exposure-chemical-contaminants>



8. Exposure of the French population to caffeine

Maximum caffeine exposure thresholds

Caffeine is well known as stimulant and for its many adverse effects, including anxiety, tachycardia and sleeping disorders. ANSES carried out a review of the different thresholds used internationally for adults and children. These differ depending on the adverse effects considered, such as the onset of anxiety syndromes, the development of tolerance and withdrawal symptoms, or general toxicity (see table below).

Population	Type of effect	Maximum threshold values adopted	Source
Adults	General toxicity and adverse cardiovascular effects, effects on bone health or the calcium balance (if calcium intake is higher than 800 mg/day), changes to behaviour, the incidence of cancer and effects on male fertility	400 mg/d	Health Canada, 2003
	Heightened anxiety	210 mg/d	NZFSA, 2010 Smith 2000
Children and adolescents	Heightened anxiety	2.5 mg/kg bw/d	Health Canada, 2003 NNT, 2008
	Development of tolerance and withdrawal symptoms	1.0 mg/kg bw/d	NNT, 2008

Table 3: Threshold values for risk assessments concerning high caffeine intake

Caffeine intake

It is thus possible to calculate the exposure of the French population to caffeine, on the basis of the results of the INCA 2 individual and national food consumption survey and the caffeine content of the different foods (chocolate, etc.) and drinks (coffee, tea, colas, etc.). It should be noted that since the INCA 2 survey was carried out before so-called energy drinks arrived on the market, the specific intake of energy drinks is not taken into account in these results. Intake from food supplements is not included either.

In France, average daily caffeine intake is: 14 mg/day in 3-10 year olds, 19 mg/day in 11-14 year olds, 34 mg/day in 15-17 year olds, 50 mg/day in pregnant women, and 168 mg/day in other adults.

Beyond these average figures, however, it is important to note the percentage of the French population exceeding the various thresholds. These calculations show that a non-negligible fraction of the French population exceeds the recommended maximum thresholds of caffeine intake:

- about 30% of the adult population exceeds the threshold established as causing anxiety (which for an adult corresponds to about six espresso coffees);
- almost 7% of the adult population exceeds the threshold beyond which more general chronic toxicity is suspected (bone and cardiovascular health, cancer, male fertility, etc.);



- 11% of 3 to 10-year-olds and 7% of 11 to 14-year-olds exceed the threshold for developing tolerance to caffeine and triggering withdrawal symptoms (which for a child weighing 35 kg corresponds to consumption of less than half a standard can of so-called energy drink or one can of cola).

% exceeding threshold values	Children 3-10 years	Adolescents 11-14 years	Adolescents 15-17 years	Adults 18 years and over	Pregnant women
1.0 mg/kg bw/d	11.1%	7.2%	13.1%	na	na
2.5 mg/kg bw/d	1.9%	1.5%	4.6%	na	na
200 mg/d	na	na	na	na	4.5%
210 mg/d	na	na	na	28.2%	na
400 mg/d	na	na	na	6.5%	na

Table 4: Prevalence of caffeine consumption exceeding threshold values in the general population without considering so-called energy drinks or food supplements

Principal contributors to caffeine intake (excluding so-called energy drinks)

In children 3 to 10 years old, alcohol-free cold beverages (sodas, colas, tea-flavoured drinks, etc.) are the principal contributors to caffeine intake (28%), followed by other hot drinks (15%), coffee (12%) and chocolate (10%). In children 11 to 14 years old, these food groups are also the largest contributors to caffeine intake (alcohol-free cold drinks: 30%; hot drinks: 20%; coffee: 15%).

In adolescents 15 to 17 years old, coffee becomes the principal contributor to caffeine intake (39%), followed by alcohol-free cold drinks (25%) and other hot drinks (17%).

In adults, coffee contributes 79% of caffeine intake, followed by other hot drinks (16%). In pregnant women, coffee contributes 63% of caffeine intake, followed by other hot drinks (25%).



9. Provisions of the European Regulations concerning caffeine

EU Regulation no.1169/2011 (which comes into force from December 2014) on the providing of food information to consumers includes provisions concerning beverages (excluding tea and coffee) in which the caffeine content exceeds 150 mg/litre, thus covering the majority of so-called energy drinks.

In particular, **the words: “High caffeine content. Not recommended for children or pregnant or breast-feeding women”** must appear in the same field of vision as the name of the beverage, followed by a reference to the **caffeine content expressed in mg per 100 ml**.

These provisions also apply to foods other than beverages, to which caffeine is added for a physiological purpose, such as food supplements; for the latter, the caffeine content shall be expressed per portion as recommended for daily consumption on the labelling.



10. The Agency's recommendations

ANSES considers that changes in practice concerning fortifying foods with caffeine, especially via so-called energy drinks, combined with the current consumption patterns of these beverages, are likely to generate risk situations.

The Agency therefore recommends:

1) Considering the frequency of genetic predisposition, which often goes undiagnosed in the population, and the potential severity of cardiac reactions, consumers should avoid:

- **consuming so-called energy drinks in combination with alcohol, as:**
 - this is likely to potentiate cardiac rhythm disorders induced by caffeine in predisposed individuals;
 - caffeine can reduce the perception of alcoholic intoxication, thus favouring risk situations (the person may overestimate his or her capabilities, continue consuming alcohol and thus increase the likelihood of risk-taking).
- **consuming so-called energy drinks during physical exercise, as:**
 - this constitutes a cardiac risk factor in predisposed individuals;
 - this requires preserving the water-electrolyte balance, which is disrupted by the diuretic effects and the hyperosmolarity of so-called energy drinks;
 - caffeine intake increases body temperature, thus increasing the risk of heat stroke.

2) Particular vigilance regarding caffeine intake, especially for certain groups of consumers:

- pregnant women and nursing mothers, as caffeine can increase the risk of retarded foetal growth and is excreted in breast milk;
- children and adolescents, a population particularly sensitive to caffeine, likely to be exposed to disturbed sleep, daytime drowsiness and the risk of developing addictive behaviour in later life;
- individuals sensitive to the effects of caffeine or presenting certain pathologies, especially: certain cardiovascular disorders, psychiatric and neurological disorders, kidney failure or severe liver diseases.

3) That consumers in general moderate their consumption of caffeinated beverages.

- Considering the levels of caffeine intake observed in the population, the Agency appeals especially to individuals subject to prolonged periods of anxiety and to sleep or cardiac rhythm disorders, to carefully review their caffeine consumption, if necessary with the help of a health professional.



- The Agency also calls for vigilance concerning the potential growth of the use of so-called energy drinks in the workplace to maintain vigilance and offset sleep deficit (10% of consumers drink these beverages at their place of work or study).

Furthermore, the Agency calls on health professionals, and especially doctors, to:

1. include questions about consumption of so-called energy drinks when interviewing patients with relevant symptoms (paroxysmal tachycardia, high blood pressure, convulsions, etc.) and to try and determine as early as possible the level of caffeine consumed;
2. continue to report to ANSES any new cases of adverse effects suspected of being related to the consumption of so-called energy drinks.

Lastly, ANSES also draws attention to the emergence in other countries (Canada, United States, Lithuania, etc.) of government policies to regulate the market for so-called energy drinks. Considering the divergence between the Agency's recommendations and current practice as reported in France, and also the lack of information available to the public, **ANSES calls for measures to be taken to inform vulnerable population groups and to regulate the advertising of so-called energy drinks to these groups and in contexts (festive, sporting, etc.) where consumption involves special risk.**

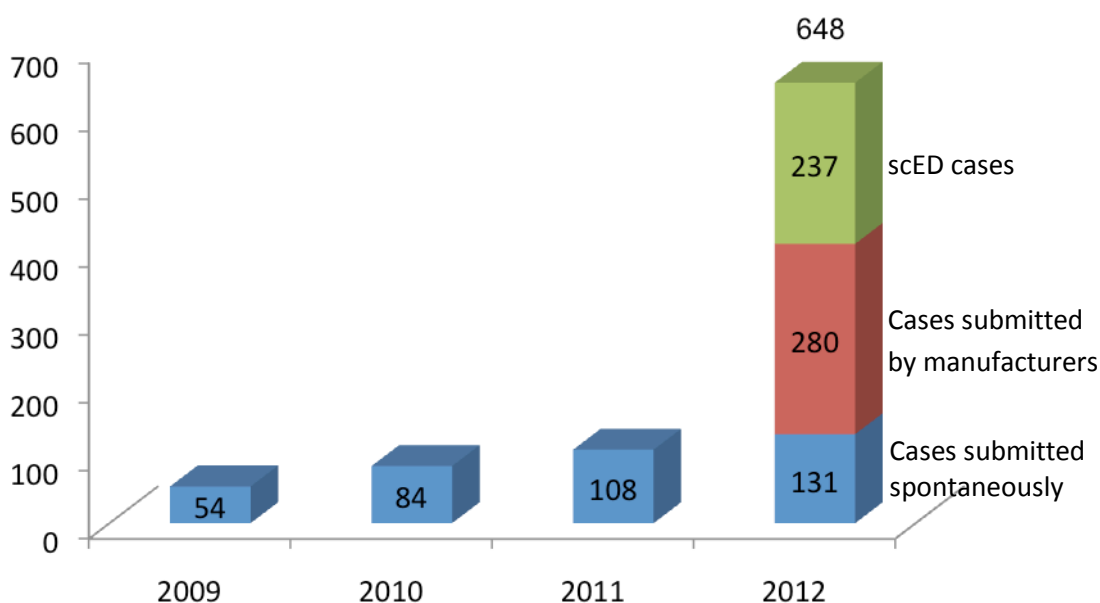


11. Nutrivigilance: the only scheme of its kind in Europe

Set up in late 2009 in compliance with the French Act on Regional Health Governance (*Loi Hôpital, Patients, Santé et Territoires*), the goal of the nutritional vigilance scheme is to collect and analyse the adverse effects of fortified foods (including so-called energy drinks), food supplements, novel foods and foods for special dietary uses. Most declarations concern so-called energy drinks and food supplements.

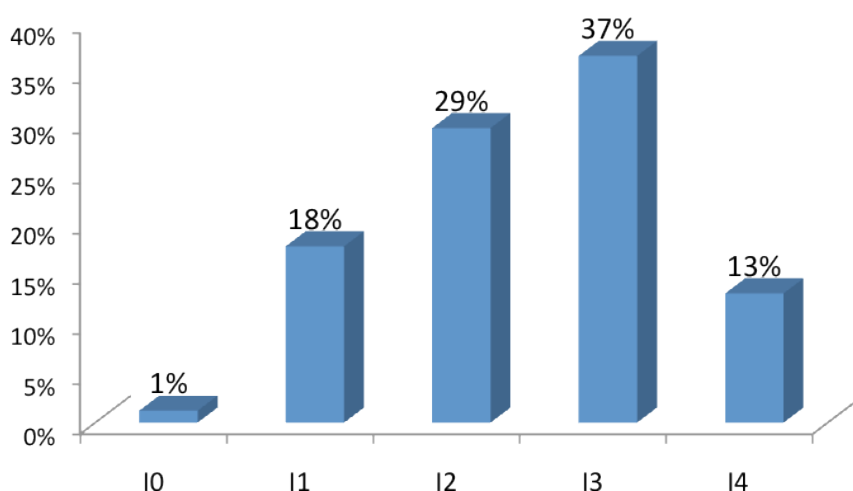
This scheme, which is unique in Europe, was initially created to monitor specific foodstuffs not covered by other vigilance schemes. A pilot phase was launched for the scheme in 2010-2011, and replaced by a full-scale scheme in 2012.

The number of cases collected through this scheme is constantly increasing, with 54 cases declared spontaneously in 2009, 84 cases in 2010, 108 cases in 2011 and 131 cases in 2012. Since 2012, the scheme has been supplemented with data from manufacturers, requested by ANSES for every declaration; the manufacturers have submitted 280 cases. In addition, 237 cases were submitted by the InVS in the context of the assessment of so-called energy drinks. In all, 648 cases were submitted in 2012.

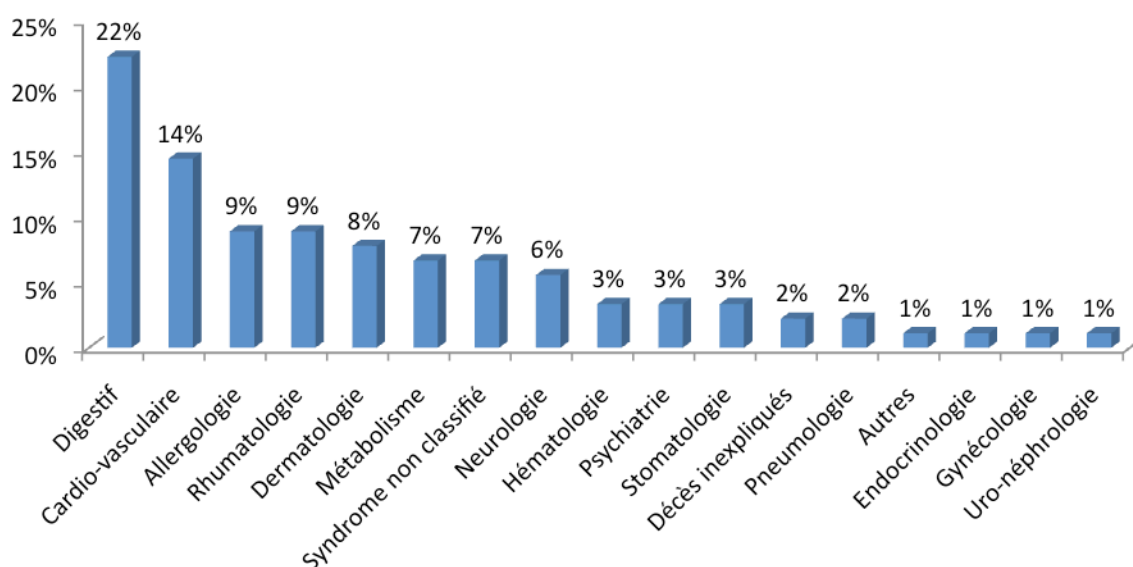


Among the 131 cases declared spontaneously, the largest number (44%) came from the regional pharmacovigilance centres (CRPV). Although the number of declarations by general practitioners has doubled compared to 2011, it still remains low (14%).

Of the 131 cases declared spontaneously in 2012, 65% were considered eligible for causality analysis. This is a method for establishing the likelihood of causality between consumption of a product and the onset of an adverse effect, at five different levels: I0 (ruled out), I1 (unlikely), I2 (possible), I3 (likely) and I4 (very likely). In 2012, categories I3 and I4 accounted for 39% and 13% respectively of cases judged eligible.



The principal adverse effects declared are mostly digestive (22%), especially hepato-biliary. Cardiovascular effects account for 14% of cases. The remaining types of effects declared include allergic (9%), rheumatological (8%), dermatological (7%), neurological (6%) and metabolic effects (6%).



A large majority (83%) of the products mentioned in declarations are food supplements.

Declarations received in 2012 clearly show the predominance of adverse effects suspected of being related to the consumption of food supplements for slimming purposes. Compared to previous years, the number of declarations concerning products used in fitness and bodybuilding activities increased (one case in 2011, five cases in 2012).

2012 also saw the declaration of three cases of congenital hypercalcaemia, following ingestion of a food supplement by pregnant women. These two new issues, compared to previous years, indicate a need for vigilance and may lead to specific studies by the Agency.



In order to investigate the cases declared, ANSES is supported by collective appraisal. Each eligible case is submitted to two clinical experts to carry out a causality analysis. This analysis is then submitted to a working group composed of experts (physicians, pharmacists and biochemists) who establish final causality and propose follow-up measures for the cases considered.

This can lead to ANSES deciding to issue an internal request for a study on the risks related to the consumption of a particular ingredient or product. Such internal requests are then investigated by the Nutrivigilance Working Group and validated by the Expert Committee on Human Nutrition.

Since it was set up, the Nutrivigilance scheme has led the Agency to issue Opinions on such subjects as:

- the use of “plant milks” for infants;
- food supplements containing ingredients such as alcoholic extracts of yams;
- food supplements containing lutein or zeaxanthin;
- red yeast rice;
- and so-called energy drinks.