German Federal Institute for Risk Assessment

FAQ

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Slush ice drinks with glycerol: refreshments with potential undesired health effects

The German Federal Institute for Risk Assessment (BfR) has assessed the health effects of glycerol in slush ice drinks, also known as ‘slushies’. The measured values were collected by official food control authorities in several German federal states ("Laender") between November 2023 and October 2024.

In the European Union (EU), the use of glycerol as food additive E 422 is permitted in many foods, including flavoured drinks. It is also used for therapeutic purposes (to reduce elevated intracranial pressure). The health risk assessment of glycerol levels in slushies revealed that younger children consuming less than 200 millilitres (mL) may already be ingesting amounts of glycerol that correspond to or even exceed the therapeutically effective dose.

What is glycerol?

Glycerol (also known as glycerine or glycerin) is a sweet-tasting, colourless liquid that is chemically classified as an alcohol and freezes at 18 degrees Celsius (°C). Both vegetable and animal fats and oils contain glycerol. It is an intermediate product produced during the alcoholic fermentation of sugar-containing solutions, which is why wine, for instance, also contains small amounts of glycerol.

Where is glycerol used in the food industry?

In the EU, glycerol is authorised as food additive E 422 for use in foods, including flavoured drinks. No maximum level has been defined and it is possible to use as much glycerol as necessary.

What were the results of the BfR's health assessment of the glycerol levels in slushies?

Glycerol is not only used in food, but also for therapeutic purposes, for example to reduce elevated intracranial pressure. Studies have shown that the lowest effective dose is 250 milligrams (mg) of glycerol per kilogram (kg) of body weight. The BfR has used this dose as a reference in its assessment of the potential health risks associated with the consumption of slushies.

The glycerol levels were measured in a total of 62 slushy samples and submitted to the BfR. The evaluation of the measured concentrations of glycerol revealed that even when consuming a slushy of less than 200 mL, younger children may already be ingesting amounts of glycerol that correspond to or even exceed the therapeutically effective dose. For example, a 5-year-old child with a body weight of 20 kg would ingest this amount when consuming a slushy of just under 200 mL with the average measured glycerol concentration (26.24 grams (g) per litre (L)).

The highest measured value of 142 g/L was found in a 'beverage syrup', which is a ready-to-drink beverage. A glycerol concentration of more than 25 g/L was found in just under half of the samples (approx. 48 %). In eight samples (approx. 13 %), the measured value was less than 1 g/L. Glycerol could not be detected in about a third of the samples (approx. 32 %).

What are the health risks of glycerol in slushies for consumers?

No general statement can be made about the probability of health consequences, as this depends on the glycerol concentration in the respective slushy, the amount consumed and the body weight of the consumer.

However, in the view of the BfR there are health concerns if the consumption of a slushy results in a glycerol intake that corresponds to or exceeds the therapeutically (for the purpose of reducing increased intracranial pressure) effective dose of 250 mg/kg body weight. According to scientific studies on the efficacy and metabolization of glycerol, undesirable side effects have been recorded, including headaches, nausea, vomiting, diarrhoea and light-headedness.

What are the particular health risks of glycerol in slushies for children?

When conducting a health risk assessment of glycerol in slushies, special attention needs to be paid to children. When children consume a slushy that contains glycerol they are exposed to a higher dose (in mg of glycerol per kg body weight) than adults due to their lower body weight. Accordingly, the volume of a slushy required to result in a therapeutically effective dose of 250 mg/kg body weight is smaller for children than for adults.

It has been calculated that a child aged around 5 years with a body weight of 20 kg that consumes a slushy of just under 200 mL with the mean of the measured glycerol concentrations of around 26 g/L ingests enough glycerol to constitute a therapeutically effective dose.

There is in general very little data on the toxicity of glycerol after oral ingestion by children. It is also not possible to reliably assess whether glycerol leads to a reduction in intracranial pressure in healthy children to the same extent as in children with increased intracranial pressure, as the BfR does not have corresponding data. However, the BfR does assume this in the sense of a conservative approach and considering the chemico-physical (osmotic) properties of glycerol.

Reduced intracranial pressure can cause several symptoms, for example headache, nausea, vomiting, dizziness, cranial nerve paralysis, double vision (diplopia) and impaired hearing.

Have undesired health effects been reported after consumption of slushies?

In response to the BfR's enquiries to the German poison centres in 2024, one case was reported in which the symptoms of an eight-year-old child (nausea, diarrhoea, fever) were possibly linked to the effects of glycerol in a slushy. Internationally, two cases were initially reported in 2021 and 2022 in which children were hospitalised after consuming slushies. Furthermore, a publication by Brothwell et al. (2025) described 21 cases of children who presented with symptoms after consuming slushies in the UK and Ireland between 2009 and 2024. It is not certain that the symptoms described in these case reports are due to glycerol in slushies. However, the BfR is of the opinion that the possibility should be taken into account.

A general problem in detecting possible cases is that symptoms such as nausea, diarrhoea and headache may not be associated with the consumption of slushies. This could lead to an underestimation of the health risk.

How can consumers avoid undesirable health effects from consuming slushies and what can manufacturers do?

A value for an acceptable daily intake (ADI) at which health impairments are not to be expected has not been set for the food additive glycerol (E 422). The European Food Safety Authority (EFSA) assessed the use of glycerol as a food additive in 2017 and concluded that there was no need to derive an ADI and that, according to available data (including data on use levels), there were no health concerns for the general population. Measured values that showed high concentrations of glycerol in slushies, as have now been determined, were not available to EFSA at that time.

To avoid any undesirable health effects from glycerol intake, consumers can avoid drinking slushies.

Manufacturers of slushies could check whether the use of glycerol is required (about one third of the measured samples did not contain glycerol) or whether the glycerol concentration could at least be reduced (in the samples containing glycerol, concentrations were in a relatively wide range of less than 1 g/L to 142 g/L).

Further information on Glycerol in slush ice drinks on the BfR website:

BfR opinion „**Glycerol in slush ice drinks can cause undesirable health effects**“
https://www.bfr.bund.de/en/opinions/glycerin-in-slush-ice-getraenken-kann-unerwuenschte-gesundheitliche-wirkungen-hervorrufen/

About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent public health institute within the portfolio of the German Federal Ministry of Agriculture, Food and Regional Identity (BMLEH). It provides advice to the Federal Government as well as the Federal States (‘Laender’) on questions of food and feed, chemical and product safety. The BfR conducts its own research on topics closely related to its assessment tasks.

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