German Federal Institute for Risk Assessment

Opinion 046/2026

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Glycerol in food: The health-based guidance value applies not only to slush ice, but also to solid foods

In brief

- Glycerol (also: glycerin) is a sweet-tasting, colourless liquid found in vegetable and animal oils and fats. The substance is authorised for use in food as food additive E 422, though not as a sweetener. It can be used, for example, in flavoured drinks such as slush ice, as well as in solid foodstuffs such as baked goods. No maximum limit has been set; as much glycerol may be used as is necessary ('quantum satis').
- Glycerol can also be used in medicine, e.g. to reduce elevated intracranial pressure.
- In 2025, the German Federal Institute for Risk Assessment (BfR) investigated whether the intake of glycerol via slush ice drinks is associated with health risks. The assessment found that, given the average glycerol content in slush ice measured at the time by the food monitoring authorities, even a small portion of slush ice could cause younger children to take up an amount of glycerol at which an effect on intracranial pressure had been observed in medical applications.
- In March 2026, the European Food Safety Authority (EFSA) derived an acute reference dose (ARfD) for a single consumption of a glycerol-containing drink. This specifies how much glycerol can be ingested without any appreciable health risk. The value of 125 milligrams (mg) of glycerol per kilogram (kg) of body weight determined by EFSA is consistent with the BfR's risk assessment.
- In this opinion, the BfR addresses whether the conclusions of both assessments also apply when glycerol is ingested via solid foods. Ideally, this should be assessed on a case-by-case basis. However, from the BfR's perspective, taking into account a human study by Nicolaiew et al. (1995) and in the absence of corresponding experimental human data on the specific food matrix in question, it is justified to assume that glycerol from solid foods is not absorbed more slowly than from slush ice drinks or other beverages. It can therefore be assumed that the effects in the body are similar.
- Accordingly, from the BfR's perspective, the acute reference dose (ARfD) (125 mg/kg body weight) derived by EFSA in the course of the assessment of the use of glycerol in

beverages and the lowest therapeutically effective dose (250 mg/kg body weight) previously identified by the BfR in the course of its assessment of the use of glycerol in slush ice drinks are, in principle, also applicable to an assessment of the use of glycerol in solid foods, including fine bakery wares (see BfR opinion on glycerol of 18 February 2025).

1 Subject of the assessment

In the context of recent food monitoring, high levels of glycerol have been detected in foods other than slush ice drinks—for example, in fine bakery wares (packaged goods).

In this opinion, the German Federal Institute for Risk Assessment (BfR) has assessed whether the acute reference dose (ARfD) for glycerol derived by EFSA in the course of its assessment of glycerol use in beverages, and the lowest therapeutically effective dose previously identified by the BfR during its assessment of glycerol use in slush ice drinks, are also applicable to the use of glycerol in solid foods such as fine bakery wares.

2 Results

In the BfR's view, the acute reference dose (ARfD) of 125 mg/kg body weight for a single consumption event (derived by EFSA during the assessment of glycerol use in beverages) and the lowest therapeutically effective dose of 250 mg/kg body weight (previously identified by the BfR during the assessment of glycerol use in slush ice drinks) are, in principle, also applicable to the assessment of glycerol use in solid foods, including fine bakery wares.

3 Rationale

In a human study performed by Nicolaiew et al. (1995) on the effects of acute oral administration of glycerol, either alone or in combination with a standardized meal, on postprandial blood levels of lipids, free fatty acids, HDL cholesterol, and retinyl palmitate in healthy subjects, the glycerol absorption was also examined. For this purpose, three tests were conducted with ten healthy subjects (five female, aged 23–52 years, BMI 17.72–22.64; and five male, aged 20–56 years, BMI 19.11–24.76) at intervals of at least one week. In the first test, subjects were administered 20 g of glycerol orally after an overnight fast. In the second test, subjects received a meal (consisting of 15–20% protein, 45–55% lipid, and 30–40% carbohydrate) providing 32 g of lipid per m^2 of body surface area. The meal consisted of coffee, milk, cheese, bread, bacon, margarine, and fruits, and had an energy content of 800–1000 kcal. In the third test, subjects received 20 g of glycerol in combination with the meal. Based on the individual body weights, the glycerol dose in the first and third tests ranged from 244 to 417 mg/kg body weight, respectively. Blood samples were collected prior to administration (time 0) and subsequently at 10, 20, 30, 40, and 50 minutes, and at 1, 1.5, 2, 3, 4, and 7 hours. The subjects were then allowed to eat a normal dinner, and following an

overnight fast, a further blood sample was taken 24 hours after administration. Blood glycerol concentrations were determined using an enzymatic method.

In this study, the maximum blood glycerol concentration was reached slightly earlier and was slightly higher when glycerol was administered in combination with the meal than when it was administered without the meal. Administration of glycerol with the meal resulted in the maximum blood glycerol concentration being reached after 16 minutes, whereas administration without the meal resulted in the maximum concentration being reached after 38 minutes. This difference was statistically significant ($p < 0.05$). The subsequent decline in glycerol concentration occurred slightly more rapidly following administration with the meal than without it. Accordingly, the area under the concentration-time curve was slightly smaller when glycerol was administered with the meal compared to administration without the meal. The meal alone (without glycerol) did not result in an increase in blood glycerol concentration.

In this study, therefore, glycerol was absorbed into the blood slightly faster when administered with a meal than without one. This phenomenon may be considered as a matrix effect. It is conceivable that a different food matrix might result in the opposite effect—slowing absorption into the bloodstream—or have no effect at all. Whether a matrix effect plays a role must be assessed on a case-by-case basis (SKLM 2006).

For the health assessment of potential effects following acute exposure, the maximum blood concentration and the time to reach it are more relevant than the area under the concentration-time curve.

Taking into account the results of the study by Nicolaiew et al. (1995) and in the absence of corresponding experimental human data for the specific food matrix in question, the BfR takes the view that it is reasonable to assume that glycerol from solid foods is not absorbed more slowly than glycerol from slush ice drinks or other beverages. Consequently, the BfR considers the acute reference dose (ARfD) of 125 mg/kg body weight for a single consumption event —derived by EFSA during its assessment of glycerol use in beverages (EFSA 2026)— and the lowest therapeutically effective dose of 250 mg/kg body weight — previously identified by the BfR during its assessment of glycerol use in slush-ice drinks (BfR 2025)— to be applicable to the use of glycerol in solid foods as well.

In its Communication 035/2026 of 26 June 2026 (BfR 2026), the BfR pointed out that the ARfD derived by EFSA is consistent with the risk assessment previously conducted by the BfR.

Further information on glycerol 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/

Communication: Ice-cold and brightly coloured: slush ice drinks containing glycerol may have adverse health effects.
https://www.bfr.bund.de/en/notification/ice-cold-and-brightly-coloured-slush-ice-drinks-containing-glycerol-may-have-adverse-health-effects/

FAQ: Slush ice drinks with glycerol: refreshments with potential undesired health effects
https://www.bfr.bund.de/en/service/frequently-asked-questions/topic/slush-ice-drinks-with-glycerol-refreshments-with-potential-undesired-health-effects/

4 References

BfR (2025) Glycerol in slush ice drinks can cause undesirable health effects. Opinion No. 004/2025.
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Nicolaiew N, Cavallero E, Gandjini H, Dolé E, Koziet J, Gambert P, Francois A, Jacotot B (1995) Effect of acute glycerol administration with or without a mixed meal in humans. Ann Nutr Metab 39, 71-84.

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About the BfR

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

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