

Maximum levels proposed for addition of molybdenum to foods including food supplements

The accompanying main opinion "**Updated recommended maximum levels for the addition of vitamins and minerals to food supplements and conventional foods**" can be found here: <https://www.bfr.bund.de/cm/349/updated-recommended-maximum-levels-for-the-addition-of-vitamins-and-minerals-to-food-supplements-and-conventional-foods.pdf>

1 Results

The German Federal Institute for Risk Assessment (BfR) recommends for the addition of molybdenum to food supplements a maximum level of 80 micrograms (μg) per daily recommended dose of a food supplement (Table 1).

For the fortification of conventional foods, maximum levels of 19 $\mu\text{g}/100\text{ g}$ for solid foods and of 5 $\mu\text{g}/100\text{ millilitres (ml)}$ for beverages are recommended, assuming a "saturated" market of fortified foods, i.e. 30 % of the daily energy intake comes from fortified foods (Table 1).

Table 1: Proposed maximum levels

Food category	Maximum levels
Food supplements (per daily recommended dose of an individual product)	80 μg
Fortified solid foods (per 100 g)	19 μg
Fortified beverages (per 100 ml)	5 μg

2 Rationale

2.1 Tolerable Upper Intake Level¹ (UL) and intake reference value

In the year 2000, the former Scientific Committee on Food (SCF) of the European Commission derived for molybdenum a UL for adults, including pregnant and lactating women, of approximately 10 $\mu\text{g}/\text{kg}$ body weight and day, corresponding to a daily intake of 600 $\mu\text{g}/\text{day}$. For adolescents between 15 and 17 years of age, a UL of 500 $\mu\text{g}/\text{day}$ was derived, based on the lower body weight (SCF, 2000).

The D-A-CH Societies² derived estimated values for an adequate molybdenum intake for people aged ten years and older of 50-100 $\mu\text{g}/\text{day}$ (D-A-CH, 2015; Table 2).

EFSA derived an *Adequate Intake* of 65 $\mu\text{g}/\text{day}$ molybdenum for persons aged 15 years and older (EFSA, 2013; Table 2).

¹ Tolerable Upper Intake Level = Maximum level of total chronic daily intake of a nutrient (from all sources) considered to be unlikely to pose a risk of adverse health effects to humans.

² German-Austrian-Swiss Nutrition Societies

Table 2: Dietary Reference Values and UL

Age groups	Dietary Reference Values		UL (SCF, 2000)
	(D-A-CH, 2016)	(EFSA, 2013)	
	µg/day		
4 to under 7 years	30 - 75	20	200
7 to under 10 years	40 - 80	30 (7–10 years)	250 (7–10 years)
10 to under 15 years	50 - 100	45 (11–14 years)	400 (11–14 years)
15 to under 18 years		65	500
Adults including pregnant and lactating women			600

2.2 Exposure

There are no representative data on molybdenum intake in Germany available. Molybdenum intake was not recorded in the second National Food Consumption Survey (NFCS II) (MRI, 2008). In a small study conducted in Germany in 1996, the mean intake determined for adult women on a mixed diet was 89 µg/day and for men 100 µg/day (Holzinger et al., 1998). Intakes of approximately 155 to 216 µg of molybdenum per day have been reported from other European countries³ (averaged 185.5 µg/day) for the 95th and 97.5th adult intake percentiles, respectively (EFSA, 2013).

2.3 Maximum levels for food supplements

Assuming a molybdenum intake of high consumers in the range of 155-216 µg/day, averaged 185.5 µg/day, the application of the procedure proposed by the BfR results in a residual amount of 314.5 µg/day:

$$\text{Residual amount} = \text{UL}_{15\text{-to } 17\text{-year-olds}} - \text{P95}_{\text{Nutrition}}$$

$$\text{Residual amount} = 500 \text{ µg/day} - 185.5 \text{ µg/day} = 314.5 \text{ µg/day}$$

If this residual amount is divided equally between food supplements and conventional foods, 160 µg molybdenum/day (rounded off) is available for each of the two categories.

In accordance with the procedure applied by the BfR for other essential minerals and vitamins, an uncertainty factor of 2 is taken into account in the derivation of maximum levels for food supplements due to scientific uncertainties with regard to a possible multiple exposure to molybdenum from food supplements. Based on the available data, this results in a maxi-

³ Data for adults were available from France and UK (EFSA, 2013). Data from UK (Adults (16-64 years), 97.5th percentile = 3.03 to 3.08 µg/kg body weight and day) were adjusted to 70 kg body weight (3.08 x 70 = 215.6 µg/day).

maximum level for the addition of molybdenum to food supplements of 80 µg per daily recommended dose of an individual product (160 µg/day / 2 = 80 µg/daily dose of a food supplement).

The BfR recommends for the addition of molybdenum to food supplements a maximum level of 80 µg per daily recommended dose of a food supplement.

2.4 Maximum levels for fortified foods

A total amount of 160 µg/day is available for the fortification of conventional foods with molybdenum. Allocating this amount to the estimated daily energy intake from fortified foods and assuming that 15 % to a maximum of 30 % of the daily energy is consumed from fortified foods results in maximum levels of molybdenum of between 11.3 and 53.3 µg per 100 kcal, depending on age (Table 3).

To ensure that the addition of molybdenum to fortified foods does not cause any of the age groups to exceed the residual amount available for fortified foods of 160 µg/day, the lowest of the molybdenum levels resulting from the calculations is proposed as maximum level for the whole population, i.e. 11.3 µg/100 kcal assuming that the fortified food market is 'saturated' (30% of daily energy from fortified foods) and 22.7 µg/100 kcal assuming that only some of the fortifiable foods are actually fortified/consumed (15% of energy intake from fortified foods) (Table 3).

Table 3: Daily energy intakes (P95) and molybdenum levels assuming that 15 % or 30 % of the energy intake comes from fortified foods

Age groups	Energy intake*	Fortification of 15 % of the energy intake		Fortification of 30 % of the energy intake	
		15 % of the daily energy intake	Molybdenum**	30 % of the daily energy intake	Molybdenum**
	kcal/day	kcal	µg/100 kcal	kcal	µg/100 kcal
4 to 6 years	2,000	300	53.3	600	26.7
7 to 9 years	2,400	360	44.4	720	22.2
10 to 11 years	2,550	383	41.8	765	20.9
12 years	3,900	585	27.4	1,170	13.7
13 to < 15 years	3,900	585	27.4	1,170	13.7
15 to < 17 years	4,700	705	22.7	1,410	11.3
Adults	3,500	525	30.5	1,050	15.2

* Data for children (P 95) up to the age of 17 years from EsKiMo (Mensink et al., 2007), for adults (P 95) from NFCS II (MRI, 2008).

** when dividing the 'residual amount' of 160 µg/day to 100 kcal portions

2.4.1 Conversion of energy-based maximum levels into maximum levels per 100 g of solid foods or 100 ml of beverages

The conversion of energy-based maximum levels into maximum amounts per 100 g of solid foods or 100 ml of beverages was performed using data from Schusdziarra et al. (2010) and Bechthold (2014).

Taking into account the average energy densities (170 kcal/100 g for solid foods and 45 kcal/100 ml for energy-containing liquids such as juices and soft drinks), the maximum levels by weight and by volume proposed for the addition of molybdenum to conventional foods are given in the following table (Table 4).

Table 4: Conversion of energy-based to weight and volume-based maximum levels

Molybdenum per 100 kcal	Molybdenum per 100 g or ml	
	Solid foods (energy density: 170 kcal/100 g)	Beverages (energy density: 45 kcal/100 ml)
22.7 µg*	39 µg	10 µg
11.3 µg**	19 µg	5 µg

* assuming that 15 % of the energy comes from fortified foods

** assuming that 30 % of the energy comes from fortified foods

If an additional criterion in setting maximum levels is that the amounts added to a food should be significant in order that a claim is allowed to be made on the product, according to the Regulation (EU) No 1169/2011 (Annex XIII: "Reference amounts"), at least 15 % of the respective reference value for labelling should be contained in solid foods (per 100 g) and at least 7.5 % in beverages (per 100 ml).

According to that regulation, the nutrient reference value (NRV) for molybdenum is 50 µg. Maximum levels of ≥ 7.5 µg/100 g (at least 15 % of the NRV in solid foods) and of ≥ 3.75 µg/100 ml (at least 7.5 % of the NRV in beverages) would thus be considered significant amounts. The maximum levels calculated in Table 4 therefore fulfil the criteria for labelling and claiming of molybdenum added to foods.

For the fortification of conventional foods, assuming a "saturated" market of fortified foods (30 % of the daily energy intake from fortified foods), a maximum level of 19 µg/100 g is recommended for solid foods and of 5 µg/100 ml for beverages. Assuming that only parts of the fortifiable foods are actually fortified/consumed (15 % of the energy intake from fortified foods), higher maximum levels of 39 µg/100 g for solid foods and of 10 µg/100 ml for beverages would be possible (Table 4).

Further information on the BfR website on the subject of minerals

Topic page on the assessment of vitamins and minerals in foods:

https://www.bfr.bund.de/en/vitamins_and_minerals-54417.html



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3 References

Bechthold A (2014). Dietary energy density and body weight. *Ernährungs Umschau international*. 1: M14-23.

D-A-CH (2015). German Nutrition Society, Austrian Nutrition Society, Swiss Nutrition Society (eds.). *Dietary Reference Values*. 2nd version of the 1st edition 2015, Neuer Umschau Buchverlag.

EFSA (2013). EFSA Panel on Dietetic Products, Nutrition and Allergies. *Scientific Opinion on Dietary Reference Values for molybdenum*. *EFSA Journal* 11: 3333, 35 pp.

Holzinger S, Anke M, Röhrig B, Gonzalez D (1998). Molybdenum intake of adults in Germany and Mexico. *Analyst* 123: 447-450.

Mensink GBM, Heseker H, Richter A, Stahl A, Vohmann C (2007). *Nutritional study as KiGGS Module (EsKiMo)*. Robert Koch Institute and University of Paderborn, 2007.

MRI (2008). Max Rubner Institute. *National Nutrition Survey II, Results Report, Part 2*. Max Rubner-Institut, Federal Research Institute of Nutrition and Food.

Schusdziarra V, Kellner M, Mittermeier J, Hausmann M, Erdmann J (2010). Energy intake, food quantity and frequency of consumption of main and snack meals of normal age groups. *Aktuel Ernährungsmed*. 35: 29-41.

SCF (2000). Scientific Committee on Food. *Opinion of the Scientific Committee on Food on the Tolerable Upper Intake Level of Molybdenum (expressed on 19 October 2000)*.

About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. It advises the German federal government and German federal states ("Laender") on questions of food, chemical and product safety. The BfR conducts its own research on topics that are closely linked to its assessment tasks.

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