Food of Animal Origin as "Functional Food" - Potentials and limitations using the example of iodine

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Influence of animal nutrition on selected nutrients in food of animal origin (Flachowsky 2007)

Food Nutrient	Milk	Meat	Eggs
Protein/ Amino acids	(+)	-	-
Fat/Fatty acids	+++	++	++
Calcium	-	-	-
Phosphorus	-	-	-
Copper	-	(Liver: +++)	(+)
Iodine	+++	(+)	+++
Selenium	++	++	++
Zinc	+	+	+
Vitamin A	(+)	(Liver: +++)	+
Vitamin D	+	+	+
Vitamin E	(+)	(+)	+++
B-vitamins	(+)	- to +	- to +

+++ very strong influence (transfer>10%), ++ strong influence (transfer 5-10%)
+ minor influence (transfer 1-5%)

Transfer of supplemented iodine into food of animal origin

Food	Transfer (% of supplementation)
Milk[1)]	30 - 40
Eggs[2)]	10 - 20
Beef[3)]	< 1
Pork[4)]	< 0.3

1) Schöne et al. 2006 2) Richter 1995 3) Meyer et al. 2007 4) Franke et al. 2008

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Supply and Risk categories for trace elements and vitamins in human nutrition (BfR 2006)

Supply categories	Criteria
1	High risk of deficiency
2	Possible risk of deficiency
3	Sufficient intake
4	Intake above recommendations
Risk categories	
High	Low margin between recommendations (RDA) and Upper Level (UL; Factor < 5)
Moderate	UL 5 to 100 times higher than RDA
Low	UL not defined or Factor > 100

Supply and risk categories for various trace elements and vitamins

Nutrient	Supply category	Risk category
Cu	3	High
Fe	1 / 2	High
I	1	High
Se	1 / 2	Medium - High
Zn	2	High
Vitamin A	2 / 3	High
Vitamin D	1	High
Vitamin E	2 / 3	Medium
Vitamin B_6	4	Medium
Folic acid	1 / 2	Medium
Niacin	3 / 4	Medium

Recommendations for iodine in human nutrition

Recommended Dietary Allowance (RDA, adults)

- 150-200 µg/d *(WHO 2001, DRI 2001, D-A-CH 2000)*

Tolerable Upper Intake Level (UL)

- 500 µg/d *(D-A-CH 2000)*
- 600 µg/d *(SCF 2002)*
- 1000 µg/d *(WHO 1994)*

→ UL 2.5 - 6.7 times higher than RDA

Requirements of production animals

Animal species/category	GfE (1995, 1999, 2001, 2006)
Dairy cows [mg/kg DM]	0.5
Beef cattle [mg/kg DM]	0.3
Growing pigs [mg/kg]	0.15
Sows [mg/kg]	0.5 – 0.6
Laying hens [mg/kg]	0.5
Broiler [mg/kg]	0.5

Maximum content of feed (EU Nr. 1459/2005)

Animal species or category	mg/kg (88% DM)
Equines	4
Dairy cows and laying hens	5
Fish	20
Other species or categories	10

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Iodine content in food of animal origin [µg/kg FM]

Food	Iodine supplementation of feed [mg/kg DM]					
	0.1-0.25 (native)	0.5	1-1.2	2	4-5	10
Milk[1)]	101	-	393	-	1215	(2692)
Beef[2)]	-	16	-	-	45	80
Pork[3)]	3.9	6.0	8.5	11	17	-
Poultry meat[4)]	-	-	22	-	-	104
Eggs[5)]	-	140	330	-	1460	-

1) Schöne et al. 2006 2) Meyer et al. 2007 3) Franke et al. 2008 4) EFSA 2005
5) Richter 1995

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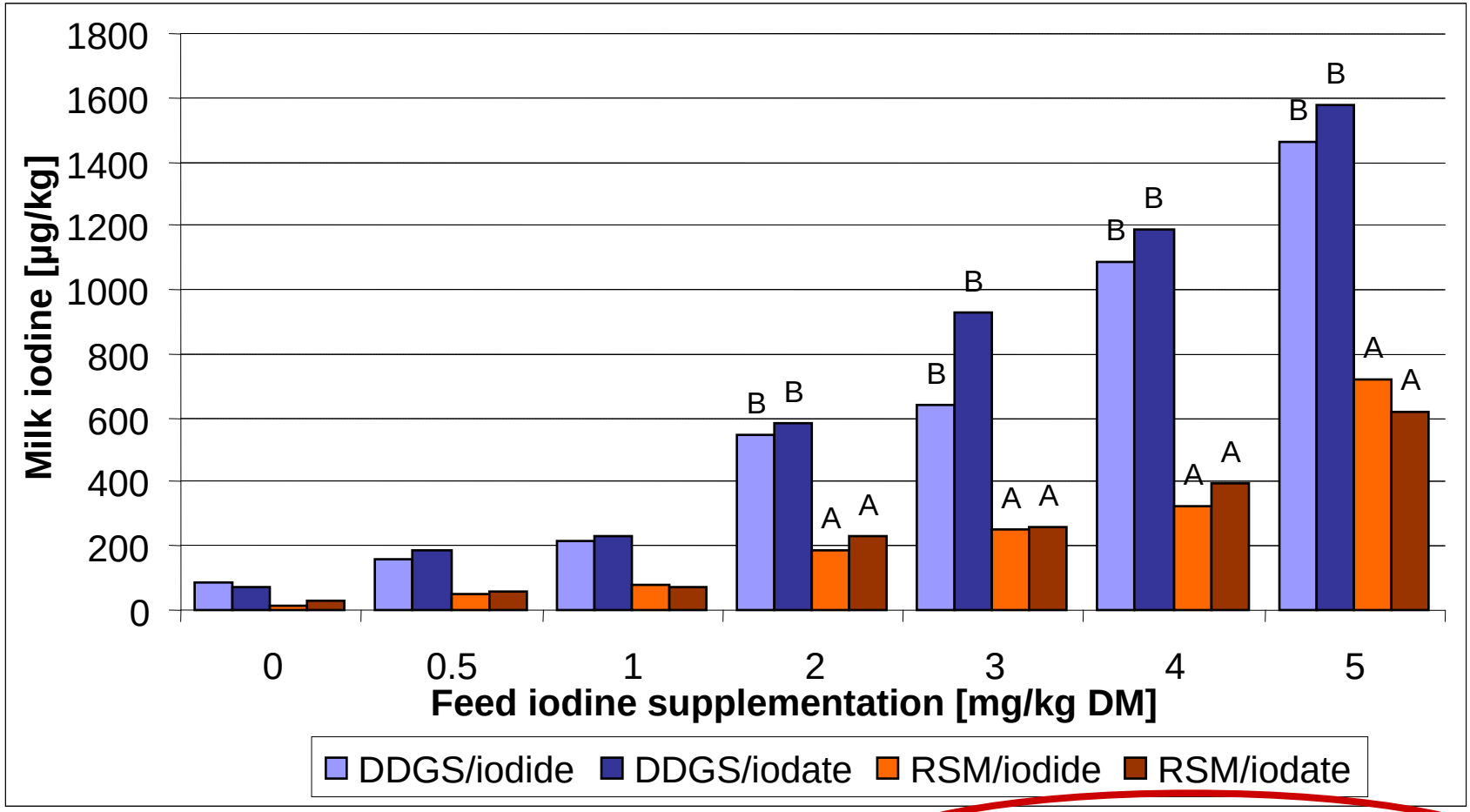
Milk iodine concentration at varying iodine supplementation in the experimental groups (µg/kg FM)



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Conclusions

- supplements in animal nutrition can contribute to the improvement of human supply with different nutrients
- in case of nutrients of the risk category “High” remarkable enrichment in certain food of animal origin may result in exceeding the UL in human nutrition
- declaration of nutrient contents on food of animal origin seems impossible →limiting content by maximum levels in animal feed
- decision on the advisability of enrichment of food of animal origin with a certain nutrient has to be made case by case
- dose-response studies are necessary especially for nutrients with a high risk of overdosing

Thank you for your attention!

Supply category Criteria

1 Risk of a clinically manifest deficiency or a depletion of body stores in specific age groups with specific physiological conditions, specific eating habits, in specific regions

2 Uncertainty about the risk of a clinically manifest deficiency or a depletion of body stores because of the lack of or the questionable validity of a biomarker, inadequate food tables, lack of epidemiological studies

3 No indication of inadequate nutrient intake or there is nutrient intake in the range of recommended intake

4 Indication of nutrient intake above recommended intake

Risk category Criterion

High: risk Nutrients for which the margin between the RDA (or measured intake) and UL is low (factor <5)

Moderate: risk Nutrients for which the UL is 5 to 100 times higher than the RDA (or measured intake)

Low: risk Nutrients for which a UL cannot be defined because up to now no adverse side effects have been identified despite intake 100 times higher than the RDA

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