

Intake, status and dietary sources of riboflavin in a representative sample of Irish adults aged 18–90 years

L. Kehoe¹, J. Walton^{1,2}, S.M. Hopkins³, B.A. McNulty³, A.P. Nugent^{3,4}, H. McNulty⁵, M. Ward⁵ and A. Flynn¹

¹School of Food and Nutritional Sciences, University College Cork, Ireland, ²Dept. Biological Sciences, Cork Institute of Technology, Ireland, ³UCD Institute of Food and Health, University College Dublin, Ireland, ⁴Institute for Global Food Security, School of Biological Sciences, Queens University Belfast, Northern Ireland and ⁵Nutrition Innovation Centre for Food and Health, Ulster University, Coleraine, Northern Ireland

Riboflavin is a water soluble B-vitamin which, in its coenzymatic forms flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD) is required for numerous oxidation/reduction reactions and plays an integral role in the metabolism of other B-vitamins and the related metabolite homocysteine. The objective of this study was to estimate the usual intake, prevalence of inadequate intakes, biochemical status and dietary sources of riboflavin in Irish adults using data from the National Adult Nutrition Survey (2008–2010) (www.iuna.net). A 4-day semi-weighed food record was used to collect food and beverage intake data from a representative sample of 1500 Irish adults (18–90 years). Dietary intake data was analysed using WISP[®] based on UK⁽¹⁾ and Irish⁽²⁾ food composition tables. Blood samples (*n* 1126) were collected, processed and analysed using standard operating procedures. Usual intakes were calculated via the NCI-method⁽³⁾ using SAS[®] Enterprise Guide. The estimated average requirement (EAR) of 1.3 mg/d (for adults ≥18 years) established by the European Food Safety Authority⁽⁴⁾ was used as a cut-off to assess the prevalence of inadequate intakes (excluding energy-underreporters). Determination of riboflavin biomarker status was by erythrocyte glutathione reductase activation coefficient (EGRac), calculated as the ratio of flavin-dependent glutathione reductase activity before and after *in vitro* reactivation with its prosthetic group FAD, with a cut-off value of >1.3 generally used to indicate low/deficient status⁽⁵⁾.

Table 1. Prevalence of low/deficient riboflavin intakes/biomarker status and key dietary sources of riboflavin

Age (years)	18–35		36–50		51–64		65+	
	Males (<i>n</i> 276)	Females (<i>n</i> 255)	Males (<i>n</i> 205)	Females (<i>n</i> 232)	Males (<i>n</i> 153)	Females (<i>n</i> 153)	Males (<i>n</i> 106)	Females (<i>n</i> 120)
Low/deficient riboflavin intakes/biomarker status								
% with intakes < EAR	9.9	21.2	14.5	25.6	14.9	19.6	25.1	19.4
% with EGRac > 1.3	62.9	70.1	58.3	63.8	53.1	57.8	54.5	50.6
Contribution (%) of food groups to intakes of riboflavin								
Milks	21.0	19.7	23.2	22.4	22.7	19.4	20.7	23.7
Meat & meat products	16.5	14.2	18.4	14.5	17.1	15.1	17.7	14.7
Ready-to-eat breakfast cereals	13.8	12.5	12.7	11.9	9.4	8.5	5.9	10.2
Beverages	10.2	6.7	10.0	8.7	12.3	7.7	11.3	7.8
Tea	1.7	3.7	4.1	6.4	6.4	6.3	7.0	6.8
Alcoholic beverages	8.3	2.6	5.5	1.9	5.7	1.0	4.0	0.3
Other beverages	0.2	0.4	0.4	0.4	0.2	0.4	0.3	0.8
Nutritional supplements	8.8	10.3	4.4	6.7	4.1	10.5	4.0	8.1
Bread & rolls	4.1	4.4	5.4	5.5	7.0	5.3	7.1	5.0
Other food groups	25.6	32.1	25.9	30.3	27.4	33.7	33.3	30.5

The mean daily intake (MDI) of riboflavin from the total diet was 2.5 mg/d (ranging from 2.2–3.1 mg/d range across population groups) with 18% having inadequate intakes (10–26% range across ages). Blood sample analysis showed that 61% of adults exceeded the EGRac cut-off of 1.3. The key dietary sources of riboflavin in the population were milks (20–24% across ages), ‘meat & meat products’ (14–18%), ready-to-eat breakfast cereals (6–14%), ‘beverages’ (7–12%) and ‘bread & rolls’ (4–7%). Nutritional supplements provided 4–10% of intakes. Results were similar when analysis was restricted to those with biochemical data only (*n* 1126). These findings show that a significant proportion of Irish adults have low dietary intakes of riboflavin. Even higher proportions have evidence of deficient/low biomarker status; however, the functional significance of an EGRac value >1.3 is unclear and requires further research.

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