Appendix 1: Vitamin A content of foods, fortified food products and supplements

In this guide

In this guide

Vitamin A content of foods, fortified food products and supplements

Table 1. Approximate Vitamin A concentrations in foods. (FSA, 2021).

Food type	**Retinol Equivalent (µg /100 g)**	**Type of Vitamin A**
Liver calf (fried in corn oil)	25,217	Preformed retinol
Liver, chicken, fried in corn oil	10,500	Preformed retinol
Giblets, turkey, boiled	3,100	Preformed retinol
Eel, yellow, raw	1,200	Preformed retinol
Ghee, butter	1,233	Preformed retinol
Fat spread, low fat (26 – 39 %), polyunsaturated	962	Preformed retinol
Carrots. raw	1,961	Carotenoids
Carrots, boiled	1,850	Carotenoids
Spinach, boiled	1,101	Carotenoids
Sweet potato, flesh only, boiled in unsalted water	927	Carotenoids
Curly Kale, raw	525	Carotenoids

Melon, Canteloupe-type, flesh only, weighed with skin	194	Carotenoids
Mangoes, ripe, flesh only, raw	116	Carotenoids
Apricots, dried	105	Carotenoids
Peaches, raw, flesh and skin	19	Carotenoids

Consumption and exposure assessments for vitamin A in various food sources

1. The following tables (Tables 2 to 13a) details consumption of selected foods containing vitamin A and indicate estimated exposure to vitamin A. The exposure estimates are derived from individual consumption of these foods and take into account various forms of the foods as well as recipes. For example, liver from different animal sources contain varying amounts of vitamin A (Table 1). As such, exposure estimates take account of only some of the concentrations shown in Table 1. All variations of foods available within the NDNS database were used to obtain the consumption and exposure estimates.

Table 2. Chronic exposure of Vitamin A (retinol equivalents) in women from food sources only (Bates et al., 2014; 2016; 2018)**.

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Age group	Mean	97.5th percentile	Mean	97.5th percentile
16 – 49 yrs	760	2,600	11	39
19 – 64 yrs	830	2,800	12	43

*Rounded to 2 significant figures.

**Based on total population.

Liver

Table 3. Chronic consumption of all types of liver (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; 2018)^.

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
25	22	38	0.33	0.56

*Rounded to 2 significant figures.

**Consumption or exposure estimates made with a small number of consumers may not be accurate. The number of consumers is less than 60, this should be treated with caution and may not be representative for a large number of consumers.

^Based on food consumers of all types of liver.

Table 3a. Chronic exposure of Vitamin A from all types of liver (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; 2018)^.

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
25	3,500	7,500	50	97

*Rounded to 2 significant figures.

**Consumption or exposure estimates made with a small number of consumers may not be accurate. The number of consumers is less than 60, this should be treated with caution and may not be representative for a large number of consumers.

^Based on food consumers on all types of liver.

Butter

Table 4. Chronic consumption of butter (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; 2018).

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
1,474	5.9	25	0.09	0.37

*Rounded to 2 significant figures.

Table 4a. Chronic exposure of Vitamin A from butter (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; 2018).

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
1,474	40	230	0.60	3.5

*Rounded to 2 significant figures.

Table 4b. Chronic consumption of ghee (butter and vegetable oil-based) (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; and Roberts et al.,

2018).

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers	Mean	97.5th Percentile	Mean	97.5th Percentile
123	3.0	12	0.043	0.18

*Rounded to 2 significant figures.

Table 4c. Chronic exposure of Vitamin A from ghee (butter and vegetable oil-based) (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; and Roberts et al., 2018).

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers	Mean	97.5th Percentile	Mean	97.5th Percentile
123	9.6	120	0.14	1.8

*Rounded to 2 significant figures.

Table 4d. Chronic consumption of ghee (butter-based) (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; and Roberts et al., 2018).

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers	Mean	97.5th Percentile	Mean	97.5th Percentile

107	3.3	13	0.047	0.2

*Rounded to 2 significant figures.

Table 4e. Chronic exposure of Vitamin A from ghee (butter-based) (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; and Roberts et al., 2018).

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers	Mean	97.5th Percentile	Mean	97.5th Percentile
107	11	130	0.16	1.9

*Rounded to 2 significant figures.

Milk

Table 5. Chronic consumption of cow’s milk (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; 2018).

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
1,814	150	460	2.2	7.1

*Rounded to 2 significant figures.

Table 5a. Chronic exposure of Vitamin A from cow’s milk (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; 2018).

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
1,814	36	120	0.54	1.8

*Rounded to 2 significant figures.

Egg yolk

Table 6. Chronic consumption of egg yolk (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; 2018)**.

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
903	8.5	25	0.15	0.38

*Rounded to 2 significant figures.

**Assumption – average egg contains 29 % yolk.

Table 6a. Chronic exposure of Vitamin A from egg yolk (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; 2018)**.

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile

903	12	34	0.17	0.52

*Rounded to 2 significant figures.

**Assumption – average egg contains 29 % yolk.

Carrots

Table 7. Chronic consumption of carrots (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; 2018).

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
1,327	21	74	0.31	1.1

*Rounded to 2 significant figures.

Table 7a. Chronic exposure of Vitamin A from carrots (with recipes) in women aged 16 - 49 (Bates et al., 2014; 2016; 2018)*.

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
1,327	330	1,300	4.9	20

*Rounded to 2 significant figures.

Peppers

Table 8. Chronic consumption of peppers (with recipes) (Bates et al., 2014; 2016; 2018).

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
1,049	14	60	0.21	0.91

*Rounded to 2 significant figures.

Table 8a. Chronic exposure of Vitamin A from peppers (with recipes) (Bates et al., 2014; 2016; 2018).

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
1,049	12	51	0.18	0.76

*Rounded to 2 significant figures.

Spinach

Table 9. Chronic consumption of spinach (with recipes) (Bates et al., 2014; 2016; 2018).

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*

Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
222	19	61	0.24	0.97

*Rounded to 2 significant figures.

Table 9a. Chronic exposure of Vitamin A from spinach (with recipes) (Bates et al., 2014; 2016; 2018).

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
222	103	517	1.6	8.4

*Rounded to 2 significant figures.

Cantaloupe melon

Table 12. Chronic consumption of Cantaloupe melon (with recipes) (Bates et al., 2014; 2016; 2018).

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
42	46	131	0.78	2.5

*Rounded to 2 significant figures.

**Consumption or exposure estimates made with a small number of consumers may not be accurate. The number of consumers is less than 60, this should be treated with caution and may not be representative for a large number of consumers.

Table 12a. Chronic exposure of Vitamin A from Cantaloupe melon (with recipes) (Bates et al., 2014; 2016; 2018).

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
42	135	384	2.3	7.5

*Rounded to 2 significant figures.

**Consumption or exposure estimates made with a small number of consumers may not be accurate. The number of consumers is less than 60, this should be treated with caution and may not be representative for a large number of consumers.

Mango

Table 13. Chronic consumption of mango (with recipes) (Bates et al., 2014; 2016; 2018).

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
235	18	105	0.26	13

*Rounded to 2 significant figures.

Table 13a. Chronic exposure of Vitamin A from mango (with recipes) (Bates et al., 2014; 2016; 2018).

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
234	15	94	0.22	1.3

*Rounded to 2 significant figures.

Apricot

Table 14. Chronic consumption of apricot (with recipes) (Bates et al., 2014; 2016; 2018).

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
88	5.7	27	0.084	0.40

*Rounded to 2 significant figures.

Table 14a. Chronic exposure of Vitamin A from Apricot (with recipes) (Bates et al., 2014; 2016; 2018).

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*

Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
88	3.8	20	0.057	0.30

*Rounded to 2 significant figures.

Peach

Table 15. Chronic consumption of peaches (with recipes) (Bates et al., 2014; 2016; 2018).

(g/person/day)*	(g/person/day)*	(g/person/day)*	(g/kg bw/day)*	(g/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
77	24	110	0.34	1.3

*Rounded to 2 significant figures.

Table 15a. Chronic exposure of Vitamin A from peaches (with recipes) (Bates et al., 2014; 2016; 2018).

(µg/person/day)*	(µg/person/day)*	(µg/person/day)*	(µg/kg bw/day)*	(µg/kg bw/day)*
Consumers**	Mean	97.5th percentile	Mean	97.5th percentile
77	4.6	21	0.67	0.28

*Rounded to 2 significant figures.

Fortified foods

2. Foods are sometimes fortified with vitamin A such as butter and other fat spreads, milk and nutritional powders and cereal products. Some foods such as spreads and sports drinks are fortified with beta carotenes which are used for colouration of the product.

Table 16. Estimated exposure from fortified food products containing Vitamin A (Tesco, Sainsbury's, Asda, Boots, Holland & Barret, Morrisons, M&S 2021).

Food product	**Vitamin A concentration**	**Vitamin A concentration (µg per serving)**	**Exposure^**
Butters and Spreads	**µg per 100 g**	**µg per 10 g serving**	**µg/kg bw/day***
Flora Original Spread 500 g	814	81.4	1.2
Flora Buttery Spread 500g	233	23.3	0.33
Flora Light Spread 500 g	839	83.9	1.2
Flora ProActiv Buttery Taste Spread 500 g	120	12	0.17
Bertolli Original Spread 500 g	800	80	1.1
Bertolli With Butter 400 g	800	80	1.1

Benecol Buttery Spread 500 g	900	90	1.3
Pure Vegan Dairy Free Olive Spread 500 g	800	80	1.1
Pure Vegan Dairy Free Sunflower Spread 500 g	800	80	1.1
Nutritional Drink powders	**µg per 100 g**	**µg per serving**	**µg/kg bw/day***
Complan Nutritional Drink Strawberry 4 X 55 g	551	303 per 55 g	4.3
Complan Nutritional Drink Drink Chocolate 4 X 55 g	522	287 per 55 g	4.1
Complan Nutritional Drink Banana 4 X 55 g	550	303 per 55 g	4.3
Complan Nutritional Drink Original 425 g	547	301 per 55 g	4.3
Slimfast Vitality Meal Replacement Shake Chocolate Intensity 400 g	81.9 (as prepared)	243 (as prepared) per 40 g	3.5
USN Diet Fuel Ultralean Strawberry Flavoured Meal Replacement Shake	474	256 per 54 g	3.6

Nutritional Drinks	**µg per 100 ml**	**µg per serving**	**µg/kg bw/day***
Tropicana+ Vitamin Victory Juice 750 ml	208	312 per150 ml	4.4
Benefit Drinks Cleanse Prune Juice	320	800 per 250 ml	11
Oshee Vitamin Cocktail 250 ml	160	400 per 250 ml	5.7
Slim-Fast Milkshake Strawberry 6 x 325 ml	73.8	240 per 325 ml	3.4
Dr Witt Multivitamin Drink 1 Litre	216	432 per 200 ml	6.1
Nutrient Powder (foods)	**µg per 100g**	**µg per serving**	**µg/kg bw/day***
Funktional Foods Spirulina Powder 100 g	3,685	369 per 10 g	5.2
Funktional Foods Wheatgrass Powder 100 g	1,289	258 per 10 g	3.7
Dried Milk	**µg per 100 ml as prepared**	**µg per serving as prepared (200 ml)**	**µg/kg bw/day***
Sainsbury's Skimmed Milk Powder 300 g	66.7	133	1.9

Tesco Instant Dried Skimmed Milk 340 g	71	142	2.0
Marvel Dried Milk Powder 278 g	66	132	1.9
Cereal bars	**µg per 100 g**	**µg per serving**	**µg/kg bw/day***
Oshee Vitamin Muesli Bar Hazlenut & Raisin 40 g	300	120 per 40 g	1.7
Oshee Vitamin Muesli Bar Plum & Cranberry 40 g	300	120 per 40 g	1.7
Slimfast Meal Replacement Very Berry Bar 4 x 60 g	400	240 per 60 g	3.4
Other products	**µg per 100 g**	**µg per serving**	**µg/kg bw/day***
Blockhead Sugar Free Vitamin D, C, B & A Gum	**µg per 100 g**	800 per 2 pieces	11
Tetley Super Fruit Multi Vitamins Berry 20 Tea Bags 40 g	30	30 per 100 ml	0.43
Potters Malt Extract with Cod Liver Oil Butterscotch 650 g	1,720	172 per 10 g	2.4

Boots Malt Extract + Cod Liver Oil – 650 g	1,400	140 per 10 g	2.0

^Exposure is calculated from the recommended serving size and the average body weight of women aged 16- 49 years (70.3kg).

*Rounded to 2 significant figures.

Supplements

Table 17. List of a sample of supplements containing vitamin A (Sources: Lloyds Pharmacy, Boots Pharmacy and Superdrug).

Supplement	**Maternal supplement?^**	**Vitamin A form**	**Recommended intake (mg/day)**	**Daily exposure (mg/kg bw)***
Vitabiotics pregnacare tablets range	Yes	Beta carotene	2,000	0.028
Vitabiotics Pregnacare Liquid	Yes	Beta carotene	1,000	0.014
Vitabiotics pregnacare breastfeeding range	Yes	Beta carotene	2,000	0.028
Seven Seas all stages during pregnancy	Yes	Beta carotene	1,000	0.014

Seven Seas pregnancy follow on	Yes	Beta carotene	1,000	0.014
Proceive Advanced Fertility Supplement Max Women	Yes	Beta carotene	7,000	0.10
Seven Seas Adult Complete Multivitamins 28	No	Vitamin A Acetate	800	0.011
Healthspan women's multivitamin super fruit 30 gummies	No	Vitamin A Palmitate	800	0.011
Pink simply radiant multivitamin for her gummies 60 gummies	No	Vitamin A	750	0.011
Superdrug Multivitamin With Iron	No	Vitamin A Acetate	800	0.011
Bassets Adult Multivitamin Pastilles	No	Vitamin A	800	0.011
Vitabiotics wellwoman original 30 capsules	No	Beta carotene	2,000	0.028

Boots multivitamins	No	Vitamin A Acetate	800	0.011

Supplement	**Maternal supplement?^**	**Vitamin A form**	**Recommended intake (µg/day)**	**Daily exposure (mg/kg bw)***
Centrum Advance multivitamins	No	Vitamin A (RE) (25% as beta-carotene)	800	0.011
Centrum Fruity Chewable	No	Vitamin A (RE)	660	0.009
Centrum MultiGummies	No	Vitamin A (RE)	660	0.009
Centrum Women	No	Vitamin A (RE)	667	0.009
SimplySupplements Cod Liver Oil 1,000 mg	No	Vitamin A	300 - 900	0.004-0.013
Holland & Barrett Cod Liver Oil Pure Liquid 500 ml	No	Vitamin A (RE)	691	0.0098
Seven Seas Cod Liver Oil One-A-Day Omega-3 Fish Oil & Vitamin D 120 Capsules	No	Vitamin A (RE)	750	0.011

Solgar Super Cod Liver Oil Complex - 60 Tablets	No	Retinyl palmitate	906	0.014

*Exposure is calculated from the daily recommended intake and the average body weight of women aged 16 - 49 years (70.3kg) ^Indicates whether the supplement is marketed specifically to pregnant or breastfeeding women.

References

Bates, B.; Lennox, A.; Prentice, A.; Bates, C.; Page, P.; Nicholson, S.; Swan, G. (2014) National Diet and Nutrition Survey Results from Years 1, 2, 3 and 4 (combined) of the Rolling Programme (2008/2009 – 2011/2012) Available at: Main heading (publishing.service.gov.uk)

Bates, B.; Cox, L.; Nicholson, S.; Page, P.; Prentice, A.; Steer, T.; Swan, G. (2016) National Diet and Nutrition Survey Results from Years 5 and 6 (combined) of the Rolling Programme (2012/2013 – 2013/2014) Available at: Main heading (publishing.service.gov.uk)

Food Standards Agency (2021). McCance and Widdowson's The Composition of Foods Integrated Dataset 2021. McCance_Widdowsons_Composition_of_Foods_Integrated_Dataset_2021..xlsx (live.com)

Roberts, C.; Steer, T.; Maplethorpe, N.; Cox, L.; Meadows, S.; Page, P.; Nicholson, S.; Swan, G. (2018) National Diet and Nutrition Survey Results from Years 7 and 8 (combined) of the Rolling Programme (2014/2015 – 2015/2016) Available at: National Diet and Nutrition Survey (publishing.service.gov.uk)