



DSM Vitamin Supplementation Guidelines 2011

for domestic animals

12th
Edition
since 1958

HEALTH • NUTRITION • MATERIALS



DSM

BRIGHT SCIENCE. BRIGHTER LIVING.

POULTRY⁽¹⁾

Category/Phase		Duration	Vit. A	Vit. D ₃ ⁽²⁾	25OHD ₃ (Hy•D) ⁽²⁾	Vit. E ⁽³⁾	Vit. K ₃ (Menadione)	Vit. B ₁	Vit. B ₂	Vit. B ₆	Vit. B ₁₂ ⁽⁷⁾	Niacin	D-Panto thenic acid	Folic acid	Biotin	Vit. C ⁽⁸⁾⁽⁹⁾	Choline
			I.U.	I.U.	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
	Broilers																
	Starters	1 - 10 days	11000-15000	3000-5000	0.069	150-300 ⁽⁴⁾	3 - 4	3 - 4	8 - 10	4 - 6	0.02 - 0.04	60 - 80	15 - 20	2 - 2.5	0.2 - 0.4	100-200	400-700
	Growers	11 - 24 days	10000-12500	3000-5000	0.069	50-100 ⁽⁵⁾	3 - 4	2 - 3	7 - 9	4 - 6	0.02 - 0.03	60 - 80	12 - 18	2 - 2.5	0.2 - 0.3	100-200	400-700
	Finishers	25 days - market	10000-12500	3000-5000	0.069	50-100 ⁽⁵⁾⁽⁶⁾	3 - 4	2 - 3	6 - 8	4 - 6	0.02 - 0.03	50 - 80	10 - 15	2 - 2.5	0.2 - 0.3	100-200	400-600
	Broiler breeders																
	Starters & growers	0 - 18 wks	10000-12000	3000-4000	0.069	80-100 ⁽⁴⁾	3 - 5	2 - 3	6 - 8	3 - 5	0.02 - 0.03	30 - 60	13 - 15	1.5 - 2	0.2 - 0.4	100-150	350-700
	Layers (& male breeders)	19 wks - end	12000-15000	3000-5000	0.069 ⁽¹⁰⁾	100-150 ⁽⁵⁾	5 - 7	3 - 3.5	12 - 16	4 - 6	0.03 - 0.04	50 - 60	15 - 25	2 - 4	0.25 - 0.4	100-150	350-700
	Hen & duck layers																
	Starters (pullets)	0 - 10 wks	12000-13000	3000-4000	0.069	50-100 ⁽⁴⁾	3 - 3.5	2 - 2.5	6 - 7	4.5 - 5.5	0.025 - 0.03	50 - 60	15 - 17	1 - 1.5	0.15 - 0.2	100-150	200-400
	Rearing (pullets)	10 wks - 2% lay	10000-12000	2000-3000	0.069	30-35	3 - 3.5	2 - 2.5	5 - 6	3 - 5	0.02 - 0.025	30 - 60	12 - 15	1 - 1.5	0.1 - 0.15	100-150	200-400
	Layers	Laying phase	8000-12000	3000-4000	0.069	20-30 ⁽⁶⁾	2.5 - 3	2.5 - 3	5 - 7	3.5 - 5	0.015 - 0.025	30 - 50	8 - 12	1 - 1.5	0.1 - 0.15	100-200	300-500
	Layer breeders																
	Growers & layers (& male breeders)	0 wks - end	10000-15000	3000-4500	0.069 ⁽¹⁰⁾	50-100 ⁽⁵⁾	2 - 5	2.5 - 3.5	10 - 12	5 - 6	0.02 - 0.04	45 - 60	15 - 20	2 - 3	0.25 - 0.4	150-200	300-500
	Ducks and geese		12000-15000	3000-5000	0.069	40-80	3 - 5	2 - 3	7 - 9	5 - 7	0.02 - 0.04	60 - 80	10 - 15	1 - 2	0.1 - 0.15	100-200	300-500
	Partridges, quails and pheasants		12000-13500	3000-4000	0.069	50-80	2 - 4	2 - 4	5 - 7	4 - 6	0.03 - 0.05	50 - 80	15 - 25	1.5 - 2	0.15 - 0.25	100-200	400-600
	Ostriches and emus		12000-16000	3000-4000	0.069	40-60	2 - 4	3 - 5	10 - 20	6 - 8	0.05 - 0.1	80 - 100	12 - 20	2 - 4	0.2 - 0.35	200-250	600-800

⁽¹⁾ Added per kg air-dry feed. ⁽²⁾ Local legal limits of Vitamin D₃ activity need to be observed. ⁽³⁾ When dietary fat is higher than 3% then add 5 mg/kg feed for each 1% dietary fat. ⁽⁴⁾ Higher level for optimum immune function. ⁽⁵⁾ Under heat stress conditions increase level up to 200 mg/kg. ⁽⁶⁾ For optimum meat quality increase level up to 200 mg/kg. ⁽⁷⁾ Use upper level as reference for animal protein free diets and when cobalt is supplemented at very low levels or removed. ⁽⁸⁾ Recommended under heat stress condition and to enhance reproductive performance in breeders. ⁽⁹⁾ Use ROVIMIX® STAY-C® (ascorbyl-monophosphate) for reducing losses during processing. ⁽¹⁰⁾ Improve hatchability by using MAXICHICK®, the combination of Hy•D® (25-OH-D₃) with 60 ppm of CAROPHYLL® Red (Canthaxanthin). The use of MAXICHICK® is covered by a DSM Nutritional Products international patent application WO 2010 057811 nationalized in US and Europe amongst others. MAXICHICK® is a trademark registered in Europe and the US amongst others.

TURKEY⁽¹⁾

Category/Phase	Duration	Vit. A	Vit. D ₃ ⁽²⁾	25OHD ₃ (Hy•D) ⁽²⁾	Vit. E ⁽³⁾	Vit. K ₃ (Menadiōne)	Vit. B ₁	Vit. B ₂	Vit. B ₆	Vit. B ₁₂ ⁽⁷⁾	Niacin	D-Panto thenic acid	Folic acid	Biotin	Vit. C ⁽⁸⁾⁽⁹⁾	Choline
		I.U.	I.U.	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
 Turkeys																
Starters	0 - 6 wks	12000-15000	4000-5000	0.092	100-250 ⁽⁴⁾	4 - 5	4.5 - 5	15 - 20	6 - 7	0.04 - 0.05	100 - 150	30 - 35	4 - 6	0.25 - 0.4	100-200	1000-1200
Growers	7 - 12 wks	10000-12000	3000-5000	0.092	60-80	3 - 4	3 - 5	10 - 15	5 - 7	0.03 - 0.04	80 - 100	20 - 25	2 - 3	0.25 - 0.3	100-200	500-1000
Finishers 1	13 - 18 wks	8000-10000	3000-4000	0.092	30-50 ⁽⁵⁾⁽⁶⁾	3 - 4	3 - 4	8 - 10	3 - 6	0.02 - 0.03	60 - 80	15 - 20	2 - 2.5	0.2 - 0.25	100-200	400-600
Finishers 2	18 wks - market	6000-9000	2000-3000	0.092	30-50 ⁽⁵⁾⁽⁶⁾	3 - 4	2 - 3	8 - 10	3 - 6	0.015 - 0.025	50 - 60	15 - 20	2 - 2.5	0.2 - 0.25	100-200	400-600
 Turkey breeders																
Starters	0 - 6 wks	12000-14000	4000-5000	0.092	100-250 ⁽⁴⁾	4 - 5	4.5 - 5	15 - 20	6 - 7	0.04 - 0.05	100 - 150	30 - 35	4 - 6	0.4 - 0.6	100-200	1000-1200
Growers	7-29 wks	8000-10000	4000-5000	0.092	60-80	2 - 4	2 - 3	10 - 15	6 - 7	0.03 - 0.04	60 - 80	25 - 30	2 - 3	0.4 - 0.6	100-200	1000-1200
Layers (& male breeders)	Laying phase	12000-14000	4000-5000	0.092 ⁽¹⁰⁾	100-150 ⁽⁵⁾	4 - 5	4 - 5	15 - 20	6 - 7	0.04 - 0.05	80 - 120	30 - 35	4 - 6	0.4 - 0.6	100-200	500-1000

(1) Added per kg air-dry feed. (2) Local legal limits of Vitamin D₃ activity need to be observed. (3) When dietary fat is higher than 3% then add 5 mg/kg feed for each 1% dietary fat. (4) Higher level for optimum immune function. (5) Under heat stress conditions increase level up to 200 mg/kg. (6) For optimum meat quality increase level up to 200 mg/kg. (7) Use upper level as reference for animal protein free diets and when cobalt is supplemented at very low levels or removed. (8) Recommended under heat stress condition and to enhance reproductive performance in breeders. (9) Use ROVIMIX® STAY-C® (ascorbyl-monophosphate) for reducing losses during processing. (10) Improve hatchability by using MAXICHICK®, the combination of Hy•D® (25-OH-D₃) with 60 ppm of CAROPHYLL® Red (Canthaxanthin). The use of MAXICHICK® is covered by a DSM Nutritional Products international patent application WO 2010 057811 nationalized in US and Europe amongst others. MAXICHICK® is a trademark registered in Europe and the US amongst others.



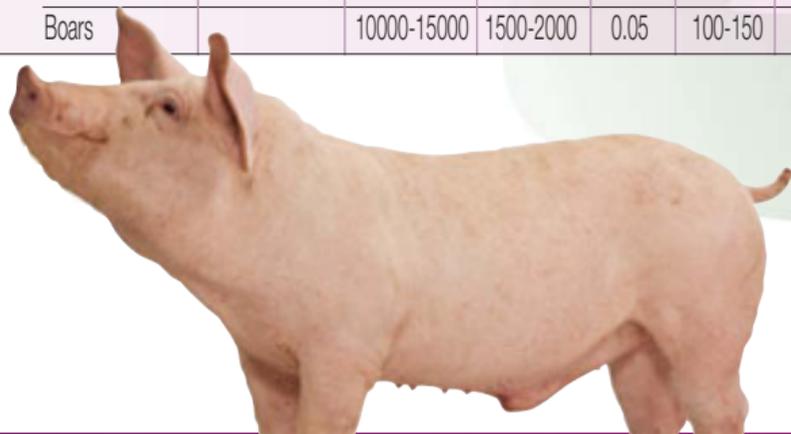
SWINE⁽¹⁾

Category/Phase	Duration	Vit. A	Vit. D ₃ ⁽²⁾	25OHD ₃ (Hy•D) ⁽²⁾	Vit. E ⁽³⁾	Vit. K ₃ (Menadione)	Vit. B ₁	Vit. B ₂	Vit. B ₆	Vit. B ₁₂ ⁽⁷⁾	Niacin	D-Panto thenic acid	Folic acid	Biotin	Vit. C ⁽⁸⁾⁽⁹⁾	Choline	β-Carotene
		I.U.	I.U.	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
 Fattening pigs																	
Pre-starters	< 5 kg	10000-20000	1800-2000	0.05	100-150 ⁽⁴⁾	8 - 10	3.5 - 5.5	10 - 15	6 - 8	0.05-0.07	60 - 80	30 - 50	1.5 - 3	0.2 - 0.4	100-200	500-800	
Starters	5 - 30 kg	10000-15000	1800-2000	0.05	100-150	5 - 6	3 - 5	10 - 15	6 - 8	0.04-0.06	35 - 55	25 - 45	1.5 - 2.5	0.2 - 0.4	100-200	250-400	
Growers	30 - 70 kg	7000-10000	1500-2000	0.05	60-100	2 - 4	2 - 3	7 - 10	2.5 - 4.5	0.03-0.05	20 - 40	25 - 45	1 - 1.5	0.15 - 0.3		150-300	
Finishers	70 kg to market	5000-8000	1000-1500	0.05	60-100 ⁽⁵⁾	2 - 4	1 - 2	6 - 10	2 - 3.5	0.03-0.05	20 - 40	25 - 45	0.5 - 1	0.1 - 0.2		100-200	
 Breeders																	
Replacement gilts		10000-12500	1800-2000	0.05	80-100	1.5 - 3	1 - 2	6 - 10	3.5 - 5.5	0.03-0.05	20 - 30	15 - 30	3.5 - 5.5	0.3 - 0.5	200-300	250-500	
Sows		10000-15000	1500-2000	0.05	100-150 ⁽⁶⁾	4.5 - 5	2 - 2.5	6 - 10	3.5 - 5.5	0.03-0.05	25 - 45	30 - 35	3.5 - 5.5	0.5 - 0.8	200-300	500-800	300 ⁽¹⁰⁾
Boars		10000-15000	1500-2000	0.05	100-150	4.5 - 5	1 - 2	6 - 10	3.5 - 5.5	0.03-0.05	25 - 45	20 - 30	3.5 - 5.5	0.5 - 0.8	200-500	500-800	

(1) Added per kg air-dry feed. (2) Local legal limits of Vitamin D₃ activity need to be observed. (3) When dietary fat is higher than 3% then add 5 mg/kg feed for each 1% dietary fat. (4) For optimum immune health: additional 100 mg/kg feed. (5) For optimum meat quality: additional 150 mg/kg feed. (6) For optimum piglet health: during late pregnancy and lactation total 250 mg/kg feed. (7) Use upper level when cobalt is supplemented at very low levels or removed.

(8) Recommended in stress condition and to enhance reproductive performance in breeders. (9) Use ROVIMIX® STAY-C® (ascorbyl-monophosphate) for reducing losses during processing. (10) For improved sow fertility: to be fed per animal per day immediately after weaning until confirmed conception.

OPTIMUM
VITAMIN NUTRITION



RUMINANTS⁽¹⁾

Category/Phase	Vit. A	Vit. D ₃	Vit. E	Vit. K ₃ (Menadione)	Vit. B ₁	Vit. B ₂	Vit. B ₆	Vit. B ₁₂	Niacin	D-Panto thenic acid	Folic acid	Biotin	Vit. C	Choline	β-Carotene
	I.U.	I.U.	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
 Calves, milk replacer 0-3 months	20000-32000	1400-1800	100-150	1 - 1.5	2.5 - 5	2.5 - 4.5	2.5 - 4.5	0.04 - 0.08	9 - 18	7 - 9	0.2 - 0.3	0.05 - 0.1	250-500	500-750	100 ⁽¹¹⁾
 Heifers Rearing	20000-40000	2500-4000	500									10 - 20 ⁽⁹⁾			300-500 ⁽¹²⁾
6-4 wks before calving	20000-40000	2500-4000	1000-3000									10 - 20 ⁽⁹⁾			500-1000 ⁽¹³⁾
 Beef cattle Growing	50000-70000	6000-9000	200-300		60 - 250 ⁽⁷⁾							10 - 20 ⁽⁹⁾			
Fattening & finishing	50000-70000	5000-7000	500-2000 ⁽⁴⁾		60 - 250 ⁽⁷⁾							10 - 20 ⁽⁹⁾			
 Beef cows	50000-120000	5000-10000	300-500									20 ⁽⁹⁾			300-500 ⁽¹²⁾
 Dairy cows Far-off & close-up ⁽²⁾	75000-100000	25000-35000	1000-3000 ⁽⁵⁾									20 ⁽¹⁰⁾			500-1000 ⁽¹⁴⁾
Transition ⁽³⁾	75000-100000	25000-35000	1000-3000 ⁽⁵⁾						5000-10000 ⁽⁸⁾			20 ⁽¹⁰⁾			500-800 ⁽¹⁵⁾
Lactation	100000-150000	30000-50000	500-1000 ⁽⁶⁾						5000-10000 ⁽⁸⁾			20 ⁽¹⁰⁾			300-500 ⁽¹⁶⁾
 Breeding bulls	50000-120000	5000-10000	300-500									20 ⁽⁹⁾			
 Sheep & goats	5000-10000	600	200-400		100							5 ⁽¹¹⁾			

⁽¹⁾ Added per animal per day. ⁽²⁾ Far-off: from 8-3 weeks before calving; Close-up: from 3 weeks before calving to calving. ⁽³⁾ Transition: from 4-3 weeks before calving to 3-4 weeks after calving. ⁽⁴⁾ Upper level for improved color shelf life. 100-120 days pre-marketing. ⁽⁵⁾ Upper level from 21 days pre-partum through 28 days post-partum. ⁽⁶⁾ Upper level for optimum udder health. ⁽⁷⁾ Upper level for cattle on high concentrate rations. ⁽⁸⁾ From 2 weeks before parturition until peak lactation. ⁽⁹⁾ For optimum hoof health and optimum meat marbling. ⁽¹⁰⁾ For optimum hoof health and milk yield. ⁽¹¹⁾ For 2 weeks after colostral period. ⁽¹²⁾ 6-8 weeks before first insemination/mating when intake of green forage is low. ⁽¹³⁾ Lower level 8 weeks before first calving; upper level 4 weeks before first calving when intake of green forage is low. ⁽¹⁴⁾ Lower level during entire dry period (far-off and close-up); upper level 3-4 weeks before calving (close-up only). ⁽¹⁵⁾ 500-800 mg from 3-4 weeks before calving and 300-500 mg 4-6 week after calving. ⁽¹⁶⁾ Dry and fresh: beginning dry period until pregnancy is confirmed.

FISH & SHRIMP⁽¹⁾

Category/Phase	Vit. A	Vit. D ₃	Vit. E	Vit. K ₃ (Menadione)	Vit. B ₁	Vit. B ₂	Vit. B ₆	Vit. B ₁₂	Niacin	D-Panto thenic acid	Folic acid	Biotin	Vit. C ⁽³⁾	Choline	Astaxanthin (Carophyll Pink)
	I.U.	I.U.	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
 Salmon/trout⁽²⁾	3000-6000	2000-2500	200-400 ⁽⁴⁾	8 - 12	10 - 20	20 - 30	15 - 25	0.03 - 0.05	150-200	40 - 60	6 - 10	0.8 - 1	150-250 ⁽⁶⁾	500-1000	50 - 100 ⁽⁷⁾
 Warm-water fish⁽²⁾ Carp/tilapia/cat-fish	8000-11000	1500-2000	100-300	5 - 10	10 - 20	15 - 20	15 - 25	0.02 - 0.05	80-120	40 - 50	4 - 7	0.5 - 1	150-250	600-1000	
 Eels⁽²⁾	8000-12000	1500-2000	150-300	3 - 6	15 - 25	20 - 30	10 - 15	0.1 - 0.2	80-120	50 - 60	4 - 6	0.3 - 0.5	150-300	800-1200	
 Seabream/seabass⁽²⁾	8000-12000	1700-2200	150-300	8 - 12	20 - 30	20 - 30	20 - 25	0.1 - 0.2	100-140	50 - 100	4 - 6	0.8 - 1	150-250	600-1000	
 Shrimp⁽³⁾	12000-15000	2000-3500	150-300	40 - 60	50 - 100	40 - 80	50 - 120	0.02 - 0.05	100-250	100 - 180	10 - 20	1 - 2	250-500	400-600	15 - 50

⁽¹⁾ Added per kg air-dry feed

⁽²⁾ Amount to be increased by 30% for fry and broodstock

⁽³⁾ At low stock density (< 10pl/m²) the lower levels are recommended

⁽⁴⁾ Additional 200 mg may be required to optimise flesh quality dependent on dietary fat levels

⁽⁵⁾ Use ROVIMIX® STAY-C® (ascorbyl-monophosphate) for reducing losses during processing

⁽⁶⁾ During winter feeding for wound healing and immune function: total 1000 mg/kg feed

⁽⁷⁾ For flesh pigmentation



ROVIMIX® STAY-C®
VITAMIN NUTRITION

HORSES & OTHERS

Category/Phase	Vit. A	Vit. D ₃	Vit. E	Vit. K ₃ (Menadione)	Vit. B ₁	Vit. B ₂	Vit. B ₆	Vit. B ₁₂	Niacin	D-Panto thenic acid	Folic acid	Biotin	Vit. C ⁽⁷⁾⁽⁸⁾	Choline	β-Carotene
	I.U.	I.U.	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
 Foals. 1st year⁽¹⁾	25000-30000	4500-5500	250-500	8 - 12	20 - 25	20 - 30	15 - 20	0.15-0.3	25 - 50	20 - 30	15 - 20	2 - 3	500-750	300-400	
 Leisure horses⁽²⁾	35000-45000	3500-4500	500-1000	6 - 12	40 - 55	30 - 40	25 - 35	0.35-0.65	55 - 85	45 - 65	25 - 35	15 - 20		600-900	
 Race horses⁽²⁾	65000-85000	6500-8500	1000-2000	11 - 22	70 - 110	70 - 85	40 - 55	0.55-0.85	110 - 200	50 - 80	45 - 65	15 - 20	1000-2000	1000-1400	
 Mares & stallions⁽²⁾	65000-85000	6500-8500	1000-2000	11 - 22	70 - 110	70 - 85	40 - 55	0.55-0.85	110 - 200	50 - 80	45 - 65	15 - 20	1000-2000	1000-1400	400-800 ⁽⁹⁾
 Rabbits⁽³⁾	8000-12000	800-1200	40-60	1 - 2	1 - 2	3 - 6	2 - 3	0.01-0.02	40 - 60	10 - 15	0.2 - 0.5	0.1 - 0.2 ⁽⁶⁾	150-250	600-800	10-20
 Mink & foxes⁽³⁾	10000-15000	1500-2000	100-200 ⁽⁴⁾	1 - 2	20 - 50 ⁽⁵⁾	10 - 20	10 - 20	0.03-0.06	20 - 40	8 - 20	0.6 - 1	0.3 - 0.6	100-200		

⁽¹⁾ Added per animal per day, based on average weight of 250 kg. ⁽²⁾ Added per animal per day, based on average weight of 550 kg. ⁽³⁾ Added per kg air-dry feed. ⁽⁴⁾ Dietary fat higher than 3%: additional 5 mg/kg feed for each 1% dietary fat. ⁽⁵⁾ When feeding raw fish: additional 50 mg/kg feed. ⁽⁶⁾ For fur production rabbits: 0.6 mg/kg feed. ⁽⁷⁾ Recommended in stress condition and to enhance reproductive performance in breeders. ⁽⁸⁾ Use ROVIMIX® STAY-C® (ascorbyl-monophosphate) for reducing losses during processing. ⁽⁹⁾ From 4 weeks before until 10 weeks after parturition.



OPTIMUM
VITAMIN NUTRITION

COMPANION ANIMALS

Category/Phase	Vit. A	Vit. D ₃	Vit. E ⁽²⁾	Vit. K ₃ (Menadione)	Vit. B ₁ ⁽⁴⁾	Vit. B ₂	Vit. B ₆	Vit. B ₁₂ ⁽⁵⁾	Niacin	D-Panto thenic acid	Folic acid	Biotin ⁽⁶⁾	Vit. C ⁽⁷⁾	Choline	β-Carotene ⁽⁸⁾
	I.U.	I.U.	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg	mg
 Dogs	15000-22000	780-1300	100-250	1 - 2	4 - 8	13 - 22	6 - 11	0.03-0.05	50-170	30 - 60	0.6 - 2	0.25-0.8	100-200	1300-2700	30 - 50
 Cats	15000-40000 ⁽¹⁾	780-1300	150-300	1 - 2 ⁽³⁾	5 - 10	22 - 27	11 - 14	0.03-0.1	50-170	30 - 60	0.6 - 2	0.25-0.8	100-200	1300-2700	30 - 50

Recommendations are expressed per kg air-dry food. The values are based on the diets containing 4000 kcal ME/kg dry matter. Diets that deviate in energy content >12.5% or have feeding recommendations that restrict energy intake should have the supplemental vitamin levels adjusted accordingly.



⁽¹⁾ Vitamin A: preformed vitamin A is vital in diets for cats. ⁽²⁾ Vitamin E: supplemental levels should at least be 5 mg/kg of dry food for each 1% of PUFA in the diet. Higher levels above are recommended to support the total antioxidant capacity of the dog and cat. ⁽³⁾ Vitamin K: supplementation is particularly important in canned catfoods that contains >25% fish when fed for long periods. ⁽⁴⁾ Vitamin B₁: levels of up to 18 mg/kg dry food for dogs and 35 mg/kg for cats are reported to help improve meal acceptance and stimulate appetite. ⁽⁵⁾ Vitamin B₁₂: increased supplemental levels up to 0.8 mg/kg dry food help in the support of liver function. Supplementation might need to be increased in vegetarian diets as plants are a poor source of this vitamin. ⁽⁶⁾ Biotin: Higher levels, up to 2 mg/day, are recommended in high fat diets and also as an aid in the improvement of coat and skin condition for cats and dogs and to help hepatic glucose excretion and thus fasting blood glucose levels in dogs with diabetes. ⁽⁷⁾ Use ROVIMIX® STAY-C® (ascorbyl-monophosphate) for reducing losses during processing and supporting the total antioxidant capacity of the animal. ⁽⁸⁾ β-Carotene: recommended for supporting the total antioxidant capacity of the dog or cat and as an immune system modulator and for supporting reproductive physiology.

ABOUT DSM

With over 75 years' experience, DSM is the world's leading supplier of fat-soluble and water-soluble vitamins, carotenoids, long-chain polyunsaturated fatty acids, enzymes, eubiotics and nutraceuticals to the feed, food, pharmaceutical and personal care industries.

Nutritional ingredient production

Reliability through backward integration

DSM operates nine bulk manufacturing and formulation sites across Europe, the United States and China. These sites produce the majority of nutritional ingredients sold as straight products or in premixes and concentrates.

Quality is at the heart of all our operations, and we work to a global quality standard, backed by our unique backward integration concept which gives unrivalled control over our supply chain. DSM has a dedicated logistics network based on three main distribution centres in Venlo (NL), Belvidere (USA) and Singapore.

Premixes and blending

Product services where customers need them

DSM has a comprehensive global network of premix plants with over 40 plants dedicated to the production of feed premixes and another six plants for human food premixes.

This network helps ensure high levels of customer service and delivery, backed by the highest levels of traceability, quality and food safety. Being close to our markets allows us to respond quickly to changing market demands.

Guidelines for Optimum Vitamin Nutrition

DSM vitamin supplementation guidelines are designed to provide Optimum Vitamin Nutrition under typical industry practices.

Optimum Vitamin Nutrition provides all vitamins in the diet at levels that permit optimum health and productivity of domestic animals. The supplementation levels required to attain Optimum Vitamin Nutrition generally exceed the levels needed to prevent clinical deficiency signs. Optimum intake compensates for the many factors which can influence the animals requirements and the feed levels thus, ensuring that vitamin fortification does not limit performance.

These guidelines are ranges and based on extensive university and industry research, published requirements and practical experience. They accommodate most factors that influence the vitamin requirements of animals, however extreme feed processing conditions may necessitate overages of sensitive vitamins.

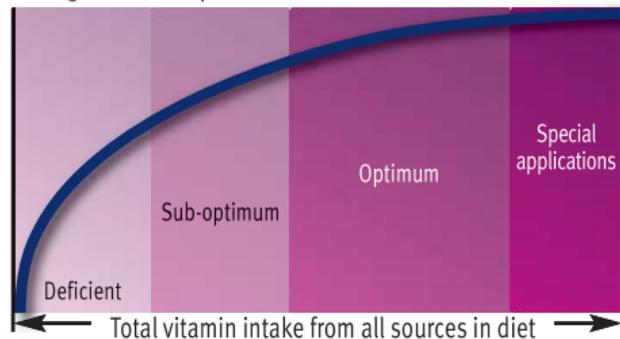
The listed vitamin levels are only guidelines and, in all cases, national feed legislation must be followed.

All figures are expressed in terms of vitamin activity. In general, amounts given are per kg air-dry feed, except for ruminants and horses.



Optimum Vitamin Nutrition concept

Average animal response



Factors influencing vitamin needs of animals under commercial production conditions:

- **Direct factors** - Stressors on animal:
 - Disease
 - Confinement
 - Restricted feeding
 - Antagonists
 - Air quality
 - Temperature
- **Indirect factors** - Variations of levels in feedstuffs:
 - Bioavailability
 - Stability
 - Quality of feedstuffs

Legends

'Total vitamin intake from all sources in diet' describes the total quantity of vitamins from all dietary sources, i.e. natural content of the feedstuffs plus supplementation.

'Average animal response' refers to any average productivity or health response of animals to vitamin intake, i.e. growth rate, feed efficiency, reproductive performance, welfare, health or immunity.

'Deficient' or 'marginal' vitamin intake means a level of supplementation below the requirements published by NRC, ARC and other officially published vitamin recommendations. Such vitamin supply puts animals at risk of developing clinical deficiencies and disorders resulting from inadequate vitamin intake.

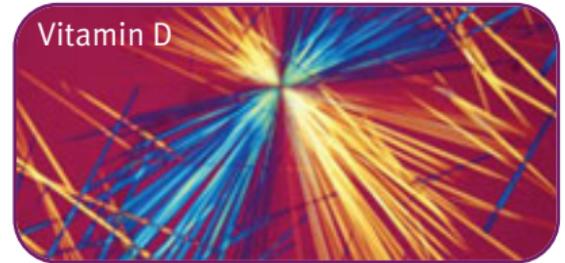
'Sub-optimum' intake relates to supplementation levels, which typically meet or slightly exceed the NRC, ARC and other officially published vitamin recommendations. These levels should prevent sub-clinical deficiency signs under good conditions, but are by no means adequate to permit optimum health and productivity. However, with stress and diseases, sub-clinical deficiency might occur.

'Optimum' intake offsets negative factors influencing animal health and performance, thus allowing to take advantage of the performance potential of modern animal breeds.

'Special applications' levels of vitamin supplementation are safe and focused in improving certain attributes e.g. meat quality and immunity.

Conversion factors

Amount of vitamin activity	Equivalent amount of vitamin salt and isomer
1 IU Vitamin A	0.344 µg Vitamin A acetate
1 IU Vitamin D ₃	0.025 µg Vitamin D ₃
1 g Vitamin E	1.0 g DL-α-Tocopheryl acetate
1 g Vitamin K ₃ (Menadione)	2.0 g Menadione sodium bisulfite = MSB 2.3 g Menadione nicotin-amide bisulfite = MNB (K ₃ Stab)
1 g Vitamin B ₁ (Thiamine)	1.088 g Thiamine mononitrate 1.12 g Thiamine hydrochloride
1 g Vitamin B ₆ (Pyridoxine)	1.215 g Pyridoxine hydrochloride
1 g D-Pantothenic acid	1.087 g Calcium D-pantothenate 2.174 g Calcium DL-pantothenate
1 g Biotin	1.0 g D-Biotin
1 g Vitamin C	1.0 g L-Ascorbic acid
1 g Choline	1.15 g Choline chloride



Active substance	Product name	Description	Use*
Vitamin A	ROVIMIX® A 1000	Powder of stabilized vitamin A in an encapsulated beadlet with crosslinked matrix	D
	ROVIMIX® A 500 WS	Spray-dried powder of stabilized vitamin A dispersed in a matrix	D,W
Vitamins A/D ₃	ROVIMIX® AD ₃ 1000/200	Powder of stabilized vitamin A and D ₃ in an encapsulated beadlet with crosslinked matrix	D
Vitamin D ₃	ROVIMIX® D ₃ 500	Spray-dried powder of stabilized vitamin D ₃ dispersed in a matrix	D,W
25-OH-D ₃ (Calcifediol)	ROVIMIX® Hy•D® 1.25 %	Spray-dried powder of stabilized calcifediol dispersed in a matrix	D,W
Vitamin E	ROVIMIX® E-50 Adsorbate	Free-flowing powder of stabilized vitamin E adsorbed on silicic acid	D
	ROVIMIX® E50 SD	Spray-dried powder of stabilized vitamin E dispersed in a matrix	D,W
Vitamin K ₃	Menadione Sodium Bisulfite FG	Fine crystalline powder	D,W
	K ₃ Stab FG	Fine crystalline powder of menadione nicotinamide bisulfite	D
Vitamin B ₁	ROVIMIX® B ₁	Fine granular powder of thiamine mononitrate	D
	Thiamine Hydrochloride	Fine crystalline powder of thiamine hydrochloride	W
Vitamin B ₂	ROVIMIX® B ₂ 80-SD	Spray-dried powder of vitamin B ₂ dispersed in a matrix	D
	Riboflavin 5'- Phosphate Sodium	Fine crystalline powder	W
Vitamin B ₆	ROVIMIX® B ₆	Fine granular powder of pyridoxine hydrochloride	D,W
Vitamin B ₁₂	Vitamin B ₁₂ 1% FG	Crystalline powder dilution	D
	Vitamin B ₁₂ Crystalline	Fine crystalline powder	W
Niacin	ROVIMIX® Niacin	Fine granular powder of nicotinic acid	D
	Nicotinamide	Fine crystalline powder	W
Pantothenates	ROVIMIX® Calpan	Spray-dried powder of calcium D-pantothenate dispersed in a matrix	D,W
Folic acid	ROVIMIX® Folic 80SD	Spray-dried powder of folic acid in a matrix	D
	Folic acid	Fine crystalline powder	W
Biotin	ROVIMIX® Biotin	Spray-dried powder of D-biotin dispersed in a matrix	D,W
Vitamin C	ROVIMIX® STAY-C®35	Spray-dried powder of stabilized (phosphorylated) vitamin C	D
	ROVIMIX® C-EC	Powder of ethylcellulose-coated vitamin C	D
	Ascorbic acid	Fine crystalline powder of L-ascorbic acid	W
β-Carotene	ROVIMIX® β-Carotene 10 %	Powder of stabilized β-carotene dispersed in an encapsulated beadlet	D
	ROVIMIX® β-Carotene 10 % P	Powder of stabilized β-carotene dispersed in an encapsulated cross-linked beadlet	D

* D: For premixes, supplements and complete dry feeds.

W: For water dispersible applications.

For more information about further products and product forms please ask your local DSM representative.



Nutritional ingredient production

Reliable through backward integration



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