

TOPIC 3. VITAMIN METABOLISM

Vitamins are organic compounds that function as metabolic catalysts, usually in the form of coenzymes (Smith 1970:634). Vitamins may be divided into a fat-soluble group (A, D, E, and K) and a water-soluble group (the B complex and C).

Vitamins have essential roles in metabolic processes. Vitamin requirements are met both by ingesting foods that contain the vitamins, and by synthesis in the body. Rumen bacteria synthesize vitamins in the B-complex and vitamin K, so ruminant animals are not dependent on a dietary source for these vitamins. Neonates, however, do not have a functional rumen, so they are dependent on dietary vitamins in the first few weeks of life. Solar radiation, especially the ultraviolet wavelengths, is an important factor affecting the amount of vitamin D in the body. Sunlight is not the "source," but the stimulus for the formation of vitamin D at the skin surface to be absorbed by the body.

A deficiency of vitamins is called avitaminoses. An excess is called hypervitaminoses. Vitamin imbalances cause malfunctions in different body functions, especially metabolic pathways, as they function as metabolic catalysts. The vitamin metabolism of wild ruminants is largely unknown, except as inferred from studies on domestic ruminants. A few measurements of vitamin levels in the tissue of *Odocoileus* have been made, but that is the extent of published literature found for wild ruminants.

Vitamin requirements of beef cattle are listed below, from a table in the NRC (1976) publication.

VITAMIN REQUIREMENTS OF BEEF CATTLE (in amount per kg of dry diet;IU)

Beef Cattle Requirements

<u>Vitamin</u>	<u>Sheep Requirements</u>	<u>Growing & Finishing Steers & Heifers</u>	<u>Dry Pregnant Cows</u>	<u>Breeding Bulls and Lactating Cows</u>
A	IU	2,200	2,800	3,900
D	IU	275	275	275
E	IU	15-60	—	15-60

This TOPIC 3 is not divided into UNITS because of the lack of information, and there are no worksheets. The paucity of information may stimulate someone who specializes in vitamins to review the pertinent literature on wild and domestic animals, and to write a good review of the concepts and principles involved in vitamin nutrition and metabolism.

LITERATURE CITED

National Research Council. 1976. Nutrient requirements of beef cattle. Fifth Revised Edition. National Academy of Sciences. Washington, D. C. 56 pp.

Smith, S. E. 1970. Vitamins. Pages 634-659 In M. J. Swenson, Ed. Dukes' physiology of domestic animals. 8th Ed. Cornell Univ. Press, Ithaca, NY 1463 pp.

REFERENCES, TOPIC 3

VITAMIN METABOLISM

BOOKS

TYPE	PUBL	CITY	PGES	ANIM	KEY WORDS-----	AUTHORS/EDITORS--	YEAR
edbo	nvif	nyny	118		symp on vitamin metabolism	brown,gm,ed; /	1956
aubo	acpr	nyny	366		biosyn vitami & rel compds	goodwin,tw	1963
aubo	hein	loen	148		vitamins in endocrine meta	jennings,iw	1970
aubo	vare	nyny	278		hndbk of vitamins & hormon	kutsky,rj	1973
edbo	nasc	wadc	72	dosh	nutrient requirem of sheep	natl research cou	1975
edbo	nasc	wadc	56	doca	nutrient req of beef cattl	natl research cou	1976

SERIALS

CODEN	VO-NU	BEPA	ENPA	ANIM	KEY WORDS-----	AUTHORS-----	YEAR
JAPRA	9--3	130	131	odvi	avitaminosis e, white-tail	indianapolis zoo	1968
JOMAA	36--4	553	557	odvi	vitamin excretion by deer	teeri,ad; pomera/	1955
JOMAA	41--3	410	411	odvi	vitamins a and e in blood	haugen,ao; hove,e	1960
JONUA	108-9	1439	1448	odvi	seleni, vit e, bioch, surv	brady,ps; brady,/	1978
JWMAA	40--1	172	173	odvi	vitam a concentr in livers	youatt,wg; ullre/	1976

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR
CBPAB 41B-4 745 758 odhe carote, vit a, liver, seru anderson,ae; med/ 1972

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR
ceel

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR
alal

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR
rata

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR
anam

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR
bibl

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR
ovca

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR
ovda

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR

obmo

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR

oram

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR

AASNA 19--- 22 28 rumi aspects of vit e deficienc oksanen,he 1973

JAVMA 151-4 430 436 rumi vit a nutition of ruminant mitchell,ge 1967

CODEN VO-NU BEPA ENPA ANIM KEY WORDS----- AUTHORS----- YEAR

AASNA 19--- 87 96 chemistry of vitamin e hjarde,w; leerbe/ 1973

CLOSING COMMENTS

This chapter has included a few basic ideas and lists of references in the areas of mineral, water, and vitamin metabolism. The amount of material in the chapter is limited by both the lack of published information on these nutrients and my own limited knowledge of the roles of these nutrients. This chapter is a good example of an opportunity for someone specializing in these nutrients to participate as an author in future revisions.

Aaron N. Moen
March 12, 1981

GLOSSARY OF SYMBOLS USED - CHAPTER NINE

DWFK = Dry-weight forage ingested in kilograms per day

SMFR = Specific mineral fraction of the forage

SMID = Specific minerals ingested per day

GLOSSARY OF CODE NAMES - CHAPTER NINE

CODEN

AASNA Acta Agriculturae Scandinavica Supplementum
 AJAEA Australian Journal of Agricultural Research
 AJVRA American Journal of Veterinary Research
 ALLKA Allattani Kozlemenyek (Hungary)
 AMNAA American Midland Naturalist
 AZATA Arizona Agricultural Experiment Station Technical Bulletin

BTROA Biotropica

CAFGA California Fish and Game
 CBPAB Comparative Biochemistry and Physiology A Comparative Physiology
 CJZOA Canadian Journal of Zoology
 CORTB Clinical Orthopaedics and Related Research

FEFRA Federation Proceedings

JANSA Journal of Animal Science
 JAPRA Journal of Small Animal Practice
 JAVMA Journal of the American Veterinary Medical Association
 JOMAA Journal of Mammalogy
 JONUA Journal of Nutrition
 JRACB Journal of Radioanalytical Chemistry
 JRMGA Journal of Range Management
 JWIDA Journal of Wildlife Diseases
 JWMAA Journal of Wildlife Management
 JZOOA Journal of Zoology

MAAIA Journal of the Scientific Agricultural Society of Finland

NAWTA North American Wildlife and Natural Resources Conference,
 Transactions of the,
 NFGJA New York Fish and Game Journal

OOKHA Okhota i Okhotnich'e Khozyaistvo

PAABA Pennsylvania Agricultural Experiment Station Bulletin
 PAARA Pennsylvania State University College of Agriculture Agricultural
 Experiment Station Progress Report
 PNASA Proceedings of the National Academy of Sciences of the United States
 PNUSA Proceedings of the Nutrition Society
 PSEBA Proceedings of the Society for Experimental Biology and Medicine

SWNAA Southwestern Naturalist
 SZSLA Symposia of the Zoological Society of London

TLPBA Theoretical Population Biology

UTSCB Utah Science

WGFBA Wyoming Game and Fish Commission Bulletin

XIBPA US-IBP (International Biological Program) Analysis of Ecosystems
Program Interbiome Abstracts

YAXAA U S D A Yearbook of Agriculture

ZEJAA Zeitschrift fuer Jagdwissenschaft

LIST OF PUBLISHERS - CHAPTER NINE

acpr	Academic Press	New York	nyny
base	Basel	New York	nyny
coup	Cornell University Press	Ithaca, NY	itny
cupr	Cambridge Univ. Press	Cambridge, England	caen
dohr	Dowden, Hutchinson, & Ross	Stroudsburg, PA	stpa
else	Elsevier	New York	nyny
hein	Heinemann	London, England	loen
macm	MacMillan Company	New York	nyny
moco	C. V. Mosley Company	St. Louis, MO	salo
nasc	National Academy of Science	Washington, D. C.	wadc
nvif	National Vitamin Foundation	New York	nyny
nyha	New York Heart Association	New York	nyny
umip	Univ. of Missouri Press	Columbia, MO	comi
uppr	University Park Press	Baltimore, MD	bama
vare	Van Nostrand - Reinhold	New York	nyny

LIST OF WORKSHEETS - CHAPTER NINE

1.2a Estimation of mineral intake based on predicted
dry-weight forage intake 10a

2.2a Water consumption as part of forage ingested 22a

JULIAN DAY: MONTH AND DAY EQUIVALENTS

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Day
1	001	032	060	091	121	152	182	213	244	274	305	335	1
2	002	033	061	092	122	153	183	214	245	275	306	336	2
3	003	034	062	093	123	154	184	215	246	276	307	337	3
4	004	035	063	094	124	155	185	216	247	277	308	338	4
5	005	036	064	095	125	156	186	217	248	278	309	339	5
6	006	037	065	096	126	157	187	218	249	279	310	340	6
7	007	038	066	097	127	158	188	219	250	280	311	341	7
8	008	039	067	098	128	159	189	220	251	281	312	342	8
9	009	040	068	099	129	160	190	221	252	282	313	343	9
10	010	041	069	100	130	161	191	222	253	283	314	344	10
11	011	042	070	101	131	162	192	223	254	284	315	345	11
12	012	043	071	102	132	163	193	224	255	285	316	346	12
13	013	044	072	103	133	164	194	225	256	286	317	347	13
14	014	045	073	104	134	165	195	226	257	287	318	348	14
15	015	046	074	105	135	166	196	227	258	288	319	349	15
16	016	047	075	106	136	167	197	228	259	289	320	350	16
17	017	048	076	107	137	168	198	229	260	290	321	351	17
18	018	049	077	108	138	169	199	230	261	291	322	352	18
19	019	050	078	109	139	170	200	231	262	292	323	353	19
20	020	051	079	110	140	171	201	232	263	293	324	354	20
21	021	052	080	111	141	172	202	233	264	294	325	355	21
22	022	053	081	112	142	173	203	234	265	295	326	356	22
23	023	054	082	113	143	174	204	235	266	296	327	357	23
24	024	055	083	114	144	175	205	236	267	297	328	358	24
25	025	056	084	115	145	176	206	237	268	298	329	359	25
26	026	057	085	116	146	177	207	238	269	299	330	360	26
27	027	058	086	117	147	178	208	239	270	300	331	361	27
28	028	059	087	118	148	179	209	240	271	301	332	362	28
29	029	[060]	088	119	149	180	210	241	272	302	333	363	29
30	030		089	120	150	181	211	242	273	303	334	364	30
31	031		090		151		212	243		304		365	31

* For leap year, February 29 = JDAY 60. Add 1 to all subsequent JDAYS.

