

DIET INFORMATION . . . The nutritional recommendations made by National have been essentially unchanged for 12 of the 14 years our Founder/Veterinary Advisor has used them. HOWEVER, we still CONSTANTLY RE-EVALUATE them, to be certain they remain compatible with results of ongoing CLINICAL RESEARCH, and in order to continue to improve . . . for the WELFARE of ALL OPOSSUMS. A.M.H.

NOS Recommended Diets

Latest Recommendations and Clarifications

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Revisions and additions by: Paula R. Arms, NOS Vice-President and Janice D. Hughlett, NOS President

Numerous times since 1987, when the infant and adult diets NOS recommends were first published, I've been asked to re-define their content, especially that for adults (anywhere from 5 months -- or 2 pounds -- and older).

In the process of my review of nutrient details provided in the companion article to this report (*Nutritional Metabolic Bone Disease...*), it seemed a good time to also discuss use of several alternative infant formula powders (i.e., Esbilac®, MultiMilk®, Milk Matrix 33/40®, and Milk Matrix 30/55®), as well as details of the adult diet.

INFANT DIET

For many years, Esbilac® has been the primary ingredient for NOS' infant formula. Numerous other powders, which appear adequate (not equal), have since become available.

Particularly due to this and -- more recently -- the totally *unsatisfactory* change in Esbilac® formulation (i.e., working with its so-called "Easy Mixing" is a near-guaranteed nightmare!) it seemed prudent we have alternative formulas which we can SAFELY recommend.

Although NOS still considers Esbilac®, *in general*, to be the basic "standard" against which all others are compared, we *must* recognize the following:

- Esbilac®, by itself, was/is formulated for the needs of cats and dogs (particularly the later).
- Esbilac® *appears* to be - for the opossum -- deficient in Vitamin A (one of the few "knowns" we have!), with perhaps other constituents in excess or insufficient amounts. Although we have partial opossum mothers' milk analysis data from two separate studies (**Table 1**)^{1,4} we *do not* know . . . how milk changes in its constituents over duration of the nursing period for *normal* pouch infants and a *healthy mother*; nor do we know how the health status of the mothers studied may have affected test results. In other words -- what's the *full* picture"? Unknown ... for now.
- There are *obvious* differences in levels of vitamins and numerous minerals, amino acids, and fatty acids, when one compares the *full* manufacturer's data from one powder to another. The significance, if any, in most of these variations on opossum infants' growth and development is unknown. Major differences in the Vitamin A content of the formula powders have been remedied by the manufacturer, resulting in the latest NOS recommendations. **Revised Table 2(a)** provides information current as of 2002. **Table 2(b)** presents the older data for comparison purposes.

Significance of Energy (Calories):

Many studies outline infant feeding schedules based on total calories to volume of formula per gram of body weight. These formulas *primarily* include protein, fat, and carbohydrate data (i.e., the source of calories). Seldom are other constituents examined or considered . . . and this is *usually* what gets one into trouble. Serious damage can occur from ignoring the presence and/or level of any component. **Two Examples:**

- Infant formulas containing liver or other meat (similar to effects of the Modified Jurgelski diet (MJD) discussed elsewhere in this issue);
- "Whipping cream" formulas.

Nutrients Added to Powder:

When "old" Esbilac® and an earlier formulation of MultiMili® (only slightly different from current) were both available, NOS published specific recommendations for use of additional nutrients in its formulas. (Vol. 10, No. 1, Jan 1996, and earlier). NOS *still* recommends certain added nutrients (**Table 3**). BUT THEIR USE HAS SLIGHTLY CHANGED, BASED UPON MORE COMPLETE EXAMINATION OF THESE POWDERS and the addition of MilkMatrix® 33/40 and MilkMatrix® 30/55 as an alternative. PLEASE NOTE that Milk Matrix® 33/40 is the *only* Milk Matrix® combination similar to Esbilac.

These comparisons and recommendations are shown in **Table 4** with analysis of their most relevant components. Please review them. Then, PLEASE **NOTE: NOS only recommends those powder-nutrient combinations as listed in Table 4, and in the February, 2005 Action-Alert.**

Weanlings (on TRANSITION DIET):

At weaning, NOS has recommended the addition of Blended Peter's Food (solubilized cat chow:blended mixed vegetables:lowfat yogurt plus fruit, in ratio of 1:1:0.25; See **Table 5**) and small amounts of fruit, with gradual increase in these to solid foods (See **Table 6**). Later, EXTREMELY LIMITED AND SPECIFIC PROTEIN is added from approximately 200 grams body weight, in transition to the full adult diet = during the fourth and fifth month (weight from 1 pound up to approximately 2 pounds).

Of course, orphans which were admitted as "well babies" (i.e., NO injury, NO illness, vigorous and active from the start) will usually be released by approximately 1 to 2 pounds body weight. At this size, they are large enough to be safe from cats, and more likely to be able to escape other 4- or 2-footed "hazards." MY POINT: Most orphans should be only in the *early stages* of transition to the *full* adult diet. What does this mean? It means that, since they are released at between 1 and 2 pounds (5 months of age), THEY WILL HAVE RECEIVED **NO** pure meat, chicken, mackerel or Vitamin E. It does mean, however, that they will have been offered BONES, whole or crushed. The bones from the two-bone section of chicken wing or crushed neck bones are good choices. Further, any protein fed to them must have been proportionate to their size and stage of growth.

So ... in view of the above, including tabulated data, PLEASE REVIEW THE UPDATED INFANT DIET **Table 7** and comments which follow.

The TRANSITION DIET sequence is only meant for HEALTHY INFANTS. If ill or injured, infants MUST have their diets adjusted for their individual needs and gradual clinical improvement. Age and/or size are lesser considerations.

Comments on Infant and Transition (weanling) Diets:

Upon examination of the above and of our *prior* reprinted INFANT DIET, one should note the following:

- Specific amounts (by weight and/or volume) are provided. Remember: There *is* a small amount of flexibility within each component ... **except the protein additions!**
- NutriCal® is added to all the mixes, primarily to increase their Vitamin content.
- Although we do not know the precise Vitamin A requirement for the opossum, nor how it changes with age, we **do** know the young of **other** mammals require higher Vitamin A per pound of body weight than do adults. We also know the cat's requirement is greater than the dog, and that opossums develop Vitamin A deficiency if fed cat chow as their primary food: Thus, the NOS diet has *appropriate* food additions.
- MultiMilk® *may* occasionally require *slightly* more apple juice - to further improve its carbohydrate content.
- Supplements of vitamins or minerals, *other* than indicated, may create serious excess and damage the opossum. DO NOT USE THEM!

Excessive Food Sources of Vitamin A or E (or supplements) can cause a FUNCTIONAL Vitamin D deficit.

ADULT DIET

I've heard -- on occasion -- the comments, "This is *too* complicated! I want an easier diet to follow!" There's one primary reason this plea will never be "relieved" -- opossums are omnivores! Humans -- also omnivores -- cannot be successfully fed through all age groups, and all changes in growth and development, by taking one or two cans off a shelf and serving it. Similarly, non-human primates and many other omnivores in captivity have been found to do poorly solely on pre-packaged "all-purpose" chows. Eventually, caregivers have had to feed, as closely as is possible, what the animal would "normally" eat ... not what is necessarily "easy." (More on the issue of "easy" below).

One major problem in trying to feed opossums the best captive diet: We don't have enough information on their requirements! Data from two (geographically) widely-separated urban opossum diet studies are available.^{2,3} But, formulating a diet *comparable* to that in "the wild" is nearly impossible. The *extensive* variety and volume of insects, slugs,

snails, and all manner of "creepy crawlies", and the variety of native herbaceous plants we would have to provide -- DAILY! - is staggering. So, we have to *appropriately* compromise. But, are we successful?

One captive male opossum, of whom I'm aware, lived over ten years on a diet entirely of the caregiver's own table food! If this one opossum was even *close* to "normal" (and there is no reason to believe otherwise, particularly from his photograph!) ... a diet rich in variety, taken from all food groups, plus at least some live food, is indicated for all opossums. Variety, changing with the season and availability, is currently apparent in two urban (i.e., "wild") opossum studies.

Thus was born the NOS recommended diet ... in 1984 ... long before *either* opossum group existed! See **Tables 8 and 9**. I've used this diet in all ensuing years -- with only minor modifications -- for *every* weaned through adult opossum in my care. Nearly all my long-term survivors have had the proverbial "one strike" against them before they came to me (i.e., they have been injured and/or gotten ill "in the environment"); no sheltered early lives for these kids. Consequently, I feel at least a small sense of accomplishment, because many of my non-releasables live 3-1/2 to 4-1/2 years. No, this isn't *great*, but it's better than what *seems* to be average across the USA (18 months to 3 years).

Mineral or vitamin supplements - except as noted - must NOT be given opossums ... unless your doctor orders (after history, physical exam, and diagnosis), and then ONLY SHORT PERIODS. One cannot "fix" a bad diet or cure illness (e.g., MBD) with supplements alone.

With continued improvements and use of prophylactic and other treatments (i.e., levamisole, antibiotics, etc.), I would expect to see gradual improvement in trauma/illness survival and life-spans of opossums ... *if* they aren't fed some of the absolutely TERRIBLE diets many are being given (i.e., the "90:10", MJD, or similar)! For, though we cannot predict life-span of those opossums, we release back into the environment (i.e., too many become "dinner" to other animals), we *can* extrapolate that *whatever* improves the health and longevity of captives WILL ALSO improve the health and *potential* survivability of those released.

Experimental Diet Studies:

Experimentally determining opossums' *precise* dietary needs would require that one cage many seemingly healthy opossums; they must be fed diets with *one* nutrient at several levels ("too high" to "too low"), for a specific length of time; one observes, takes blood and other tests, does post mortems ... deaths can be expected in experiments. This must be repeated over and over, for EVERY analyzable nutrient! In non-domestic animal studies, one must *always* factor in the potential/actual effect of stress from caging and repetitive handling for noxious procedures in a species unaccustomed to intimate human contact.

The above doesn't address issues of the source from which subject opossums are "obtained." Are they trapped from the environment? Or are females kept in captivity to provide serial litters? ... a sort of "sanctioned" version of puppy mills. And do the persons conducting this experiment know opossums require certain medications? Will they *permit* antibiotics or other treatment? Will they *recognize* illness? And then deal with it *appropriately*, or will they kill the animal.

This is a nightmare for animals. Particularly with non-domestic species, more often than not, it yields data of questionable value. Of course, ethical and moral issues haven't been considered: purposefully placing *wildlife* in injurious situations which MIGHT or MIGHT NOT yield information useful in helping other opossums. Worse yet ... helping *another* species (humans!) exclusively!

Enter CLINICAL RESEARCH. This is, predominantly, how we in NOS have come to our current level of knowledge ... with, admittedly, *much more to learn* than we already have learned. But, what *has* been gained, has been FIRST for benefit of the individual, as he/she was fed and provided care. The sum of results from one test or treatment in *many* opossums -- proven and reproducible data (i.e., the scientific approach) -- is what, ultimately, appears in these newsletter articles, diets, the Medication List, and much more. We all *must* share information, so that our body of knowledge on the opossum can continue to expand ... **and so we may thoroughly debunk the TERRIBLE DIETS!**

"This is too Complicated! I Want an Easy Diet!"

Several experienced rehabilitators/orphan caregivers with whom I've spoken have given their own reply to the above ... "rehabilitation and orphan care *isn't* easy. It is, very often, fun; but make no mistake: It's serious *work!*" To which I hope we *all* add: If we're not willing to do it appropriately, perhaps we ought to reconsidered *why* we're doing it at all.

Having said this ... and chanced offending *someone* ... let's move on to deal with the complaint.

It's usually the weanling through adult recommended diet which leads to comments of "complicated" or "to hard." The following is a simplified way to view the diet. The SAMPLE provided is for the 6 to 9 pound adult. Juveniles between 2 pounds and 6 pounds, or smaller adults, **must** receive proportionately less of all foods ... *particularly* PROTEIN (which changes from 2 grams at about 2 pounds, to 10 grams at about 6 pounds and over, with increase in SIZE, **not** AGE!).

Comments on Adult Diet, Shown in Table 9

This sample schedule has been in continuous use since *before* 1987 (when first published in 'POSSUM TALES). Some specific points to remember:

- The SAMPLE diet in **Table 9** provides quantities for 6 to 9 pound **ADULTS**. Juvenile (2 to 6 pounds) and *smaller* adults require proportionately less of *each* item ...particularly important for *juveniles* is *amount of protein* -- estimated 2 grams of protein for 2-pound opossums, gradually increasing to 10 grams for a 6 to 9 pound opossum.
 - LIVE FOOD -- which should be given -- must be in variety, too. There is NO ADVANTAGE to feeding a larger percent of their diet as live (or whole dead animal) if it is always the same.
 - Be aware of *proportions and quantities*. Compare the size of the animal with the amount of food he/she is being fed ... decide if it *really* seems appropriate when compared to amounts a cat or dog (or you!) might eat.
- A. To become aware of *estimated* quantities, one *must measure foods* until one becomes comfortable with what sizes "look like."

Examples:

Item	Standard Measure	Approximate Gram Weight
Dry cat chow	1/2 cup	50 grams
Chunk veggies, or fruit	1/4 cup	20 grams
Est. One-Quarter of 2-1/2-inch apple		20 grams
Lowfat yogurt with fruit (pre-stirred):	1 generous serv ing Tablespoon	10 grams
All meats (exclusive of bone)	Level measur ing Tbsp.	10 grams
	Level measur ing 1/4 tsp.	2 grams

B. Approximate Total Amount of Diet to Feed:

Weight	Amount
6 to 9 pound Adult	~100 grams (1 cup)
Over 10 pounds	~100-150 grams (1 to 1-1/2 cups)
Adult under 6 pounds (Same percentages as adult)	≤ <u>Up to</u> 100 grams (1 cup)
Juveniles to 6 pounds (Percentages are gradually changed from weaning to adult)	≤ <u>Up to</u> 100 grams (1 cup)

- C. **Be cautious with high Vitamin A foods.** These include deep orange, leafy green and red vegetables such as spinach, squash or carrots, and mackerel). These *are* needed, but in appropriate amounts (see above).
- D. **Do NOT use BEEF LIVER ... ever!** Some persons have *insisted* it is needed to "prevent cannibalism"! WRONG!! *True* cannibalism doesn't occur in juvenile opossums. The "attack" behavior one may see in immature groups of opossums is caused by one or more of the following: illness, need for *correct* deworming, or husbandry problem (See article in 'POSSUM TALES, Vol. 7, No. 1-2, April-July 1992, Page 7, *for full discussion*). The seeming "cannibalism-fixing power" of beef liver is - in actuality - it's causing animals to be too ill and in pain to be able to *successfully* attack. (See MBD discussion, this issue); or the animal is older, and the effects merely delayed.

EXERCISE

Any discussion of adult/captive opossum diets *must* include at least a brief one on exercise.

Regular exercise is very important for animals in captivity. Opossums -- in the environment -- have a nightly range of 1/4 to a little over 1/2 mile in non-winter months. And their foraging rarely, if ever, yields food in such quantities as the "banquet" usually set before them in captivity.

The combination of insufficient activity and adequate (or excess?) caloric intake results in -- for ALL OF US! -- OBESITY! However, opossums are *extremely* efficient at conserving calories: *all* those not used for structural growth, repair and healing, or reproduction.

It is important that long-term captives be given the greatest opportunity to roam, climb and explore -- to the extent of their abilities -- for *at least* two hours a night. Not only will this improve the likelihood they'll avoid obesity, but it will also improve their apparent *mental* health (yes!) and decrease the stress of forced confinement.

An exercise wheel (construction described in 'POSSUM TALES, Vol. 8, No. 1-2, July-October 1994) is a great boon to helping them keep fit; most opossums will, eventually, use it if they are not ill. That includes many recovered handicapped opossums! They may not be able to run in it, but they do walk. Use of the wheel also seems to reduce stress-related, repetitive behavior patterns which constant caging can induce. Chronic stress states have been shown -- in humans -- to retard healing and predispose to certain types of illness. ■

References

1. Barker, et al. (1967). Marsupial biomodule evaluation study. *Life Science Operations*, Space and Information Systems Division, No. American Aviation, Inc., El Segundo, CA.
2. Hamilton, WJ. The Food of the Opossum I New York State. *Journal of Wildlife Management.*, Vol. 15, #13 (July 1951), p. 258-264.
3. Hopkins, DD and Forbes, RB. Dietary Patterns of the Virginia Opossum in an Urban Environment. *The Murrelet*, Vol. 61 (Spring 1980), p. 20-30. Portland, OR.
4. Jenness, R and Sloan, RE. The Composition of Milks of Various Species: A Review. *Dairy Sci.*, Vol. 32, No. 10:599-612. Review Article No. 158.
5. Kirschmann, JD and Dunne, LJ. *Nutrition Almanac*, 2nd Ed. (1984), pp. 313. [Note. There is a 4th Ed., which contains many new categories, but the 2nd Ed. is actually more complete for foods used for wildlife.]
6. Pennington, JA. *Bowes & Church's Food Values of Portions Commonly Used*, 16th Ed. (1994). JB Lippincott, pp 483.
7. Russkopf, Walter, Jr., D.V.M. Personal Communication concerning his patient. 1984
8. United States Department of Agriculture *National Nutrient Database for Standard Reference, Release 17*. July 2004
9. PetAg, *Typical Analyses for Esbilac®*, *ZoologicMilkMatrix® 33/40*, *ZoologicMilkMatrix® 30/55*. October, 2004
10. Hoffman, Debbie, PetAg representative. Personal communication concerning changes in Vitamin A levels in various PetAg products. October, 2004

SEE, ALSO, COMPANION ARTICLE ON METABOLIC BONE DISEASE IN "PERTINENT POSSUM 'POOP," IN THE "General Nutrition" SECTION.

Table 1

Table 1. ANALYSIS OF OPOSSUM MILK Percent of 100 grams		
	Jenness & Sloan	Barker, et al.
Solids	24.4	23.2
Protein	4.8	8.4
Fat	7.0	11.3
Carbohyd.	4.1	1.59
Energy (Calories)	99	142

See also references and Addendum Comments

1. Differences in age or numbers of infants at time of milk sampling?
2. Status of female at sampling?
3. Is there a change in milk constituents from start to end of nursing period (as exists in other species)?
4. Calories = sum of (Pro+carb) x 4 and (fat) x 9.

Tables 2(a) and 2(b)

Table 2(a) (Revised Feb 2006)
**COMPARISON BETWEEN THREE BASIC FORMULAS
USED FOR OPOSSUMS**
(30 grams mixed in 100 grams distilled water)

	Units	New Esbilac	Milk Matrix 33/40	Milk Matrix 30/55 or MultiMilk
Energy	Kcal	158	162	174
Protein	grams	10.4	10.2	9.5
Fat	grams	12.5	12.9	16.5
Carbohyd.	grams	4.4	4.7	Trace
Calcium	mg	367	349	327
Phosphorus	mg	296	240	226
Ca:Phos		1.24 : 1.1	1.45 : 1.10	1.44 : 1.0
Vit. A	IU	945	925	1,097
Vit. D	IU	237	228	307
Vit E.	IU	1.9	3.6	10.3

1. Comparison between the full analyses of each formula (provided by manufacturer, current in 2004). Numerous differences still exist for nutrients in addition to those above (e.g., copper, zinc, iodine, choline, folic acids, several amino acids, and numerous fatty acids).
2. DO NOT USE MATRIX 20/55; its constituents are *widely* divergent from the above three formulas; compare any "new" formula to Esbilac®.
3. The 30g of powder may be diluted to whatever final volume and/or dilution is desired (1:3 to 1:5 is suggested).

Table 2(b) (Old - 1997)
**COMPARISON BETWEEN THREE BASIC FORMULAS
USED FOR OPOSSUMS**
(30 grams mixed in 100 grams distilled water)

	Units	New Esbilac	Milk Matrix 33/40	Milk Matrix 30/55 or MultiMilk
Energy	Kcal	158	173	188
Protein	grams	10.2	10.2	9.0
Fat	grams	12.5	12.9	15.7
Carbohyd.	grams	4.4	4.7	1.6
Calcium	mg	345	349	327
Phosphorus	mg	249	240	226
Ca:Phos		1.39 : 1.1	1.45 : 1.0	1.44 : 1.0
Vit. A	IU	730	3,304	3,386
Vit. D	IU	143	228	307
Vit E.	IU	1.9	3.6	10.3

1. Comparison between the full analyses of each formula (provided by manufacturer, current in 1993, 1993 and 1991, respectively) reveals numerous differences between levels in addition to those above (e.g., copper, zinc, iodine, choline, folic acids, several amino acids, and numerous fatty acids).
2. DO NOT USE MATRIX 20/55; its constituents are *widely* divergent from the above three formulas; compare any "new" formula to Esbilac®.
3. The 30g of powder may be diluted to whatever final volume and/or dilution is desired (1:3 to 1:5 is suggested).
4. According to our communication with PetAg



representative, MilkMatrix 30/55 and MultiMilk are exactly the same product.

Table 3

Table 3. ANALYSIS OF SOME COMMONLY ADDED NUTRIENTS FOR OPOSSUM INFANT FORMULAS Added to 1 cup (200 grams) prepared formula						
	A	B	C	D	E	F
	Yolk (large)	Yogurt (Lowfat w/fruit pre-stirred)	Apple Juice	NutriCal	Brewer's Yeast	Calcium
	One-half ~8 g (~8 ml)	10 g (10 ml) (1 serving tablespoon)	10 g (10 ml) (1 serving tablespoon)	2-3" line (6 gm)	One-half 7.5 grain Tab ~ 1 gram	200 mg.
Protein - g	1.3	0.4	0.06	0.06	0.39	...
Fat - g	2.6	0.1	0.11	2.1	0.1	...
Carbohyd. - g	0.02	1.9	11.7	2.8	0.39	...
Calcium - mg.	12	14	7	0.18	2.1	200
Phosphorus - mg.	41	11	7	0.03	17.8	...
Ca:Phos	1.0 : 3.5	1.27:1.0	1.0 : 1.0	6.0:1.0	1.0:8.5	...
Vit. A - IU	165	4.9	1.01	940	0	...
Vit. D - IU	113	4.4	1	60	0	...
Vit. E - IU	0.3	(a)	(a)	6	0	...
(a) Values not available for this nutrient. (b) Brands may vary						
Revised February, 2006						

Table 4

FORMULA FOR OPOSSUMS THREE RECOMMENDED MIXES WITH VARIOUS NUTRIENT COMBINATIONS Total in 1 cup (~200 g) prepared formula			
All formula bases require the additives A,C,D,E, F- yolk, apple juice, NutriCal, brewers yeast, calcium. Made as directed in the recipe, the infant formulae have the following analyses.	Esbilac® plus A,C,D,E,F	MilkMatrix® 33/40 plus A,C,D,E,F	MultiMilk® or Milk Matrix® 30/55 plus A,C,D,E,F
Protein - g	12	12	11
Fat - g	18	18	22
Carbohydrate - g	19	19	15
Calcium - mg	587	569	547
Phosphorus - mg	349	294	280
Ca:Phos Ratio	1.7:1.0	1.9:1.0	2.0:1.0
Vit. A - IU	2,050	2,030	2,202
Vit. D - IU	304	295	374
NOTE: Each mix is made with 30g powder plus 100-150 g (or ml) distilled water, plus the added nutrients mentioned, to achieve an approximate 1:3 to 1:5 dilution (i.e., 30g:100-150 ml = 150-200 ml formula); thus each named constituent is total gm per total vol. of formula.			

FROM ORANGE COUNTY REGISTER – BOYD COLUMN – 10 JULY 98:

If typical, you lost about 6 percent of your bone cells last week, and gained that many new ones. [*Dr. Henness Comments*: "Mostly for adults; the % is higher in young, growing of **all** species." (Reprinted in Vol. 12, #1-2, 1998)

Table 5

Table 5. PETER'S FOOD, TO WHICH OTHER NUTRIENTS ARE ADDED FOR OPOSSUMS; ANALYSIS DATA				
	Cat Chow (a)	(One Example) Broccoli + Carrot + Cauliflower	Lowfat Yogurt with fruit (pre-stirred)	TOTAL Combined Diet
Grams	50 grams (c)	50 grams (c)	12.5 grams (c)	112 grams
Protein - g	15.8	1.0	0.40	17.2
Fat - g	4.0	0.12	0.14	4.3
Carbohydrate - g	20.1	3.5	5.3	28.9
Calcium - mg	600	170	173	943
Phosphorus - mg	500	260	14	774
Ca:Phos				1.2:1.0
Vit. A - IU	400	4,898	6	5,304
Vit. D - IU	40 (d)	(d)	(d)	>40 (d)

(a) ~~Purina® dry chow preferred.~~ It is more uniformly accepted by opossums and standardized. We no longer recommend Purina®. Use, instead, quality cat chow with approximately Protein 32%, Fat 12%, Calcium 1.1%, Phos 0.8%, Vitamin A 10,000 IU/kg. Some nutritionists view soy as a harmful recent addition to chow products, and you may want to avoid it. Chows vary widely and change frequently without warning. Check your labels! Some higher priced, prescription or "designer" brands do not contain appropriate percent of various components.

(b) May be used particulate (i.e., blended vegetables and yogurt coat dry chow, or entirely blended, as need arises for specific situations.

(c) Percent (ratio) of chow to blended or whole/chopped mixed vegetables drops to 10-20 grams of chow to 50-60 grams of vegetables after one year of age to prevent obesity. Yogurt drops to 10-20 grams TOTAL maximum per day.

(d) Values all or partially unavailable.

(e) May prepare blended mixed vegetables in bulk and freeze.

Table 6

Table 6. SAMPLE TRANSITION DIET FOR THE WEANLING OPOSSUM, 100gm to 454 gm (EXAMPLE illustrated is for approximately 200 gram infant)					
Per 100 Grams of Total Diet	Multi Milk plus A,C,D,E & F	Cat Chow plus Mixed Veggies plus Yogurt	Fruit	Protein (see permitted) (f) below	INFANT SIZE (grams)
STARTING % of Total	≤ 90%	<10%	<10%	None	~100
MID-POINT % of Total	50%	35%	15%	≤1%	~200
ENDING % of Total	10%	~70%	~20%	~2%	~454
SAMPLE MID-POINT (Approx. 200 gram Infant)					
	Multi Milk plus A,C,D,E&F (1:5 Dilution)	Cat Chow plus Mixed Veggies plus Yogurt (d)	Apple (e)	Chicken Liver	TOTAL DIET
Nutrient by Volume or Weight	50 ml	35 g	15 g	<1g	100g
Protein g	2.75	5.33	0.03	0.18	8.29
Fat g	5.5	1.33	0.05	0.04	6.92
Carbohyd. g	3.75	8.96	3.15	0.03	15.89
Calcium- mg	138	292	1	0.9	432
Phosphorus - mg	70	240	1	2.7	314
Ca:Phos					1.3:1.0
Vit. A - IU	551	1,644 (b)	7.4	164	2,366 (c)
Vit. D - IU	94	>12 (a)	None	(a)	>106 (a)
<p>(a) Data all or partially unavailable. (b) Predominant source - plant. (c) Over ½ source - plant. (d) Final portion taken from <u>Blended</u> Peter's Food (1 part chow - 1 part mixed vegetables - ¼ part yogurt - or 1.0:1.0:0.25 – 100g:100g:25g). (e) Apple is ~"standard," 2.5" diameter: ~10% = 1/8, and ~20% = ¼ of this apple. (f) Protein Sources: chicken liver (once/week); salmon or sardine (twice/week); low-fat cheese (once/week) NO MACKEREL - NO CHICKEN MEAT! (approx. 2 grams, or ¼ level measuring teaspoon). Small bones are ok. NO "Road Kill!" Revised February, 2006</p>					

Table 7
Table 7. INFANT DIET – THROUGH TRANSITION TO ADULT AT FIVE MONTHS
FOOD GROUPS FROM WHICH TO CHOOSE – I, II, II
I. FORMULA

	Esbilac	Milk Matrix 33/40	MultiMilk Milk Matrix 30/55
Powder (per est. 1 cup final formula)	30 g	30 g	30 g
Add following water and nutrients to above and mix well			
Distilled Water (to Dilute 1:3 to 1:5)	Est. 130-150 g	Est 130-150 g	Est 130-150 g
A. – Egg Yolk	8 ml	8 ml	8 ml
C – Apple Juice	10 ml	10 ml	10 ml (See Comments)
D – NutriCal®	2-3" line (6 ml)	2-3" line (6 ml)	2-3" line (6 ml)
E – Brewer's Yeast Crushed	1/2 tab (~1 g)	1/2 tab (~1 g)	1/2 tab (~1 g)
F – Calcium Tab Crushed	200 mg	200 mg	200 mg

These formulas may be made in large quantities and frozen in small, clean containers (Esbilac® powder must be *carefully* added after all other ingredients.

II. SEMI-SOLID FOODS

	FOOD
A	Blended Peter's Food (PF) = 1 part cat chow: 1 part blended mixed vegetables: 0.25 part lowfat fruit (pre-stirred) yogurt.
B	Small amounts of softened fresh or baby food fruit and vegetables (up to maximum of approximately 10 ml each).
C	Lowfat yogurt with pre-stirred fruit (as in Peter's Food) may also be given above 200 grams body weight up to a maximum of 10 ml (approx. 1 serving Tbsp.)
D	Soft Scrambled Egg (above 200 gram body weight, up to 10 grams) = (1/4 egg, small-medium)

III. SOLID FOODS

From approximately 200 grams up to 1 lb. Body Weight

	FOOD
A	Meal worms (~1 tsp.)
B	Bones of chicken neck or 2-bone wing section. ALL MEAT REMOVED. Crush bones if necessary. 1-2 times per week.
C	ONLY PROTEINS PERMITTED – (1 gram, ~1/4 tsp., Up to 2 g ~1/2 tsp. by 1 lb.) 1. Cooked chicken liver – once a week 2. Sardine or Salmon – once or twice a week. 3. NO mackerel!
D	Vegetables – fresh, steamed or quick-thawed) – Daily: Up to 10 grams (~1/8 cup) by 1 lb. body weight – Daily
E	Fresh Fruit – Up to 10 grams (~1/8 cup) by 1 lb. body weight · Daily

PROGRESSION IN FEEDING BY AGE

AGE	Est.Weight	FOODS TO INCLUDE
Less than 2 mos.	≤60 grams	Formula (one of the three given choices); baby food fruit and vegetables.
2-3 mos	Up to 200 grams	Formula; Start Semi-Solid; Peter's Food mixed into formula in increasing amounts to make gruel; offer dry chow in separate dish.
Approx. 3 mos	≤200 grams	Begin to discontinue formula; continue Peter's Food; gradually start Solid Foods.
3-4 mos.	Up to 1 lb.	Continue above; gradually convert to adult diet, from the 4 th to 5 th month.

PLEASE NOTE:

- This diet is not optional. One might **appear** to successfully rear opossums with diets limited to a few ingredients. **Nutritionists** have shown even seemingly minor deficiencies at critical stages in growth of the young (any species) can have far-reaching consequences. Fatal consequences if it hampers mobility!
- Do **NOT** supplement with vitamins except as instructed in this diet, or by a veterinarian.
- Do **NOT** use generic or dog chows. Use cat chow approximating these values: Protein 31.5%, Fat 11%, Calcium 1.1%, Phosphorous 0.9%, Vitamin A 10,000 IU/kg. See Acrion-Alert, February, 2005.
- Opossums **do not** require teaching to eat live food! **Or** to forage! They are not an altricial species!
- Between 4 and 5 months of age, the infant/juvenile makes the transition to the full adult diet.

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Table 8

Table 8. SAMPLE BASIC DIET FOR ADULT OPOSSUM OF APPROXIMATELY 6 TO 9 POUNDS; ANALYSIS DATA

100 Grams Equals 1/2 Cup of Food

	PETER'S FOOD* CAT CHOW + MIXED VEGETABLES + YOGURT	FRUIT (Apple)	PROTEIN (e.g. chicken liver)	TOTAL DIET (f, g)
Nutrient (g)	70 grams (c)	20 grams (d)	10 grams (e)	100 Grams (1/2 cup)
Protein g	11.7	0.036	1.8	13.54
Fag g	2.9	0.066	0.4	3.37
Carbohyd. g	16.6	4.2	0.3	21.1
Calcium mg	540	1.3	9	550
Phosphorus	380	1.3	27	408
Ca:Phos				1.3:1.0
Vit. A – IU	3,709 (b)	9.9	1,640	5,359(b)
Vit. D – IU	>28 (a)	None	(a)	>28 (a)

- a. Data all or partial unavailable.
- b. Predominant source – plant, with carrots in vege mix. WATCH Vit. A!
- c. Final portion taken from (dry chow) **particulate*** Peter's Food, unless state of recovery or health dictates use of blended: **This** sample taken from 50:50, chow:mixed vegetables = must change with age, etc.
- d. Apple – 20 grams (Approx. 1/4 of 2-1/2 inch diameter)
- e. **Protein Sources** – [same as those choices shown for infants], with addition of mackerel and other fish, etc. **Max** 10 grams for this size opossum. (10 g equals approximately 1 level measuring Tbsp.) In transition from 1-pound juvenile to 6 to 9-pound adult, the total amount of protein will **gradually** increase from 2 grams to 10 grams to correspond/assist growth. Smaller (or larger) adults will receive proportionately less (or more) than 10 grams. **NO "ROAD KILL"!**
- f. **NOTE:** This is **sample basic diet only**; one must still add **other items for variety**; some items required once/week, others less frequently – see text.
- g. Mobility, activity level, stage of health, and body weights above or below this range **will** dictate higher or lower **proportionate** total amount per adult.
- * May be used particulate (i.e., blended vegetables and yogurt coat dry chow, or entirely blended, as need arises for specific situations.

Table 9
Table 9. SAMPLE DIET SCHEDULE FOR THE 6-9 POUND ADULT OPOSSUM
(TAKEN FROM THAT USED BY AUTHOR IN CARE OF ALL OPOSSUM PATIENTS, ETC.)

Food Sources	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Protein (all cooked) plus vegetables and fruit	Scrambled Egg (max 1)	Sardine or Salmon 1 level measuring Tbsp.	1/2 chicken wing or neck w/bones (no skin or fat) plus 1-2 serving tablespoons Yogurt	Lowfat mozzarella cheese (est. 1/2 to 1 ounce)	Similar to Monday	Similar to Tuesday	1 (measuring) Tbsp. chicken liver plus 1 serving tablespoon yogurt
Vegetable	Amount for size of opossum (estimated 1/4 to 1/2 cup): Variety, all forms - especially include <u>some</u> yellow, red and green vegetables such as carrots, broccoli and spinach, etc.						
Fruit	Amount for size of opossum (estimated 1/4 cup): Variety; in season; all forms (including dried)						
WEEKLY				EVERY 1-2 WEEKS			
Live Food - Estimated 1-2 (measuring) Tbsps. Brewer's Yeast - 2 to 4 tablets (7.5 gr. size) Pasta, Oatmeal, etc. - Maximum - 1/2 cup More! Including grains, rice, grasses, etc.				Vitamin E - From gel cap (5 units per pound weight) - Into mouth or mix with yogurt.) Monkey Chow - 1 to 2 biscuits Oat-bran Cookie - 1 small; Avocado - Maximum - 1/4; Nuts - Maximum 2-3 Tbsps.* Other "goodies" - Small amounts More!			
<i>THINK: VARIETY!</i>							
Regarding above:							
<ol style="list-style-type: none"> Daily, add appropriate amount of cat chow - (By 9 to 12 months, max 10-20%). See Tables 5, 6 and 7 In place of dry cat chow, may use <u>particulate</u> Peter's Food (see below) if opossum is reluctant to eat vegetables. Feed a <u>small amount</u> of what you are eating, daily. After 9-12 months of age, give only "non-fat" forms of all foods. Avoid "pure" proteins -- <u>watch</u> amount! Add yogurt (if necessary) to improve calcium content. NO "Road Kill"! AVOID vitamin supplements, <u>except</u> as listed. Caution with high Vitamin A foods - (leafy green, orange, yellow veggies; mackerel; salmon; liver) After 5 months of age, <i>may</i> use mackerel and other proteins occasionally. CAUTION WITH AMOUNTS! 							
Revised February, 2006							