# Formula for Columbiform Hatchlings©
# (Crop Milk Substitute)

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## Background

Columbiform species (pigeons and doves) are different from virtually all other birds in that they feed their hatchlings a substance created by (not regurgitated from) their own crops (Levi, 1986). "Crop milk," is similar in appearance and consistency to curd; it is produced by both male and female birds. The dry matter contains about 50% protein, about 45% fat, and virtually no carbohydrate (Baer 1999; Mirachi 1993; Levi 1986; Leach et al 1971; Shetty et al 1992). The amino acid profile of crop milk protein appears to be similar to avian muscle meat, possibly because crop milk is sloughed epithelial tissue (e.g. Bharathi et al 1997). Mineral composition of crop milk has also been described (e.g., Shetty et al 1990). To simulate natural crop milk, Baer (1999) recommends protein levels between 45-55% and fat levels between 38-48% (dry matter basis). "MacMilk" (MacLeod & Perlman 2002) is one home-made substitute for crop milk. Another, Formula for Columbiform Hatchlings, is described below.

The original version of this recipe was developed in 2001; since then, periodic revisions have been made to accommodate changes in product composition as well as more information about the nutrients in natural crop milk. Previous versions of the formula have been used for hatchling pigeons and mourning doves at Avian Haven, circulated privately, and presented at conferences since 2002. So far in the 2010 season, the current recipe has been used to raise three pigeons from the egg, including the two shown in this photo. The authors welcome feedback on the formula; Diane Winn may be contacted at dwmp@avianhaven.org.

**Formula for Columbiform Hatchlings (Crop Milk Substitute)**

- 1 (71 gm) jar Beech-Nut Stage 1 Chicken & Chicken Broth® Baby Food
- 1 ½ tsp corn oil
- 1/8 tsp active culture plain yogurt
- 0.3 g calcium carbonate
- 2 100-125 mg scoops Avi-Era® Avian Multiple Vitamins
- 0.2 ml Kirkman Liquid Iron
- 1.5 ml Lambert Kay Avimin® Liquid Mineral Supplement for Birds

Blend above ingredients until smooth (small amounts of additional water may be added to achieve tubing consistency). Egglets may benefit from the addition of Pancrezyme® or Pancreatin. As is analysis: 78% Moisture, 11% Protein, 10% Fat, 0.20% Calcium, 0.11% Phosphorus; Metabolizable Energy 1.20 kcal/g. Dry weight analysis: 51% Protein, 44% Fat, 0.92% Calcium, 0.49% Phosphorus; Metabolizable Energy 5.48 kcal/g.

## About the Ingredients

Beech-Nut Chicken & Chicken Broth® Baby Food: All brands of chicken baby food differ in their fat and protein contents. Though other brands could be used in a crop-milk substitute, this formula assumes the macronutrients in Beech-Nut.

Corn Oil: Any oil can provide fat; however, corn oil helps the formula approximate proportions of the particular fatty acids most prevalent in natural crop milk.

Yogurt provides live beneficial gut bacteria.

Calcium Carbonate ($CaCO_3$): You will need a scale accurate to a tenth of a gram to weigh the amount that is added to this formula.

Kirkman Liquid Iron and Lambert Kay Avimin® provide trace minerals. (The trial size of Liquid Iron available at http://www.kirkmanlabs.com/ViewProductDetails@Product_ID@122.aspx will provide plenty for most practices.)

Vitamins: The target amount of vitamins in a crop milk substitute can be provided with two of the 100-125 mg scoops that come with Avi-Era®. Do not substitute another brand of multiple vitamins; its vitamin amounts may not be comparable to those of Avi-Era®.

Pancrezyme® or Pancreatin: These products contain digestive enzymes that may be useful for egglets (newly-hatched birds). About 15-20 minutes before the next feeding add a *tiny* amount to the formula that will be used in the next feeding and mix

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well; discard any unused formula. Alternatively, Pancreatin may be added to a small amount of water and tubed as a "chaser" to formula.

Water: Natural crop milk has a thick, almost cheese-like consistency; however, more water should be added if the crop is slow to empty. For egglets, add at least ½ tsp. water to the basic recipe (or add water proportionately to the amount for each feeding).

**Transition from Crop Milk to Seed in Wild Columbiformes**

At first, crop milk is produced only while the parents' crops are empty of seed; it is the sole food of hatchlings for the first few days. Research described in Johnston (1992) indicates that seeds are mixed with crop milk after day 4 in Rock Pigeons. It remains the primary food of the young pigeon for the first week to 10 days (Baer 1999), during which time the parents introduce and gradually increase the proportion of adult foods such as regurgitated seeds. According to work summarized in Johnston & Janiga (1995), full transition from crop milk to seed occurs during the juvenile's second week. Similarly, in Mourning Doves, feedings consist almost entirely of crop milk for the first 3-4 days; by 5-6 days, parents are feeding more seed and decreasing quantities of crop milk (Otis et al 2008).

**Suggested Transition from Crop Milk, Feeding Amounts and Intervals**

For pigeons and doves in rehabilitation, a commercial hand-rearing formula for psittacines such as Kaytee Exact® or ZuPreem Embrace® may substitute for regurgitated seed. If the hatch date is unknown, it may be estimated via the transition from closed to open eyes. In Rock Pigeons, eyes open at 4-5 days (Johnston, 1992), about the same age at which the parents begin to mix regurgitated seed with crop milk. In Mourning Doves, eyes are partially open at 4-5 days and fully open at 6-7 days (Otis et al 2008), again coinciding with the introduction of seeds by the parents. Therefore, a guideline is to begin mixing the crop milk substitute with Kaytee Exact® or ZuPreem Embrace® when the bird's eyes begin to open, gradually increasing the proportion of the latter over the next few days. Columbiform species have a greater crop capacity, and are fed less frequently, than Passerines. A rough guideline for feeding amounts is 10-12% of the body weight, with the formula delivered directly to the crop. Younger birds may be fed 4-5 times per day, and older birds 2-3 times. Allowing the crop to empty between feedings ensures that the hatchling/nestling is processing the food. Before each feeding, gently palpate the crop. If it is not empty or nearly empty, consider waiting longer before feeding again. If formula remaining in the crop feels hard, tube a small amount of warm water and massage the crop very gently. Add additional water to formula fed subsequently.

Offer older nestlings a seed mix formulated for columbids, such as Hagen Pigeon and Dove VME Seeds Mix or Blue Seal Pigeon Feed, and also a small amount of appropriately-sized grit. Discontinue tubing when palpation of crop reveals the presence of self-fed seed.

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