

# NUTRITION AND SONGBIRDS

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## NUTRITION

- Proper nutrition is a critical part of wildlife rehabilitation
  - Plays an important roll in raising orphaned animals
  - Aids in preventing the loss of lean body mass.
  - Essential to successful wound healing
  - Overcoming viral and bacterial diseases
- Balanced diets should provide all required nutrients in proper ratios
  - Missing one nutrient can effect the efficient digestion of the entire diet
  - Surplus of a nutrient can cause the bird to avoid the diet altogether
  - Surplus of certain nutrients can stop the absorption of another
    - Calcium/phosphorus
  - Lack of one nutrient can hinder the absorption of another
    - Vitamin D3/calcium

## NUTRITION

- Diets need to be free of bacteria and toxins
- All animals need
  - Balanced diet
    - Ingredients that contain proper nutrients
    - Birds will have unique adaptations between species
      - The manner in which they eat and digest will differ
      - The manner in which nutrients are absorbed and utilized will be the same
  - Diets contain nutrients and energy
    - Birds cannot create energy through photosynthesis
      - Depend on energy provided through diet
      - Diets that do not contain enough energy components will not permit the bird's system to use the rest of the nutrients in the diet

## ENERGY

- All living organisms need energy to maintain proper metabolic function and to sustain life
- The energy content of a diet is obtained from:
  - Proteins
  - Carbohydrates
  - Fats
- Those nutrients are ingested, digested, absorbed, and transported to cells where they are used to generate energy and thus sustain life

## ENERGY REQUIREMENT

- Energy requirements for birds can be very difficult to determine

- Extensive variations in nutritional and energy requirements
  - Physiological conditions
    - Age: hatchlings and juveniles need extra protein
    - Size: small birds will consume more food per body weight than a larger one
    - Sex: calcium for egg production and laying

## ENERGY REQUIREMENT

- Environmental conditions :
  - Weather: Cold - food higher in fat and carbohydrates
  - Season: breeding – food higher in protein
- Energy expended is lowest when the bird is inactive and under thermoneutral conditions
- Energy expended is highest during flight

## ENERGY REQUIREMENT

- **BER-** Basal Energy Requirement
  - Energy needed for healthy, awake, fasting animal in thermoneutral environment
    - Enough energy to maintain body function on a cellular level
- **RER-** Resting Energy Requirement
  - Healthy animal at rest, thermoneutral conditions
    - Sufficient energy for digestion, absorption, and metabolism of food
- **MER-** Maintenance Energy Requirement
  - Healthy, moderately active animal
    - BER plus energy for regulating body temperature and moderate activities
- **DER – Daily Energy Requirement**
  - Healthy, normal activity for the species
    - Energy sufficient to maintain normal body weight
    - Energy needed for work, growth, lactation, and gestation

## ENERGY REQUIREMENT

- **RER**
  - Placental animals
    - $70(\text{body weight in kg})^{0.75}$      $70(\text{BWkg})^{0.75}$
  - Marsupial animals
    - $49(\text{body weight in kg})^{0.75}$
  - Reptiles
    - $10(\text{body weight in kg})^{0.75}$
  - Passerine birds
    - $129(\text{body weight in kg})^{0.75}$
  - Non-passerine birds
    - $78(\text{body weight in kg})^{0.75}$
  - Seabirds
    - $90(\text{body weight in kg})^{0.75}$

## ENERGY REQUIREMENT

- **DER for sick, anorectic, and wounded animals** is 1.5-2 x RER
  - Cells need extra energy to be able to heal

- It is safe to start the diet plan at RER and increase it gradually to DER for the specific situation
- **DER for healthy orphans** is 4 x RER
  - Young animals need the extra energy for new tissue growth and proper development
- **DER for sick orphans** is 5x RER
  - Supply sufficient energy for new tissue growth and for fighting infections or healing injuries

## RER EQUATION

- Estimate the RER of a specific animal
- Multiply by an appropriate factor to find DER
- The result will present the daily amount of Kcals/day (different then ml/day)
  - Passerine birds
    - $\frac{129(\text{body weight in kg})^{0.75}}$ 
      - Need to know the amount of kcal per ml of food or emergency supplement given

## FLUIDS

- Not a nutrient
- The first and most important component of a sound diet
  - Newly admitted orphans or injured adults
  - Emergency care
  - Successful rehabilitation process
- A bird can lose almost all of its body fat, and half of its protein and stored carbohydrates
  - Still survive
- Loss of 10 -20% of body water will cause serious illness and death

## FLUIDS

- Two water sources
  - Ingested water
    - Drinking
    - Moisture contained in food
  - Metabolic water
    - Produced when food is digested
      - Some food will contain more water than others
      - Fruits vs. Seeds
  - All birds should have clean, fresh water at all times
    - Check water dishes frequently – if you are not going to drink it – the birds will not!

## HYDRATE FIRST

- Most injured and orphaned birds will be in some state of dehydration and/or hypothermia

- During the act of digesting food, fluid is pulled out from cells into the GI tract to aid in the process of digestion
  - If the bird is even mildly dehydrated, feeding will worsen the problem

## LIPIDS

- Used by birds for energy
  - Provides 2.25 times more calories of energy and water per unit
    - 1gr of fat = 9 cal    1gr of protein/carb = 4 cal
- Birds preparing for migration
  - Some will almost double their body mass in fat and flight muscles (Storage of protein)
  - Stored fat amount will vary depending on bird's need
    - Length of migration route
    - Size

## LIPIDS

- Fat-rich food should be offered
  - Migrating birds
  - Young juveniles before release
  - Hatchlings and babies for proper growth and feathers formation
    - Insects
    - fruits

## LIPIDS

- Without fatty acids
  - Poor skin condition
  - Poor feather growth
  - Impaired growth in young
  - Accumulate fat in liver (fatty liver disease)
  - Inability to absorb fat soluble vitamins

## PROTEIN

- Proteins are part of every cell, tissue, and organ in the body
  - Plays a crucial role in all biological processes in the body
  - Essential for growth, repair and maintaining healthy body tissues
  - Muscle contraction, immune protection, transmission of nerve impulse
  - Provides structural support to skin and bones
  - Source of energy

## PROTEIN

- The protein in the foods is digested into amino acids

- There are 22 different amino acids that join together to make all types of protein for use by the body's different structures
- Some of these amino acids can not be made by the body
  - These are known as essential amino acids, and must be provided in the diet
- Animal proteins contain a better balance of the essential amino acids than plant proteins
  - Also called high quality protein
  - Plant foods are referred to as low quality proteins

## CARBOHYDRATE

- Basic source of energy
  - Carbohydrates take the form of sugar and starch
    - Provides accessible fuel for physical performance, and provides the only source of energy for the brain
- Birds do not usually suffer from carbohydrate deficiency
- Carbohydrates are an excellent source of immediate energy boost

## CARBOHYDRATE

- Glucose
  - Simplest carbohydrate
  - Does not need to be digested
  - Absorbed as is
  - Used instantly for energy without the need for any chemical changes on the way to the cell
  - Found in honey, some fruits
- Fructose
  - Simple sugar
  - Found in honey, fruits and vegetables
- Birds get carbohydrates from insects, fruits, and nectar

## VITAMINS AND MINERALS

- Vitamin and minerals make up only a small part of a bird's diet
- But play an important role in the physical and physiological well being of the bird
- Birds only absorb what they actually need
  - Mineral absorption drops after a certain level in the tissues is achieved

## VITAMINS AND MINERALS

- In the wild, birds will select dietary items so as to meet their requirement for a specific mineral
- All birds regardless of natural diet will
  - Increase their intake of animal food items at the onset of the breeding season
  - Increase their body reserves of calcium

- Feed their young a diet rich in animal food items
  - Increased calcium for bone structure

## VITAMINS

- Divided into 2 groups
  - Fat soluble vitamins
    - A
    - D
    - K
    - E
      - Stored in body fat and in the liver
  - Water soluble vitamins
    - B complex
    - C
      - Are not stored in body

## VITAMIN A

- Vitamin A (beta carotene)
  - Involved in vision, reproduction, immunity, membrane integrity, growth, resistance to infections (sinuses) and the maintenance of epithelial cells
  - Vitamin A is of animal origin and does not occur in plant tissues
    - Some carotenoids can be converted to vitamin A in the intestinal wall
  - Approximately 90% of total-body vitamin A is stored in the liver
  - Reduced levels are generally not detected until animal reaches a severe deficiency
- Vitamin A levels in invertebrates are very low
- Fish store large amounts of vitamin A in their liver and fatty tissue.
- Some fruits and vegetable can provide large quantities of vitamin A
  - Orange fruits and vegetables
    - Apricots, cantaloupe, peaches
  - Dark green leafy vegetables
    - Carrots, squash, sweet potato, broccoli, and dandelion leaves

## VITAMIN A

- Signs of vitamin A deficiency resemble those of vitamin A toxicity
  - Degeneration of eye structure
    - Prolonged deficiency will result in blindness
  - Loss of membrane integrity
    - Interferes with water retention
  - Poor feathering

- Both deficiency and excess of dietary vitamin A suppress immune function

## VITAMIN D

- Vitamin D “sunlight vitamin”
  - Required to regulate the absorption of calcium in birds' system
    - Normal mineralization of bone
    - Bone growth and remodeling
    - Prevention of MBD
- Naturally presented in very few food items
  - Fish such as salmon, and tuna, fish liver oils
- Vitamin D is produced in the body after exposure to UVB rays
- Vitamin D3 is the only D vitamin utilized by birds

## VITAMIN D

- **Deficiency**
- Nutrient deficiencies are the result of dietary inadequacy, prolonged indoor caging, and physiological impairments
  - Impaired absorption
  - Increased requirement or increased excretion
  - Limited exposure to sunlight
  - Kidneys cannot convert vitamin D to its active form
  - Absorption of vitamin D from the digestive tract is inadequate
  - Deficiency can cause impacted uropygial gland

## VITAMIN K

- Only known biological role is blood clotting
  - Stop bleeding through clot formation
  - Vital to proper liver function
- Vitamin K is a fat-soluble vitamin
  - Body stores very little of it
  - Stores are rapidly depleted without regular dietary intake
- Dietary source of vitamin K is generally green leafy vegetables: broccoli, peas, green beans

## VITAMIN E

- Vitamin E is an antioxidant
  - Prevents chemicals in the body from damaging cells
- Birds with a vitamin E deficiency
  - Lack energy
  - Develop problems that are associated with the nervous system
  - Blood, vascular, and muscular disorders
  - Found in leafy green vegetables, walnuts, almonds, and sunflower seeds

## VITAMIN C

- Essential to keeping the body functioning
  - Making neurotransmitters to allow communication between cells
  - Utilization of iron, folic acid and vitamin A
  - Required in the production of collagen (protein found in skin, bones, blood vessels, tendons, and ligaments)
  - Binds muscle tissue
  - Increases immune system resistance to infections
- Most birds synthesize vitamin C in the kidney, and liver

## VITAMIN C

- Birds under stress will have an increased requirement
  - High temperatures
  - Growth and reproduction
  - Suppressed immune system
- Can only be obtained from plant food sources
  - Orange, papaya, guava, ripe tomato, mango, strawberries, cantaloupe, watermelon, pears, kiwi, bananas
  - Dark leafy greens, green and red papers, snow peas, broccoli, sweet potatoes

## VITAMIN B COMPLEX

- B complex consists of eight water soluble vitamins
  - B1 (thiamine), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid), B6 (pyridoxine), B9 (folic acid), B7 (biotin), and B12 (cobalamin)
  - The B vitamins assist the bird's body in responding to stress
    - Enhance metabolism of carbohydrates and proteins for available energy
    - Boosts immune and nervous systems
    - Maintains skin and muscle health
    - Aids in cell growth and division
  - Important during breeding, molting, and the rehabilitation process
- Brewer's yeast is one of the best sources of the B vitamins

## VITAMIN B COMPLEX

- B vitamins are water soluble
  - Excesses are passed out in urates rather than being stored in the body
  - Important that birds get a consistent amount of B vitamins in their diet
    - Dietary sources include whole, unrefined grains (such as cracked and whole wheat, brown rice, rye, and wheat germ), leafy vegetables, peanuts (B1), raisins, oranges (B1, B9), almonds, pecans, broccoli (B2), sunflower seeds, peanut butter (B3, B7), bananas (B7, B9),

## MACRO MINERALS

- Calcium
  - Development of bones and muscles
  - Normal contractions of muscles



- Heart
  - Blood coagulation
  - Egg formation (85% calcium)
- Calcium, phosphorus and vitamin D are all connected
  - Poor calcium absorption is due to high phosphorus levels
    - Dark leafy green vegetables
- Calcium is absorbed in birds' bodies in the presence of vitamin D and moderate amounts of fat.
- Cottage cheese, unprocessed cheeses, and yogurt are good sources of calcium
  - Birds do not have the enzyme necessary to digest the lactose in milk
  - Non-food elemental calcium can be added to diet
  - Calcium and phosphorus must be balanced in diet (2:1)
    - Seeds are very high in phosphorus
    - Mealworms are deficient in calcium and high in phosphorus

## MACRO MINERALS

- Phosphorus
  - Growth
  - Maintenance of healthy system
  - Repair of bone and tissues
  - Maintaining structure and function of bones
  - Aids in conversion of protein, fats, and carbohydrates into energy
    - Found in peanut butter, almonds, broccoli, lima beans, and animal food items
      - Check all food for proper ca/p ratio

## MACRO MINERALS

- Potassium
  - Regulates body fluids
  - Function of nervous system
  - Maintains normal contraction of muscles
  - Aids in carbohydrate metabolism
    - Found in bananas, apricot, oranges, cantaloupe, squash, peanuts, and a variety of vegetables

## MICRO (TRACE) MINERALS

- Copper is a part of several proteins, and enzymes
- Cobalt, needed in very small amounts but very important
  - Required for blood, bone, tissue and skin construction
  - Building block for vitamin B 12
- Iodine
  - Healthy thyroid function

- Zinc and magnesium
  - Protein synthesis
- Selenium
  - Disease prevention, boosting of immune system
- It is unlikely that birds will suffer from deficiency of those trace minerals and supplementation is not usually needed unless a specific medical need arises

## OTHER CONSIDERATIONS

- Hydration and proper nutrition are the first and most important treatments one can offer to birds admitted into a wildlife center
- Many factors of the bird's physical and physiological conditions play an important role in the bird's system's ability to use the nutrients you are providing

## MALNUTRITION

- Malnutrition - inadequate intake of nutrients
  - Bird can eat large amount of food, but is unable to digest, absorb and/or convert food into energy
    - Parasites
    - Disease
      - Aspergillosis
      - Lead poisoning
    - Foreign body in GI
    - Food is insufficient in nutrients
      - Captivity (improper diet)
      - Stress

## STARVATION

- The bird is unable to acquire sufficient amount of food for an extended period of time
  - Injuries
  - Diseases
  - Environmental conditions
- A birds that consumes a sufficient amount of food but is not gaining, or is losing weight
  - Might be suffering from malnutrition
    - Further investigation into the cause is necessary

## OTHER CONSIDERATIONS

- Diet considerations for birds admitted into a rehabilitation facility differs considerably from those of pet birds
  - Nutritional components offered to pet birds are not always right for wild birds
    - Eggs
      - High quality protein

- Very rich in Methionine (an essential amino acid)
- Most toxic amino acid in excess
- Surplus in diet will cause deficiency in other amino acids
- Suppresses growth and proper development
- Depletion of vitamin B6
- Too rich for birds that do not eat animal food items in the wild
- Source of salmonella (when fed raw)

## OTHER CONSIDERATIONS

- Preparation of food
  - Clean bowls every time you feed/water
  - Wash fruits and vegetables before cutting
    - Bacteria can be found on the surface of fruits and vegetable
    - Once cut, bacteria can multiply and spread to all food items in bird's dish
  - Cut fruits and vegetables into appropriate sizes
- Never add supplements to a commercially made formula

## OTHER CONSIDERATIONS

- Presentation of food
  - Important to learn the natural history and behavior of native species
  - Birds have diverse foraging techniques
    - Need to present food to mimic natural feeding behavior
      - The birder's handbook – a field guide to the natural history of north American birds
    - Feeding smaller portions 3-4 times a day
      - Promotes healthy appetite
      - Mimics natural behavior
        - Promotes psychological well being

## OTHER CONSIDERATIONS

- Mealworms are deficient in calcium and high in phosphorus
  - Raise and store in a nutritional media
    - Bran, wheat germ, mixed grain baby cereal, bone meal, vitamins
    - Feed mealworms everyday
      - Thin slices of apple and carrots
      - Greens
  - What you feed your mealworms is the nutrition you are providing to the birds in your care

## THE END

- Any questions??