

NON-RUMINANT DIGESTION NUTRITION

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RUMINANT vs NON-RUMINANT

- Evolution and Adaptation
 - Age of the simple stomach
 - Age of the ruminant digestive system
 - Why and how the ruminant system evolved?
 - Why do non-ruminant animals still exist?

NON-RUMINANTS

Who are they? Most importantly, dogs, cats, pigs, chickens and many other animals including HUMANS.

What do they eat? (herbivore?, carnivore?, omnivore?)

- Wild animals vs Confined animals.
- Why do non-ruminants eat what they eat?

BASIC NUTRITIONAL REQUIREMENTS OF ANIMALS

- Energy
- Amino Acids
- Vitamins
- Inorganic chemical elements
- Water
- Oxygen

- These requirements are either ingested or produced by the animal

NON-RUMINANT SIMPLE

- Mouth
- Teeth
- Saliva
- One way esophagus
- Stomach
- Acids and mixing and breakdown of ingesta
- Intestines and absorption
- Peristalsis-muscles and movement-excretion

ENERGY

- Mechanical, thermal, electrical, light, nuclear, and molecular
- Animals mostly use molecular energy.
- chemical energy stored in food into---
- kinetic energy of chemical reactions of
- metabolism and of work and heat.

ENERGY

- Primary sources of energy for animals is carbohydrates and fats.
- Other sources include protein and other organic (containing carbon) compounds
- Animals eat food primarily to satisfy hunger or a craving for energy

ENERGY

- The process to convert a bowl of rice or a banana to molecular energy is very complex.
- For the most part, the starch in the carbohydrate in the banana is converted to sugar, (primarily glucose).
- The glucose then undergoes another extremely complex metabolic process that yields high energy phosphate compounds.

ENERGY

- Every cell in the animals body has these phosphate compounds.
- A complex cycle ensues with about 15 different steps.
- $ATP = ADP + \text{energy}$
Adenosine triphosphate goes to
Adenosine diphosphate + energy

ENERGY

- Not all proteins, carbohydrates, and fat can be digested by all animals.
- Only the metabolizable portion of feedstuffs can provide energy and essential nutrients.

PROTEIN

Protein is a dietary essential and is made of amino acids.

There are approximately 20 amino acids joined together in various complex ways to build muscles, cartilage, connective tissue, blood proteins, hormones, enzymes and other nitrogen containing compounds.

PROTEIN

- Twelve or fourteen of the 20 amino acids are essential nutrients for the non-ruminants.

They cannot be produced by the animal

- The other amino acids can be made by the animal if its diet is adequate.

PROTEIN

- Each protein, whether vegetable or animal tissue has a specific pattern of amino acids.
- Vegetable proteins most suitable for animals are those having amino acid proportions most similar to the amino acid pattern of the animal tissue proteins, especially in terms of essential amino acids and the needed nitrogen.

PROTEIN

WHAT ???

PROTEIN

- Corn, cornmeal (oil extracted), soybean, cotton seed meal, fish meal, cull fruit, coconut, barley, oats, fats and oils etc, are all good feedstuff for animal feeds.
- Not one of them standing alone can meet the complete nutritional needs of the non-ruminant.

REFERENCE LIST OF AMINO ACIDS

- Amino acids: Alanine, Argine, Asparagine, Aspartic acid, Cysteine, Glutamic acid, Glutamine, Glycine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Proline, Pyrrolysine, Selenocysteine, Serine, Threonine, Tryptophan, Tyrosine, Valine,
- Twelve of these are essential (must be consumed) by the chicken.
- Eight of these are essential in human nutrition
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PROTEIN

- The non-ruminant, then needs a combination of several vegetable proteins to satisfy amino acid profile.
- The list of possible palatable combinations that will satisfy an animals amino acid profile is very large,
- Commercially, a combination of corn and soy meet most profiles.

PROTEIN

- Non-ruminants may also use animal products, often as supplements.
- Fish meal, meat and bone meal, and whey are
- some examples.

VITAMINS

- There are two main groups of vitamins.
 - Fat soluble vitamins---A, D, E, and K
 - Water soluble vitamins--- B1, B2, B6, B12, nicotinic acid, pantothenic acid, folic acid, biotin, and choline.
 - - Vitamin C in humans and some other primates

VITAMINS

- An organic compound
- A component of natural food
- Is present in foods in minute amounts
- Is essential for health, growth, maintenance
- When absent from the diet results in a specific disease or syndrome
 - British sailors were called “Limeys” because they took barrels of limes on their ships and ate them to prevent scurvy, a specific disease caused by deprivation of Vitamin C --

ESSENTIAL INORGANIC ELEMENTS

- These elements are often called minerals
- Even though essential, some minerals can also be toxic.
- Minerals are required in very small amounts.
- Lack of a specific mineral will cause a specific symptom.

REFERENCE LIST OF MAJOR MINERALS

- Calcium Ca
- Phosphorus P
- Sodium Na
- Potassium K
- Chlorine Cl

REFERENCE LIST OF TRACE MINERALS

Magnesium Mg

Manganese Mn

Zinc Zn

Iron Fe

Copper Cu

Molybdenum Mo

Selenium Se

Iodine I

THE COMPLETE DIET

- We looked at what a non-ruminant needs to grow reproduce and maintain body temperature.
- Energy, amino acids or protein, vitamins, minerals.
- The two most important factors—
 - **WATER AND OXYGEN**
- are often taken for granted

ALL OF THE ESSENTIALS

- Where do they come from?
- In the wild? -pigs, birds, bats, snakes, mice
- Forage for what they need.
- Confined domestic animals? pigs, chickens
- The farmer must provide.

ALL OF THE ESSENTIALS

- The farmer that confines the animal must know what essential nutrients are in his choice.

The farmer must know what essential nutrients are required by his animal for optimal oertformance.

OPTIMAL

- Optimal-----Sub-optimal
- Best-----Less than best

- Performance, growth, reproduction, costs, time to slaughter or market.
- Can the farmer afford optimal?
- Can the farmer afford sub-optimal?
- A whole new presentation!
- Cost of production, farm business plans etc.

FINDING THE ANSWERS

- Today information is available at the click of your (non-ruminant) mouse
- Nutrients available in feeds
- Nutrient requirements of specific animals for specific goals.
- Breeding boars, gestating sows, starting, growing and finishing market pigs etc.

FINDING THE ANSWERS

- Non-ruminants do better as the variety and number of choices for food increases
- Humans
- Wild animals
- Confined animals

- The chicken and the coconut!
- The coconut is palatable and filling but does not contain a broad spectrum of required nutrients.
- Optimal for energy sub-optimal for protein so overall sub-optimal