

Lecture 9

FEEDS AND FEEDING

Feed is a material, which after ingestion by the animal is capable of being digested, absorbed and utilized to satisfy metabolic needs i.e. being transformed into body elements of the animal. The compounds of a feed that are capable of being transformed into body elements are known as nutrients.

The metabolic needs include:

- (i) Maintenance – supply of energy for physiological processes whether new tissue or products are formed.
- (ii) Growth – this is a building process of the body. Growth may be defined as correlated increase in mass of body indefinite intervals of time in a way characteristics of the animal specie. There are two types of growth – Hyperplasia which is the increase in number of cells. Hypertrophy – which refers to increase in size of cells.
- (iii) Growth of hair and feathers
- (iv) For work – muscle action. Energy is needed for work
- (v) For reproduction – including egg production in poultry
- (vi) For fattening – specialized production activities
- (vii) Milk production – Lactation in milk producing animals, man, pigs, rabbits and pigeons
- (viii) For synthesis of specialized products – synthesis of enzymes, hormones, haemoglobins, etc
- (ix) Catalysis – in stimulating and regulating body activities e.g. vitamins, hormones and enzymes
- (x) Sleeping, breathing are important activities requiring good nutrition.

TERMINOLOGIES AND DEFINITIONS

- (1) Nutrition – the science involving various chemical and physiological activities, which transform feed elements (nutrients) into body elements.
- (2) Feed – is a material, which after ingestion by the animal is capable of being digested, absorbed and utilized i.e. before transformed into body elements of the animal. A feed is

merely the carrier of nutrients. No feed has been found that is nutritionally complete for and balanced to the need of a given animal.

- (3) Feedstuff/Feed ingredients – a feeding stuff is any product, whether of natural origin or artificially prepared that when properly used has nutritional value in the diet. It includes natural feeds of animal origin, synthetic and other pure nutrients.
- (4) Nutrients – a nutrient is defined as any feed constituent or group of feed constituents of the same general chemical composition or a pure chemical compound that aids in the support of animal life. The constituents of a feed that are capable of being transformed into body elements are known as nutrients.
- (5) Ration or Diet – is a 24-hour allowance of feed or of mixture of the feedstuffs/feed ingredients making up the diet.
- (6) Feeding – is a practical application of nutrition, i.e. consideration of management, formulation, palatability, economics, etc.
- (7) Formulation – is the process of constructing a feed or diet formular.
- (8) Balanced diet – the food or feed that supplies all the essential nutrients in the proper amounts required for optimum performance of the animal.
- (9) Complete feed – a balanced ration for the animal in a single form. It provides all the nutritional requirements (except water) needed to maintain normal health or to promote production.
- (10) Basal (Energy) Feeds – nutritionally, basal feeds are mainly concentrated sources of energy being especially rich in starches and sugars. They are grains and grain by-products that contain not more than 16% protein and 18% crude fibre.
- (11) Supplement – is a feed or a feed mixture use with another feed to improve the nutritive balance of the total ration or diet.
- (12) Concentrate – is usually described as feed or feed mixture which supplies primary nutrients (protein, carbohydrates and fat). It is a commercially prepared supplement which refers to a concentration of protein, minerals or of vitamins in excess of those found in basal feeds. Have digestibility.
- (13) Husks – is leave enveloping an ear of maize or outer covering of kernels or seeds especially in the dry form.
- (14) Ear of maize – entire fruiting head of *Zea mays* including only cob and grain.

- (15) Cob – the fibrous inner portion of the ear of maize from which the kernels have been removed.
- (16) Kernel – refers to a whole grain.
- (17) Hulls – outer covering of grain or kernel.
- (18) Forage or roughage – any material substance for feeding livestock, which contains more than 18% crude fibre, materials making up the fodder.
- (19) Anorexia – loss of appetite in disease condition.
- (20) Appetite – is a desire or inclination for food. It is a conditioned reflex. It is related to taste, smell and appearance of food. Well developed in man than in farm animals.
- (21) Additive – a substance (or mixture of substances) added to the feed to meet a specific purpose. An additive may enhance the nutritive value, sensory value or shelf life of the feed. Additive is involved in the production, processing, packaging and/or storage of the feed without being a major ingredient.
- (22) GIT – gastro intestinal tract, responsible for the digestion, absorption and assimilation of feed and nutrients.
- (23) Ration Formulation – this is the act of combination and re-combination in specific ratios of feed ingredients/feedstuffs to obtain feed for the nutrient requirement of farm animals.
- (24) Feedmill – is an establishment/place where feeds/commercial feeds are provided using specialized equipment according to the feed formulation.
- (25) Feedmillers – owner of a feedmill, for commercial/personal use.
- (26) Proximate Analysis – this refers to the analysis of chemical constituents of feed, feed ingredients using established standard methodologies/procedures AOAC (1995).
- (27) Nutrient Requirements – this refers to specific requirements for nutrients by farm animals and this can be affected by a number of factors.
- (28) Antinutritional factors – these refers to chemical compounds/metabolites which interfere with the normal process of digestion, absorption and assimilation of nutrients from feedstuffs/feeds.
- (29) Feed Microscopy – this is the science of identification, evaluation of feeds/feedstuffs by visual appraisal using a microscope, hand lenses. Essentially it involves physical and textural examinations.

(30) Nutrition evaluation – refers to the assessment of feed/feedstuff for its nutritional adequacy. This can be physical, chemical, biological or microbiological in nature.

NUTRIENT REQUIREMENTS

Nutrient requirements deal with the adequacy of the feed to the needs of the farm animals. Adequate nutrition seems to be the most important environmental factor that influences the ability of the animal to attain their genetic potential for growth, reproduction, longevity and respond to stimuli.

There are at least 40 specific nutrients (chemical elements) that need to be present in the diet to support life, growth and optimum reproduction. These consist of 13 important amino acids, 13 vitamins, 13 essential minerals and 1 fatty acid known as linoleic acid.

Amino acids – Arg, Cystine, Gly, Hist, Ile, Lys, Met, Phe, Thr, Tryp, Tyr, Val

Minerals – Ca, P, Mg, Na, K, Cl, Mn, Zn, I, Cu, Fe, Co, Se

Vitamins – A, D, E, K, Thiamine, Riboflavin, Niacin, Pantothenic acid, Pyridocine, Biotin, Choline, Folic acid, B₁₂

Fatty acid – Linoleic acid

The essence of nutrition is to define the nutrients required by the animal to perform at a certain level, identify a suitable source of those nutrients and match these two in a diet formulation to obtain a balanced diet.

The requirement for any nutrient may be defined as the amount of that nutrient which must be supplied in the diet to meet the needs of the normal healthy animal given an otherwise completely adequate diet in an environment compatible with good health.

Summarily, nutrient requirement is the amount of a given nutrient required by the animal to maximize performance e.g. a specified rate of growth or a stated level of production.

The nutrient requirements of farm animals are documented and published by National Research Council (NRC), USA, Agricultural Research Council (ARC), UK, Nutrient Requirements Table, Aduku (1993), Nutrient Requirements of Poultry by Fetuga (1984); Nutrient Requirements Table by Olomu (1995).

FACTORS AFFECTING NUTRIENT REQUIREMENTS

Certain factors affect the levels of nutrients required for optimum performance of farm animals. These includes –

- (1) Texture of feed – feed particle size affects nutrient requirement. Coarse feed may not be consumed sufficiently by very young animals. Pelleting of a bulky diet will increase the nutrient density per unit volume thus increasing nutrient consumption.
- (2) Energy content of the diet – the largest single dietary need of animals is for energy. Energy is required for all processes of life. This energy is bound in molecules of carbohydrate, fat, protein and alcohol. Birds tend to satisfy their energy requirements first hence the energy content of the diet tends to influence the intake of other essential nutrients. Efficient utilization of proteins is dependent on the amount of energy available, hence, the concept Protein:Energy ratio in farm animal nutrition.
- (3) Environmental condition – Temperature, climatic conditions have marked effect on energy requirement and hence on feed intake and other nutrients. Animals tend to eat less in warm/hot than in cold environments – rainy/harmattan. Temperature also influences the requirement for (vitamins).
- (4) Age – nutrient requirements change with age of the animals. Age relates to growth and increased metabolic activities.
- (5) Sex – boars, bucks (male farm animals) require more energy and nutrients than, sows, does (female animals).
- (6) Physiological/Productive state – rate of growth, egg production, amount of milk produced, pregnancy lactation can affect the nutrient requirements of farm animals. Mature cockerel will have low requirement for amino acids (nutrients) than the laying hen producing eggs.
- (7) Physical activity – active farm animal require more energy and nutrients than inactive/less active animal e.g. Athletes and non-athletes.
- (8) Size of the animal and breed – large animals and people need more feed and hence nutrients than smaller animals. Breed effect is important e.g. light breed and heavy breed, fish (genetical) vs. rabbit.
- (9) Effect of health status – this can affect the requirement for nutrients. Diseased condition or ill-health, absence or presence of internal parasites. Animals recovering from illness need more energy and nutrients than healthy animals e.g. diarrhea and H₂O.

- (10) Balance between nutrients – the balance between amino acids, dietary protein levels versus individual amino acids, this may affect the metabolic utilization of individual nutrients and hence their requirements.
- (11) System of management – in poultry and pigs, floor or cage rearing, intensive or extensive management system can affect requirements for specific nutrients.
- (12) Presence of antinutritional factors – availability of nutrients from various feedstuffs may be affected by certain substance (anti-metabolites) e.g. phytase, oxalate may render ions of Zn, Mn and Ca completely unavailable to the animal.
- (13) Destruction or loss of nutrients in feed/feedstuffs – improper processing e.g. overheating of a feedstuff may result in denaturation of protein or the browning reaction of Maillard's reaction.
- (14) Stress – stresses occur in every day life and these may affect nutrient requirements e.g. hot weather and vitamin C supplementation in feed or water.
- (15) Competition for absorption due to nutrient imbalances and competition for active transport of nutrients. Metabolites may react with the epsilon amino groups of lysine thereby decreasing protein value of diet.

NUTRIENT/CHEMICAL COMPOSITION OF FEEDSTUFFS

This refers to the chemical constituents of feedstuffs. It depicts the amount of nutrients present in a feed ingredients/feedstuffs which confers specificity on the feed ingredients.

This composition indicates is a pointer on the usefulness and for what purpose the feedstuff can be incorporated or used in the nutrition/feeding of farm animals. Most importantly, nutrient composition assists in the classification of the different feedstuffs. The nutrient/chemical composition of feedstuff is affected by

- (1) Processing method
- (2) Season/climatic conditions
- (3) Age/growth stage in forages
- (4) Presence of antinutritional factors
- (5) Storage