

Animal Nutrition

UNIT-IV (NON-RUMINANT NUTRITION)

UG Lecture: 1-3

Nutrient requirements in Poultry, Swine & Equine

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UG Lecture: 1

Objectives.....

- **To know the nutrient requirements for various categories of chicken.**
- **Different factors influencing nutrient requirement in chicken.**

NUTRIENT REQUIREMENTS IN POULTRY

- **Nutrient requirements are the amount of nutrients required by poultry to support normal function.**
- **Requirements may be expressed in quantities of nutrients or in dietary proportions.**
- **Quantitative descriptions of the amounts of nutrients required for poultry have been provided by various agencies or organizations such as;**
 - ✓ **In India we usually follow BIS specification.**
 - ✓ **In USA and in many other nations NRC specifications is followed.**
 - ✓ **However certain commercial poultry farms follow their own standards.**

Nutrient requirements for poultry as per Bureau of Indian Standard (BIS)-2007

	Broiler Feed (0-6 wks)			Layer Feed					
Nutrient	Pre-Starter (0-7 days)	Starter (8-21 days)	Finisher (22-42 days)	Chicks (0-8 wk)	Grower (9-20wk)	Layer Phase-1 (21-45wk)	Layer Phase-II (46-72wk)	Broiler Breeder male (23wk onward)	Layer Breeder male (23wk onward)
Moisture max %	11	11	11	11	11	11	11	11	11
ME (kcal/kg)	3000	3100	3200	2800	2500	2600	2400	2750	2600
CP min %	23	22	20	20	16	18	16	15	16
Ether Extract min %	3	3.5	4	2	2	2	2	2.5	2
Crude fibre max %	5	5	5	7	9	9	10	9	9
AIA max %	2.5	2.5	2.5	4	4	4	4.5	4	2.5
Salt as (NaCl) Max %	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5

	Broiler Feed (0-6 wks)			Layer Feed					
Nutrient	Pre-Starter (0-7 days)	Starter (8-21 days)	Finisher (22-42 days)	Chicks (0-8 wk)	Grower (9-20wk)	Layer Phase-1 (21-45wk)	Layer Phase-II (46-72wk)	Broiler Breeder male (23wk onward)	Layer Breeder male (23wk onward)
Calcium min %	1	1	1	1	1	3	3.5	1	1
Total Phosphorus min %	0.7	0.7	0.7	0.7	0.65	0.65	0.65	0.7	0.6
Available Phosphorus min %	0.45	0.45	0.45	0.45	0.40	0.40	0.40	0.40	0.40
Lysine min %	1.3	1.2	1	1	0.7	0.7	0.65	0.8	0.8
Methionine min %	0.5	0.5	0.45	0.40	0.35	0.35	0.30	0.4	0.4
Meth + Cystine min %	0.9	0.9	0.85	0.7	0.6	0.6	0.55	0.7	0.6
Aflatoxin B1 max (ppb)	20	20	20	20	20	20	20	20	20
Linoleic acid min %	1.1	1.1	1.1	1	1	1	1	1	1

EGG PRODUCTION

- **Good flocks of layer produce about 250 eggs per bird per year (i.e. 70% production).**
- **Their eggs weigh on average 57 g.**
- **Birds start laying at around 20-21 weeks of age & continue for 52 weeks but laying fewer eggs near the moulting period.**
- **The typical production cycle lasts about 17 months (72 weeks).**
- **On average a bird produces one egg per day.**
- **Not all birds start to lay exactly when they are 21 weeks old.**
- **In temperate climates birds can produce 250 - 300 eggs per year.**

Energy Required per Hen per Day by Chickens in Relation to Body Weight and Egg Production (kcal), NRC

Body Weight (kg)	Rate of Egg Production (%)					
	0	50	60	70	80	90
1.0	130	192	205	217	229	242
1.5	177	239	251	264	276	289
2.0	218	280	292	305	317	330
2.5	259	321	333	346	358	371
3.0	296	358	370	383	395	408

Factors affecting the Nutrient Requirements of Poultry

- **Genetics- species, breed or strain of bird**
- **Age - body weight and the stage of maturity.**
- **Sex - sexes have only small differences in their nutrient requirements.**
- **Reproductive state - level of egg production in hens & sexual activity in males.**
- **Ambient temperature - increased energy requirements to maintain normal body temperature in cold temperatures and the opposite in hot conditions.**
- **Housing system - housing system will influence the level of activity of the birds and therefore their energy requirements.**
- **Health status - disease conditions require an increase intake of some nutrients, commonly vitamins.**

Discussions.....

Questions, if any.....??

THANKS

UG Lecture: 2

Objective.....

- **Learn about the nutrient requirement for various swine rations.**

NUTRIENT REQUIREMENTS IN SWINE

Swine / Pigs require many nutrients for their maintenance, growth and production.

Carbohydrate Requirement

- ❖ **Pigs can utilize crude fibre to a lower extent.**
- ❖ **The utilization of fibre by the pigs depends on the age of and weight of pigs and characteristic of non-fibrous portion of the ration.**
- ❖ **For growing and finishing pigs 5-6% crude fibre level in their diet is recommended.**
- ❖ **In sows, 10-12% level of CF in diet can be well tolerated.**

Fat Requirement

- **When high fat diets are fed to pigs there is deposition of excessive fat inside the body.**
- **If this feed fat contains higher concentration of short chained fatty acids (ex. Soybean and groundnut) there is a production of soft pork which is not desirable.**
- **Pigs fed on rations containing 0.5% fat, make a satisfactory gain and stores normal amount of body fat.**
- **However, the practical level of fat inclusion is higher than this i.e. about 4%.**

Protein Requirement

- **In Swine/Pig feeding it is important to provide good quality protein in the ration.**
- **All essential amino acids should be present in right quantity and proper balance.**
- **Even if one essential amino acids is lacking or is in excess it will cause marked reduction in the feed intake which will affect the growth and production**
- **A combination of animal and vegetable protein in a pigs diet will provide all essential amino acids in proper proportion.**

Protein requirements of pigs express as % in the feed

S. No.	Class of Pig	% of protein in diet
1.	Pigs - preweaning/creep feed	18-22
2.	Weaned pigs	16
3.	Growing pigs '45 kg BW'	14
4.	Breed gilts	15
5.	Sows	14
6.	Breeding boars	14
7.	Lactating sow	15

Mineral Requirements

- If swine is fed on concentrates alone calcium is more likely to be deficient and if fed only on pasture, phosphorus deficiency results.
- The recommended calcium and phosphorus levels for swine diet are as ;

Category of pig	Weight	Ca %	P %
Growing & Fattening Pigs	(5-10 kg)	0.80	0.60
	(10-45kg)	0.65	0.50
	(45-90 kg)	0.50	0.40
Gilts & Sow bred		0.75	0.50
Lactating Sows		0.60	0.40

- ❖ **In practical swine ration it is routine practice to add 0.5-1% limestone and 0.5% di-calcium phosphate/bone meal.**
- ❖ **As per the NRC 0.5% common salt is recommended in rations of all classes and ages of pigs.**
- ❖ **Iodine need of pig is 0.2 mg/kg diet which should be supplied in the form of iodised salt.**
- ❖ **Requirement of copper is 6mg/kg diet.**
- ❖ **Requirement for Manganese is 10mg/kg diet.**
- ❖ **Requirement for zinc is 50mg/kg diet.**

Piglet anaemia “Thumps”

- ❑ **Seen in piglets, housed in concrete floors under intensive farming system.**
- ❑ **Anaemic piglets are listless and flabby with wrinkled skin and unhealthy looking hair coat.**
- ❑ **At birth, piglets contains 50 mg iron and daily requirement is 7 mg & about 1 mg is supplied in daily sow milk consumed by the piglet.**
- ❑ **So, deficit of 6mg/day will exhaust the body stores within a week if iron is not provided.**
- ❑ **This condition can be prevented by giving iron orally or by injections.**
- ❑ **Iron dextrose 100 mg on third day of birth followed by 50 mg on 21 day prevents anaemia.**
- ❑ **Painting the udder of the sow with a pate of ferrous sulphate causes intake of iron when the piglet suckles its mother and helps prevent thumps.**

Vitamin Requirements

- ❖ **Vitamin K is synthesized in the intestine of the pigs by micro-organisms in adequate amount and hence has no practical importance.**
- ❖ **Deficiency of B-complex may occurs under practical conditions in pigs raised on feeds like cereal grains without much inclusion of green forage.**
- ❖ **Liberal supply of good quality legume fodder hay, dairy products will take care of vitamins of B-series.**
- ❖ **Vitamin C is synthesized in the body and hence not of practical importance.**

Nutrient Requirement in Swine as per BIS (Bureau of Indian Standard)

Nutrients	Requirement		
	Starter/Creep feed	Growth meal	Finishing / Breeding meal
Moisture content (Max %)	11.0	11.0	11.0
Crude protein (Min %)	20.0	18.0	16.0
Crude fat (Min %)	2.0	2.0	2.0
Crude fibre (Max %)	5.0	6.0	8.0
Total ash (Max %)	8.0	8.0	8.0
Acid insoluble ash (Max %)	4.0	4.0	4.0
Metabolizable energy (Kcal/kg), Min	3360	3170	3170

Creep Ration

- **The practice of self feeding of concentrates to young ones away from their mother is called as "Creep Feeding".**
- **It is usually given in a separate enclosure which the sow cannot access.**
- **In pigs, it is given from second week of age.**
- **Creep feed should contain 19-20% CP and 3360 kcal/kg of ME.**
- **Major portion of creep feed should be of animal origin.**
- **The feed should contain appropriate quantity of vitamins and minerals.**
- **It should contain low crude fibre.**
- **Dry creep feed are called as pre-starter feed.**

Creep feed

S. No.	Ingredients	Parts
1.	Ground Yellow maize	40
2.	Skim milk	10
3.	Ground nut oil cake	10
4.	Sesame oil cake	10
5.	Wheat bran	10
6.	Molasses or jaggery	10
7.	Fish meal	6
8.	Brewers yeast	2
9.	Mineral mixture	2

NUTRIENT REQUIREMENT IN SWINE AS PER NATIONAL RESEARCH COUNCIL (NRC)

Nutrient requirement of Growing pigs

	Body Weight (kg)					
	3–5	5–10	10–20	20–50	50–80	80–120
Average weight in range (kg)	4	7.5	15	35	65	100
DE content of diet (kcal/kg)	3,400	3,400	3,400	3,400	3,400	3,400
ME content of diet (kcal/kg)	3,265	3,265	3,265	3,265	3,265	3,265
Estimated feed intake (g/day)	250	500	1,000	1,855	2,575	3,075
Crude protein (%)	26.0	23.7	20.9	18.0	15.5	13.2

Requirement of Barrows and Gilts

Body weight range	50–80 kg Body Weight					
Lean gain (g/day)	300	300	325	325	350	350
Gender	Barrow	Gilt	Barrow	Gilt	Barrow	Gilt
Average weight in range (kg)	65	65	65	65	65	65
DE content of diet (kcal/kg)	3,400	3,400	3,400	3,400	3,400	3,400
ME content of diet (kcal/kg)	3,265	3,265	3,265	3,265	3,265	3,265
Estimated feed intake (g/day)	2,750	2,400	2,755	2,400	2,755	2,400
Crude protein (%)	14.2	15.5	14.9	16.3	15.6	17.1

Body weight range	80–120 kg Body Weight					
Lean gain (g/day)	300	300	325	325	350	350
Gender	Barrow	Gilt	Barrow	Gilt	Barrow	Gilt
Average weight in range (kg)	100	100	100	100	100	100
DE content of diet (kcal/kg)	3,400	3,400	3,400	3,400	3,400	3,400
ME content of diet (kcal/kg)	3,265	3,265	3,265	3,265	3,265	3,265
Estimated feed intake (g/day)	3,280	2,865	3,280	2,865	3,280	2,865
Crude protein (%)	12.2	13.2	12.7	13.8	13.2	14.4

Nutrient requirement of Gestating sows

	Body Weight at Breeding (kg)					
	125	150	175	200	200	200
	Gestation Weight Gain (kg)					
	55	45	40	35	30	35
	Anticipated Pigs in Litter					
	11	12	12	12	12	14
DE content of diet (kcal/kg)	3,400	3,400	3,400	3,400	3,400	3,400
ME content of diet (kcal/kg)	3,265	3,265	3,265	3,265	3,265	3,265
Estimated feed intake (kg/day)	1.96	1.84	1.88	1.92	1.80	1.85
Crude protein (%)	12.9	12.8	12.4	12.0	12.1	12.4

Nutrient requirement of Lactating sows

	Sow Postfarrowing Weight (kg)					
	175	175	175	175	175	175
	Anticipated Lactational Weight Change (kg)					
	0	0	0	-10	-10	-10
	Daily Weight Gain of Pigs (g)					
	150	200	250	150	200	250
DE content of diet (kcal/kg)	3,400	3,400	3,400	3,400	3,400	3,400
ME content of diet (kcal/kg)	3,265	3,265	3,265	3,265	3,265	3,265
Estimated feed intake (kg/day)	4.31	5.35	6.40	3.56	4.61	5.66
Crude protein (%)	16.3	17.5	18.4	17.2	18.5	19.2

Discussions.....

Questions, if any.....??

THANKS

UG Lecture: 3

Objective.....

- **To know the nutrient requirements of horses in different physiological activities.**

NUTRIENT REQUIREMENT IN EQUINE

Energy

- ❖ **Is what horses use to do work.**
- ❖ **Energy requirements are influenced by age & work's degree & its duration.**
- ❖ **Mature mares in the first 2 trimesters of pregnancy require less energy.**
- ❖ **Young growing horses, horses at work & lactating should be supplemented with densified energy sources to meet their energy requirements.**

Protein

- **Horses use protein to synthesize various body tissues.**
- **Proteins are composed of amino acids of varying composition.**
- **Protein requirements vary for different classes of horses.**
- **Young, growing horses have a higher requirement for protein.**
- **Mature horses have a much lower requirement for protein young because it needs for maintenance of body tissue rather than growing new tissue.**

Minerals

- **Required for various purposes, serving as components of the skeletal system to maintaining nerve conductivity, muscle contraction and electrolyte balance.**

Vitamins

- **Vitamins A, D and E are the most common vitamins added to horse diets.**
- **Although B complex vitamins are synthesized in the large intestine of horses, including them in performance horse diets may be necessary.**

Factors influencing nutrient requirements in horses

- **Body weight of the horse or its size.**
- **Breed**
- **Age**
- **Physiological status of the horse - gestation, lactation, rate of growth**
- **Nature and intensity of work**
- **Body temperament**
- **Hair coat**
- **Fat insulation**
- **Environment – temperature, wind velocity and relative humidity**
- **Health status**
- **Vices of the horse**

NUTRIENT REQUIREMENTS OF EQUINE AS PER INDIAN STANDARD

Class	TDN (Kg/day)	Crude Protein %	Calcium %	Phosphorus %	Feed intake %, BW
Adult horses at rest	3.7	8.0	0.30	0.2	1.5
Pregnant mare (last 3 months of pregnancy)	4.2	10.0	0.45	0.35	1.75
Lactation (First 3 months)	6.4	12.5	0.45	0.35	2.75
Nursing Foal (3-5 months) Requirements in addition to milk	1.6	16	0.8	0.55	0.75
18-24 months	3.9	10.0	0.40	0.35	2.0
12-18 months	3.8	12.0	0.50	0.35	2.5
2 year old to maturity	3.7	9.0	0.40	0.35	1.75

Energy requirement of horses for various types of physical activity (In addition to maintenance requirement)

Physical Activity	Mcal / Hour / 45 Kg Body weight	TDN / Hour / 45 Kg Body weight
Walking	0.02	4.53
Slow Trot	0.23	54.36
Fast Trot and Cantering	0.57	99.66
Cantering and Galloping	1.05	240
Strenuous effort	1.77	403.17

NUTRIENT REQUIREMENT IN EQUINES AS PER NATIONAL RESEARCH COUNCIL (NRC, USA)

Requirements for Sedentary, Mature Horses of Different Body Weight

Size of Horse	Digestible Energy (Mcal/day)	Crude Protein (gm)	Calcium (gm)	Phosphorus (gm)
Maintenance (500 Kg)	15	600	18	13
Maintenance (550 Kg)	16.5	700	20	14
Maintenance (600 Kg)	18	750	22	15

Requirements for growth & different Production Stages (BW of 550 Kg)

Age of Horse (Weight/growth)	Digestible Energy (Mcal/day)	Crude Protein (gm)	Calcium (gm)	Phosphorus (gm)
6 months				
240 Kg/1000 g per day	15.5	750	39	22
12 months				
350 Kg/500 g per day	19	900	38	21
24 months				
470 Kg/200 g/day	19	850	37	20
Class of Horse				
Breeding Stallion	22	850	20	14
Broodmare				
Early Pregnancy	17	700	20	14
8 months pregnancy	18.5	850	28	20
11 months pregnancy	21	1000	36	26
Lactation (1st month)	32	1700	59	38
Lactation (3rd month)	31	1600	56	36
Lactation (5th month)	28	1450	40	25

Requirements for different working horses

Working Horse	Digestible Energy (Mcal/day)	Crude Protein (gm)	Calcium (gm)	Phosphorus (gm)
Light exercise	20	750	30	18
Moderate exercise	23	850	35	21
Heavy exercise	27	950	40	29

Discussions.....

Questions, if any.....??

THANKS