






- **POULTRY NUTRITION**

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- Increase in global demand for meat products
 - Consumption of meat will rise from 233 million t in 2000 to a possible 300 million t by 2020.
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In Turkey 600.000 people are working in poultry sector (2,4 m)

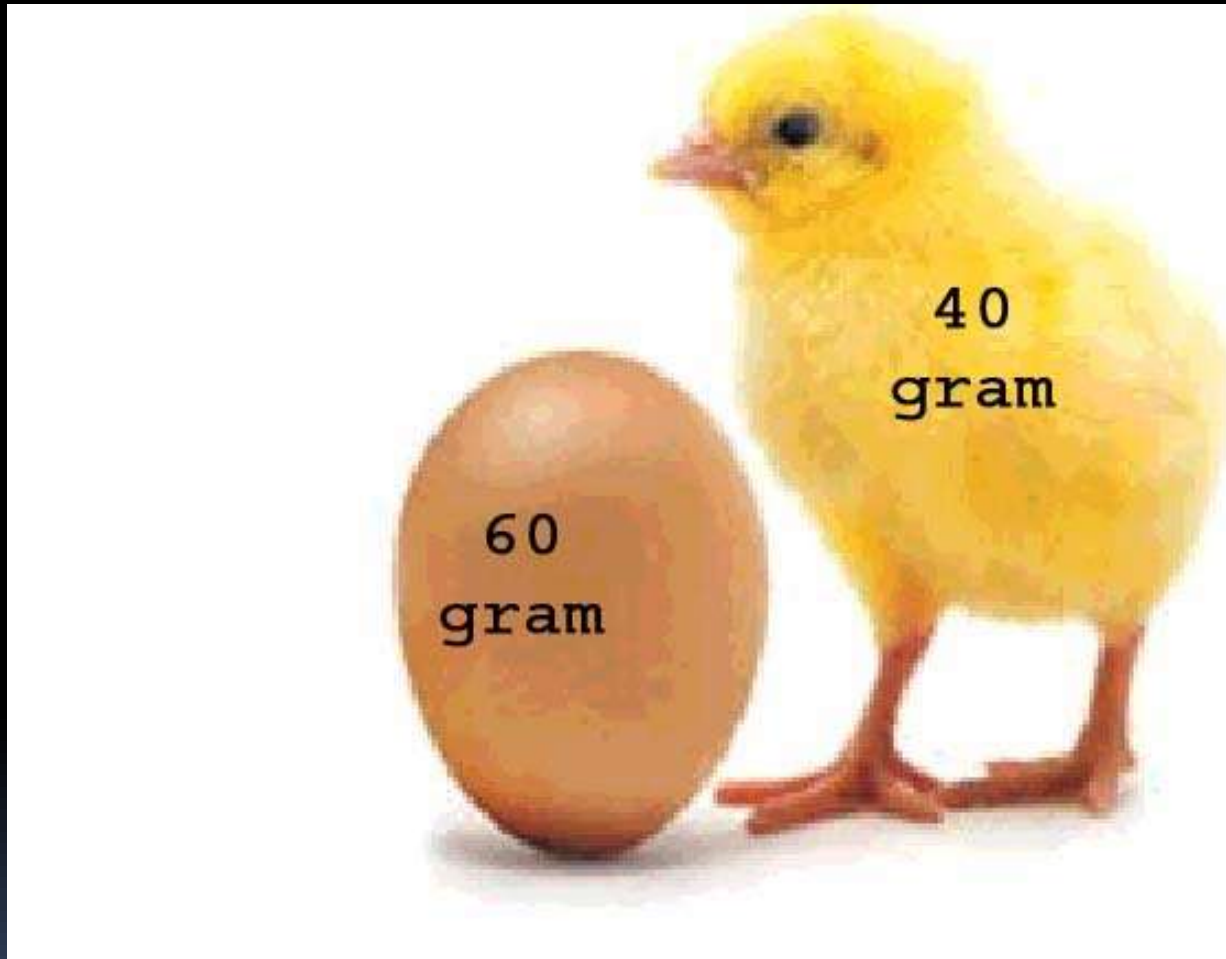
- Primary Breeders
 - Feed Mill
 - Breeders
 - Hatchery
 - Growout Farms
 - Processing Plants
 - Further Processing
 - Transportation and Marketing
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Broiler meat production in some countries

	2011	2012	2013*
USA	16.694	16.476	16.341
Chine	13.200	13.700	14.100
Brasil	12.863	12.750	13.005
EU-27	9.310	9.840	9.580
Mexico	2.900	3.160	3.420
India	2.906	2.945	2.950
Turkey	1.614	1.687	1.700

Meat consumption per capita in some countries (2012 - kg)

	beef	pork	chicken	lamb	Total
USA	38.4	27.3	43.2	0.0	108.9
Argentina	55.7	6.7	36.7	0.0	99.1
EU	15.7	40.7	18.1	2.6	77.1
Australia	35.4	21.4	35.4	0.0	92.2
Brasil	41.2	13.5	42.7	0.0	97.4
China	4.2	38.4	10.1	1.9	54.6
Indonesia	1.9	2.4	6.2	0.4	10.9
India	1.7	0.0	2.3	0.0	4.0
Japan	9.7	19.7	16.2	0.0	45.5
Turkey	10.7	0.0	19.3	1.5	31.5
New Zeland	28.0	11.1	30.1	0.0	69.2




Development in broiler production

- 1940: 85 day 1360 gr BW 4 kg feed
- 1970: 56 day 2 kg BW 2.25 kg feed
- 2015: 42 day 3.2 kg BW 1.58 kg feed

The role of genetic and nutrition in the progress of broiler performance

Character	Genetic %	Nutrition %
Increase in growth rate	85	15
Increase in meat production	91	9
Improvement in feed efficiency	62	38

EGG CONSUMPTION

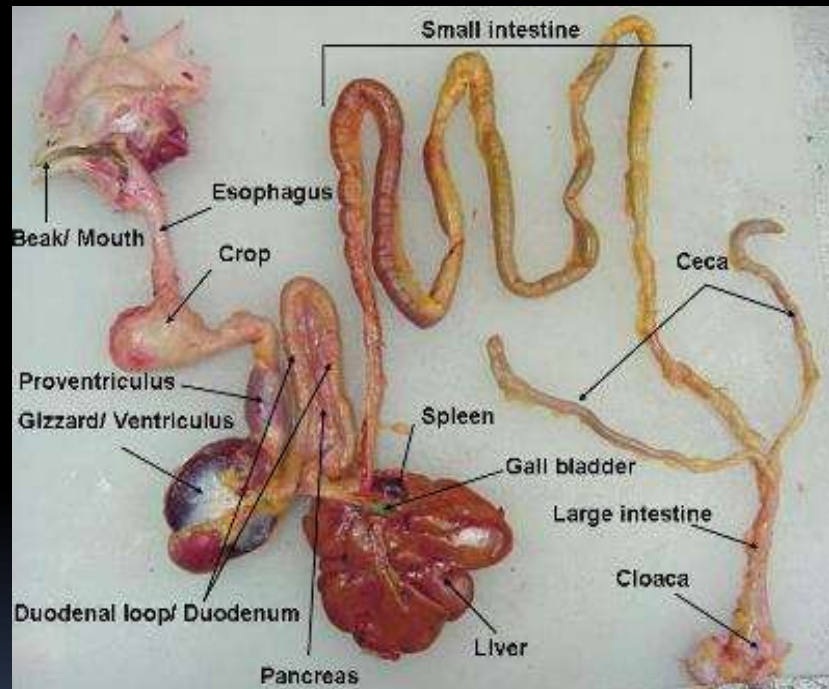
- Developed country  250-300
- In Turkey  200-220



- **DIGESTIVE SYSTEM**

Digestive System

- Understanding of the development and the function of digestive system in poultry is important for right and economic nutrition as well as animal health



Digestive System

- **Chicken's Body Length to the Digestive Tract ratio (1:4)**
- **Passage rate of the feeds 4-12 h**
- Short digestive tract and fast passage rate
- Feeds: contain easily digestible nutrients
- Not bulky feed
- Not fiber rich feed

Digestive System

Crop: No secretion, storage of feed

Proventriculus: Secretes hydrochloric acid

Gizzard: Crush or grind the feed (seed, grits)

Pancreas: Lies in the duodenum neutralizes the acid secretions of the proventriculus secretes enzymes that hydrolyzes protein, starches and fats

Small intestines: absorption part

Gizzard

Transit time and pH in poultry GIT		
GIT Segment	Transit Time(Min)	pH
Crop	50	5.5
Gizzard	90	2.5-3.5
Duodenum	5-8	5-6
Jejunum	20-30	6.5-7.0
Ileum	50-70	7.0-7.5
Colon	25	8.0

Source: R. Gauthier(2002)

- If gizzard size and activity level are increased at a younger age,
- -improve the digestibility of nutrients
- inactivate potential microbial pathogens
- increased retention time of feed- increased enzymatic digestion and starch digestibility

Nutrients requirements of poultry

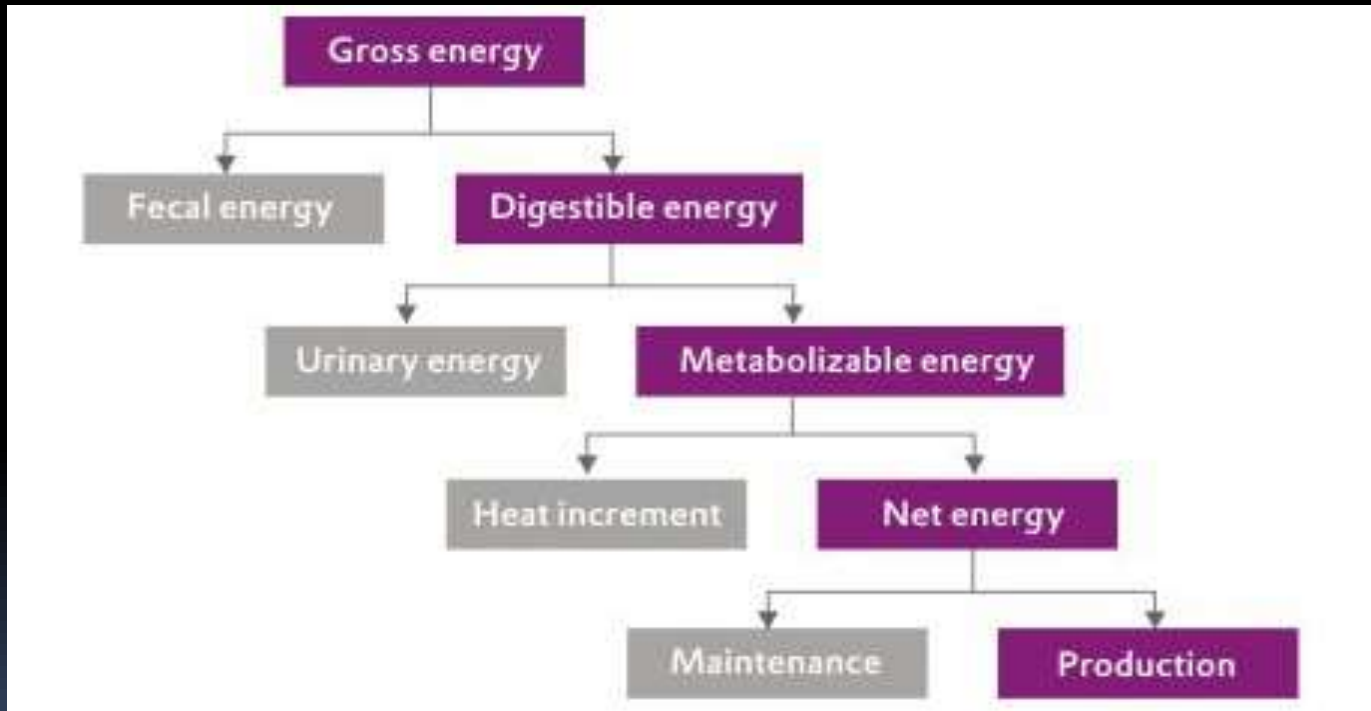
1-Energy requirement:

- Ration for poultry calculated on the basis of ME.

(bird's digestive and urinary tracts opens cloaca (vent) and feces and uric acid are excreted together)




Distribution of Energy as Biological Steps



1-Energy requirement

- **The Three Most Expensive Nutrients**
- **1. Energy**
- **2. Amino Acids (protein)**
- **3. Available Phosphorus**
- Energy costs make up about 75% of total cost of poultry production
- Formulating diets on basis of least cost per energy will result in the lowest feed cost per unit of gain.

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- Having limited crop and digestive capacities poultry can not meet their energy requirement for growth and egg production from the high fiber and low energy diets even if they increase feed intake.



not use fiber and hemicellulose

1-Energy requirement



High energy cereal grains are the principal energy sources.

Fat may be added at levels of 3-8% to increase dietary energy concentrations.



1-Energy requirement:

Factors affecting feed intake

1-Energy levels in the ration:


↑ energy level \Rightarrow ↓ feed intake

↓ energy level \Rightarrow ↑ feed intake

2-Environmental temperature:(SET, 16-24C)

↑ Temp. \Rightarrow ↓ feed intake

↓ Temp. \Rightarrow ↑ feed intake

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- Fat provides nine calories of energy per gram, while carbohydrates provide only four. corn oil, soy oil and canola oil. Common sources of supplemental fat in commercially produced poultry feeds include animal fat and vegetable fat
 - Fats are composed of smaller compounds called fatty acids.
 - Although there are many different fatty acids, poultry have a specific requirement for one—**linoleic acid**—so it must be included in the diet.
 - Fat must be present in the diet for poultry to absorb the fat-soluble vitamins A, D, E, and K. In addition to its role in nutrition, fat is added to feed to reduce grain dust. Fat addition also improves the palatability of feed (that is, makes feed more appetizing).
 - Fats, including those incorporated in feed, have a tendency to go bad, or become rancid. This is a year-round problem, but the risk of feed going rancid is even greater in the summer. To prevent feed from going rancid, antioxidants are added to poultry diets containing added fat.

1-Energy requirement:

Factors affecting feed intake:

3-Health of the bird

4-Genetics

5-Form of the feed

6-Nutritive balance of the diet

7-Stress

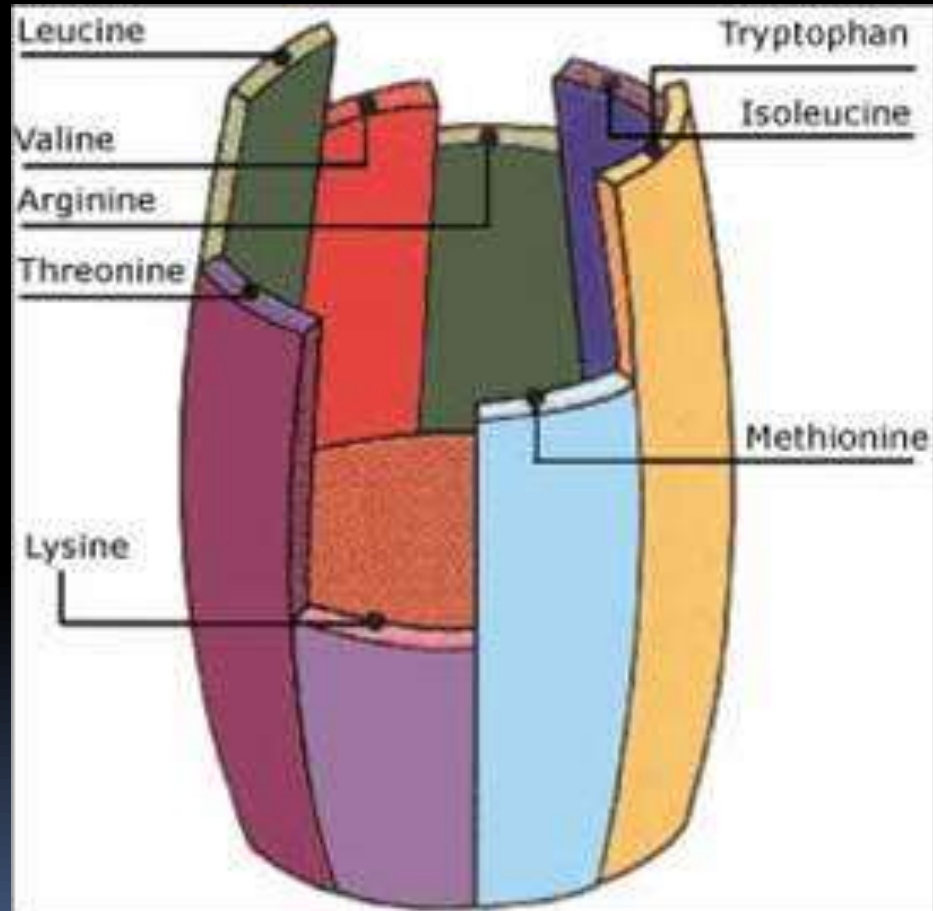
8-Body size



9-Rate of growth & egg production

2- Protein requirement

- The amount of protein required is proportional to the energy level in the ration.
- Poultry required the 14 essential AAs.
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- **Lysine and Methionine:** First two essential AA for poultry fed corn and soybean meal based diets
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Mitchel barrel



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- The main sources of protein in poultry diets are plant proteins
 - Soybean meal,
 - Canola meal,
 - Corn gluten meal and so on.
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3- Mineral requirements:

- The major minerals needed in poultry diets are Ca, P, Na, Cl

Calcium and Phosphorus:

- For broiler diets P:Ca= 1:1.2 (1:1 to 1:1.5)

For laying hen diets: 1:4 (Ca important egg shell formation)

Ca sources: Limestone

P source: DCP

Phosphorus-Phytate-Phytase Enzyme

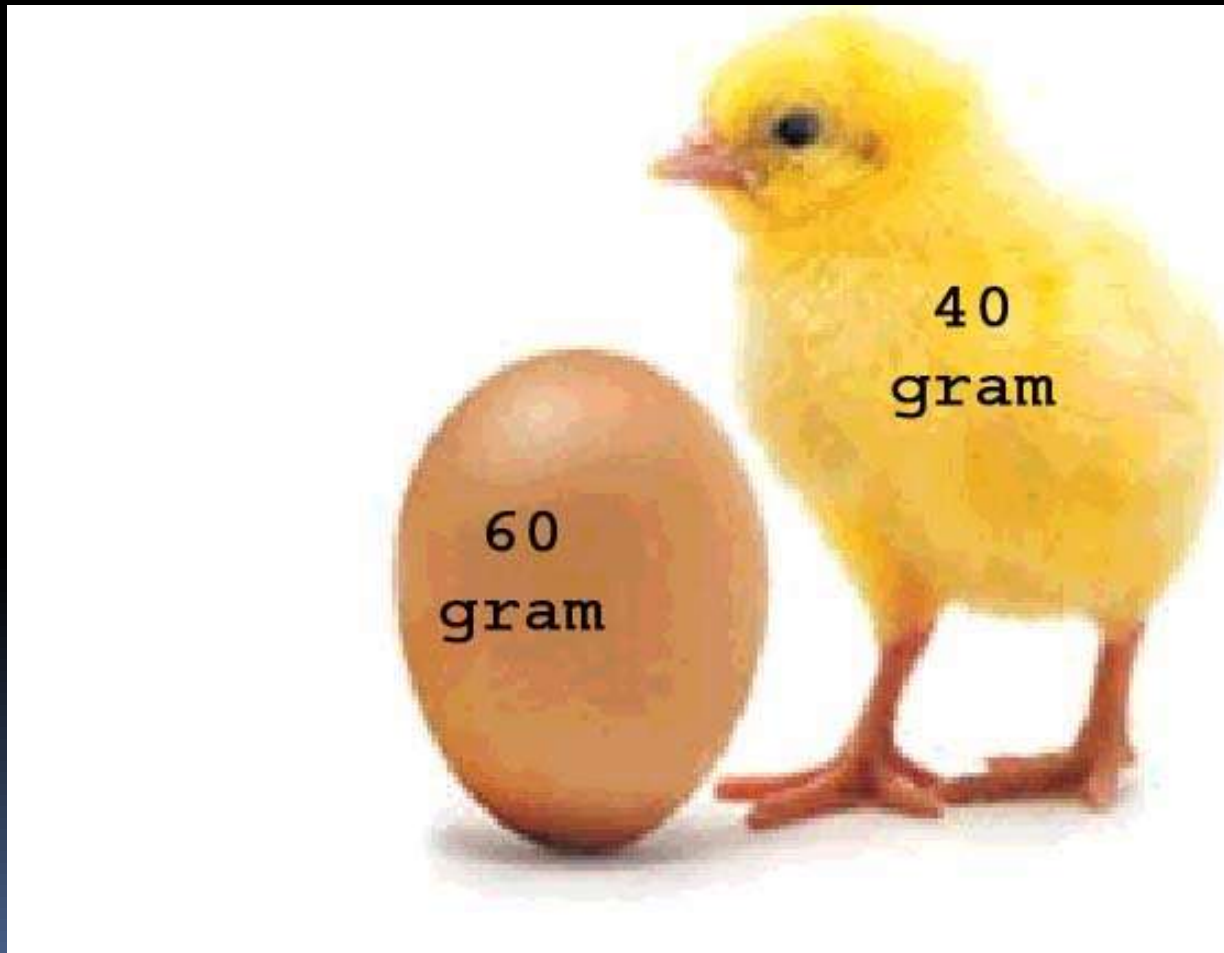
- Phosphorus in grain such as corn, wheat soy is bound in **phytic acid** only 30-40% is available for poultry.
- Phytase enzyme in poultry diets:
 - Increase phytate P availability
 - Decrease environmental pollution (reduce P excretion)
 - Improve CHO, protein, Ca and other mineral utilization
 - Allow to prepare economical rations
- **IMPROVE WEIGHT GAIN, FEED INTAKE AND FEED EFFICIENCY**

B- Salt (NaCl):

common salt (0.5-1% of diet)

- The amount added depend upon the feed ingredients.
- The recommended level in the ration 0.5-1% of the ration.
- Adult poultry can tolerate much higher inclusion but the water consumption increased.

FEEDING OF BROILERS



LIFE SPAN, week

- **Broiler**

- 0 ----- 2 ----- 5 ----- 6

- broiler chick broiler chicken preslaughter

DEVELOPMENT IN BROILER PRODUCTION

- 1940: 85 d 1360 gr body weight 4 kg feed
- 1970: 56 d 2 kg body weight 2.25 kg feed
- 2012: 42 d 2.8 kg body weight 1.65 kg feed
- 2015: 42 d 3.0 kg body weight 1.55 kg feed

The Role of Genetic and Nutrition on Improvement of Broiler Performance

Performance parameters	Genetic %	Nutrition %
Improved growth rate	85	15
Increased carcass yield	91	9
Improved feed conversion ratio	62	38

FEEDING OF BROILERS

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Feed intake (g or kg)}}{\text{Weight gain (g or kg)}}$$

Factors affecting feed conversion:

- 1-Type of feed
- 2-Strain of the birds
- 3-Environmental temperature
- 4-Age and weight of the birds
- 5-Diseases
- 6-Rodent & flying bird control in feeding area
- 7--Feed wastage
- 8-Form of the feed

NUTRIENT REQUIREMENTS

- <https://www.nap.edu>
- en.aviagen.com
- www.hubbardbreeders.com
- www.cobb-vantress.com

FEEDING OF BROILERS

Age / Nutrients	Protein (%)	ME (Kcal/kg)
Starter ration (0-3 weeks)	22-24	2800
Grower ration (3-5 weeks)	20-22	3000
Finisher ration (5-7 weeks)	18-20	3200

Feed preparation

- Commercial feeds for poultry as mash, pellets or crumbles.
- Less wastage when using pellets or crumble and poultry grow faster and more commonly used for broilers and turkey than for laying hens (laying hen tend to become too fat unless they are on the restricted feeding program).




Feed Form and Physical Feed Quality

- Broiler growth and efficiency of feed use will generally be better if the Starter feed is crumbs or mini-pellets, and the Grower and Finisher feeds are pellets.
- Depending on pellet size fed, it may be necessary to provide the first delivery of Grower feed as crumbs or mini-pellets.



Feed Form and Physical Feed Quality

- Poor quality crumbs and pellets will reduce feed intake and performance.
 - On the farm, attention should be given to reduce breakage of crumbs and pellets during handling
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Feed Form



Pelet feed



Crumble feed




Mash feed

Form of Feed by Age in Broilers

Age	Feed Form	Size
0-10 days	sieved crumbs or mini-pellets	0-10 days 1.8 -
11-20 days	pellets	2.8-3 mm
21-30 days	pellets	3.0- 3.5 mm
25 days to processing	pellets	3.5 mm \varnothing



Early Nutrition

- Important to reach feed and water as early as possible after hatching
 - -Immunity
 - GIT development
 - Performance
- 




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FEEDING OF LAYING HENS

FEEDING OF LAYING HENS

	Starter	Grower	Finisher 1	Finisher 2
Age in days	0-10	11-22	23-30	>30
ME/kg	3000	3050	3150	3200
CP %	22.5-23	20	19	17.5

LIFE SPAN, (Week)

- chick
- 0 ----- 6 ----- 12 ----- 20 layer pullet
grower developer
- 20 ----- 42 ----- 62 ----- 76
layer 1. Phase layer 2. Phase layer 3. Phase
- After 76 weeks: a-slaughter b- molting

FEEDING OF LAYING HENS

Nutrient requirements of laying hens:

1-Energy requirement:

- For maintenance (2kg wt.) = 220 Kcal
- For 70% production = 130 Kcal
- For 1 g gain/day = 3 Kcal
- The usual energy conc. is 2800 kcal ME/kg diet

FEEDING OF LAYING HENS

3-Mineral requirements:

A-Calcium:

- Laying birds need large amounts of Ca because egg shells composed entirely of CaCO_3
- ↓ Ca in laying ration \Rightarrow ↓ egg production & egg shell weak.



FEEDING OF LAYING HENS

Phase-feeding of laying hens:

To adjust nutrient intake in accordance with the rate of egg production

A-Phase I (most critical period):

During 20 W period (22-42 W of age) :

- 1- ↑ egg production from zero to peak (85-90% production).
- 2- ↑ body weight from 1300 to 1900 g.
- 3- ↑ egg size from 40g/egg at 22W to over 56g/egg at 42W of age

FEEDING OF LAYING HENS

B-Phase II :

- Period after 42W of age when the hens attained mature body weight
- The period ranged from 42-72W of age.

Effect of temp. on egg shell:

- Hot weather \Rightarrow \uparrow respiration rate \Rightarrow \uparrow CO_2 loss \Rightarrow \downarrow blood bicarbonate level \Rightarrow \downarrow egg shell formation

Nutrition and egg quality

A-Egg size (egg weight):

Factors affecting egg size:

1-Level of protein in diet:

- 14-20% CP rations
⇒ balanced AAs ⇒ heavier eggs

• 2-Energy intake

3-Mineral & vitamin levels:

- ↑ Ca & ↓ vit.D ⇒ ↓ egg weight

4-Level of linoleic acid:

- Linoleic acid ⇒ formation lipoprotein in liver ⇒ ovary uptake by ova ⇒ higher egg weight

5-Strain

RESTRICTED FEEDING


Broiler breeder

Laying hen

- Chickens bred for meat production grow rapidly & reach sexual maturity at early age
⇒ too many small egg = not good for hatching.
- and = not good for selling
- Bird kept for breeding purposes, it is necessary to slow down their rate of growth & development of sexual maturity.



Methods used:

- 1-Restricting feed intake to approximately 70% (when pullets at 7-9 weeks till 23 weeks), or
 - 2-A skip –a-day program involves full feeding six days in a week at 7 day 8-10 g whole grain (generally oat) per bird.
 - 3-Feeding a diet containing 10% protein.
 - 4.Reducing amino acid levels in diet
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Mineral requirements:

- The major minerals needed in poultry diets are Ca, P, Na & Cl.
- Trace minerals may be added as mineral premixes

A-Calcium & Phosphorus:

- The recommended ratio Ca:P in diet of poultry is 1.2:1 (range 1:1 to 1.5:1)

For laying hen 1:4 (Ca important for bone & shell formation)


- \uparrow Ca in diet \Rightarrow \downarrow utilization of Mg, Mn & Zn.
- Inorganic P have a higher availability than organic P
- All P from animal origin & 40% from plant origin (wheat bran & rice bran) is available.

B- Salt (NaCl):

- The amount added depend upon the feed ingredients.
- The recommended level in the ration 0.25-0.5% of the ration.
- Adult poultry can tolerate much higher inclusion but the water consumption increased.




HEAT STRESS

- Wings held outwardly
 - Increase in water consumption
 - Decrease in activity levels
 - Decrease in feed intake
 - Panting
- 



Diet Formulation - Energy

- Increase energy from fats
 - Lower heat increment of the diet
 - Reduce total heat load
- 



Diet Formulation

- Increase vitamin C
 - Improved shell quality in layers
 - Improved broiler growth
 - Use vitamin E
 - Improved immune response
 - Fewer disease incidences
 - Less downgrading of carcasses
- 