



Learning Module 4

Attending to poultry husbandry, health care and bio security practises (broiler production, nutrition, water, ventilation and record keeping)



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Nutrition, Environmental Control and Role of Water

Introduction

The cost of feed is by far the largest portion of the production cost of broilers; the efficient use of feed by the chicken will therefore determine to what extent a broiler operation will be successful. For example say the total cost to produce 1kg of live weight amounts to R10/kg then the cost of only the feed alone will be R7.00. Factors that cause feed not being used by the bird to grow and to put on weight, for example a disease, will lead to an increase in feed cost.

The purpose with the information in this chapter is to enable you to have an understanding of the following:

-  What must be provided by feed so that the chicken can grow at an optimal rate.
-  To provide and manage conditions that has a positive effect on growth rate. This could for example, be ideal house temperatures or a healthy flock.

What must the feed provide? Nutrients!

The body of a chicken consists of millions of cells in the various organs. Nutrients are substances that are incorporated by cells to increase in number and size. This process is known as growth.

Compounds in the feed, for example starch or proteins or fat, have to be digested to make the nutrients available for absorption. Digestion thus means breaking down into absorbable substances, such as glucose, amino acids or fatty acids.

Essential knowledge: nutrients	Feedstuffs used as sources of nutrients in broiler diets
Glucose is a nutrient. It is the source of energy for the chemical reactions inside body cells. Glucose is the main component of starch and is the end product after digestion of starch.	Yellow maize is the main source of starch. Soya beans also contain some starch.
An amino acid is a nutrient. Chains of amino acids form the various proteins in tissues of the body. A particular protein, for example, in muscles, can have as many as 20 different amino acids in the chain with some occurring more than once in the chain ¹ read the footnote.	Soya bean meal ² is the main source of proteins (amino acids) in feed. Yellow maize also contains a small amount of protein. Thus digestion of proteins renders amino acids.
Vitamins are nutrients. Their functions are to act as facilitating agents in all chemical reactions inside body cells. (Without the presence of vitamins glucose cannot be used as source of energy or amino acids cannot bind into a chain to form a protein.)	Pure vitamins are included as a premix. All the necessary vitamins are thus present in feed in the correct quantities to meet the bird's requirements.

¹ Examples of proteins are the following: haemoglobin in red blood cells, gelatine in meat, albumin in egg white, myosin in muscle. Thousands of proteins can be found in the body performing various functions.

² Soya bean oil cake meal is produced by pressing whole soy beans to extract the oil.

Formulation of diets: Energy and Amino acids

The nutritionist at the feed mill has information on nutrient requirements for broilers at various ages and also of the nutrient composition of the feedstuffs (maize, soya and other protein sources). The feedstuffs are then mixed in the correct quantities to meet the broiler's requirement. The chicken's requirements for nutrients change with age. More amino acids in relation to energy are needed by young birds for the formation of body proteins than by older birds. With age the requirements change and this is the reason why different feeds have to be given.

The nutritionist also changes the ratio of feedstuffs in the diets of the broilers as they increase in age: the amount of maize increases relative to soya to increase the energy content and to decrease the protein level in the feed by including less soya bean oil cake meal. This is why a range of diets, for example pre-starter, starter, finisher and post-finisher, during the rearing period is being fed.

Feed structure also changes with age: day-old chickens cannot swallow a 3mm pellet and are therefore given crumbs for approximately a period of ten days. The reason for feeding crumbs or pellets is to ensure that very fine substances such as vitamins or minerals will be consumed in the right quantities to ensure optimal growth.

Formulation of diets: Vitamins and Minerals

Vitamins are essential elements to ensure that the many chemical reactions inside body cells can take place. These chemical reactions include processes such as: Formation of muscle tissue (in other words growth of the body). Formation of strong bones of the skeleton, see Figure 1 . Formation and maintenance of cell membranes to prevent bleeding of brain tissue see, Figure 1.

Minerals include calcium and phosphorus as the main elements of bone and thus give strength to the skeleton as framework for muscle attachment. Other minerals include zinc, manganese, iron and many others. They are required only in very small quantities and their functions are very similar to those of vitamins, for example to take part in various reactions such as the prevention of slipped tendons, see Figure 2.



Crooked breastbone due to a Vitamin D deficiency in the feed



Bleeding in brains removed from birds caused by vitamin E deficiency in the feed

Figure 1. Left: Crooked breastbone due to vitamin D deficiency. Right: Symptoms of vitamin E deficiency in a chicken, note the bleeding in brains removed from chickens showing vitamin E deficiency symptoms.

Figure 2. Embryos without legs due to zinc deficiency. On the right is a chicken with deformation of the leg and slipped hock tendon, this condition is known as perosis and is the result of a manganese deficiency in the feed.



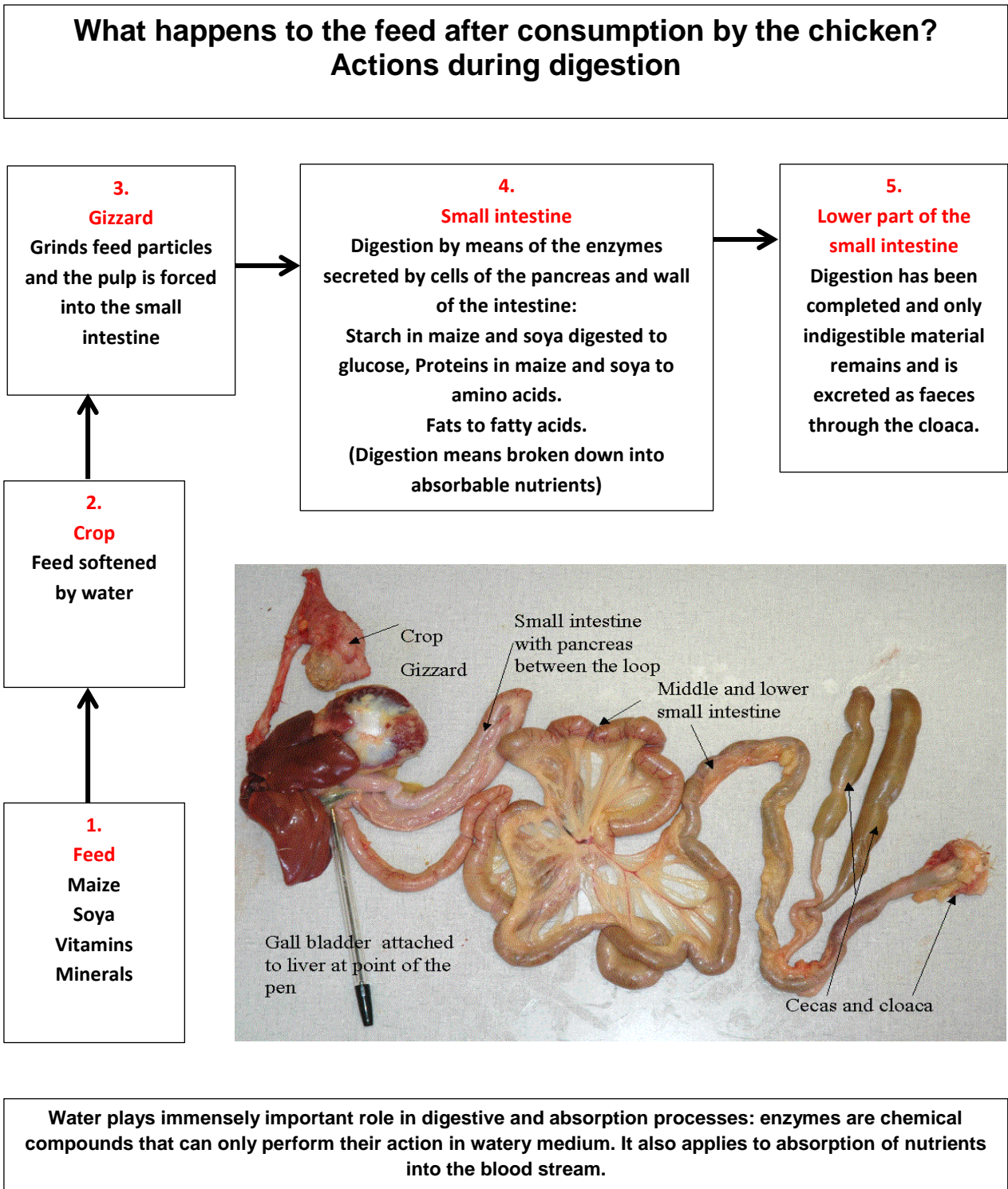
Vitamins are normally covered with a gelatine coating to protect them from destruction by oxygen in the air. In feed the vitamins can be destroyed by mould growth. Mould also needs vitamins to grow and feed that has become mouldy would therefore be deficient in certain vitamins. It is thus important to ensure that feed bins are water-tight to prevent mould growth and that vitamins will retain their potency in mixed feed.



Figure 3 Mould-growth inside a feed bin.

Lumps of feed due to fungus growth in a feed bin that was not properly sealed against rain water.

Figure 4 The digestive process in chickens



The digestive system: Enables the broiler to grow and increase in weight

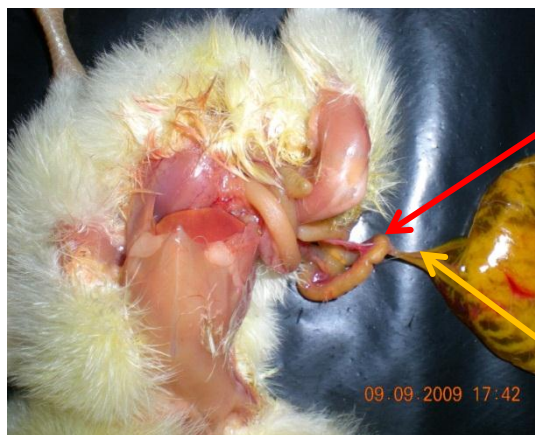
- The body of the chicken consists of millions of cells that have to increase in size and in numbers.
- Absorbed nutrients from the feed provide the building blocks (amino acids) to form cells and the enlargement of cells in: muscles, lungs, heart, skin, bones of the skeleton, feathers, blood cells etc.
- Digestive system consists of muscle tissue and thus depends on nutrient supply to develop its function: to produce enzymes to digest feed and to absorb nutrients.
- Glucose provides the energy to enable the digestive system to perform its functions.

The importance of early feed intake by the day-old chicken

The capacity of the digestive system in a day-old chicken is limited and will only increase if the chicken consumes feed that enables the digestive system to grow and also to provide other organs with essential nutrients. Ideal conditions to stimulate feed intake is most important to ensure a healthy and uniform flock:

1. The yolk sac contains antibodies deposited by the hen that protects the day-old chicken against disease causing organisms in the environment.
2. The flow of yolk material into the chicken's body is stimulated by feed in the digestive tract.

The sooner these antibodies can be taken up into the system of the chicken the better are the chances that the day-old chicken is protected.



Red Arrow:
Blood vessel to
the blood system

Yolk sac connected to the small
intestine by means of a tube,
known as the diverticulum of
Meckel.

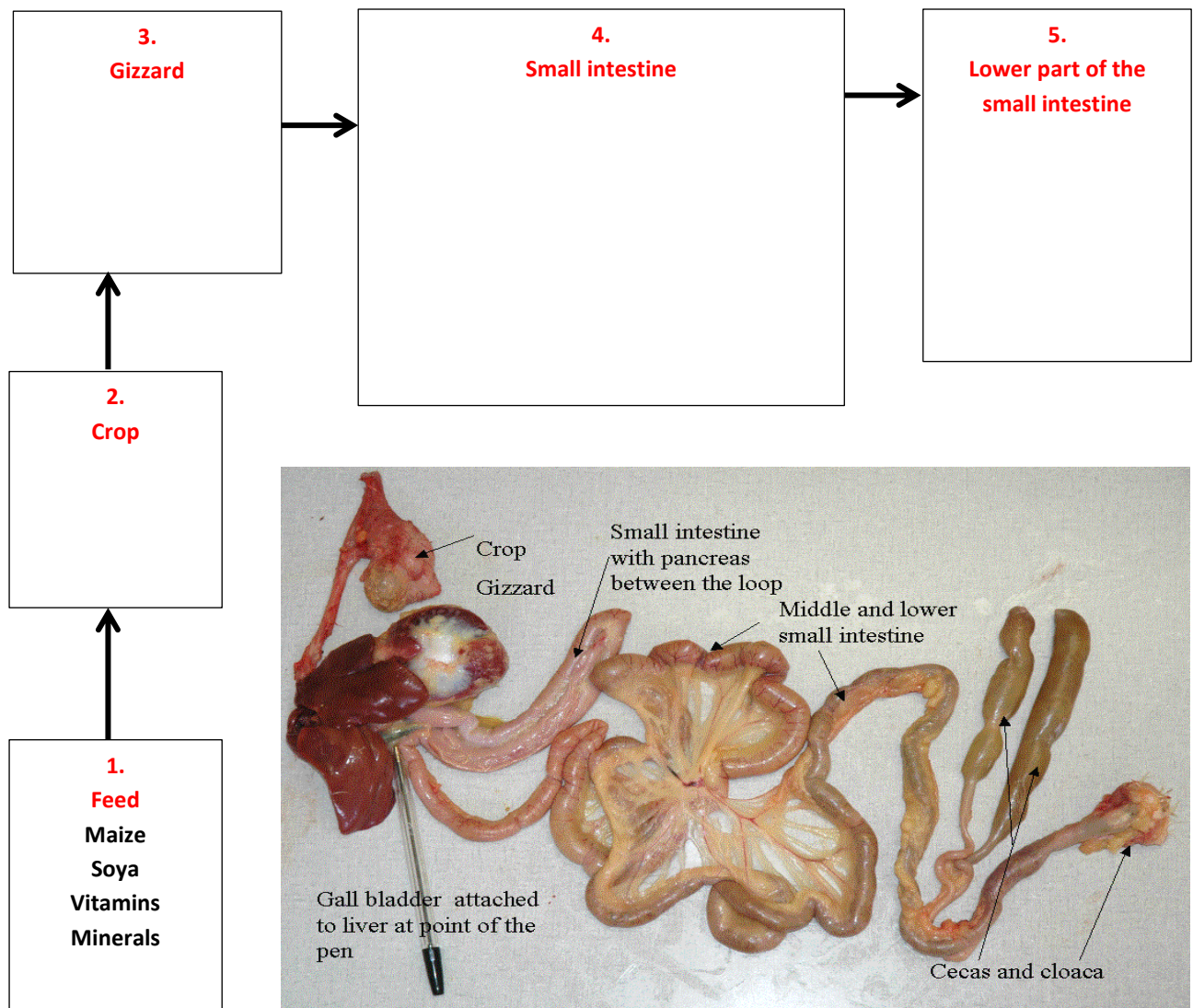
3. As many as possible day-old chickens should start eating as soon as possible after placement to ensure uniformity in weight: Crop scoring after eight hours should indicate that 80% of chickens have feed in their crops and after 24 hours the figure should be 95 – 100%.

The ideal conditions to stimulate feed intake:

1. Temperature warm enough to stimulate chickens to move around and eat from the paper strips or pan feeders and the water lines.
2. Cool enough to prevent sleepiness and panting.
3. Uniform of temperature distribution and no cold draughts.
4. Water and feeder lines within access of the smallest chickens to allow them to drink and eat.
5. Sufficient space on paper strips to prevent crowding.

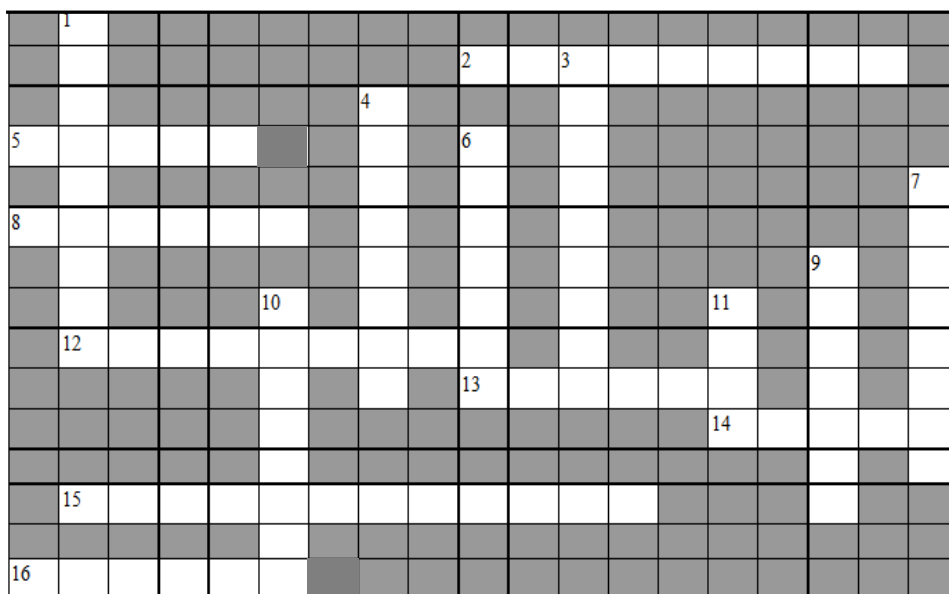
Note to the Learner. Revision on the fate of nutrients after feed consumption. Complete the diagram of the digestive process. See how far you can get without referring to the notes. Should you find you are unable to complete the diagram, read through the section again. If you do not understand the section please discuss this with your supervisor or facilitator.

**What happens to the feed after consumption by the chicken?
Actions during digestion: Complete the blank spaces.**



What is the function of water in the digestive process?

Test your memory challenge number 1 Nutrients and Digestion



Clue Across	Clue Down	
	1	The process by which feed is broken up to make the nutrients available
	3	The mineral that is needed by the chicken to prevent bone deformation, a condition known as perosis.
	4	Substances in body tissues that consist of chains of amino acids
	6	The nutrient that can be utilized by the chicken as source of energy.
	7	The framework of bones to which muscles attach.
	9	This nutrient is a mineral and utilized in the formation of strong bones
	10	These nutrients are essential agents to facilitate chemical reactions inside body cells
	11	The oil cake meal from these beans is an important source of proteins for broilers
2		This product is added as a source of calcium in broiler diets.
5		The building blocks of organs in the body
8		This substance is made by plants and renders glucose after digestion
12		The general term that is used for the substances after digestion of feed in the small intestine.
13		The driving force of chemical reactions inside body cells.
14		These acids are the end products of protein digestion
15		A person at the feed mill that does the formulation of poultry diets
16		The type of structure of the feed for day-old chickens

Note to the learner. Memory challenge number 1 is based on information you have learned so far on the nutrients and digestion. See how far you can get without referring to the notes. If you find that you not able to complete the challenge a suggestion is to read through the notes again slowly and carefully. Should you find you are unable to understand some of the concepts then you need to discuss these with your supervisor or facilitator.

Role of environmental control in poultry husbandry.

Environment includes the following aspects:

1. Temperature of the surrounding air in the broiler house.
2. Moisture content of the surrounding air in the broiler house.
3. Dust content of the surrounding air in the broiler house.
4. Carbon dioxide and carbon monoxide.
5. Light intensity (illumination) in the broiler house.
6. Ventilation (air movement).



Knowledge Box

1. The normal body temperature of a chicken is 42°C
2. The body heat originates from chemical reactions associated with physical actions such as:
 - pumping of blood by the heart muscles
 - contraction of abdominal muscles for respiration
 - contraction of intestinal muscles during digestion,
 - Growth of tissues: body cells increasing in size.
3. Chemical reactions uses glucose as an energy source.

Temperature of surrounding air.

- ⚠ Importance of a comfortable surrounding temperature. The heat produced during muscle actions or chemical actions is an on-going process in young and adult birds. Thus if heat is not lost at the same rate as being produced the body temperature will increase and the bird will die.
- ⚠ At normal environmental temperatures, for example 25°C, the bird is able to lose heat (mainly from the skin) to the surrounding air at the same rate as which it is being produced.
- ⚠ At high environmental temperatures, more than 30 °C, the body temperature will start to increase. This is because the air does not absorb heat fast enough to enable the chicken to maintain a normal body temperature. The birds will start panting to lose heat by means of evaporative cooling from the respiratory tract. (More about this a little later).
- ⚠ At low environmental temperatures the bird will lose more heat than what is being produced by the chemical reactions inside the body cells. Human beings will start shivering. It means some muscles are contracting and heat is being generated. The same happens in chickens: although not clearly visible they shiver; they use glucose to obtain energy and feed intake increases. We know from experience that feed conversion is poor in cold weather because as lot of the energy is used for shivering during the cooler climate.

The heat loss from the body under different temperature conditions will be illustrated on the next page. Effect of the surrounding air temperature on heat loss from the body:

Three situations in air temperatures are illustrated in Figure 5: in A at 15°C, B at 25°C and C at 35 °C. It is assumed that the floor temperatures are the same as air temperatures.

Size of the arrows indicates the heat loss from the chicken at various air and bedding temperatures.

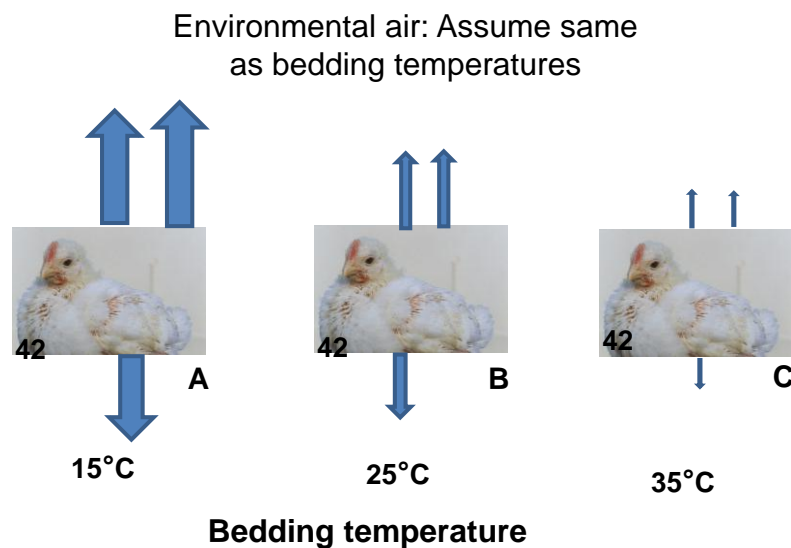


Figure 5 The effect of air temperature on body heat loss by a chicken



In the first illustration, A, there is a big difference between the body of the chicken at 42°C, and the temperature of the surrounding air and bedding temperature at 15°C. It stands to reason that the chicken is going to lose a lot of heat to the environment; they will start shivering to increase heat production. (The flow of heat is like water, from a high to a low level.) The second illustration, B, is a condition at an environmental temperature of 25 °C, which is a comfortable temperature for a chicken. At this temperature heat loss will be in balance with heat production. The chickens will not pant nor will they shiver to keep warm, they will be comfortable and will feed and drink normally. In the third illustration of Figure 5 shows an environmental temperature of 35°C.

Under such conditions chickens are not able to lose sufficient heat to maintain a constant body temperature. Their temperature will increase beyond 42°C. They start to pant; they increase their respiratory rate to evaporate moisture from the wet surfaces of the respiratory tract. Evaporation of moisture cools those surfaces and also the blood circulating through those areas.

Role of moisture levels in poultry husbandry

1. Role in ammonia formation in bedding.
2. Role in body temperature regulation of chickens.

Development of ammonia

Wet bedding causes the development of ammonia. Ammonia is a gas that has serious negative effects on the wellbeing of broilers and poultry in general, these include the following:

Ammonia causes skin burn under the feet of broilers and this prevents them to feed and drink and weights are poor. Ammonia causes cracks on the inner lining of the respiratory tract and makes it is easy for disease causing organisms to infect it.



*Picture on left: Skin burn under the feet.
Right: Normal and damaged lining inside respiratory tract due to ammonia.*

Moisture in bedding originates from the following sources:

Excreted with faecal matter which has a 80% water content. Water is however essential to enable the bird to excrete faeces and it thus makes a very big contribution to the moisture content of bedding, especially towards the end of the rearing period. Leaking water nipples can also make a big contribution and care should be taken to replace leaking nipples as soon as possible.

The removal of moisture from bedding can only be done after it has evaporated into the air and then removed by ventilation. Factors affecting the evaporation of moisture are temperature and the prevailing moisture content of the air in the house. At low temperatures, for example in winter, air cannot hold much moisture and it is difficult to dry the bedding.

In the post-brooding stage, especially in winter, it should be avoided to have fans running on low-speed or minimum ventilation settings at night. This leads to cold temperatures and very little moisture is removed. The turning of litter is most important because it exposes the underlying wet material to air and will thus speed-up evaporation.

High moisture in the air makes it difficult for chickens to cool themselves in hot weather

If the loss of body heat to the environment is insufficient to prevent the body temperature from increasing beyond 42 °C, the chicken starts to pant. This enables the chicken to lose heat by means of the evaporation of moisture from the wet linings in the respiratory tract. In some parts of the country, close to the sea or large rivers and direction of the wind, summer temperatures are accompanied with high moisture content in the air. It is then said the *relative humidity is high*. Under such conditions the chicken is unable to lose heat by means of the respiratory system and mortalities

often occur. The use of cooling pads in summer creates more comfortable conditions for broilers and layers. Hot air is cooled when pulled through the wet pads and birds are able to survive. The efficiency of cooling by the cooling pads is determined by the humidity of the outside air. The lower the moisture content, the more can evaporate and the lower the temperature will be of the air that enters the building through the cooling pad.

Dust content in the air of the broiler house

High levels of dust in the air inside the broiler house can have negative effects on broilers. The dust accumulates on the wet linings inside the respiratory tract and bacteria on dust cause widespread infections. It has been estimated that dust can contain between 200 000 and 800 000 bacteria per gram. Bacteria, known as *E. coli*, are the main cause of such infections and they are able to reproduce themselves every 20 minutes under moist and hot conditions, such as the inside of the air sacs.

Bedding management

The condition of bedding is one of the most important factors that contribute towards good health and production of poultry. It must not be too dry, as the bedding is dusty, or too wet which will cause high levels of ammonia. The ideal is a situation where the bedding contains just enough moisture to limit dustiness. A practical method to evaluate the correct consistency of the bedding is when a handful is compressed it should form a lump that crumbles slowly when released.

Wet bedding

It is most important to realise that the removal of moisture (water) in bedding is only possible if the water evaporates and the vapour is removed by ventilation. Thus the purpose of turning the bedding (to *do!*) is therefore to expose the underlying material to the air so that water can evaporate and the vapour taken up by the surrounding air.

Factors determining the efficiency of evaporation of moisture from bedding:

- The temperature of the air inside the building. We all know that washing does not dry easily in winter. That is because cold air cannot hold a lot of moisture before it is saturated. In winter the problems of wet bedding (and thus high levels of ammonia in the air) is greater than in summer. It is therefore most important to set the ventilation to allow for the air inside the building to increase in temperature from heat given off by the birds. Low levels of minimum ventilation during the night will lead to low temperatures and wet bedding.

It is better to have short spurts of fast air movement to allow for proper mixing of air and then to stop ventilation and allow temperatures to increase before the next cycle of ventilation. This system can unfortunately not be practiced in houses with curtains that have not also been fitted with fans for mechanical ventilation.

- The moisture content of the air outside the building. In areas of naturally high humidity will make difficult to remove a lot of moisture from the bedding material because the air has a

limited ability at a particular temperature before becoming saturated³ with moisture.

Effect of carbon dioxide and carbon monoxide on growth rate

Carbon dioxide is exhaled by the chickens and carbon monoxide is formed by malfunctioning gas-heaters. These gases when they accumulate in the chicken house due to poor ventilation will cause sleepiness and chickens become very inactive.

Some of the modern chicken houses have gauges that measure the concentration of these gases in the air and fans will be activated automatically to increase the ventilation rate. However, if such equipment is not available a good stockman will be able to correct the situation by increasing ventilation from previous experience, although he or she might not even know exactly what had caused the inactivity in the chickens.

Effect of light on broiler growth

During early brooding, first seven days, most companies would supply a 23 hour light period with a fairly high intensity, ± 35 lux. The reason is to enable chickens to find the feed and water easily and to adapt to the environment.

After seven days of age the general practice is normally to supply a rest period of four to six hours darkness until three days before slaughter. Broilers are able to adapt to the dark periods and change their feeding pattern and they fill their crops before the lights go out.

During the rest period the digested feed is used more efficiently for growth because they don't spend energy to move around. Leg abnormalities and skin scratches are also less than in birds with short rest periods for example one hour darkness.

During the last three days before slaughter the light period is often increased to 23 hours light to maximize body weight.

A very important aspect regarding the supply of light to broilers is to ensure that all bulbs or tubes are providing light. When this is not the case the broilers will move to the brighter lit areas and crowding around the feeder and water lines. This in turn cause wet bedding and ammonia formation that give rise to problems such as ammonia burn of the skin under the feet and infections in the respiratory tract of chickens.

Ventilation

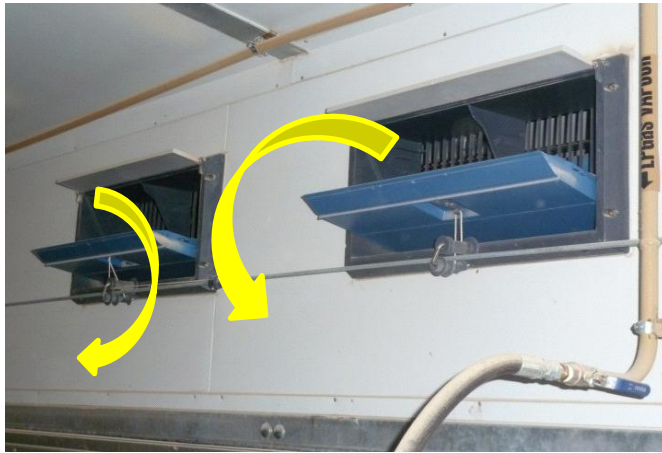
A. Patterns of air flow

The word *ventilation* means movement of air through an opening, whether it is louvers or curtain openings. In mechanically ventilated houses fans are used to pull air out of the building and air from outside will enter the building through any existing opening to fill the air space that was created.

The size of an opening determines the speed with which air will enter through that opening. For example if fans would be running at a particular setting, the speed with which air enters the building will be much higher with a small louver opening than with a large louver opening. The speed of the air will determine the distance it will travel into the building, or height towards the ridge. Air that enters a building at a low speed will drop to the floor instead of moving upwards and mixing with air close to the ridge of the building, see

³ Saturated means **filled to capacity**, further uptake has become impossible.

Figure 6



Low air speed.
Cold air drops to the floor.



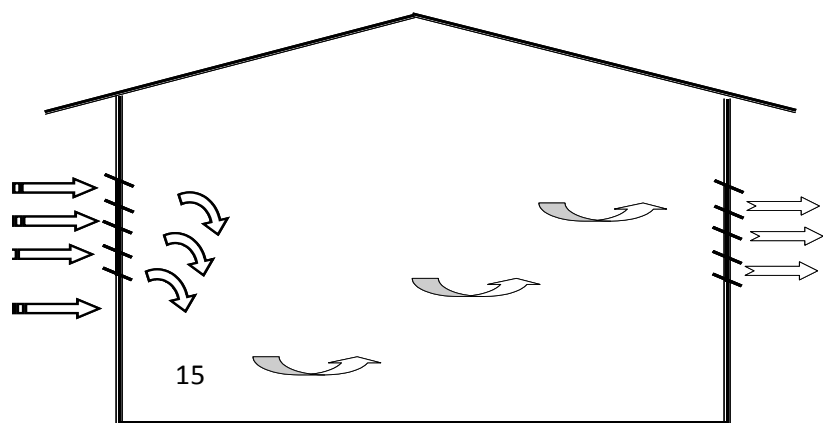
High air speed.
Cold air mixes with the hot air near the ceiling.

Figure 6 Left: Low air speed, only one fan running. Right: High air speed with four fans running at full speed.

In houses with curtains ventilation can only take place if wind is blowing. The size of the curtain openings and the wind speed will determine the amount of air that will be replaced inside the building. If no wind is blowing there will be no ventilation!! Fortunately there is often a slight breeze that causes some ventilation and most of these buildings have openings in the ridge of the roof through which hot air can move out due to natural convection of hot air that rises and the space is taken by cooler air. In winter cold air dropping to the floor is especially a problem these houses where control over incoming air is difficult and cold and wet spots will be present close to the wall.

The correct setting of fans and curtains is probably one of the most important actions that determine the successful rearing of broilers. The person caring for the chickens in the broiler house has a big responsibility to ensure that purpose of ventilation is carried out effectively. He or she must be able to notice and correct or seek advice when problems with the ventilation are not favourable for optimum growth and maintenance of health.

An illustration of ventilation patterns in a broiler house with wind blowing from the left.





Cooling Pad

Right: Broiler houses equipped with cooling pads on side.



Role of ventilation in heat removal and cooling of incoming air

The heat generated by the chicken's body can effectively be removed by ventilation as long as the air temperature of outside air is low enough to create a cool environment inside the building. During high summer temperatures, however, this will not happen and the only means to create comfortable conditions for the chickens is to pass the air through a cooling pad, **Error! Reference source not found..** The cooling of the air is brought about by the evaporation of the water on the cooling pad. When water evaporates, it changes from a liquid to a gas, and during this process heat is taken up from the air, in other words, the temperature drops by a few degrees. The temperature of the water has no effect on the efficiency of cooling! The efficiency of cooling is determined by the following factors: The humidity of the air before it passes through the cooling pad: In those areas of the country where the relative humidity is normally high, for example 60%, the ability of such air to absorb a lot moisture is much less than that of air containing only 30% moisture. Less water will evaporate and the cooling effect will thus be lower.

- 1) The size of the cooling pad and the coverage with water: Large pad areas as opposed to smaller areas with pads will be more effective because more water can evaporate. The same applies to coverage with water, areas that are clogged and not wetted will not add to the cooling efficiency.
- 2) Air speed through the cooling pad. If the air speed is too low, for example not enough fans are running, the cooling effect will be poor and temperatures close to the cooling pads might alleviate uncomfortable conditions. However, further away and at the other end of the chicken house, high temperatures will still prevail. Chickens will also move to the cooler areas which will lead to wet litter in those areas and crowding at water and feeder lines. If the air speed is too high water droplets will be carried into the chicken house, cooling will be poor and wet litter will create conditions for ammonia development.

Role of ventilation in moisture removal from bedding

Ventilation is the only means by which moisture can be removed from the bedding. This was previously discussed in detail. *Dust content in the air of the broiler house* and will not be repeated. Moisture control in bedding is one of the most important tasks to be performed correctly and the reader is advised to familiarise him / herself on this topic.

The role of water in poultry husbandry

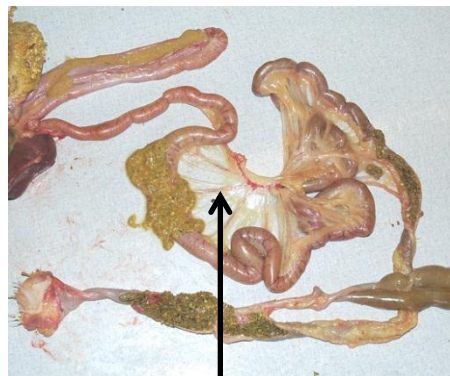
Water can be regarded as one of the most important nutrients for poultry. Water is one of the four main components of the bird's body; more than 60% of the body mass is water. This means that a chicken weighing 1500 grams contains 900 g water. In the following paragraphs we shall be discussing:

1. Role of water in digestion, absorption and transport of nutrients.
2. Role of water in excretion of waste products.
3. Role of water in body temperature regulation.
4. The role of water in health management.
5. Signs of water shortage.

Role of water in digestion, absorption and transport of nutrients

The swallowing of feed and the movement of feed through the digestive tract is brought about by means of muscle contraction. However it is only wet material can be forced out of the crop and down the gastro-intestinal tract. On right is the crop of a chicken that had no access to water and it can clearly be seen that feed could not pass down to the gastro-intestinal tract to be digested⁴.

The coarse content of feed in the muscular stomach (gizzard) is clearly visible in the picture below and also shows how the grinding action and digestive enzymes has transformed it into watery slurry. These processes as well as the absorption of nutrients by the bloodstream could only have taken place in a watery medium. Water is essential for the digestion of feed, the absorption and the transport of nutrients.



Blood vessels



⁴Digestion is the breaking up of starch and proteins in feed by means of enzymes into absorbable substances such as glucose and amino acids.

The role of water in excretion of waste products: faeces and uric acid

Indigestible substances are the fibrous parts of plants such as the hulls of sunflower seeds or the cellulose layer that surrounds a maize kernel. Products that could not be digested and absorbed by the body are usually visible as the dark brown contents in the lower part of the small intestine. It contains a lot of moisture which is absorbed in the cloaca, the opening through which faeces is excreted.

Faecal matter is not the only waste product that has to leave the body. Uric acid is a waste product from the many chemical reactions that take place in the body cells. It is insoluble and floats in the blood stream as small crystals, almost like fine sand.

In the kidneys the uric acid crystals are filtered out and collected by the kidney tubes and flushed in a stream of water to the cloaca. In the cloaca water is re-absorbed and concentrated uric acid is excreted as that white cap on the faeces. Uric acid is degraded by bacteria in bedding material and is the source of ammonia in the air of the chicken house.



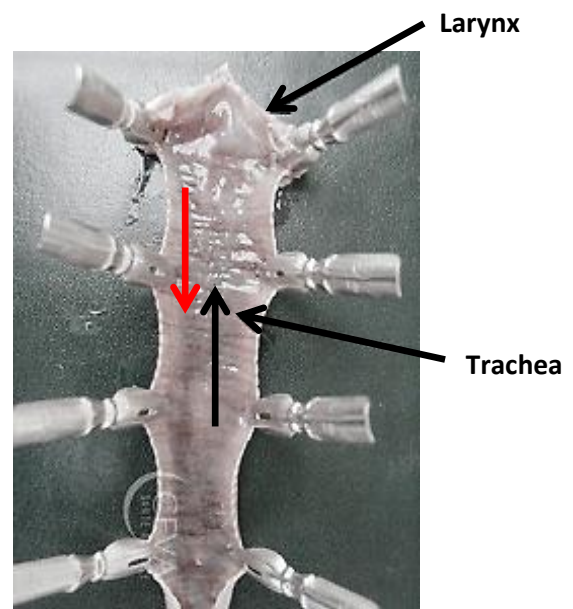
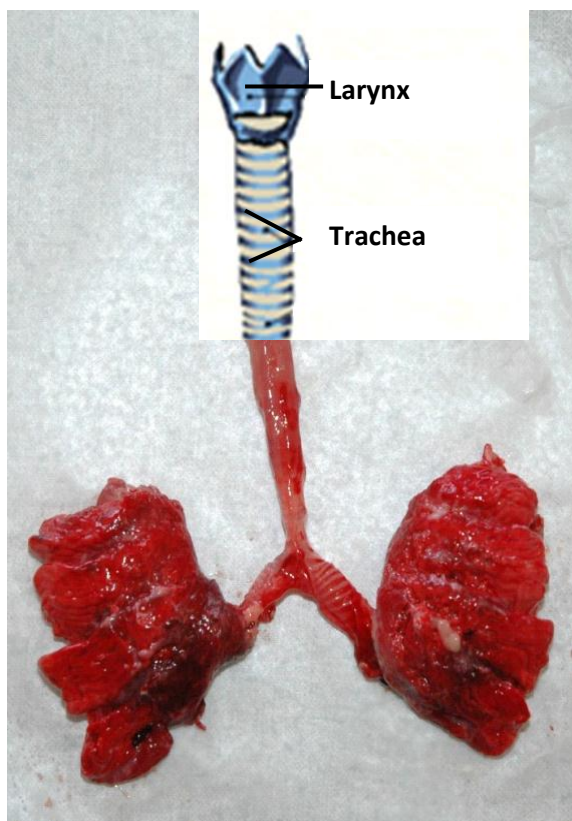
Role of water in body temperature regulation

During very hot weather humans will start sweating and the evaporation of the moisture from the skin results in cooling. The cooled blood in contact with the skin returns to the deep body and that helps the person to maintain a constant body temperature.

Poultry however, have no sweat glands in the skin and they will start panting during environmental temperatures above 30 °C. Moisture from the inner surfaces of the mouth and respiratory tract (larynx and trachea) evaporates and that has the same cooling effect as sweating.

The inner surfaces of these areas are cooled, and so also the blood serving these areas. Cooled blood returns to the inner body which lowers the temperature of the bird. **Figure 7**

Windpipe (trachea) and lungs



When inhaling air (red arrow) evaporation of moisture takes place on the wet inner surface of the trachea. Blood in contact with the trachea is cooled and returns to the body tissues and cools the bird. Black arrow shows the air leaving the body.

Figure 7 Respiratory system of the bird showing the area where evaporation of moisture on the trachea takes place

In those areas of the country close to the sea, such as Durban, where the air contains a lot of moisture, the *relative humidity* is high, and the evaporation of sweat is not very efficient. The same applies to poultry. In areas of high humidity during hot summer days poultry are unable to cool themselves by means of panting. Evaporation of moisture from the respiratory tract is poor and not a lot of heat is thus removed from the blood serving these tissues. Broilers close to slaughter age and meat-type breeder birds die and high mortalities can occur in areas of high humidity in summer.

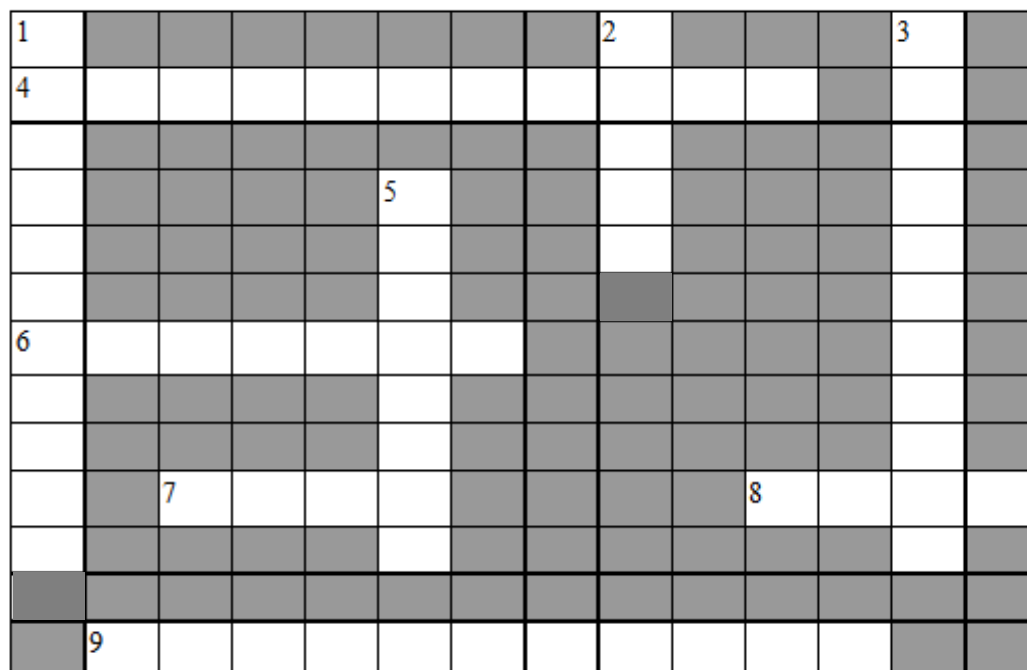
The role of water in health management

It was previously mentioned that the linings of the respiratory tract contains cells that secrete moisture. These cells have the form of tiny hair-like structures, called cilia, which are able to perform sweeping actions to remove bacteria that are inhaled. In birds that have limited access to drinking water these structures will dry out and the sweeping actions will stop. Bacteria will accumulate on the surface of the respiratory tract and penetrate the underlying tissue to cause infections.

Signs of water shortage

Severely restricted intake of water leads to a condition known as dehydration. In such a situation the body cells have lost so much water that they became wrinkled, especially visible on the toes and legs. In day-old chickens that have travelled for more than a day during very hot conditions and that panting had been so severe that a lot of body moisture was lost, these signs are quite evident. In chickens that have died the white spots of accumulated uric acid on the outer surface of the liver and kidneys are clearly visible.

Memory challenge number 2 Environmental control



Clue Across	Clue Down	Clues to answers
	1	The inner lining of the tract of this system is affected by ammonia gas
	2	Hair-like structures in the lining of the respiratory tract that remove dust and bacteria
	3	The word for movement of air through an opening
	5	The word that describes the moisture content of air
4		The process by which water changes from a liquid to a gas
6		Skin burn under the feet of broilers is caused by this gas
7		This material in the air of the chicken house contains bacteria that causes infections on the inner lining of the respiratory tract
8		The chicken is able to store feed in this organ for digestion at night
9		A condition where body cells have lost a lot of moisture due to water shortage in drinker lines

Note to the learner. Memory challenge number 2 is based on information you have learned so far on environmental control in broiler production. See how far you can get without referring to the notes. If you find that you are not able to complete the challenge a suggestion is to read through the notes again slowly and carefully. Should you find you are unable to understand some of the concepts then you need to discuss these with your supervisor or facilitator.

Poor performance without obvious reasons

It might happen that chickens just stop performing according breed standards without obvious reasons or visible shortcomings in the normal husbandry practices. Under such circumstances it is useful to use the acronym FLAWSS as guideline for a systematic investigation for causes of such problems. FLAWSS stands for the following six factors: Feed, Light, Air, Water, Sanitation and Space. The procedure would be to look very closely at each of these factors and to establish whether conditions for each of them are in compliance with the norm and standards that are applicable to each.

Feed

The most obvious action is to make sure the feeder lines are accessible to all chickens and that feed is always available. Look carefully at the consistency and dustiness of the feed in the trough, is it in accordance to what it used to be or are there many fines and only small quantities of pellets. It is most important to know exactly what the feeding behaviour normally has been. Taste and smell the feed and be sure that it is the same as it used to be with no traces of rancidity or change in colour. It is also useful to feel the crops of a few just to make sure that they are consuming feed. Feed is the most costly item in the production cost of broilers and it is of utmost importance to be able to identify any deviation that could lead to birds refusing to eat.

Light

An even distribution of light in the chicken house is most important to ensure an even distribution of chickens throughout the house, this will obviously only apply for an even distribution of temperature throughout the house. Light bulbs not working must be replaced as soon as possible. Where light programs are practiced the time switches must be inspected every day.

Air

Air quality includes aspects such as temperature, dust, gases such as ammonia, moisture and carbon dioxide. The air quality is probably one of the most important factors that determine the comfort of birds in a poultry house. Ventilation is the only means by which changes can be brought about. A lot of time should be spent on evaluating the behaviour of chickens after ventilation settings have been adjusted. It is indeed also important to follow up with regular visits after changes have been made.

Water

The availability and quality of water is of overriding importance for the successful rearing of broilers. Birds drink twice the amount of water than feed consumed. This is under normal temperatures, during hot weather it increases dramatically. Bacteria in water from contaminated water lines or water sources not chlorinated correctly will cause mortalities and loss in weight gains. Attention to ensure good water quality and to have samples analysed is most important.

Sanitation

Sanitary (clean) conditions means that less opportunity is available for disease causing organisms to multiply on dead birds, less opportunity for flies to carry viruses to the birds and less dirt that offer protection to bacteria and viruses. There is thus less exposure to disease causing organisms.

Space

Due to cold spots in certain areas crowding of the chickens takes place. Wet spots with ammonia formation develop and bacteria increase in numbers. The factors responsible for such conditions can be cold air that enters the house at night at a low speed and then drop to the floor. It could also be that louver openings are too large for the amount of air that enters the house and it does not travel far enough to mix with hot air close to the ceiling but drops to the floor. In houses with curtains it is especially difficult to have the right setting and requires constant attention during winter.

Record keeping practices

Of all agricultural industries, poultry production can boast to be practiced on the highest scientific level than any of the others. The application of genetic principles to select outstanding poultry lines for meat or egg production, or the accurate formulation of feed based on chemical analysis of feedstuffs to formulate diets to meet the requirements of the different types of birds, are all proof of the science that goes into poultry farming practices. The measurements which had been taken and expressed in figures formed the basis for the progress that had been achieved. In the following number of paragraphs it will be attempted illustrate the important role of measurements in the everyday farming environment.

Calculating percentages and averages

Percentages

The word per cent means per hundred or per *century* shortened to per *cent*, indicated by %. (The word century is still in use, for example in cricket: "He scored a century (100 runs) during the first hour" or "For a century (hundred years) no murder has taken place in that little village". It is most important to express some results on the farm per 100 birds with other words in percentages. The following serve as an example:

A small scale farmer bought 200 day-old chickens and found 16 dead on the second day, it thus means eight per one hundred, i.e. eight per cent. His neighbour also had 16 deaths on the second day but he had received 400 birds, he therefore had a mortality of only 4 per cent, 4 per 100. He probably had a better brooding system and therefore the lower mortality per 100. The reason for using percentages is to be able to make comparisons by using the same baseline. The calculation of the figures in the aforementioned example was fairly easy:

You first divide the number of mortalities, 8, by the total number of the flock placed. then multiply by 100 to obtain the figure per 100, which gives the percentage. A further illustration of the importance to express certain events in terms of percentages can be illustrated by comparing two houses with different numbers of broilers:

House A was placed with 15 000 day-old chickens and after 10 days the total mortalities amounted to 85. House B was placed with 20 000 day-old chickens and when they were 10 days of age a total of 100 chickens had been counted as mortalities.

According to the procedure mentioned earlier, mortality can be calculated as follows:

For House A: $85/15000 \times 100 = 0.56\%$

For House B: $100/20000 \times 100 = 0.5\%$.

More chickens had died in House B but when expressed as percentage of the number placed, it was lower than for A. If such a trend persists then one would start looking for some management problem in House A.

Averages

Sometimes the word mean instead of average is used to describe the same concept. An average value is calculated by adding up all values in a range of figures and then to divide the sum by the number of figures in the range. For example the following weights, in grams, were recorded for five individual day-old chickens: 42, 35, 40, 37 and 41. The sum of these five values is: $45+35+40+37+41 = 198$. The average weight, or the mean $= 198/5 = 39.6$ g. (This sample is purely for demonstration purposes, one would never use such a small sample).

Sampling and accuracy of data

Sample size

The more chickens one weighs the more reliable would the value be that one calculates as the average value. One or two outliers, extremely light or heavy, will have less influence on the total mass in a large sample than in a small sample. This is reason why sample sizes to estimate the average for a house would seldom be less than 800 birds weighed in houses of 30 000 birds.

The term that is often used is that a representative sample should be taken. This means that birds are fenced-in from particular areas, for example front, centre and the back of the house, and all birds within the frames are weighed. This ensures that the more flighty ones are also included in the sample and their weights were taken up into the calculation.

Accuracy of data

An aspect of immense importance is that the values that are being collected are reliable, whether it applies to bird weights or temperature recordings is immaterial. Conclusions drawn from data will only be valid if the collected data is accurate. For example: Instead of accepting a scale is accurate, why not always use a standard test weight to check the accuracy of the scale. When taking readings from thermometers have they been tested against a reference one that is always correct.

There is absolutely no sense in collecting unreliable figures. The reason for data collection is to enable one to identify factors that could have resulted in poor performance of the flock. The most common application is to relate high or low environmental temperatures to fluctuations in feed conversion for a particular flock.

Use of graphs or charts

A graph is a picture of data collected. One wants to know what the trend is for example with mortality figures. When just looking at the figures as collected it is difficult to see whether there is a slow or rapid rate in the numbers of birds dying. When data is plotted on a graph such trends are easy to identify.

When body mass and temperatures are graphed over time one can see how environmental factors had influenced growth rate. It means that one can explain a condition and not speculate whether it might have been a problem with feed. During practical sessions you will be given the opportunity to draw graphs and interpret the data.

The value of records

In the poultry industry the keeping of records, and it is assumed that it was done accurately, is one of the most important tools to be efficient and profitable. Problems have to be identified as soon as possible to enable the taking of corrective actions, be it a problem with feed, disease, water or ventilation. Accurate records enables one to relate drops in growth rate with management changes for example in feeding practices, vaccination failures, disease outbreaks due to non-conformance of staff to biosecurity procedures, poor disinfection results due to changes in cleaning procedures etc. The reader will most probably be able to add more examples to this list.

Solutions to memory challenges 1 and 2

Solution for memory challenge number 1

Solution Across	Solution Down		
	1	Digestion	The process by which feed is broken up to make the nutrients available
	3	Manganese	The mineral that is needed by the chicken to prevent bone deformation, a condition known as perosis.
	4	Proteins	Substances in body tissues that consist of chains of amino acids
	6	Glucose.	The nutrient that can be utilized by the chicken as source of energy.
	7	Skeleton	The framework of bones to which muscles attach.
	9	Calcium	This nutrient is a mineral and utilized in the formation of strong bones
	10	Vitamins	These nutrients are essential agents to facilitate chemical reactions inside body cells
	11	Soya	The oil cake meal from these beans is an important source of proteins for broilers
2		Limestone	This product is added as a source of calcium in broiler diets.
5		cells	The building blocks of organs in the body
8		Starch	This substance is made by plants and renders glucose after digestion
12		Nutrients.	The general term that is used for the substances after digestion of feed in the small intestine.
13		Energy.	The driving force of chemical reactions inside body cells.
14		Amino	These acids are the end products of protein digestion
15		Nutritionist	A person at the feed mill that does the formulation of poultry diets
16		Crumbs	The type of structure of the feed for day-old chickens

Solutions for memory challenge number 2

Across	Down		
	1	Respiratory	The inner lining of the tract of this system is affected by ammonia gas
	2	Cilia	Hair-like structures in the lining of the respiratory tract that remove dust and bacteria
	3	Ventilation	The word for movement of air through an opening
	5	Humidity	The word that describes the moisture content of air
4		Evaporation	The process by which water changes from a liquid to a gas
6		Ammonia	Skin burn under the feet of broilers is caused by this gas
7		Dust	This material in the air of the chicken house contains bacteria that causes infections on the inner lining of the respiratory tract
8		Crop	The chicken is able to store feed in this organ for digestion at night
9		Dehydration	A condition where body cells have lost a lot of moisture due to water shortage in drinker lines

