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# UNIT 8 FREEDOM FROM HUNGER, THIRST AND MALNUTRITION

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## 8.1 LEARNING OUTCOMES

- a) **Knowledge and Understanding:** After studying this Unit you will be able to:
  - Understand the definitions of hunger and thirst.
  - Explain the principles of assessing hunger and thirst.
- b) **Practical and Professional Skills:** After studying this Unit you will be able to:
  - Discuss how hunger and thirst affects animal welfare with scientific rationality.

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## 8.2 INTRODUCTION

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Dear Learner,

In Unit 7, the Five Freedoms were introduced as a framework for understanding the needs and wants of animals in a scientific way. We also discussed their advantages, limitations and developments since the Five Freedoms. In this Unit, we will consider the first of the Five Freedoms, and the means to achieve them as *'freedom from hunger, thirst and malnutrition by ready access to fresh water and a diet to maintain full health and vigour'*.

In the following sections, definitions of each of these states will be provided and discussed. Major issues involved are reviewed along with the most appropriate methods for assessing these states. A case study is provided to illustrate how a scientific understanding of the underlying problem has led to a solution. For the state of hunger, a broader issue is discussed in detail.

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## 8.3 HUNGER

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### 8.3.1 Concepts and Definitions

Access to food is a basic animal need. As stated in Unit 7, hunger can be defined as the state experienced when the animal has not been able to meet its nutritional requirements. Hunger is associated with an increasing motivation to find food and eat. Hunger can be short-term or chronic long-term:

- a) The short-term hunger drives an animal to seek the next meal
- b) Chronic long-term hunger occurs when an animal is chronically undernourished.

This does occur on farms under some specific management conditions (see section on Issues below). Farmers and animal owners should ensure that sufficient feed is provided to the animal to cover its basic daily needs (this is known as the maintenance allowance). There are states in which animals will have additional requirements, such as when they are growing, pregnant or lactating. Growing animals will have additional requirements above maintenance, pregnant animals have additional requirements associated with the growing foetus and the lactating female animal with milk production.

### 8.3.2 Balanced Feed vs. Animal Welfare

Animals require a balanced diet that includes protein, carbohydrate, fats and minerals and micronutrients. 'Specific' hungers also exist for particular nutrients like salt. Avoiding hunger involves providing animals with adequate feed, in an accessible manner. The following are the issues to consider:

- a) Feed quantity, quality and diet formulation
  - b) Feeding patterns of animals and
  - c) Access to feed.
- a) Feed Quantity, Quality and Diet Formulation:**

There has been a great deal of research into animal nutrition, which has aimed to develop diets to provide for the dietary requirements of the species,

age, lactation or reproductive state of livestock. In many production systems, food intake is directly linked to growth and productivity, such as growth in broiler chickens and pigs, and milk yield in dairy cows, so farmers generally are well aware of the need to provide animals with sufficient feed. Feed quality is also important. Crop residues are important sources of animal feed for smallholders. However, it is important to ensure that there is sufficient carbohydrate in these residues. Digestibility of crop residues is also important (Box 8.1).

### Box 8.1: Crop Residues

Crop residues are the abundantly available feedstocks that are obtained after crop harvesting. They are of two types mainly:

- Straw – obtained after harvest of fine grains like rice, wheat, oat etc.
- Stover – obtained after harvest of coarse grains like maize, sorghum, millets etc.

Globally nearly 4 billion metric tons of crop residues are available for feeding to livestock. In India alone nearly 100 million metric tons each of rice straw, wheat straw and sugarcane bagasse crop residues are available, which are otherwise unfit for human consumption.

Cereal crop residues have the following limitations:

- Low feeding value - poorly available nitrogen, low digestibility with lack of useful minerals
- Low voluntary intakes - around 1.5-2 kg/100 kg mature body weight

Despite the above limitations, they constitute and continue to be an important feed resource for sustainable dairy production in the developing world, as energy-protein malnutrition among livestock is a serious problem in these countries. Straws of legume crops have generally better nutritive value, forage quality and thus are nutritionally superior to cereal straws. Stovers have better nutritional quality than straws with respect to intake and digestibility. Straws and stovers are generally used to feed low producing animals or can be used as a source of bulk in the high producers' ration to fulfil their appetite, can help correct physically effective fibre shortage for milk fat synthesis in high concentrate feeding systems and may beneficially provide additional heat increment during cold stress conditions.

*Source: Mahesh and Mohini (2014)*

### b) Feeding Patterns of Animals:

Typically, animals do not eat their daily requirement in just one bout of feeding, but choose to eat in smaller portions or meals, just as humans do. The timing of these meals typically relate to the light: dark cycles and the availability of feed within these times. In intensively managed systems, such as for cattle, pigs and poultry, feeding patterns revolve around the time that feed is delivered, even if feed is available ad libitum. Animals are motivated to access fresh feed, as the quality may be slightly higher. In ruminants, such as cattle and sheep, the meal pattern distribution across the day is driven by the need to maintain appropriate rumen function, so periods of feeding are interspersed with periods of rumination.

In animals at pasture, the major grazing periods occur early in the morning (including dawn) and in the late afternoon/evening (including dusk). The period of grazing at dusk is the most intense, and most herbage is ingested in this period. This is thought to reflect the fact that the plants have accumulated carbohydrates via photosynthesis over the day, so grass nutritional quality is highest at dusk. Where the grazing is poor, animals may graze for longer or more frequent periods. In hot climates, grazing may occur at night. Cows may spend 8-10 hours grazing per day. Horses graze 50-80% of the 24 hour period. Sheep can graze for up to 15h/day, but variation occurs in all species dependent on:

- Grazing quality
- Body condition status
- Distance to water etc.

**c) Access to Feed:**

Ideally, all animals should be able to access the feed provided whenever they choose. In unrestricted grazing animals, access to feed can be limited by the amount of grazing or browsing material available. However, following issues are to be noted from animal welfare perspective for intensively housed animals:

- Intensively housed or managed animals are typically fed from troughs, bins or feed hoppers, care must be taken to allow all animals to get access to sufficient feed each day.
- In growing pigs and cattle, where animals have *ad libitum* access to feed, they are typically fed in long troughs. In some housing designs, there can be restrictions in the length or size of the trough space that can be provided.
- In addition, social animals prefer to feed at the same time, a phenomenon known as social facilitation. This preference results in all animals coming to the feeders when fresh feed is delivered, which can result in competition between animals if there is not sufficient space for all animals to feed together.
- Individuals low in the dominance hierarchy or 'pecking order' can experience aggression when they try to access feed, which causes an increase in stress and may cause injury. These low ranking individuals have to wait until the dominant animals have finishing feeding. In situations with very poor feeder space, the lower ranking animals may not be able to access sufficient feed each day. The design of the feeders or management of feeding can reduce aggression (Fig. 8.1 and 8.2).
- The presence of dividers or head bails on feeders prevents animals displacing others from the feeder. Providing *ad libitum* feed, or feeding two or more times per day will allow animals more unrestricted access.



Fig. 8.1: Broiler chicken feeder



Fig. 8.2: Dairy young stock (Photos: SRUC)

Before we proceed, please complete activity 1.

**Activity 1 (Visit):** Visit a nearby dairy farm and discuss with the farm supervisor about different issues related to feeding vis-à-vis animal welfare. Compare their views with the one given above and write your observations on the following:

a) Feed quantity, quality and diet formulation:

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b) Feeding patterns of animals:

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c) Access to feed:

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**Check Your Progress 1**

**Note:** a) Use the spaces given below for your answers.

b) Check your answer with those given at the end of the unit.

1) How can hunger be described?

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2) Write the difference between short-term and long-term hunger.

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3) What is a balanced diet?

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4) What are the feed related issues to consider in avoiding hunger?

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5) Why is the period of grazing at dusk the most intense?

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6) Write the approximate grazing hours / day for the following animals

- a) Cows : .....
- b) Horses : .....
- c) Sheep : .....

7) What factors influence grazing time?

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8) In animals kept in groups, poor access to feeders can cause hunger. Explain how this might be avoided.

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## 8.4 ASSESSMENT OF HUNGER

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Hunger can be assessed scientifically using the following methods:

- 1) Simple weighing of animals
- 2) Body condition scoring system
- 3) Behaviour studies (e.g. Increased willingness to feed, feeding motivation, distance willing to travel to feed etc).
- 4) Physiological indicators

### 8.4.1 Simple Weighing of Animals

Hunger caused by long-term under-nutrition results in loss of bodyweight. Therefore, weighing animals regularly using a calibrated weigh-scale is one simple method of determining that an animal is not receiving sufficient feed. However, weighing animals is not always practiced on farms and inadequate nutrition can lead to slow growth. In some welfare assessment schemes, the age of piglets at weaning is used as an indicator of the quality of feeding on a farm.

### 8.4.2 Body Condition Scoring System

Long term hunger also causes a loss of body tissue and fat, or 'body condition'. The regular assessment using a scoring system can allow a loss of body condition in animals to be detected. Body condition scoring systems have been developed for adult pigs, cattle, horses, goats and sheep. For some species, e.g. horses, this can be carried out by visual inspection. However, for species such as sheep the

presence of a woolly fleece means that body condition scoring must be done by manual palpation of individual animals. A system for scoring dairy cattle is shown in Box 8.1, and Figures 8.2 a-c show a system for sheep, both involving manual palpation.

<b>Box 8.1: Descriptions of each level of condition score for modern breeds of dairy cattle</b>	
(Source: SAC Technical Note 588, Pollott)	
<b>Score</b>	<b>Description</b>
1	The individual spinal processes are sharp to the touch and easily distinguished
2	The spinous processes can be identified individually when touched, but feel rounded rather than sharp
3	The spinous processes can only be felt with very firm pressure and the areas on either side of the tail head have some fat cover
4	Fat cover around the tail head is easily seen as slight mounds, soft to the touch. The spinous processes cannot be felt.
5	The bone structure of the animal is no longer noticeable and the tail head is almost completely buried in fatty tissue.

A description of body condition scoring in sheep has been described by researchers at SAC, Scotland. The technique involves firstly using the tips of the fingers to assess the level of fat cover over the spine. The degree of sharpness or roundness of the lumbar vertebrae indicates the amount of fat cover. Then the prominence and degree of fat cover over the horizontal processes of the spine and the amount of muscle and fat under the ends of these bone scan be assessed. By pressing the fingers into the area between the vertical and horizontal processes, the extent of the eye muscle and its fat cover can be examined. A scale from 1 to 5 can be assigned to each animal based on this assessment technique.

### 8.4.3 Behaviour Studies

In research settings, hunger can be assessed in a number of ways through animal behavioural studies. The experience of hunger can be expressed in an increased willingness to feed, but also to perform behaviours that will give access to feed. Thus, hunger can be assessed by giving an animal access to feed, and measuring the total amount of feed it consumes or the speed at which it eats. Feeding motivation can also be measured by requiring the animal to expend time or energy to gain access to feed. Studies have used long runways or passages to force animals to travel some distance to eat. The distance they are willing to travel, and the speed of movement can be used as indicators of hunger. In other studies, animals must push through past a weighted door or repeatedly press a button to gain access to feed. The maximum amount of weight tolerated, or button-presses made, is an indicator of feeding motivation.

### 8.4.4 Physiological Indictors

There are also physiological indictors of hunger. Body glucose levels are reduced in a hungry animal. Other indicators of hungers can be assessed from a blood



sample. Beta hydroxybutyrate and non-esterified fatty acids are commonly used indicators, particularly in late pregnant animals where they can be used in management to prevent metabolic diseases.

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## 8.5 HUNGER SPECIFIC ISSUES

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Conflict between The Five Freedoms identifies freedom from hunger as a basic ‘right’ of animals. However, there are specific situations in modern farming systems where access to feed is deliberately restricted, with the result that animals will experience hunger.

*Example 1:* A major one is the case of food restriction in broiler breeders. Modern fast-growing genotypes of broilers grow very quickly, and can reach their required slaughter-weight at as little as 5-6 weeks of age. Selection for this fast growth rate is accompanied by increased appetite and high feeding motivation. However, the cockerels and hens that are the parental stock (known as broiler breeders) also grow at this fast rate, but must be reproductively functional throughout their first year of life. If they are fed to appetite, they will grow at the rate of the broiler chicken intended for slaughter, but as they live longer, become obese and suffer leg bone pathology and thermal discomfort. It is necessary to restrict the amount of feed supplied to these animals by 30-50% of their *ad libitum* intake for their growing period, with a lower restriction applied during the laying period. A number of studies have shown that this practice leads to high levels of feeding motivation. These birds will eat 3 times more than birds that are not feed restricted in this way.

*Example 2:* A similar situation occurs in breeding sows. Again, modern pig genotypes have been selected for fast growth, and the appetite for feed in growing animals matches this growth rate. But as for broiler chickens, the animals destined for breeding stock also have this high motivation to feed. This means that these animals must be feed-restricted in other that they do not become too fat and achieve reproductive fitness.

This is a clear case where there is conflict in attempting to fulfil the five Freedoms. Food restricted broiler breeders are clearly experiencing hunger, but to allow them unrestricted access to feed would not allow them to experience the 3rd freedom, ‘Freedom from pain, injury and disease’. To try to resolve the problem, current research is exploring the use of diets high in fibre or other bulky substances, or the use of appetite suppressant substances. From a welfare point of view, the use of broiler and pig genotypes that do not have the high levels of growth, and whose parent stock do not require feed restriction would be preferable, but this would compromise productivity.

Before we proceed, please complete activity 2.

### Activity 2 (Hunger Case Study & Visit):

- a) **Hunger Case Study- Design of Feeders for Pigs:** Growing pigs that are housed in groups are generally observed to feed together. When fresh food is delivered, it is common to observe all pigs eating or attempting to eat. Where there is open access to the feed trough, and food restriction, there may be intense competition and fighting for access to the feed. In many codes of recommendation, it is stated that there should be enough

trough space to allow all pigs to feed at the same time. In theory, the minimum amount of trough space that a single pig should occupy is equal to the width of its shoulders. Researchers showed that shoulder width can be calculated according to the following formula:

$$\text{Width} = 0.065 \times \text{liveweight}^{0.33}$$

However, studies by Baxter in the 1980s established that even when groups of pigs were provided with a space allowance of 9% greater than the sum of the shoulder widths, pigs only were able to eat together for 24% of the feeding time, as a result of aggression at the trough. A pig was displaced every 2 mins from the feed trough. The pigs that were displaced were typically the sub-ordinate animals. Further experimentation showed that including head bails or dividers on the feed trough reduced the aggression and while no aggression at all was shown when pigs were fed in a design that included both head and shoulder dividers. Furthermore, less food was wasted in the trough designs that had the dividers between the pigs. Studies carried out in Canada showed that much of the feed is wasted when pigs fight over feed. The using of dividers between animals or higher space allowances at the feeder will improve feed intake for all animals, particularly the smaller or sub-ordinate animals and reduce feed wastage. It is now very common to see dividers on pig feeders or on feed troughs. Further studies investigated pig's preferences for the elevation of the feed trough. It was found that pigs prefer to eat from feeders that are at or slightly above ground level.

- b) **Visit:** Visit a nearby pig farm and discuss the above case with the farm supervisor. Observe feeding space and feeding behaviour of pigs in the farm. Write your remarks:

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**Check Your Progress 2**

**Note:** a) Use the spaces given below for your answers.

b) Check your answer with those given at the end of the unit.

1) Name different methods of assessing hunger.

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2) How does weighing animals regularly help in detecting hunger caused by long-term under-nutrition?

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3) What is the rationale behind hunger assessment using body condition scoring?

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4) Write one animal behaviour example through which we can assess hunger.

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5) Name the physiological indicators of hunger.

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## 8.6 THIRST

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### 8.6.1 Concepts and Definitions

As stated in the Unit 7, thirst is the experience caused by the lack of adequate water. Like access to feed, access to water is also a basic animal requirement. All animals required daily access to sufficient water. All animals require water:

- for normal tissue and metabolic functioning
- to maintain body temperature through transpiration
- for the maintenance of mineral homeostasis
- as a carrier in the removal of metabolic end products such as urea.

Estimates of the daily water requirement of some of the major livestock species are shown in Box 8.2.

Box 8.2: Typical Daily Water Requirements of Animals	
Species	Daily water requirement per individual
1. Dairy cows	60 L / day; high producing Holsteins up to 100L
2. Buffalos	65-70 L / day
3. Grower pigs	8-12 L/day
4. Pregnant sows	12-25 L/day
5. Laying hens	0.5 L/day
6. Broiler chicken	5.28 ml/day
7. Horses	20-40 L/day

As well as the appropriate quantity of water, the water must be clean and fresh. Poultry have been shown to avoid drinking when the water contains high levels of calcium. High levels of zinc and nitrate will also depress drinking. Cows may refuse dirty or contaminated water. In pigs, drinking from water bowls is reduced when there is a build-up of debris from feed collected at the bottom of the bowl. Beef cattle have also been shown to prefer water with low levels of minerals. The NRC of the United States has developed a quality scoring system for water

quality for cattle that takes into account odour, physiochemical attributes (pH, dissolved solids, dissolved oxygen, hardness), the presence of toxic compounds, mineral composition and presence of microbes and contaminants. The last two factors are considered the most detrimental to quality of the drinking water. Cleaning out troughs and drinkers on a regular basis is important to ensure that animals will drink freely.

Water consumption depends on the following factors:

- 1) Ambient temperature and humidity
- 2) Animal status – dry animal, pregnant, lactating etc
- 3) Dryness of the feed (e.g. Animals grazing moist grass will need less water than animals being fed a dry concentrate diet).
- 4) Distance from the grazing area to the water troughs also affects drinking behaviour, with animals visiting less often when distances are long.
- 5) In housed animals, water consumption is associated with feeding periods (e.g. peaks of water consumption occur immediately before and after food delivery).
- 6) Animals require more water in high temperatures, as many animals use evaporative cooling to reduce their heatload (i.e. they sweat to cool down). This means that increased water must be provided during hot weather.
- 7) In very cold weather, low water temperatures may cause animals to avoid drinking the quantities they drink under normal temperatures.

Provision of water is important for dairy cattle, because milk is nearly 85% water, and a lack of water can depress milk yield. Holstein dairy cows drink at least 60L per day, and can drink up to 14 L per minute. For cattle and pigs, the water flow rate is an important factor in ensuring that sufficient water is available to the animals, particularly when peaks of water consumption are associated with feeding periods. Low flow rates will mean delays in trough refilling or poor intakes through nipple drinkers for pigs. Performance was lower in sows which had a flow rate of 70ml/min compared to sows with drinkers on 750ml/min, indicating the importance of water flow-rate. Water tanks or bowsers are useful when the water is not on a piped system. For dairy cows, it is recommended that there is space for 10% of the herd to drink at once. Each cow needs 70cm of trough space and the rim of the trough should be 75cm above the ground. For pigs up to 35kg, one water nipple drinker per 10 pigs is recommended, with up to 15 pigs for nipple drinker for older animals (Figures 8.3 a-c).



**Fig. 8.3a: Bowl Drinker for Pigs**  
(Photo source: SRUC)



**Fig. 8.3b Nipple Drinker for Pigs**  
(Photo source: AFBINI)



**Fig. 8.3c: Broilers with Nipple and Cup Drinkers on Left and Pan Feeders on Right (Photo: jlastras from Flickr)**

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## **8.7 ASSESSMENT OF THIRST**

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Lack of water causes dehydration. Dehydration causes a loss of fluid in the skin and it becomes less elastic. Thirst can be assessed scientifically using the following methods:

- 1) Skin tent test
- 2) Inspecting the mucous membranes
- 3) Behavioural test
- 4) Welfare Quality protocols

### **8.7.1 Skin Tent Test**

Veterinarians commonly used the ‘skin tent’ test to detect dehydration in animals. The skin on the neck or thorax of the animal is pinched between the thumb and forefinger and then released. In animals in a normal state of hydration, the skin moves back to its normal position almost immediately. The longer the skin takes to return to normal, the more dehydrated the animal is.

### **8.7.2 Inspecting the Mucous Membranes**

Inspecting the mucous membranes (gums and inside the nostrils) is another method of detecting dehydration. These areas should be moist. The eyes of a dehydrated animal may also appear sunken into the eye sockets.

### **8.7.3 Behavioural Test**

By the time the animal shows a positive response to the ‘skin tent’ test, or shows dry mucous membranes or sunken eyes, it is quite dehydrated and may require veterinary intervention. However, there are currently few reliable measures available that are more sensitive to lower levels of dehydration. A study in Belgium and Brazil showed that broiler chickens deprived of water for 12 hours drank more after the deprivation period than non-deprived animals. The experiment was repeated with a comparison of 0 and 6 hours. Only birds in Brazil showed more drinking after 6 hours deprivation, while the birds in Belgium did not, suggesting that high ambient temperatures play a role in the motivation to drink.

### 8.7.4 Welfare Quality Protocols

Because of this lack of a sensitive test, most welfare assessment protocols assess the quantity or space allowance of the drinkers available relative to the number of animals, and the water flow rate and the cleanliness of the water. For instance the Welfare Quality protocols that cover, pigs, dairy and beef cattle, and poultry, considers the cleanliness of the water and the functionality of the drinkers. For cattle, the flow rate is also assessed.

Before we proceed, please complete activity 3.

#### Activity 3 (Case Study & Visit):

##### a) Thirst Case Study- Designing Water Troughs for Dairy Cattle

As mentioned above, drinking behaviour is very important for dairy cattle, as their milk yield is directly dependent on their level of water consumption. However, there is a wide variation in the ways in which water is presented in troughs. Perhaps surprisingly, cattle have been shown to prefer drinking from a trough rather than from an open stream. A group in Brazil (Universidade Federal de Santa Catarina) conducted a number of studies into the design of water troughs for dairy cattle, to determine what features of the troughs best promoted drinking behaviour. In their first study, they investigated the water consumption and preference of dairy cattle for different sizes of water trough. They found that the cows preferred larger to smaller troughs, and drank more water from the larger troughs, with the largest surface area. They then investigated the preference for the height and depth of water troughs. Cows drank more from troughs that were 60cm from the ground compared to the one that was 30cm from the ground. The water depth did not affect preference or water consumption. In a further study, this group also tested the effect of providing shade over the water trough, but this did not affect the amount of water consumed.

b) **Visit:** Visit a nearby dairy farm and discuss the above case with the farm supervisor. Observe water consumption and preference of dairy cattle for different sizes of water trough drinking in the farm. Write your remarks:

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**Check Your Progress 3**

**Note:** a) Use the spaces given below for your answers.

b) Check your answer with those given at the end of the unit.

1) Give a definition of thirst.

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2) Why do animals require water?

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3) Write the daily water requirement for the following species of animals:

- a) Dairy cows : .....
- b) Buffalos : .....
- c) Grower pigs : .....
- d) Pregnant sows : .....
- e) Horses : .....

4) What are the quality indicators for drinking water?

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5) What is the skin tent test?

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- 6) What feature of a water trough is the most important for cattle: the surface area or the depth?

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## 8.8 MALNUTRITION

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Malnutrition, in all its forms, includes under-nutrition (wasting, stunting, and underweight), inadequate vitamins or minerals, overweight, obesity, and resulting diet-related non-communicable diseases. Malnutrition can occur when animals are not provided with the right quality of food to meet their specific needs. This differs from hunger in that the animals may be able to eat a sufficient quantity of food to be satiated, but the quality of the food is insufficient. This may be, for example, because the diet is inadequate for protein, even if it contains sufficient carbohydrate or fat, or because important micronutrients or trace elements are not present. The requirements of animals can vary during different life stages, from the very rapid growth of young animals, to the specific needs of pregnant and lactating animals. Thus malnutrition can occur due to lack of knowledge, as well as an inability to provide a diet of sufficient quality.

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## 8.9 LET US SUM UP

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- The Five Freedoms provide a framework to determine what animals need from their environments.
- We can define hunger as the state experienced when an animal has not been able to meet its nutritional needs.
- The quantity of feed or pasture grass provided for the animal is clearly important, but feed quality is also important in providing appropriate nutrition for animals.
- In animals kept in groups, it must be ensured that all animals have access to adequate feed.
- Hunger is typically assessed on farms by scoring body condition. In research, the motivation to feed can be assessed by various methods.
- Thirst will be experienced when the animal has not been able to ingest adequate water.
- Water quality is also important, as water intake is reduced when quality is poor.
- Long-term thirst causes dehydration, and this can be assessed using the skin-tent test.
- Animals should have access to adequate water troughs, which are kept clean and which have good flow rates.

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## 8.10 KEYWORDS

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**Ad libitum Feeding:** This means that the diet is available at all times and thus, animal can feed whenever they choose.

**Feeding Patterns:** Animals do not typically eat their daily ration in a single bout of eating. Animals on an *ad libitum* diet will typically choose to eat several smaller meals per day. The daily scheduling of these meals is referred to as feeding patterns.

**Hunger:** The state experienced when the animal is not able to meet its nutritional requirements. Hunger is associated with high motivation to seek food and eat.

**Maintenance Allowance:** Feed provided to the animal to cover its basic daily needs is known as maintenance allowance.

**Restricted Feeding:** This refers to restricting the amount of food offered to an animal while still ensuring nutritional adequacy.

**Rumination:** Also called cud-chewing, this is the process by which ruminants (e.g. Cattle, Buffalo, sheep, goats) regurgitate previously consumed feed and masticate it a second time. They usually spend more time chewing during rumination than they do when they eat.

**Thirst:** State experienced when the animal has not been able to ingest adequate water.

**Water Quality:** Water for animals must be clean and fresh. It must be free of microbial and chemical contaminants and dirt.

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## 8.11 REFERENCES AND FURTHER READING

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D'Eath, Tolcamp, Kyriazakis and Lawrence (2009). 'Freedom from hunger' and preventing obesity: the animal welfare implications of reducing food quantity or quality. *Animal Behaviour*, 77: 275-288.

De Jong, van Harn, Gunnick, Hindle and Lourens (2012). Footpad dermatitis in Dutch broiler flocks: prevalence and factors of influence. *Poultry Science*, 91:1569-1574.

Devendra, C. and Leng, R.A. (2011). Feed resources for animals in Asia: issues, strategies for use, intensification and integration for increased productivity. *Asian-Austr J Anim Sci*, 24: 303-321.

Houpt (2011). *Domestic Animal Behavior for Veterinarians and Animal Scientists*. Wiley.

Kilgour and Dalton (1984). *Livestock Behaviour: a practical guide*. NSW University Press.

Mahesh, M.S. and Mohini, M. (2014). Crop Residues for Sustainable Livestock Production. *J Adv Dairy Res*, 2(2)1000e108. doi:10.4172/2329-888X.

Teixeira, Hötzel and Machado Filho (2006). Designing better water troughs . Surface area and height, but not depth, influence dairy cows' preference. *Applied Animal Behaviour Science*, 96: 169-175.

**Websites:**

Agricultural and Horticulture Development Board (UK): [www.ahdb.org.uk](http://www.ahdb.org.uk)

<http://animaltransportguides.eu/wp-content/uploads/2016/05/Horses-Feeding-Watering-FINAL.pdf>

Welfare Quality : Animal welfare assessment protocols. [www.welfarequality.net](http://www.welfarequality.net)

Cool cows Australia: dealing with heat stress in Australian dairy herds. <http://www.coolcows.com.au/go-on-alert/thi.htm>

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## **8.12 SELF ASSESSMENT EXERCISES**

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- 1) Discuss the issues involved in providing animals with adequate feed in an accessible manner.
- 2) What is body condition scoring, and how can it be used to assess hunger?
- 3) How can behaviour studies help in the assessment of hunger?
- 4) In animals kept in groups, poor access to feeders can cause hunger. Explain how this might be avoided.

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## **8.13 ANSWERS / HINTS TO CHECK YOUR PROGRESS**

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### **Check Your Progress 1**

- 1) Hunger can be described as the state experienced when the animal has not been able to meet its nutritional requirements. Hunger is associated with an increasing motivation to find food and eat.
- 2) The short-term hunger drives an animal to seek the next meal, whereas chronic long-term hunger occurs when an animal is chronically undernourished.
- 3) Animals require a balanced diet that includes protein, carbohydrate, fats and minerals and micronutrients.
- 4) The issues to consider are: feed quantity, quality and diet formulation; feeding patterns of animals; and access to feed.
- 5) The period of grazing at dusk is the most intense and most herbage is ingested in this period. This is thought to reflect the fact that the plants have accumulated carbohydrates via photosynthesis over the day, so grass nutritional quality is highest at dusk.
- 6) Approximate grazing hours / day : (a) Cows - 8-10 hours; (b) Horses – 12-19 hours ; (c) Sheep – Up to 15 hours
- 7) Grazing time variation occurs in all species dependent on grazing quality, body condition status, distance to water etc.
- 8) Problems of access to the feeders can arise when the size of the feed trough is small compared to the number of animals in the group. Access can be improved by increasing the length of the feeder or by using partitions or

barriers between animals to prevent them from displacing neighbours from the feeder.

### Check Your Progress 2

- 1) Hunger can be assessed scientifically using methods like Simple weighing of animals, Body condition scoring system, Behaviour studies and Physiological indicators.
- 2) Hunger caused by long-term under-nutrition results in loss of bodyweight. Therefore, weighing animals regularly using a calibrated weigh-scale is one simple method of determining that an animal is not receiving sufficient feed.
- 3) Long term hunger causes a loss of body tissue and fat, or 'body condition'. The regular assessment using a scoring system can allow a loss of body condition in animals to be detected.
- 4) Hunger can be assessed by giving an animal access to feed, and measuring the total amount of feed it consumes or the speed at which it eats. Feeding motivation can also be measured by requiring the animal to expend time or energy to gain access to feed.
- 5) Body glucose levels, Beta hydroxybutyrate and non-esterified fatty acids are commonly used physiological indicators of hunger, which can be measured by blood sampling.

### Check Your Progress 3

- 1) Thirst is the experience caused by the lack of adequate water.
- 2) Animals require water: for normal tissue and metabolic functioning; to maintain body temperature through transpiration; and for the maintenance of mineral homeostasis
- 3) Daily water requirement for: (a) Dairy cows: 60 L / day; (b) (c) Buffalos : 65-70 L / day; (c) Grower pigs : 8-12 L/day ; (d) Pregnant sows : 12-25 L/day; (e) Horses: 20-40 L/day.
- 4) The scoring system indicators for water quality are odour, physiochemical attributes (pH, dissolved solids, dissolved oxygen, hardness), the presence of toxic compounds, mineral composition and presence of microbes and contaminants.
- 5) Veterinarians commonly used the 'skin tent' test to detect dehydration in animals. The skin on the neck or thorax of the animal is pinched between the thumb and forefinger and then released. In animals in a normal state of hydration, the skin moves back to its normal position almost immediately. The longer the skin takes to return to normal, the more dehydrated the animal is.
- 6) Studies have shown that surface area is the most important feature. Animals will choose troughs with larger surfaces areas and will drink more from them.