Taste the difference
What is palatability?

1.1 Smell ......................................................... 5
1.1.1 Breed .................................................... 7
1.1.2 Age ..................................................... 7
1.1.3 Degree of exposure ................................. 8
1.1.4 Satiety ................................................... 8
1.1.5 Health ................................................... 8
1.2 Taste ......................................................... 8
1.2.1 Acid units ............................................. 10
1.2.2 Amino acid units ................................. 10
1.2.3 Salt units ................................................. 10
1.2.4 X-fibre units ........................................... 11
1.3 Texture ...................................................... 11

The owner’s perception of palatability

The palatability of pet food

3.1 What determines food and flavour preferences? .......... 14
3.2 Ingredients ............................................... 15
3.2.1 Types of ingredients .................................. 15
3.2.2 Quality and freshness ................................ 16
3.3 Flavourings ............................................... 16
3.4 Effects of the manufacturing process ..................... 17
3.4.1 Dry food manufacture ............................... 17
3.4.2 Canned food manufacture ......................... 18
3.5 Packaging .................................................. 18
3.6 The role of antioxidants ................................ 18

The scientific measurement of palatability

4.1 The two bowl test ......................................... 19

Illness

5.1 Achieving palatability without compromising superior nutrition ......................... 22
5.2 How can the owner encourage their pet to eat? ........ 22
• Summary of key points
• Self-assessment questions
• Building your portfolio
By the end of this chapter, you will be able to:

- define the term palatability
- explain how smell, taste and texture affect palatability
- demonstrate how the owner’s perception of palatability may not be the same as a pet’s
- summarise the factors that determine the palatability of pet food
- explain the relationship between palatability and illness.
What is palatability?

We eat what we like. If it tastes bad, we don’t eat it. What is palatability? ‘Palatable’ is defined as being ‘pleasing to the palate or taste’. Pet owners commonly use the term ‘like’ – “My dog likes its food”. However, palatability and liking are not the same.

Definition
The palatability of a food is the degree to which it is acceptable to an animal based on the sensory response. This consists mainly of:
- smell
- taste
- texture.

Palatability is an attribute of the food. Liking the food is the response of the pet or the person.

No matter how palatable the food is there will always be some pets that prefer some other food. (This is discussed in detail later on in the section about Palatability of pet foods.)

Palatability is not just the taste of the food; it consists of a whole range of factors, of which the most important are:
- smell
- taste
- texture.

The combination of smell and taste is commonly known as flavour, but 70-75% of our ability to taste something comes from our sense of smell.

Exercise
Materials needed: Chewable sweets with the same shape and texture but with different tastes.

Put two sweets in front of you. The sweets should have different tastes but otherwise be completely the same. Pinch your nose shut with your fingers and pop a sweet into your mouth. Chew and swallow. Without releasing your nose, put the other sweet in your mouth.

Answer these questions:
1. Could you tell the difference between the tastes?
2. How was it to chew on something when you could not smell it?
3. Did you eagerly want to chew on the second sweet?
4. Now, think about how a cat or a dog might feel if their nose is closed off.
1.1 Smell

The sense of smell varies in different animals. The more cells the animal has in its nose that are dedicated to smell, the better the animal will be able to smell. Different animals have different areas of cells dedicated to smell:

- Humans possess 2–4 cm²
- Cats possess 7–21 cm²
- Dogs possess 18–150 cm²

This is why dogs are able to sniff out the most amazing things – including dead bodies under water, hidden drugs and explosives. Some dogs have even been trained to identify malignant melanomas (skin cancer) by smell and to indicate where they might be on people.
When an animal sniffs, the flow of air over the mucosa in the nose is increased significantly. This increases the contact between the odour molecules and the mucosa.

The contact depends on the mucus that is present in the nose, because the mucus binds the odour molecules and ‘carries’ them to the receptor molecules. In this way, odour molecules can be concentrated in the mucus to 10,000 times their level in the air.

Many factors influence how well a dog or a cat will be able to smell. Some of them are:

- breed
- age
- degree of exposure
- satiety
- health.

Smell is a chemical sensory system which:
- perceives
- recognises
- measures odours.

Odours are primarily composed of volatile compounds that are easily airborne. When these volatile compounds come into contact with special nerve receptors in the nasal cavity the compound is registered and a message is sent to the brain.

To put this into perspective, a human is able to identify 1 mg of strawberry extract in 10,000 litres of water. If we can do this and the dog has a much better sense of smell, just imagine what they are capable of! It is truly a different world for them.

Location of the olfactory mucosa within the nasal chamber (dog)

Influence of air flow on olfaction

Air flow in inspiration: 100 ml/sec moving at 1 metre/sec

Air flow in expiration: odour molecules from food reach olfactory mucosa

Air flow in sniffing: 1 litre/sec moving at 10 metres/sec
1.1.1 Breed

How well a breed is able to smell will increase with the breed size. The larger the breed, the bigger the nose will be.

A long narrow nose (breeds like Dobermans or retrievers) will have a greater flow of air over the receptors than a short, stopped up nose (like pugs, Pekingese or English bulldogs). This may mean that dogs with a short, stopped up nose have less of an appetite, because they do not smell the food as well.

1.1.2 Age

As animals get older, the sense of smell is usually the first to deteriorate. This happens in part because of age-related changes in the brain and the nasal neurons, and in part because of age-related changes in the nasal mucosa. When the animal no longer smells things as acutely, it may develop a diminished appetite.
1.1.3 Degree of exposure

Prolonged exposure to a particular odour will reduce an animal's sensitivity to it. The same is true of humans. For example, if you were to walk into an area with a distinct odour, like a stable or a chlorinated swimming pool, you would notice the smell quite strongly to begin with, but after a while you wouldn’t notice it as much, if at all.

1.1.4 Satiety

A hungry animal will have a heightened sense of smell and will notice the smell more acutely than an animal that has just been fed. Cats are the exception. Even cats that are quite satiated might still eat more if the food has a meaty odour.

1.1.5 Health

Many diseases are associated with a reduced sense of smell especially if the nose or the respiratory system is involved as in:

- generalised respiratory disease:
  - canine distemper
  - feline viral rhinotracheitis (cat flu).
- localised nasal disease:
  - nasal tumours.

1.2 Taste

For many living beings, taste provides critical information about the environment, particularly about the safety of what to eat and drink. People will routinely recognise the taste of bread that contains traces of mould – even if the bread looks completely normal.

There are two different types of sensory receptors in the mouth:

1. **taste buds:**
   - small, nipple-like structures (papillae) located on the tongue, which can be seen with the naked eye,
   - located on the roof of the mouth and down the throat.

2. **free nerve endings:**
   - throughout the mouth.

**Interesting fact**

Odours seem to fade away after a while. This is not necessarily because they are no longer present, but is because we process the odour differently after a while. The change that causes an odour to smell weaker with continued exposure is known as **odour adaptation**.

**Clinical note**

Since the sense of smell makes up a major component of food flavour, people with reduced sense of smell often incorrectly think that they have a diminished ability to taste.

**Definition**

A **taste bud** is a small structure with many taste cells on it. Taste cells are specially adapted to recognise many different types of taste stimuli.
On the tongue, there are two different types of papillae that contain taste buds:

1. **fungiform:** shaped like a mushroom (fungus).
2. **circumvallate:** shaped like a little hill or a dome surrounded by a valley or a trench.

Cats have a third type of papillae, **filiform**, that are horny protuberances pointing in the direction of the throat. These are used when the cat grooms itself and they are the reason cats find it so difficult to spit hair out once it is in its mouth. Unfortunately, the same difficulty is not encountered when it comes to spitting out pills.

On the papillae are collections of taste cells that lie next to each other so the whole thing looks like an onion. These collections of taste cells form the **taste buds**.

The structure that is actually responsible for recognising the taste compound is the taste cell, otherwise known as the **taste neuron**.

When we taste something, a taste molecule binds to a receptor of the taste neuron. This causes the taste neuron to release a neurotransmitter (a messenger) that tells the sensory neurons that something is going on, and will send the message to the brain where it is registered as a taste.

---

**NUMBER OF TASTE BUDS**

<table>
<thead>
<tr>
<th>Animal</th>
<th>Taste Buds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cats</td>
<td>3,000</td>
</tr>
<tr>
<td>Chickens</td>
<td>24</td>
</tr>
<tr>
<td>Dogs</td>
<td>at least 1,700</td>
</tr>
<tr>
<td>Catfish</td>
<td>300,000</td>
</tr>
<tr>
<td>Humans</td>
<td>2,000 to 9,000</td>
</tr>
</tbody>
</table>

Catfish have taste buds on the surface of their bodies and are known as ‘swimming tongues’.
In mammals, a recent classification divides the taste neurons into four categories:
1. acid
2. amino acid
3. salt
4. X-fibre units (these units react to different compounds in different species).

**1.2.1 Acid units**

Dogs and cats have many taste neurons that respond strongly to acidic substances. This is why acidic flavours are greatly preferred by cats and liked by dogs. In this group, we also find taste neurons that the pet can use to identify a specific water source.

**1.2.2 Amino acid units**

Because dogs and cats have a taste system that is especially responsive to amino acids, foods of animal origin are usually preferred to foods of vegetable origin. In dogs, these amino acid receptors can also be stimulated by sugars, and they were previously classified as ‘sweet’ receptors. Dogs like sugar, and this is linked to the seasonal fruit-eating behaviour of some dogs. Cats, on the other hand, are indifferent to sugars.

**1.2.3 Salt units**

Salt (NaCl) units have been identified in herbivores. This is why cows and horses are so partial to their saltlicks. Cats and dogs however, have not been shown to have any salt-specific receptors. This is probably because their natural prey has a balanced sodium content, and therefore there is not the same need for cats and dogs to seek out and recognise salt.
1.2.4 X-fibre units

X-fibre units were previously classified as ‘bitter’ receptors. They react to a wide range of different substances in dogs and cats, including phosphates, bile salts and alkaloids.

Just as with the sense of smell, there is a progressive decline in the sense of taste with advancing age. This is important to remember, as the pet may eat less or choose its food based on texture rather than taste. This can lead to some odd eating habits in elderly pets if the owner is not careful.

1.3 Texture

The texture or ‘mouth-feel’ of a food is an important factor in its selection. A number of factors influence how a pet feels texture in its mouth:

1. pressure receptors
2. movement detectors.

These allow animals to judge food characteristics such as:

- hardness
- elasticity
- adhesiveness.

With dry food, dogs and cats prefer the ingredients to be finely ground because coarse ingredients give a gritty texture. They also prefer the surface of the food to be smooth without sharp edges or projections.

As for actually chewing the food, there are preferences here as well. Cats’ teeth are not designed to enable them to grind hard kibbles so they prefer a crisper, softer texture that is easier to break up. Cats may develop strong preferences for particular shapes of kibble. The size of the kibble is important and, contrary to what owners may think, dogs often prefer them to be larger.

Let your client know

Dogs and cats prefer food that is easy to chew, and they do not like sticky food (like peanut butter). Fat is a favourite because it makes the food moist and appeals strongly to the sense of smell.
The owner’s perception of palatability

Owners have their own ideas about what makes a food appetising to their pets, and more often than not, they are wrong.

The visual appearance of the product and the packaging can greatly influence the owner’s perception of its quality and palatability. Recently, there has been an increase in ‘gourmet’ foods that emphasise these aesthetic attributes rather than any nutritional benefits.

Generally, owners will use the following as indicators of how much the pet enjoys the food:

- how readily the pet eats the food after it is offered
- the speed of eating
- the amount of food (if any) that remains uneaten
- whether the pet asks for more.

Owners are often confused and worried by their pet’s behaviour towards foods. Some pets will consistently seem finicky and have a low food intake. This can be distressing for the owner who is trying to provide the pet with the nutrition it needs. But this behaviour may not be due to the pet disliking the food, and the animal should be given a thorough physical examination by the vet to rule out any medical reasons like dental or organ disease.

Some dogs and cats appear to be fussy because they have a reduced sense of smell due to local problems or inherited defects in the nose and this can lead to a reduced appetite.
There are several things that an owner can do to increase their pet’s enjoyment of its food:

- **Store the food carefully**
  Reseal opened bags and cans to preserve freshness and flavour

- **Refrigerate opened cans and use within three days**

- **For finicky dogs**
  Moisten the dry food with water at body temperature (approx. 38°C) and let it soak for 10 minutes before feeding. This releases extra flavour from the dry food

- **Ensure that feeding bowls are clean**
  Watch out for detergent residue. Rinse the bowl carefully after washing – even if it is washed in a dishwasher

- **Avoid leaving wet food in the bowl uneaten**
  Wet food quickly becomes stale at room temperature and leaving it out may attract flies

- **Provide a quiet and undisturbed eating environment**

- **Position a cat’s feeding bowl away from its litter tray**

- **Cats do not find moistened dry food appealing, they prefer it dry.**

**Let your client know**

The major differences between pets and humans in their response to food are that pets are:

- much less concerned about the appearance, particularly the colour, of the food
- more influenced by its smell and taste
- better able to judge the quality and freshness of ingredients.

The major similarities between pets and humans are that they:

- develop individual preferences for certain ingredients and flavours
- look for novel foods
- are wary of foods that are too different from those experienced previously. These may need to be introduced to them gradually.
The palatability of pet food

The palatability of a food results from:
- basic ingredients, including different types and freshness
- use of specific flavouring agents.

3.1 What determines food and flavour preferences?

Food and flavour preferences are determined largely by experience and to a lesser extent by instinctive and genetic factors.

Examples of innate behaviour include:
- the rejection of bitter compounds
  - a natural mechanism to protect against toxic substances. In nature, many toxic substances have a bitter taste
- eating only a small quantity of a new food initially
  - allows the pet to assess the safety of the food
  - most often seen in cats
- in extreme cases a new food may be rejected persistently, no matter how palatable it is
  - most often seen in illness.

As animals mature, instinctive behaviour is modified by experience. Animals become not only willing to try novel foods but seek them out, if they have good palatability and are similar to already familiar foods. New foods are eaten in greater amounts and may eventually be preferred.

Clinical note
Older pets may require stronger flavours to overcome sensory losses and maintain their appetite.
A food aversion may develop rapidly to any taste or smell that is associated with an unpleasant experience. This can be the case if vomiting occurs within 24 hours of eating. Fireworks, pain or other unpleasant factors can also be associated with a certain food, so the pet suddenly refuses to eat it.

3.2 Ingredients

The ingredients are the basics on which both good nutrition and high palatability rest.

3.2.1 Types of ingredients

Both dogs and cats prefer ingredients of animal origin and increasing the content of animal fat and/or protein will often increase the pet’s liking for the food.

The appetising flavour of meat is largely due to the presence of particular amino acids and other compounds. When meat is cooked, even more intense flavours are produced. This is because the amino acids are broken down by heat and interact with sugars to form a variety of complex organic compounds.

However, no matter what some studies may say, individual animals show considerable variation in their preference for animal-derived ingredients. For example, it was found that sardines are highly palatable to some cats while others reject them.
3.2.2 Quality and freshness

Both the quality and the freshness of ingredients influence palatability. Dogs and cats can readily detect both. Ingredients that are not completely fresh might have one or more of the following problems:

- oxidation of fats, which make them go rancid
  - because fat goes rancid so readily, it is important that antioxidants are always added to the fat.
- contamination with bacteria
- contamination with moulds.

All of the above will significantly decrease the palatability of any pet food. Contamination with bacteria or moulds can result in unattractive mouldy and musty flavours. This emphasises how important it is for pet food manufacturers to use only fresh ingredients of top quality and to make sure they stay that way. Care must be taken to avoid incidental contamination during the manufacturing process.

Quality control is an extremely important feature of pet food production.

Clinical note

In the case of pets with a diminished appetite, flavourings can help to encourage acceptance and stimulate eating. However, excessive levels of some flavourings like salt and fat can result in a nutritionally unbalanced food, which may lead to health problems.

Interesting fact

Hill’s Pet Nutrition has stringent ingredient specifications, backed up by regular testing and careful handling during storage and manufacture. This ensures that all products are of high quality.

To maximise freshness, many ingredients are used in Hill’s foods within hours of their production by suppliers. This emphasis on freshness is reflected in the high palatability scores of the products.

3.3 Flavourings

Just as the cook at home adds salt, herbs, spices, stock cubes, onion, garlic, lemon and synthetic essences like vanilla and caramel to enhance the palatability of natural ingredients, so do pet food manufacturers. Nevertheless, an unpalatable food can never be made palatable simply by adding flavouring agents, so the freshness and quality of ingredients are still the most important way to ensure the best palatability.

Let your client know

Good palatability is not the same as good, balanced nutrition. Carefully balanced correct nutrition is always more important.
Some of the flavourings which may be used in pet foods, include:

- **salt**
  - cheap
  - the most widely used flavouring in pet foods, despite lack of proof that pets have taste buds sensitive to salt
  - levels used are sometimes at ten times the maximal nutritional requirements!
- **fats and oils**
- **onion and garlic**
  - not always popular with the owner...
  - potentially toxic and not advised
- **amino acids**
- **monosodium glutamate**
  - naturally present in soy sauce
- **sugar**.

For dogs also:

- **organic and inorganic acids**
  - e.g., phosphoric acid.

The amount that is used is critical — too little is ineffective, too much can be unpleasant and even dangerous. These flavourings can either be incorporated into the food or, in the case of dry foods, they can be applied to the surface. Most dry pet foods are coated with something called a ‘digest’, which is produced from a combination of meat ingredients and yeasts by the action of heat and/or enzymes. This creates highly palatable meat extracts or essences with concentrated flavours.

Just as with the ingredients, freshness is critical to the palatability of the digest.

### 3.4 Effect of the manufacturing process

The manufacturing process has an influence on various nutritional factors, including palatability.

#### 3.4.1 Dry food manufacture

Most commercially prepared dry pet foods are manufactured using a batch system to blend the ingredients into a ‘dough’, which is then extruded. Extrusion is a process in which the dough is forced through a die-plate, simultaneously cooking it by friction, and shaping it. A rotating knife blade then cuts it into individual kibbles. The high temperature generated by extrusion cooks the food (improving its digestibility), destroys micro-organisms and increases its palatability.
3.4.2 Canned food manufacture

Meats are ground and mixed with other ingredients before cooking in the optimum time/temperature combination to maximise flavour. The food is then placed into cans, which are sealed and passed through a machine that is similar to an autoclave, to sterilise the food.

3.5 Packaging

Packaging has a vital role to play in preserving the freshness and palatability of the food and in protecting it from contamination.

To protect the food from contamination, the packaging process takes place in a controlled environment. This limits the food’s contact with oxygen so oxidation of fats is avoided. Since inappropriate packaging may taint the food with tastes and odours and this may negatively affect the palatability, it is essential to use high quality packaging materials. Hill’s uses resealable bags so the pet owner can store the food at home more efficiently.

3.6 The role of antioxidants

Food antioxidants are added to dry foods to prevent fats from becoming rancid. This maintains the food’s palatability and prolongs its shelf life. These antioxidants are different from the biologically active, nutritional antioxidants, which provide health benefits. For example, the biologically active form of vitamin E is alpha-tocopherol. The forms of vitamin E that are most effective in preserving fat in the pet food are gamma- and deltadecopherols. This means that pet foods that are advertised as being ‘preserved with vitamin E’ will not necessarily provide antioxidant protection for the pet.
The scientific measurement of palatability

To compare the palatability of foods it is essential to use a method that is:
• reliable
• unbiased
• fair.

The test procedure most commonly used for pet foods is a pair-comparison test, generally referred to as the Two-Bowl Test.

4.1 The Two-Bowl Test

A number of animals that are fed separately are allowed free access to two bowls containing the two pet foods being compared. Each bowl must contain an amount greater than that which the pet would be expected to eat during the test period. The amount of each food consumed is then used to determine the individual animal’s preference and from that the overall preference of the group.

Let your client know
In Europe alone, Hill’s Pet Nutrition undertakes extensive palatability studies: 35,000 individual study results per year.
To achieve meaningful, statistically significant results, it is necessary to:

- feed sufficient animals
  - at least 20–35 is recommended (Hill’s uses more)
- repeat the test on other days
  - at least 2–3 test periods are necessary
- alternate the position of the bowls when the test is repeated
  - to correct for any bias for feeding on the left or the right

- feed for a sufficient length of time
  - 30–60 minutes for dogs
  - 11–23 hours for cats
- use a variety of animals
  - e.g., different canine breeds
- exclude animals with atypical feeding behaviour
  - e.g., pets that have low food consumption, play with the food, or spill the food, so it cannot be accurately measured
- conduct the test in a controlled environment
  - e.g., to ensure that the environment is free from distractions such as competing odours.
Illness

In many medical and surgical disorders, pets will have a complete or partial loss of appetite. Reduced appetite can also be a side effect of drug therapy. Many types of drug affect the pet’s ability to taste and smell.

Some disorders are characterised by the presence of metabolic ‘waste products’ that depress the appetite centre in the brain. The most typical are:

- renal disease
- hepatic disease.

This poses a challenge because pets that are unwell have a crucial need for an adequate intake of nutrients to:

- ensure repair of tissues
- ensure regeneration of tissues
- preserve immunity
- meet daily energy requirements.

Because of this, it is essential that clinical diets should be sufficiently appealing so that they will be eaten voluntarily wherever possible. Increases in palatability that ensure an adequate nutrient intake will not only promote a feeling of well-being but have also been shown to improve survival.
5.1 Achieving palatability without compromising superior nutrition

It is important to remember that food that delivers a high degree of palatability may not provide the appropriate nutrition.

Typical examples may be raw liver, which is very appealing to most cats, but if fed to a cat with renal disease, the high levels of phosphorus in the liver may actually exacerbate the disease and make the cat feel worse. This in turn leads to further loss of appetite and then the raw liver might be the only thing that lures the cat to eat, which then again worsens the situation, etc.

Therefore, increasing the palatability of clinical foods can directly influence the wellbeing of pets that are receiving nutritional management for clinical conditions but it should never be increased by compromising the nutrition itself.

5.2 How can owners encourage their sick pets to eat?

There are a number of steps that can be taken to encourage pets to eat.

1. Introduce a new food gradually, ideally over a period of a week, unless it is essential that it should be fed as the sole food immediately. Mix it with the pet’s usual food, increasing the proportion each day until only the new food is being fed.
2. Warm canned food to body temperature – but no hotter – before feeding.
3. ‘Loaf-type’ canned foods can be cut into slices and lightly fried before serving. They may also be mixed with warm water in a blender to create a smoother texture.
4. Keep the nasal passages clear to preserve the sense of smell.
5. Place small amounts of canned food on the paws or lips. This may encourage a licking response and stimulate appetite.
7. Try moistening the dry food for dogs.
Summary

Summary of key points

1. Palatable food is acceptable or pleasing in terms of smell, taste and texture.
2. Smell and taste senses are interrelated but may vary in dogs and cats according to breed and age.
3. Smell is a chemical sensory system.
4. Taste relies on chemical sensory receptors in the mouth and on the tongue.
5. Texture is important for palatability as well.
6. Dogs and cats prefer different types of texture.
7. Owners’ perceptions of palatability may not reflect the pets’.
8. Dogs and cats tend to prefer ingredients of animal origin.
9. Fresh ingredients of high quality are essential to achieving good palatability.
10. High palatability is not the same as balanced nutrition.
11. Flavourings should be added with care and in moderation, sometimes as a digest.
12. The manufacturing process may also influence the nutritional content and palatability of pet food.
13. Packaging and antioxidants will help preserve the freshness.
14. Palatability may be measured scientifically using the Two-bowl Test.
15. The pet’s perception of palatability may be affected by illness and/or treatments.
16. There are a number of ways to encourage sick pets to eat.

Self-assessment questions

1. How does palatability differ from liking?
2. How do we detect flavours?
3. What factors influence how well a dog or cat can smell?
4. What are the four categories of tastes detectable by mammals?
5. What textures do dogs prefer?
6. What determines an owner’s perceptions of the palatability of a pet food?
7. What factors affect the palatability of pet food?
8. What is the Two-Bowl method of measuring palatability?
9. What steps can be taken to encourage a sick pet to eat?

Footnotes

Building your portfolio

Photocopy and use the form below to keep a record of your answers to the questions below. Keep this information for your portfolio.

Exercise

a. Explain to Mr Yum-Yum, in simple terms, what he can do if his sick or healthy pet refuses to try the new food.

b. How would you explain, in simple terms, why an owner’s perceptions of palatability may not be accurate?