

# CATS and DOG NUTRITION

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# General Information of Cats and Dogs

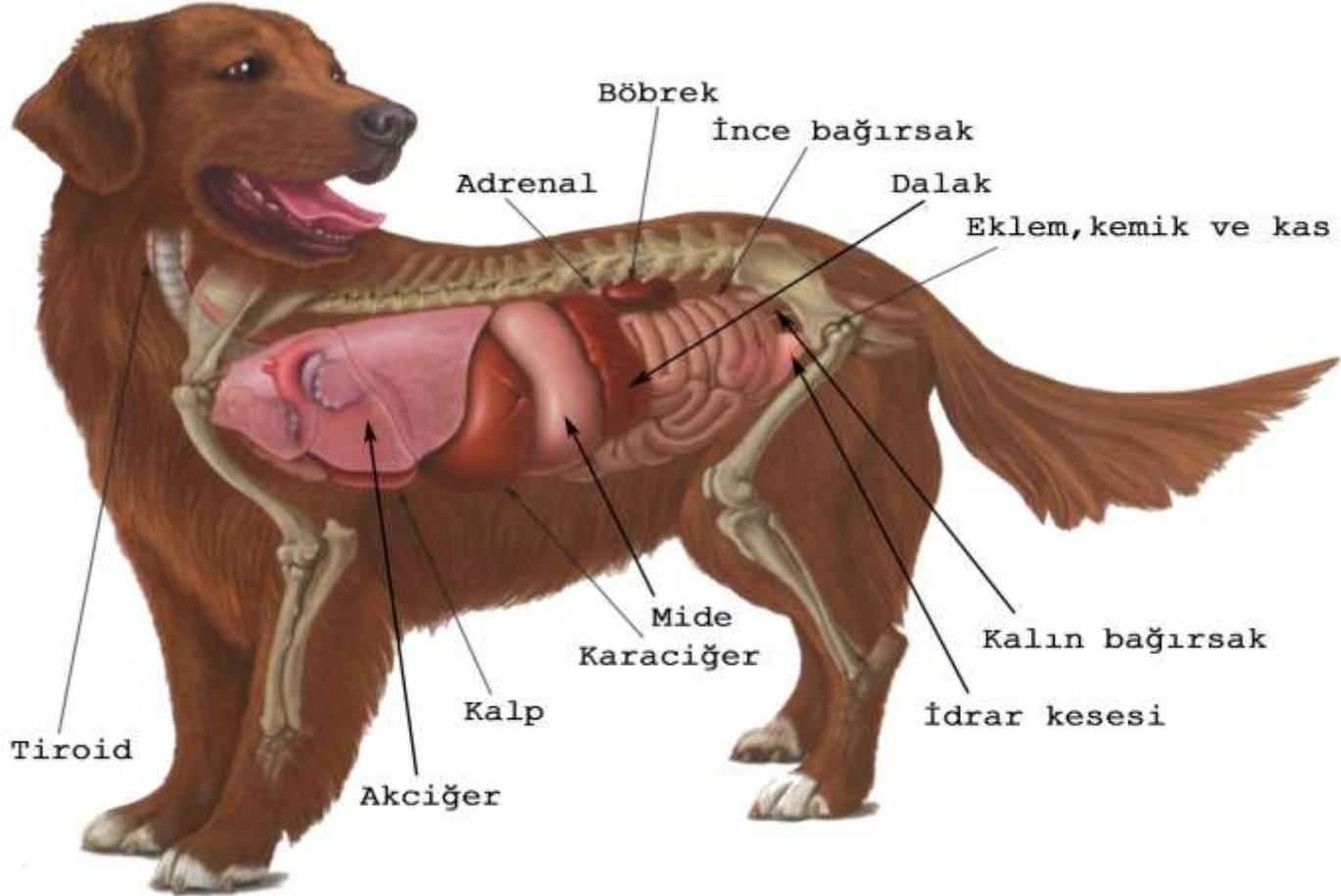
## Dogs

- In family Canidae
- Domestication a few 1,000 years
- 72 million dogs live in U.S.
- Height 6 inches to 40 inches at the shoulder
- Life expectancy 9 to 15 years, some 20 years.
- Small dogs live longer than large dogs
- 42 adult teeth
- Sweat glands on nose and feet
- Hearing 2 times better than humans higher frequencies

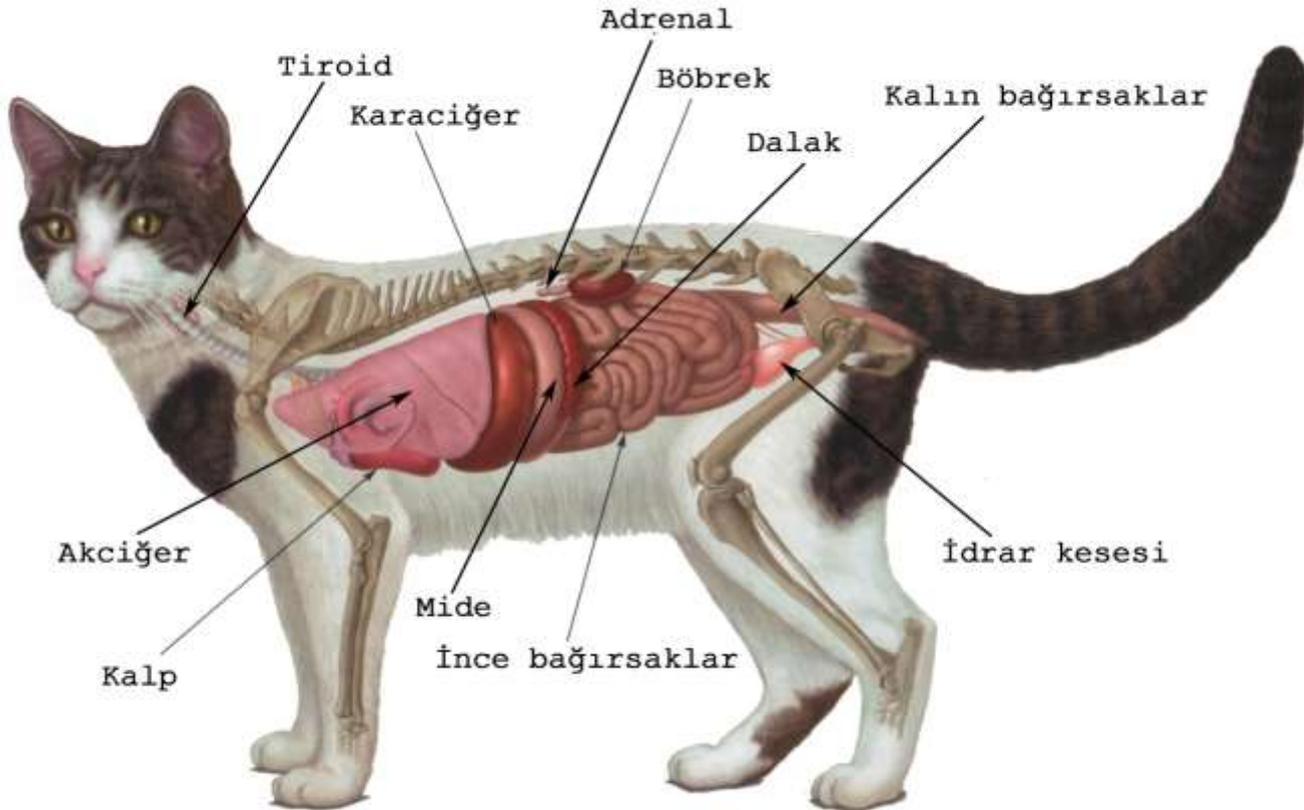
## Cats

- In family Felidae
- Domestication a few 1,000 years
- 82 million cats live in U.S.
- Weight 4 to 18 pounds
- Life expectancy 10 to 15 years, some 22 years
- 30 adult teeth
- Excellent night vision
- Vision up to 120 feet distance
- Can hear 1 ½ times better than dogs
- Semi-circular canals in ear help maintain balance aids in cat's ability to land on feet in a fall
- Smell 14 times better than humans

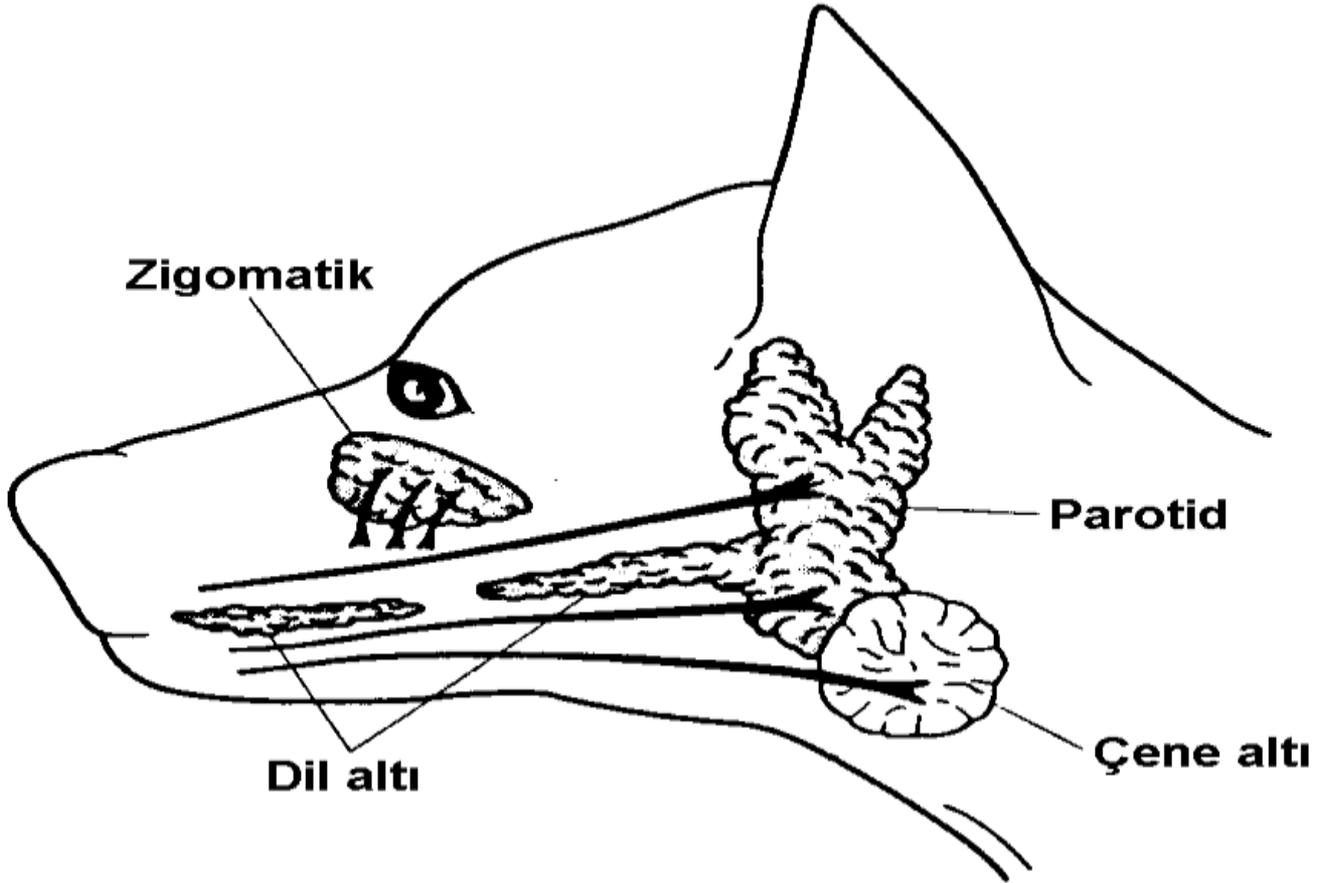
# Digestive System in Dogs



# Digestive System in Cats



# Salivary Glands



# SALIVA

Saliva secretion continues during food ingestion and chewing. 99% of the saliva is water, and the remaining 1% is mucus, inorganic salts and enzyme. The mucus is effective as a lubricant and facilitates ingestion of dry foods in particular.

In dogs and cats' there is no  $\alpha$  -amylase activity in saliva acting on starch, unlike humans.

- Nutrient Requirement

# Water

Water consumption:

**According to BW:**

- Dogs: 50-60 ml/kg BW/day
  - **According to energy intake:**
  - 200 kcal/day energy intake = 200 ml water intake
- Cats drink water less than dog (desert animal)
- Formation of urinary calculi

# Energy

- Energy producing nutrients
- Protein (built of amino acids)
- Carbohydrates
- Fat

# Factors that Affect Energy Requirements

- Growth
- Lactation
- Stress
- Physical exertion
- Breed
- Environmental conditions
- Age

- Cats are true carnivores
  - Protein are their primary energy source
  - Need taurine (amino acid)
- Dogs are omnivores
  - CHO are their primary energy source

- **RER=resting energy requirement**  $RER=30 \times (\text{weight in kg}) + 70$
- **MER=maintenance energy requirement**
- $MER= 1.0-1.8 RER$
- RER can also be multiplied by a factor to account for different life stages of the animal
  - Examples
    - Puppies 3 x RER
    - Kittens 2.5 x RER
    - Gestation 3 x RER
    - Lactation dogs 4 to 8 x RER
    - Lactation cats 2 to 6 x RER

## ENERGY REQUIREMENT

- ▶ Small breeds (< 2.7 kg):
- ▶ Medium breeds (<11-12 kg):
- ▶ Large breeds (<35 kg):
- ▶ Giant breeds (> 35 kg):

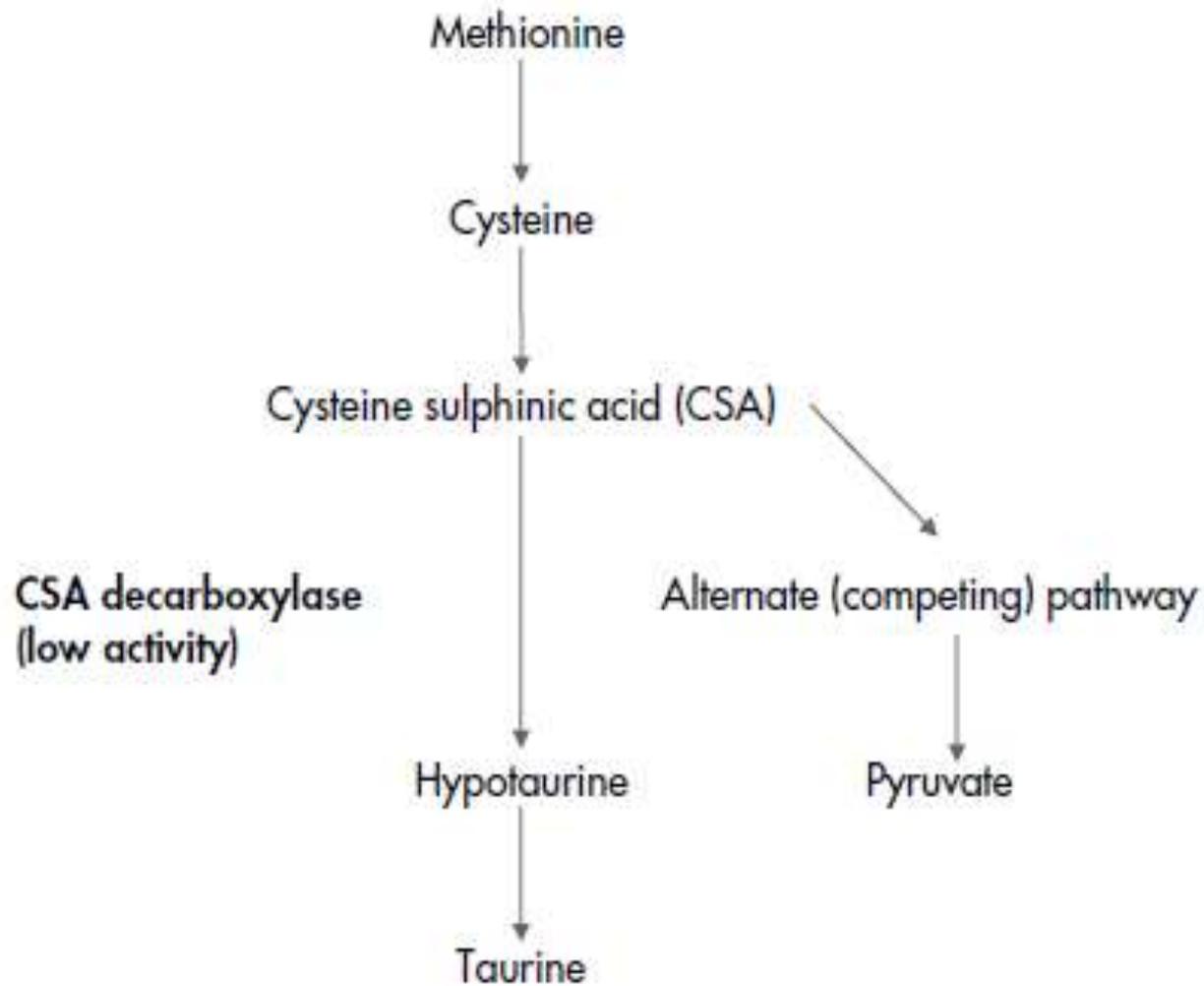
- Trauma, illness, stress and sepsis will increase an animal's metabolism, thus increasing the animals energy requirement

# Protein

- Importance:
  - Necessary for of growth and development
  - Structural component
  - Needed for the *immune system*.
  - Burned as calories and can be converted to and stored as fat.

- Cats and dogs do not need the protein but they need amino acids.
- There are **22 amino acids** that animals need. Animals can synthesize 12 of them.
- The remaining ones must be consumed (essential amino acids)
- Arginine,
- Histidine,
- Isoleucine,
- Leucine,
- Lysine,
- Methionine,
- Phenylalanine,
- Threonine,
- Tryptophan,
- Valine,
- and for cats, **TAURINE**
  
- Dogs can synthesize taurine, and therefore, it is not supplemented in their food.

- **Taurine:** Taurine is an amino sulfonic acid and is in the list of 25 amino acids. However, taurine is not part of the peptide chains of proteins.
  - Taurine is necessary for proper bile formation, health of the eye, and functioning of the heart muscle.
  - Cats require a high amount of taurine for their body functions, but have limited enzymes to produce taurine from other amino acids such as methionine and cysteine.
  - If taurine is deficient, signs such as a heart condition called dilated cardiomyopathy, retinal degeneration, reproductive failure, and abnormal kitten development can occur



**Figure 12-1** Taurine synthesis and metabolism in the cat.

## Taurine

- It is excreted via urine and feces.
- Therefore, taurine is lost during the daily digestive process.
- The need for adult cats is higher than that of the offspring.
- The cats in lactation are more sensitive to taurine deficiency, especially because it is excreted with milk.
-

## Especially important for cats for 2 reasons

- ▶ 1. The enzyme (cysteine dioxygenase and cysteine sulfinic acid decarboxylase) which converts methionine and cysteine into taurine in the liver is insufficient.
- ▶ In other words, cats do not have an enzyme system capable of synthesizing taurine in sufficient amounts from the cysteine.
- ▶ 2. In the formation of bile salts, other animals may use glycine instead of taurine. However, cats cannot use glycine for this purpose and they must use taurine for this purpose.

## Taurine Deficiency

- Irreversible retinal disorders in eyes
- Regression of reproductive activity during pregnancy and lactation (due to fetal resorption)
- The weak birth
- Retardation of growth in surviving pups
- Dilated cardiomyopathy
- Immunosuppression (immune suppression)

- Taurine Supplementation for Cat Foods
- 1 g/kg = %0.1 for dry foods
- 2 g/kg=%0.2 for canned foods

- Special needs

- Arginine.

- Most animals manufacture ornithine through various processes, some of which require arginine.
      - Ornithine is necessary because it binds ammonia produced from the breakdown of protein.
    - In cats, the only method to produce ornithine is to convert it from arginine.
      - If cats are deficient in arginine, there will not be enough ornithine to bind the ammonia, and severe signs such as salivation, vocalization, ataxia, and even death can result from the high ammonia levels.
      - Arginine deficiency is rare, but can occur in cats who are not eating or have certain liver diseases such as **hepatic lipidosis**

# Nutritional Requirements - Protein

## Protein Requirements of Cats

Species and Growth Stage	Recommended Protein %	Recommended Fat %
Kitten	30%	20%
Adult cat	25-30%	15-20%

Pregnant and lactating cats: need higher protein - feed kitten food.

Sick, weak, and debilitated animals need extra protein.

Animals with kidney disease need a protein-restricted, but high biological value diet to lessen the effects of the kidney disease.

## Protein Requirements of Dogs

Species and Growth Stage	Recommended Protein %	Recommended Fat %
Puppy	28%	17%
Adult dog	18%	9-15%
Performance dog	25%	20%
Racing sled dog	35%	50%
Lactating dog	28%	17%

# Nutritional Requirements - Protein

- **too much protein?**

- If a healthy cat eats too much protein, some gets excreted in the urine and the rest gets used as calories or is converted to fat
- If cat has a kidney problem, high protein diets are not recommended.
- Protein is the most expensive cost component in the food.

# CARBOHYDRATES

- Most commercial dry foods contain between 30% and 70% carbohydrates
- Wild felines and canines do eat some CHO (berries and intestinal contents of the prey).
- While carbohydrates are an important part of dry commercial pet foods,
- they can occasionally cause medical problems in dogs including **obesity** and **maldigestion**.

- Benefits of using carbohydrates:
  - Less expensive and more readily available as an energy source than proteins.
  - Essential in the formation of dry pet food. The starchy carbohydrates are used to add structure, texture, and form to kibbled food helping to create a product that is stable and easy to feed.
  - Canned foods could be composed without the addition of carbohydrates, but dry kibble could not exist in its current form without carbohydrates.

- Carbohydrates used in foods generally include the starchy portion of a plant that can be easily broken down in the digestive tract of the dog.
- Soluble carbohydrates are found in high concentrations in cereal grains such as rice, wheat, corn, barley, and oats.
- **The cooked or extruded forms of carbohydrates** are easily and rapidly digested by dogs and cats.
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- It should be noted that not all forms of starch are easily digested by dogs and cats. Raw cereal grains are digested much more slowly in the intestine and there are some starchy carbohydrates, including raw potatoes and bananas that are completely resistant to digestion in pets.

## Disaccharides

Cooked starch can be rapidly digested. Disaccharides sucrose and lactose are less tolerable. These animals contain sucrose (akt-fructofronidase) and lactase (ar-galactosidase) enzymes for lactose in the intestines.

While these enzyme activities are at the highest level in dogs and kittens, activity decreases with age and especially in adult cats **LACTOSE INTOLERANCE** occurs.

## Lactose Intolerance

- It is the primary carbohydrate lactose in milk, which
- constitutes 20-25% of KM in cat milk and is lower than cow's milk.
- In the first 5 weeks of life of the puppies there is a good fit in lactose and it provides lactase.
- At the end of milk absorption, lactase secretion is reduced by 75-90% and at week 12 it reaches the level of adult animals and this level is 10-30 times less than a newborn baby.
- It is 1-2 g lactose / kg BW for those who absorb roughly tolerance by taking into account individual differences.

## Starch Digestibility

- ▶ Amylase activity in dogs is 3 times more than cats.
- ▶ In dogs, high levels of starch are involved in the diet, while amylase activity is six fold and is limited to two fold in cats.
- ▶ Because of this feature, two weeks is sufficient for dogs to adapt to a new diet, while cats need months.
- ▶ Cats can tolerate 4-5 g starch / kg body weight per day without diarrhea.
- ▶ Dogs can tolerate well over 2.5 times more well-cooked starch.

# LIPIDS

Cats cannot convert linoleic acid to other fatty acids as in lions

Due to these properties, it should be ensured that cats have sufficient level of **arachidonic acid** in their diet.

## FATTY ACIDS

In mammals there are 4 important unsaturated fatty acids series

- 1- palmitoleic (omega 7)
- 2- oleic (omega 9)
- 3- linoleic (omega 6)
- 4- linolenic (omega 3)

- $\omega$ -6-linoleic -----Arachidonic acid
- $\omega$ -3-linolenic-----EPA (eicosanopentaenoic acid)
  - Arachidonic Acid
  - Dogs can convert LA (linoleic acid) to AA (arachidonic acid), whereas in cats arachidonic acid synthesis is limited.
  - Therefore, a sufficient amount of arachidonic acid in cat diets should be taken into consideration.
  - Otherwise, symptoms of inadequate essential fatty acids occur.

## Symptoms related to deficiency of essential fatty acids seen in cats

- ▶ insufficient growth,
- ▶ - hyperkeratosis in the skin,
- ▶       - shedding of hair,
- ▶ - delay in blood clotting time,
- ▶ - mouth and skin lesions,
- ▶ - fat in the liver,
- ▶ - prolonged wound healing time,
- ▶ - degeneration of testes, kidneys and adrenals,
- ▶ - thrombocytopenia,
- ▶ - the chicks are less likely to live.

# Feeding Kitten and Puppies

- The neonatal period in puppies and kittens is considered to be the first 2 weeks after birth.
- Puppies and kittens are born in a relatively immature state and are completely dependent upon their mother's care.
- Because of this immature state, preweaning mortality for puppies and kittens are estimated to be as high as 40%, and the vast majority of deaths occur during the neonatal period.

# Composition of Milk

- Like all mammals, female dogs and cats produce a special type of milk called *colostrum* during the first few days following parturition.
- Because the immune system of puppies and kittens is not fully developed until they are about 16 weeks of age, the transfer of this protective is important for their survival.

# Avarage Nutrient composition of dog and cat milk

	Dog Milk	Cat Milk
Protein (%)	8-10	7-8
Lactose (%)	3-4	3-4
Fat (%)	11-13	5-7
Calcium (mg/L)	1400-2200	700-1800
Magnesium (mg/L)	90-100	65-70
Iron (mg/L)	2-7	8-9
Zinc (mg/L)	4-6	6-7
Copper (mg/L)	1.0-1.4	1.0
Energy (kcal/L)	1500-1800	850-1600

## Milk composition in some mammals, %

Tür	Su	protein	yağ	laktoz	kül	Ca	P	Kcal/100 g
keci	82.2	7.0-9.1	3.3-5.0	5.0	0.51	0.035	0.070	101
köpek	75.4-80.0	7.5-11.2	8.5-9.6	3.1-3.5	0.73	0.230-0.325	0.160-0.222	164
inek	87.2	3.5	3.7	4.9	0.71	0.121	0.095	73
koyun	80.1	5.8	8.2	4.8	0.92	0.250	0.166	127
keçi	86.5	3.6	4.0	5.1	0.80	0.131	0.104	79
balina	42.8	12.2	42.3	1.3	1.42	0.300	0.193	465
insan	87.5	1.0	4.4	7.0	0.21	0.035	0.013	

- The gastrointestinal tracts of newborn puppies and kittens are uniquely suited to digest and absorb the milk produced by the mother dog and cat, respectively.
- Fat and lactose are the primary sources of energy in milk; puppies and kittens have high intestinal lactase activity and are capable of
- digesting milk fat very early in life
- Puppies are only able to absorb the antibodies from colostrum during
- the first 18 (or less) hours of life.

- Growing puppies progress through three critical phases in the first 12 months of life
- **1.Nursing period:** This period is largely influenced by the nutrition of the bitch during gestation and early lactation
- **2.Whening period:** The transition from bitch's milk to solid food.
- **3.Postweaning period:** from 2 to 12 months of age

- During the first few weeks of life, puppies and kittens should nurse every few hours, at a minimum of four to six times per day. The frequent intake
- of small amounts of milk is necessary because of the small size of the neonate's stomach.
  
- The eyes of puppies and kittens open between 10 and 16 days after
- birth and their ears begin to function between 15 and 17 days after birth.

- Newborns should be weighed daily during the first 2 weeks and then every 3 to 4 days until weaning.
- A helpful guideline is for puppies to gain between 1 and 2 grams (g) per day for every kg of anticipated adult weight for the first 3 to 4 weeks of life.
- Kittens usually weigh between 90 and 110 g at birth and should gain between 50 and 100 g per week until they are 5 to 6 months of age.
- Volume of milk intake is affected by age, rate of growth, and for dogs, breed size.

- In healthy puppies and kittens, the dam's milk supports normal growth until the young are 3 to 4 weeks old. Supplemental feeding with commercial milk replacer is usually not necessary, with the exception of unusually large litters.
- After 4 weeks, milk alone no longer provides adequate calories or nutrients for normal development.
- Supplemental food should be introduced to puppies and kittens when they are 3 to 4 weeks of age. A commercial food made specifically for weaning puppies or kittens can be used.

- Cow's milk should not be used to make the gruel because it is higher in lactose than bitch's and queen's milk and may cause diarrhea.
- at 5 weeks of age, puppies and kittens are readily consuming semisolid food.
- The deciduous teeth erupt between 21 and 35 days after birth. By 5 to 6 weeks of age, puppies and kittens are able to chew and consume
- dry food.

# PRACTICAL FEEDING TIPS: ORPHAN PUPPIES AND KITTENS

- - Milk replacers composition similar to that of bitch's or queen's milk and meet nutrient requirements puppies or kittens
- There are some recipes available for the formulation of homemade milk replacers.
- -Cow milk
- -Goat milk
- -Egg
- Eggs are added to increase the protein content and dilute the lactose concentration of the ruminant milk.
- Divide the formula into four to five equal feedings per day.
- Weigh orphans regularly: one time per day for the first week and one to two times per week thereafter.
- Introduce semisolid food at 3 to 4 weeks. Wean to dry pet food by 6 to 8 weeks.

- **Weight Gain**
- Puppies reach 2 x bird weigh until 10-12 days of age
- **Normal birth weght**
- Toy breees: 100 g
- Medium breeds: 200-300 g
- Large breeds: 400-500 g
- Giant breeds: 700 + g

- **Gestating and Lactating Cat and Dog Nutrition**

## Laktasyonda besleme

- ▶ Burada anne için önemli olan yavrularının sayısı, büyüklükleri ve yaşlarıdır. Yavrular 6-7 hafta süt emerler.
- ▶ Yavruların enerji ihtiyaçları 3-4. haftalarda pik yapar.
- ▶ Anne 4-5'den fazla yavru emziriyorsa diyetinde % 28 - 30 protein ve % 20-25 yağ olmalıdır.
- ▶ Vitamin ve mineral gereksinimleri karşılanmalı fakat öncelikle Ca/P oranına dikkat edilmelidir.

## Laktasyonda besleme

- ▶ Annelerin gereksinmesi ilk hafta 1.5 kat, 2. hafta 2 kat, 3. hafta 2-3 kat artırılarak sürdürülür.
- ▶ Emziren annelerin diyetleri 427 cal/100 g olmalıdır. Aksi takdirde canlı ağırlık kaybı kaçınılmazdır.
- ▶ Örneğin 4 ve daha fazla yavru emziren dişilerin diyetleri 310 cal/ 100 g olduğunda ağırlık kaybı kesinlikle olmaktadır.
- ▶ Diyetteki enerjinin artırılması laktasyonun sağlıklı devamını sağlar.

## Gebe laktasyonda köpek diyeti

- Özellikle gebeliğin son 3-4 haftası ve laktasyonda
- Sindirilebilirliği en az % 80
- Protein en az % 25
- Yağ en az % 17
- Enerji 3500 kcal /kg
- Lif (selüloz): % 5'den az
- Ca % 1-1.8 P % 0.8-1.6
- **Kediler için**
- Gebeliğin son 3 haftası ve laktasyonda
- Sindirilebilirliği en az % 80
- Yağ en az % 17
- Enerji 3600-3700 kcal/kg
- Ca % 1-1.8 P % 0.8-1.6

- ⦿ Bazı ipuçları
- ⦿ \*İyi kaliteli mamadan başka ilave takviye yapılmamalı (Et, süt, Ca, P, veya vitaminler)
- ⦿ \* İlk 5 hafta normal yaşama payı beslemeye devam edilir.
- ⦿ \* 5 - 6 haftadan sonra yem miktarı gebelik süresine göre % 15-25 daha fazla enerji sağlayacak şekilde giderek artırılmalı (Ad libitum veya günde 2 kez)
- ⦿ **Laktasyon döneminde:**
- ⦿ \* Günde en az 3 kez veya ad libitum beslenmeli
- ⦿ Laktasyonun 1, 2 ve 3. haftalarında sırasıyla yaşama payının 1.5, 2 ve 3 katı yem verilmeli

- Annesiz yavrular için st ikame rneęi
- 250 ml st
- Bir tutam tuz
- 3 adet yumurta sarısı
- 1 yemek kaşıęı mısır yaęı
- $\frac{1}{4}$  ay kaşıęı vitamin

- NUTRITIONAL DISEASES

# Food Allergy

- 
- In some cats and dogs, while most of them digest food without showing sensitivity, immunological mechanisms against specific antigens are activated.
- Antigens are proteins and the most important are glycoproteins.
- 
- Antigenic foods for dogs
  - Milk protein
  - Soybean
  - Wheat
  - Beef
  - Horse meet
  - Egg
  - Poultry meat
  - Pig meat
  - Yeast
  - Also fish for cats

# Food Allergy

- Non-seasonal pruritus is the most common clinical symptom of food allergy.
- Clinically the reaction may suddenly appear months or years after feed consumption.
- There is no race, age or gender predisposition.
- Dermatological symptoms
  - pruritis,
  - urticaria,
  - otitis externa and
- Gastrointestinal symptoms
  - Vomiting or diarrhea (blood or bloodless)
  - Occasionally eosinophilia can be observed.

# Food Allergy

- **Treatment in food allergy;** antigen - if it is detected - it depends on the elimination of the diet.
- In the case of gluten allergy, a veterinary diet or a diet known to be gluten-free must be administered throughout the remainder of the dog's life.
- Intestinal changes return to normal within 6 weeks of the diet regimen.
- It may take weeks for clinical signs to be lost even when fed with antiallergic (hypoallergenic) diets.

- By adding the feedstuff to the individual diet, it is determined whether the possible antigen is present and the animal's tolerance to it.
- Normally, clinical symptoms occur within 7 days following consumption of the antigen-containing diet. Each feed is tested one by one until the whole diet is fully controlled.
- In some cases, the animal may have to be fed with hypoallergenic diets for the rest of its life.

- **Dietary restrictions:**
- Although lamb and rice are popular for diet-related applications, the advantage is limited

Lamb and rice alternatives  
camel, ostrich,  
rabbit, duck,  
fish, egg

Oatmeal, turnip,  
sweet potato, Tofu

# Renal Failure

- Because the kidney tissue has a poor regeneration power, the nephrons cannot be renewed when they are destroyed.
- Renal insufficiency only occurs when nephrons are destroyed by 70% or more.
- At the time, different symptoms such as vomiting, anorexia, diarrhea, weight loss and hypoalbuminemia develop with symptoms of polydipsia and polyuria.

- In renal failure, normal products of protein metabolism cannot be effectively removed by the kidney
- It causes effects on vomiting, diarrhea and occasional convulsions.
- The protein requirement increases as the amino acid is lost in the urine.
- While the loss of calcium increases with the water-soluble vitamins from the kidneys, the phosphorus is generally kept.
- **Calcium: phosphorus ratio varies from 1.5: 1 to 1: 4.**

# Chronic Renal Failure

- Treatment strategy in chronic renal failure is a low protein diet.
- Water-soluble vitamins and calcium losses should be replaced,
- Sodium accumulation with phosphorus should be prevented.
- 2.0-2.2 g high quality protein / kg live weight / day for dogs in ideal mild to moderate levels of protein
- 3.3-3.5 g protein / kg live weight / day for cats is recommended

## Dietary recommendations for cats and dogs with chronic kidney failure

Besin maddesi	Köpek	Kedi
Protein	≤ %15	≤ %30
Fosfor	%0.15-0.3	%0.04-0.6
Sodyum	%0.25	%0.35

# Chronic Renal Failure

- Aluminum hydroxide can be used to form chelates with phosphorus
- Aluminum hydroxide cats 30-90 mg / kg / day should be used with caution.
- Calcium addition should only be made when calcium: phosphorus ratio is corrected.
- All calorie requirements of cats and dogs must be provided from fat and CHOs.

# Diabetes Mellitus

- It is an endocrine disease resulting in hyperglycemia and ketoacidosis resulting from the effects of protein, carbohydrate and fat metabolism.
- Diabetes mellitus is mostly seen in females above the middle age (older than 8 years).
- Keeshund 's less than one year old hereditary form is seen.
- It is seen hereditary disposition in Cairn and Scottish terrier, Poodle, Samoyed, King Charles, Rottweiler and Daschund.
- There are two types of diabetes mellitus: insulin-dependent and non-insulin-dependent.

# Diabetes Mellitus

- **Type-I:** Insulin-dependent diabetes mellitus is the most common type in small animals.
- Patients are normal weight or weak. The insufficiency of insulin secretion occurs as a result of cell failure in the islets of Langerhans.
- **Type-II:** This form of diabetes is associated with obesity and results in insulin resistance, hyperinsulinism and decreased insulin receptor numbers. The increase in blood sugar is the result of an insufficient level of insulin. As obesity progresses, the resistance to insulin increases.

- **Type-III:** This is an abnormal glucose tolerance of the patient without showing clinical signs of diabetes. This may be related to type I and type II diabetes and to the early stage and obesity.
- With the attenuation of obese animals, the number of insulin receptor sites is increased and the diabetic effect is reduced. Type-III diabetic diet and oral hypoglycemic drugs can be used.

- Since home-made diets are not stable, these should be avoided and veterinary diets should be used.
- If the animal is obese, diabetics and weight loss are controlled by reducing the diet.
- High calorie diets should be used if the animal has lost weight.
- Insulin therapy is necessary in type-I diabetes. However, an important part of the treatment forms a diet.
- The timing and caloric content of meals in this type of diabetes is important.
- To reduce the risk of vascular disease, the saturated fat and cholesterol content of the diet should be low (10% KM).

- The diet should contain an average amount of protein (25-30% KM) with high biological valence.
- It should contain high levels of complex carbohydrates (45-50% KM). A carbohydrate diet in these ratios has no negative effect on diabetes control.
- A high amount of fiber in the diet reduces serum lipid level by reducing carbohydrate absorption.
- Therefore, the amount of fiber in the diet should be increased. Dietary fiber (average 10-13% KM)

## Nutrition and Skin Health

- Skin and hair health of dogs and cats can be affected by many nutrients. Most important ones
- protein,
- vitamin A,
- vitamin E,
- essential fatty acids and
- Zinc
- Manganese
- Copper
- Iodine

- Nutritional skin diseases typically show a series of common symptoms.
- Abnormal sebum production and / or keratinization in the skin
- Extreme crusting accompanied by secondary bacterial infections and itching,
- dandruff, erythema,
- hair growth or a poor hair cover development and an oily skin.
- Typically, deficiencies may occur for several months with diets resulting in feeding symptoms.

## Protein and Skin Health

- In all animals, approximately 65-95% of the hair is protein (mainly keratin) and contains high levels of methionine and cystine from sulfuric amino acids.
- Approximately 30-35% of the animal's daily protein needs is required for the continuation of skin and hair.
- Abnormal keratinization in protein deficiency, depigmentation of hair, sebum and changes in epidermal lipids occur.
- The skin becomes susceptible to thick, oily and bacterial infections.

- There are no problems with protein deficiency in cats and dogs fed with balanced foods.
- Protein deficiency, hunger, anorexia (pancreatic disease) due to diseases, excessive protein loss (kidney or intestinal disorders) or long-term unbalanced diets are the result of feeding.
- Change in diet requires the addition of high quality protein sources such as meat, eggs and milk. However, the prognosis may be complicated by the presence of the underlying disease.

# Vitamins and skin Health

- **Vitamin A**
- Both excess and deficiency of Vitamin A cause skin lesions in cats and dogs.
- Symptoms include hair loss, bad hairiness, hyperkeratinization in the epidermis and hair follicles, and skin thickening and susceptibility to secondary bacterial infections.
- **Vitamin A level in dog food** is the same for growth / reproduction and survival rate of 5.050 IU / kg DM;
- **in cat food** 3.333 IU / kg DM for growth and survival
- 6.666 IU / kg DM for pregnancy and lactation

## Vitamin E

- Vitamin E acts as a natural antioxidant, capturing free radicals, protecting cells from oxidative damage.
- Vitamin E requirement is closely related to PUFA levels in diet. Vitamin E deficiency occurs naturally in cats fed with high-fat diets.
- Vitamin E deficiency is not seen in dogs.

- In cats, a disorder called pansteatitis is formed in diets with very high levels of unsaturated fatty acids and low vitamin E levels.
- In Pansteatitis; anorexia, fever, poor hair, subcutaneous nodules, but mainly characterized by the fact that the fat tissue has a color ranging from solid to yellow to orange-brown.
- Complete and balanced diets, vitamin E supplementation (25-75 mg / kg body weight / day), corticosteroids and supplementary treatments are applied in the treatment.

- for dog diets at least 400 IU / kg DM
- for cat diets at least 500 IU / kg DM vitamin E is recommended.

## B complex vitamins

- B complex vitamins are required as cofactors in many metabolic functions, especially in energy metabolism, and therefore many body systems are involved in their deficiencies, including skin and hair.
- Deficiency may be seen only after prolonged use of oral antibiotics, post-anorexia, or increased body water loss in cases such as polyuria or enteritis.

- Since raw eggs contain avidin, a protein that binds the biotine, **biotin deficiency** appears in the case of feeding large amounts of raw eggs.
- Thickening of the skin, hair loss and itching are observed in biotin deficiency. The addition of biotin is thought to be useful in the treatment of nonspecific skin and hair related conditions.
- **Riboflavin deficiency**; In addition to seborrhea, it causes cheilosis. However, if meat or dairy products are present in the diet, this is not shaped.
- **Niacin** causes pellegras in humans in deficiency, whereas in dogs; ulceration of the mucous membranes, diarrhea and extreme weakness, as well as occasional ischemic disease accompanied by itchy dermatitis in the hind limbs and in the ventral abdomen. In the case of pyridoxine deficiency; as a result of only experimental studies, hairs were seen with a matte, oily and scattered appearance and hair loss.

# Minerals and Skin Health

- **Copper**
- Copper is required for the conversion of tyrosine amino acid to melanin in the skin. Therefore, depigmentation occurs in hairs inadequacy.
- In the absence of copper, symptoms such as loss of normal color of the hair, loss of hair and decrease in volume and rough and dull state are observed.
- The lack of copper in cats and dogs is due to the lack of copper-insufficient diets, the low availability of copper in feeds, or the high concentration of copper antagonist-minerals, in particular zinc.
- The evaluation of copper in feeds is different. Chicken, turkey and ruminant liver of poultry by-products are high in copper, soybean meal in corn meal and corn gluten meal is low in pig and rat liver and copper oxide.

- **Zinc**

- Zinc plays a critical role in the regulation of many cellular metabolisms associated with the continuation of healthy skin and fur structure.
- Zinc deficiency in adult animals is mainly caused by changes in skin and hair health. Skin changes in young animals are accompanied by slowing growth, loss of appetite and other health problems.

- **Genetics:** In many dogs (Alaskan Malamutes, Siberian Huskies and American Eskimos, Bull Terriers) zinc absorption and metabolism is suppressed by genetic diseases.
- **Diet:** Zn deficiency in the diet Zn deficiency, Specifically high levels of Ca and phytate, P, Mg
- As a result of EYA deficiency, zinc deficiency occurs.
- **Small bowel diseases:** Zinc deficiency may occur in viral enteritis and malabsorption diseases.