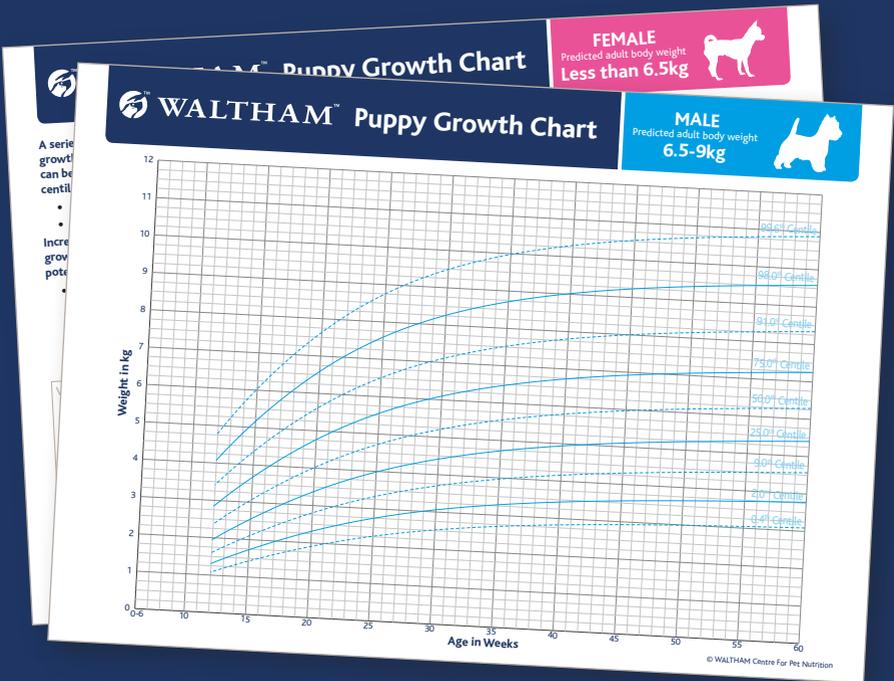


The complete guide to



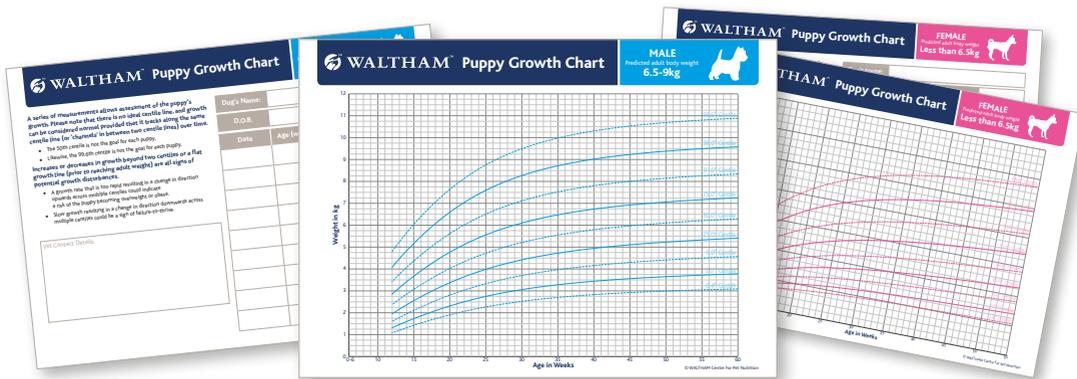
**WALTHAM**<sup>TM</sup>

# Puppy Growth Charts



## What are the WALTHAM™ Puppy Growth Charts?

WALTHAM™ Puppy Growth Charts are a user-friendly clinical tool designed for veterinary professionals to monitor growth in dogs. The charts are based on data from 50,000 healthy young dogs and are intended to be a standard for healthy growth. They have been scientifically developed in a similar manner to charts used to monitor the growth of children (e.g. the WHO growth standards), which are used by healthcare professionals around the world. As dogs come in a variety of shapes and sizes there are 10 charts comprising separate charts for male and female dogs in five size categories, valid for dogs up to a predicted adult weight of 40 kg.



## Why should I use WALTHAM™ Puppy Growth Charts?

When it comes to canine weight problems, we know that prevention is better than cure. Healthy weight for life starts with healthy growth in puppyhood. However, tracking healthy growth in puppies can be a challenge as it can be hard to know the correct weight for a puppy or how much weight he/she should be gaining between visits to the practice. Whilst body condition scoring can provide some guidance as to whether an individual is over- or underweight, it can be unreliable in puppies and young dogs. Furthermore, once early vaccinations are complete, puppies often do not visit the veterinary clinic again until either neutering or booster vaccination. This means that there is a long period during early life when a puppy's growth is not assessed, and no veterinary guidance is given to owners. This is a crucial period in development, and it is important that the right support is in place to minimise the chances of problems occurring.

The WALTHAM™ Puppy Growth Charts are the first evidence-based growth standards for pet dogs and have been developed using professionally accepted scientific methods using data derived from 50,000 dogs. The charts provide a useful tool to track puppy growth and tailor your advice to build a strong and lasting client bond. It facilitates a programme of early-life checks, which present opportunities for the veterinary team to provide guidance on various aspects of preventive healthcare including nutrition, vaccinations, ecto- and endoparasite control and behaviour. It also provides opportunities to identify potential growth issues quickly and implement corrective measures.

Therefore, by using the WALTHAM™ Puppy Growth Charts, you can provide guidance to owners about puppy growth including:

- Providing an owner with reassurance that they are feeding the right amount and type of food
- Identifying puppies that are growing too quickly and are at risk of becoming overweight
- Identifying puppies that are growing too slowly as this may indicate under-feeding or a growth disorder
- Providing a basis on which to recommend changes to a puppy's nutrition plan e.g. increasing or decreasing food if a puppy is growing too slowly or too quickly
- Providing a justification for recommending further investigations if a disorder of growth is suspected

## How do I use the WALTHAM™ Puppy Growth Charts?

- Calculate the puppy's age
  - The chart plots weights against age in weeks
  - If you have a WALTHAM™ Age Wheel, set the first wheel to the date of birth, and the second wheel to the date of weighing, to see the age in weeks in the window. You can also use the WALTHAM™ Age App
- Weigh the puppy
  - When weighing the puppy, remove any items such as a collar, lead or harness or ensure the puppy is wearing the same collar at every weighing to account for the added weight
  - Ensure the puppy has all four feet on the scales and note the weight, in kilograms
- Choose the right chart
  - There are 10 charts available to choose from based on the puppy's predicted adult weight and whether they are male or female
- Plot a weight on the chart
  - Find the age of the puppy along the bottom of the chart
  - Find the puppy's weight along the side, and mark with a small dot



## The science behind the charts

### Where did the data come from to create the charts?

In order to develop evidence-based growth standards for pet dogs, WALTHAM and collaborators from Banfield Pet Hospitals, University College London and the University of Liverpool analysed bodyweight and age data from 50,000 healthy young dogs attending Banfield Pet Hospitals, Mars Petcare's network of primary care veterinary clinics across the USA. Data used to construct the charts were derived only from dogs that remained healthy and in ideal body condition for the first three years of their life.

### Why does it matter that the data were only from healthy dogs?

As illnesses in early life have the potential to disturb the pattern of growth it was important to limit the analysis to dogs that were known to have stayed healthy. Furthermore, to ensure that the centile lines on the charts truly reflect healthy growth, it was important to exclude dogs who were overweight or underweight since these dogs grow too quickly, and too slowly, respectively. As a result, using the WALTHAM™ Puppy Growth Charts means that dogs which are not growing at a healthy rate can be identified and supported.

### How were the curves on the charts created?

Statistical modelling techniques were used to develop the growth curves, which were then displayed graphically as a set of centile lines covering the age range 12 weeks to 2 years. The methodology was similar to that used to construct the WHO Child Growth Standards and was undertaken in conjunction with colleagues at University College London, who have considerable expertise in growth modelling. A large number of growth curves were first created for dogs of various breeds; further analysis of similarities and differences amongst these curves enabled the development of curves for five "size categories" for dogs based on predicted adult bodyweight. These centile curves were then validated by comparing the pattern of growth depicted with growth patterns in different populations of healthy dogs, dogs with abnormal body condition (underweight, overweight and obese), and dogs diagnosed with conditions associated with accelerated or retarded growth.

### How did the curves become the WALTHAM™ Puppy Growth Charts?

The growth centile curves created during statistical modelling were used as a basis for constructing the WALTHAM™ Puppy Growth Charts. The design process also involved the development of user-friendly instructions and a host of supporting materials for training and education.

# FAQs - Frequently Asked Questions

## What tools are available to help me use the growth charts?

There are a number of tools to help you use the WALTHAM™ Puppy Growth Charts

- Waltham™ Puppy Growth Charts Instructions For Use
- The complete guide to WALTHAM™ Puppy Growth Charts
- Infographic
- Instructional video
- WALTHAM™ Age App - coming 2017



## What do regular weight measurements tell us?

A single weight measurement provides a guide that enables the puppy to be compared with others at a similar age. However, on its own, it does not confirm that the puppy has developed normally, and/or will do so in the future. The process of growth monitoring means taking a series of measurements over time and plotting them to determine whether a puppy is developing normally (i.e. at a healthy rate). This is done by comparing the puppy's individual growth chart with the growth trajectories of a large population of healthy puppies known to be developing normally. The major strength of this approach is that growth disturbances can be recognised more rapidly, enabling corrective measures to be implemented sooner.

## What do the lines on the charts mean?

Each chart includes curves, called centile lines, which represent the expected range of growth which is considered to be normal for dogs of that sex within that category. Nine centile lines are shown, which depict the 0.4th centile, 2nd centile, 9th centile, 25th centile, 50th centile, 75th centile, 91st centile, 98th centile, and 99.6th centile. The number of the centile reflects the percentage of the population whose weight falls below that line; for example, if a dog is on the 75th centile, it means that 75% of dogs in that population group will weigh less (and 25% will weigh more).

Although weights falling between the 0.4th centile and 99.6th centile are considered to be 'normal', it is important to realise that growth of an individual dog depends on a number of variables, and growth patterns can be markedly different. Typically, you would expect a healthy puppy's weights to stay approximately in the same part of the chart throughout growth. However, some healthy puppies track more closely to the centile lines than others. By plotting weights on the chart and tracking growth, problems can also be identified and managed more quickly. For example, puppies crossing centile lines upwards are growing quicker than expected, whilst those crossing downwards are growing more slowly than expected. Whilst such centile crossing can occur in healthy dogs, it is more likely to occur when there is a problem with nutrition or development.

## Why have size charts rather than charts for individual breeds?

Extensive research has been undertaken to develop and validate the growth charts. We have found that, despite the breed differences, pure-bred dogs of a similar predicted adult weight develop in a similar manner. This observation mirrors the research into healthy growth in children which appears to be similar worldwide, despite differences in ethnicity and geographical location. A further advantage of using an 'predicted adult size' approach is the fact that fewer charts are required to cover the majority of the dog population, than would be the case if individual breed charts were used. The only exception to the adult breed size approach is for giant breed dogs (see FAQ below).

## What is the basis for the predicted adult size ranges which were chosen?

The ranges are based on the average bodyweights of a collection of dog breeds which grow at a similar rate. The upper and lower limits of the predicted adult body weight range are based on the average adult weight of the largest and smallest breeds within each size range.

## Why do the top and bottom centile curves sometimes plateau at weights outside the predicted adult weight range?

The upper and lower limits of the predicted adult size ranges are based upon an average weight, whereas the centile curves represent the full range of bodyweights of all individuals within a particular size class. Dogs growing on the lower (0.4th) or upper (99.6th) centile curve within a size class may be growing at a healthy rate, however they are likely to be smaller or larger than is typical for the breed.

## Can the growth charts be used for mixed-breed dogs?

Whilst the growth charts were developed and validated using data from pure-bred dogs, the use of size charts means that they are also valid for mixed breed dogs, where the date of birth and expected adult weight is known. The charts should be used more cautiously if either the predicted adult weight is not known (for example if the breed mix is unclear) or the date of birth are not known.

### What if the predicted adult size of the puppy is unknown?

The charts can still be used to monitor growth, but veterinary professionals should be more cautious in interpreting them. Start by choosing the chart on which the puppy's current weight lies between the 9th and 91st centiles, and plot three serial measurements at monthly intervals. At that stage, decide whether the puppy's growth continues to follow a centile line (or is tracking between centiles). If this is the case, and if the puppy is healthy and in good body condition, it is likely that you have selected the correct chart, and can proceed with subsequent weight measurements. However, if the puppy appears to be healthy and in good bodily condition but the growth pattern is markedly deviating from the curves on the chart selected, you may need to consider transferring the plotted points onto a different chart to determine if it fits the growth pattern better.

### What if the age of the puppy is unknown?

Where the age is not known, it may be possible to ascertain a reasonable estimate by looking at the dentition of the puppy, based upon the eruption times of permanent teeth. Since this age will only ever be an estimate, the growth curves should be interpreted with more caution, and complemented with other information. Making serial assessments of dentition, undertaken at the same time as the weight measurements, can help to confirm and/or refine the accuracy of the age estimate. In addition, regular assessments of body condition score, comparison with growth development in litter mates, and reference to the adult weight of the parents will also help to confirm that growth is on track.

### Why are growth charts not available for giant breeds?

During research, it became clear that there were marked differences in growth patterns amongst the giant breeds, meaning that it is not possible to construct a single growth chart and centile curves to represent the growth of dogs that attain a bodyweight above 40kg. As a result, validated growth charts for dogs in this size category are not yet available but we plan to develop growth charts in the future for the most common giant breeds.

### What is a normal rate of weight gain and growth?

Puppies don't all grow at the same rate. A dog's weight is most likely to track along one centile line or within one centile space (the gap between two centile lines). Some puppies may cross a centile line upwards or downwards during growth and this isn't necessarily an issue if they are otherwise well. Acute illness can affect how a puppy grows, for example by crossing centiles downwards. However, on recovery the puppy's weight would be expected to return to its original centile within a few weeks. In contrast, any sustained drop or rise through two or more centile spaces (crossing two centile lines) is unusual and should be carefully assessed, as it can indicate a possible growth disturbance. Whilst healthy dogs can occasionally cross two or more centiles, this occurs more commonly in puppies that are growing too quickly or too slowly i.e. are at risk of becoming overweight or have a growth disturbance.

### Should all healthy puppies be on the 50th centile line?

The 50th centile line is not a target for puppies to achieve, it simply indicates the weight at which 50% of puppies in the population are lighter. In fact, any centile line (or space between two centile lines) can be considered a healthy weight for an individual puppy; what is more critical is that the centile is tracked, and centile crossing does not occur.

A puppy which is very small or very big compared to its peers (i.e. puppies of the same age and predicted adult weight) can sometimes have an underlying illness, or may be receiving improper nutrition. Puppies who are at the extremes of the ranges (i.e. greater than the 99.6th or less than the 0.4th centile) are displaying a pattern of growth that is very unusual. This does not mean that this puppy's growth is definitely abnormal, but extra care should be taken to monitor growth in these dogs. By regularly plotting weights on the chart and tracking growth, problems can be identified and managed more quickly.



### What if the puppy's individual growth curve crosses more than two centiles or displays a flat growth line?

Both of these patterns are signs of growth disturbances and indicate the need to consider some form of intervention.

If the puppy's individual growth trajectory crosses centiles in an upwards direction, it could suggest that the puppy is becoming overweight, especially if two or more centiles are crossed. Assessing the puppy's body condition score using a validated BCS system can help to guide your decision. Overly rapid growth can also be associated with skeletal abnormalities such as osteochondrosis and hip dysplasia. When interpreting such changes, consider parental weight, sibling growth rates, and nutritional intake wherever possible. Also consider whether the puppy has recently been neutered, as this may affect growth. In these cases, it may be necessary to make adjustments in feeding and activity, together with close weight monitoring (monthly) in order to rectify the problem.

If the puppy's weight crosses in a downwards direction (especially when two or more centiles is crossed), or demonstrates a flat growth line, it could be a sign of either inadequate nutrition or a disease associated with retarded growth (e.g. nutritional hypoparathyroidism, portosystemic shunt, pituitary dwarfism). Consider whether there have been any recent acute illnesses e.g. gastroenteritis, which can lead to a temporary halt in growth (although growth should catch up subsequently). Also consider parental weight, sibling growth rates and nutritional intake wherever possible. If an obvious cause is not evident consider performing investigations into overall health status, and/or adjustments to feeding and activity.

### If a puppy has crossed two or more centiles in the same direction, does that definitely mean it has a problem?

Not necessarily. For example, it is possible for healthy growing dogs to cross two or more centiles in the same direction, but this is relatively uncommon. In contrast, about 60% and 70% of dogs that become overweight and obese, respectively, cross two or more centiles. Therefore, crossing centiles upwards should be a flag to a veterinary professional to check the health status of the puppy, review the nutrition plan, and consider if specific investigations are required.

### If a puppy has not crossed any centiles, does that guarantee it will be healthy?

Not necessarily. Tracking centiles and not crossing them is certainly a characteristic of healthy dogs. Therefore, a puppy following the expected trajectory is much more likely to be healthy and remain at an ideal weight. However, some dogs with diseases that affect growth may not cross many centiles, not least those with disorders that tend to retard growth. For example, dogs with conditions such as portosystemic shunt and dwarfism tend to be light for age (in the lowest quartile) at 12 weeks, but under half of them cross two or more centiles. Instead, many may continue to track the lower centile curves. Therefore, absence of centile crossing should not be used to rule out a possible developmental disease, not least if the puppy is showing suspicious clinical signs. Always consider the puppy's health status, and review the clinical history and nutrition plan before deciding whether investigations are required.

### Will neutering affect puppy growth?

The charts have been validated for use in both entire dogs and also those neutered during their growth phase. After neutering, you should monitor growth monthly for the first three months, and then every three months until the puppy reaches adult size. If subsequent growth is healthy, the weight will continue to follow the centile lines. Of course, neutering can lead to growth disturbances if puppies are overfed for their energy requirements, with the most likely pattern being upwards crossing of centile lines. In such cases, an adjustment to the feeding plan (e.g. a reduction in food intake) may be necessary.

### What if a weight measurement is missed?

Whilst not ideal, missing the occasional measurement is not critical. In such circumstances, try to encourage the owner to bring the puppy to the veterinary practice as soon as possible so that weight can be checked, and encourage regular measurements thereafter.

## What if the owner wants to weigh the puppy at home?

It is not advisable for owners to weigh dogs at home. The charts are designed to be used by veterinary professionals in partnership with owners. This ensures that calibrated weighing equipment is used and enables the chart to be incorporated into the puppy's health record. It also ensures that appropriate veterinary advice is given if a growth disturbance is identified.



## Who should be responsible in the veterinary practice for performing and recording weight measurements?

It is advisable for weight measurements to be taken either by qualified veterinary surgeons or registered veterinary nurses/technicians, after appropriate training. This ensures that growth trajectories can be properly monitored and advice given to puppy owners should the need arise. Since different practices may function differently, it is best for the individual practice to decide which staff are best for overseeing the use of the growth charts.

## What is the latest age that recording can start?

Although recording weight can start at any age, too long a delay in starting beyond 12 weeks means that the most rapid period of growth may be missed.

## The puppy has come for scheduled weight check but is unwell. Should the reading still be taken?

The weight can still be measured and recorded but further weight measurements are advisable after the puppy recovers (e.g. at least monthly for 3 months).

Acute illnesses (e.g. gastroenteritis) can lead to a temporary halt in growth, and may mean one centile line is crossed. However, in most cases, growth should catch up again subsequently, and again follow the original centile line. It can be useful to note on the chart if the puppy was unwell at the weight check. If more than two centile lines are crossed, or growth does not catch up again, further assessment may be advisable.

## The owner wants to weigh the puppy more frequently. Is that advisable?

Whilst many owners may wish to have more regular weight measurements this is not always worthwhile and can lead to unnecessary worry. This is because day-to-day variability in measurements (e.g. effect of recent meal consumption, urination or defecation) might lead to unnecessary concern. Weight measurements over a longer period are more likely to reflect the true change in weight of body tissues. Therefore, as long as growth is developing normally, it is usually best to carry out monthly weight checks until 6 months of age, and at least every 3 months thereafter. Of course, more regular checks may be needed if you are concerned about a growth disturbance but this should be decided upon, and conducted by, the veterinary care team.

## Can I use the chart to predict the adult weight of the dog?

Whilst a single weight measurement can demonstrate the puppy's size relative to others of a similar age, repeated measurements are more accurate. Once you have taken enough measurements so as to establish the centile line that the puppy is following (we recommend three serial measurements), you can then use this to predict expected adult weight, assuming that the puppy continues to grow at a healthy rate.

## I have used growth charts in the past and they have not been helpful. How are these growth charts different?

Over 6 million bodyweight measurements from 50,000 healthy growing puppies have been used to develop and validate the charts. The work has been undertaken in collaboration with scientists at University College London, who have developed similar growth charts for children. The same statistical methodology used for the child growth charts has been used to create and refine the centile lines, and the final charts have then been further validated in prospective studies in different populations of dogs.