

Hypoglycemia in puppies and kittens



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Most veterinarians know that because puppies and kittens have a smaller liver and muscle mass (decreased glycogen stores) and a larger brain (increased glucose utilization) in proportion to their body size, they are at greater risk of developing hypoglycemia than adult dogs and cats. Most also know that inadequate glycogen stores are the most common cause of hypoglycemia in puppies and kittens that survive past weaning. We learned some new information by reviewing our clinical database of hypoglycemic events in puppies and kittens up to 16 weeks old seen at Banfield hospitals between January 1, 2001, and December 31, 2005.

Serum glucose concentrations

Puppies less than 16 weeks old and juvenile dogs from 16 weeks to 1 year old had slightly higher and perhaps more labile average serum glucose values than adult dogs (*Table 1*, page 20). In contrast, kittens and juvenile cats had serum values a little lower than more mature cats. Our data also show that adult dogs have lower average serum glucose values than adult cats.

In examining the data, we found that 3,350 puppies and 948 kittens were diagnosed with hypoglycemia and had supporting serum glucose data (*Table 2*, page 22). Others were diagnosed similarly with hypoglycemia based on the history and clinical signs, but serum glucose values were either not measured or listed as zero and, therefore, discarded.

Veterinarians can expect most sick puppies and kittens to be hypoglycemic because of their ready depletion of glycogen stores and immature hepatic function. Newborns most commonly suffer from transient hypoglycemia and those surviving past weaning most commonly experience substrate-limited hypoglycemia secondary to malnourishment.

Glucose values less than 40 mg/dl are considered significant hypoglycemia, and they may precipitate seizures. Note that values above 40 mg/dl accompany many other conditions that cause sickness in puppies and kittens.

Hypothermia

Hypothermia usually accompanies hypoglycemia in puppies and kittens. However, the normal rectal temperature of puppies and kittens during the first week of life is

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- Explore the health and well-being of Pet populations
- Evaluate new clinical treatments
- Monitor Pets as sentinels of zoonotic disease in family environments
- Transform Pet medical data into knowledge, *i.e.*, open new windows into Pet health care using the Banfield medical caseload and database.

Table 1: Normal Serum Glucose Values by Age and Species*

Age Group	Number of Dogs in Group	Number of Cats in Group	Average Glucose—Dog (mg/dl)***	Average Glucose—Cat (mg/dl)***
All ages	651,228**	220,201**	116.3 ± 18.8	121.4 ± 26.8
≤16 weeks	16,282	5,011	121 ± 31	119 ± 25
16 weeks–1 year	264,658	91,648	123 ± 16	112 ± 18
1–3 years	143,495	40,306	114 ± 19	121 ± 27
3–10 years	233,322	60,338	113 ± 19	129 ± 29
>10 years	78,075	39,214	110 ± 20	128 ± 31

*As determined at Banfield hospitals from 2001 to 2005.

**Some Pets were examined as juveniles and later as adults.

***Average value ± 2 standard deviations.

approximately 96°F. From birth to about 4 weeks of age, there is a gradual change from largely poikilothermic to homeothermic, with the body temperature usually settling in the 99°F to 101°F range. Body temperature continues to rise over several weeks until it reaches the normal adult level. Data collected from the Banfield Medical Database support this understanding but also suggest a possible correlation between the severity of hypoglycemia and hypothermia (Tables 2 and 3, page 22).

Hypothermia can be considerably more severe than our data show; rectal temperatures of 86°F or less are common in sick puppies and kittens. It is important to monitor their temperatures because intestinal function is severely compromised in hypothermia; ileus is likely to occur at temperatures below 96°F.

Clinical signs and diagnoses

The reported presenting signs of hypoglycemia in puppies and kittens are seizures, hypothermia, depression, lethargy, confu-

sion, incoordination and weakness. Common predisposing factors include poor nutrition, infections, intestinal disturbances, prolonged fasting and vaccination. The hypoglycemia cases seen at Banfield were generally mild and diagnosed in the early stages of the condition.

The most commonly recorded presenting clinical signs and observations are unthriftiness, vomiting, diarrhea, depression and lethargy, anorexia, dehydration, hypothermia, tachycardia and tachypnea. Seizures were only observed in puppies with glucose levels below 40 mg/dl; they were relatively common in kittens at this glucose level. Melena, pale gums and the presence of fleas were also common findings in kittens.

The clinical diagnoses that were most commonly associated with hypoglycemia in puppies and kittens include:

- Idiopathic hypoglycemia
- Coccidiosis
- Gastroenteritis and parvoviral infection
- Hypovolemic shock

Table 2: Serum Glucose Values of Puppies and Kittens Diagnosed with Hypoglycemia

	Puppies	Kittens	Serum Glucose (mg/dl)**,**
	1,443	799	70–100
	448	35	50–70
	236	17	40–50
	1,223	97	<40
Total	3,350	948	

*The Pets in this table were diagnosed with hypoglycemia. The glucose values of the samples collected did not always confirm the diagnosis.

**Only the initial glucose level taken during each hypoglycemic episode (72 hours) was used for categorizing puppies and kittens.

Table 3: Serum Glucose and Rectal Temperature in Hypoglycemic Hypothermic Pets

Serum Glucose (mg/dl)	Puppy Temperature (°F)*	Kitten Temperature (°F)*
70–100	96.4 ± 4.4	96 ± 5.2
50–70	96.2 ± 4.1	95.6 ± 6.2
40–50	95.7 ± 4.8	93.2 ± 6
<40	95.8 ± 4.7	93.7 ± 5.6
All hypoglycemic Pets	96 ± 4.5	94.6 ± 5.8
Normal Pets	101.4 ± 9	101.4 ± 8.4

*Average value ± 2 standard deviations.

- Anemia
- Pneumonia.

Common laboratory findings included:

- Decreased serum albumin, globulin and total protein concentrations
- Decreased hematocrit and platelet and white blood cell counts
- Decreased creatinine concentration and serum amylase activity
- Elevated blood urea nitrogen level.

These observations suggest that many of the cases seen at Banfield hospitals involve secondary hypoglycemia precipitated by gastrointestinal disturbances and infections; 60 percent of sick puppies and kittens have diarrhea or infection at some point.

Breed predilection

As expected from reviewing the literature, the most commonly affected breeds of dogs were the toy breeds, with the only exception being the Standard Poodle (*Table 4*, page 23). No reference or explanation for the latter was found. There was no breed predilection in cats.

Treatment

Hypoglycemia, hypothermia and dehydration occur quickly when a puppy or kitten is not fed adequately. Treatment is straightforward and involves fluid therapy, glucose replacement and warming. This can be accomplished by administering warmed dextrose-saline solution subcutaneously or intravenously, depending upon the severity of the condition. You should also treat concurrent infections. (For more information see *Treating neonatal and pediatric hypoglycemia* on page 34.)

At Banfield hospitals, affected puppies and kittens are commonly hospitalized, exposed to external warming devices, intravenously catheterized, given warmed intravenous dextrose-saline solution and, if indicated, given a parenteral antibiotic, including ampicillin, cefazolin or amoxicillin-clavulanate. In our experience, we have found that approximately 10 percent to 15 percent of affected puppies and kittens with demonstrable hypoglycemia do not survive despite appropriate treatment.

Recurrence

The toy breeds also show the highest frequency of recurrence (*Table 5*, page 23). Recurrent hypoglycemic events are defined as recurrences at least 72 hours following a previous successfully treated event. Recurrence suggests an ongoing substrate deficiency or underlying pathology. Such cases

**Table 4: Breed Predilection for Hypoglycemia:
Top Breeds According to Banfield Data**

Breed	Number Diagnosed with Hypoglycemia	Total Dogs per Breed*	Prevalence per 10,000 Dogs	Death Rate**
Yorkshire Terrier	390	20,831	187	7.2%
Maltese	195	12,072	162	9.2%
Toy Poodle	121	7,862	154	14.8%
Chihuahua	746	53,561	139	12.2%
Standard Poodle	149	13,969	107	10.7%
Shih Tzu	158	27,433	58	15.7%
Dachshund	89	21,655	41	14.6%
Pit Bull	109	57,988	19	19.3%
Labrador Retriever	128	81,009	16	11.7%

*Total number of that breed seen in Banfield hospitals between 2001 and 2005. Too few per breed at less than 16 weeks of age to estimate prevalence at puppy stage.

**Percent of puppies with hypoglycemia that died.

require thorough re-evaluation particularly for hepatic dysfunction.

In general, the majority of puppies and kittens diagnosed with hypoglycemia were only mildly affected and responded well to treatment. A minority of Pets was severely affected or had repeated episodes warranting further investigation. A few of these Pets had elevated levels of serum bile acids and hepatic enzymes, but no definitive diagnoses of portacaval shunts were made.

An analysis of our data on hypoglycemia in puppies and kittens indicates general agreement with previously published data. However, these findings do raise additional questions. For example, why do Standard Poodles have a relatively high prevalence of puppy hypoglycemia? There is more work to be done in studying hypoglycemia. 

**Table 5: Most Common Breeds
with Recurring Hypoglycemia**

Breed	Number of Puppies with Recurrence	Percent of Breed with Hypoglycemia
Chihuahua	38	5.1%
Yorkshire Terrier	22	5.6%
Maltese	12	6.2%
Standard Poodle	12	8.1%
Toy Poodle	5	4.1%

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