

Diluting Insulin Primer

from the FDMB collective

Note: this document should act as a starting point for your research into researching whether or not to dilute insulin for your kitty's dose. It is strongly recommended that you start this research (or any research that involves changing treatment protocol) in partnership with your veterinarian. This document in no way is meant to take the place of the essential discussions you should have with your kitty's vet.

This information pertains only to Eli Lilly Humulin insulins.

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Intro: What exactly is diluted insulin and why would I dilute?

You are probably familiar with injecting insulin to treat your diabetic cat – the hows, whats and whys (if you're not, please see the FDMB FAQ for a basic overview). Diluted insulin is the same insulin you're using, but dispersed in more solution so that you have the same insulin in more liquid. *Imagine you're mopping the floor. You add 3 capfuls of cleaner to a bucket of water. So you're still washing the floor with 3 capfuls of cleaner – its just easier to mop with a whole bucket of water than 3 capfuls of cleaner.*

Why would someone dilute the insulin? When you adding diluent to your insulin you're adding more fluid – more mass. This means you can now more accurately measure doses that end in .25 (by following a formula that would change the amount of “liquid” to be dosed to an even number). Or you can even give tiny doses like 0.1 u of insulin (yup – some cats need that .1 and not a drop more).

Also, by injecting more fluid under the skin, it is believed the insulin is carried to more cells – thereby increasing the effectiveness of the insulin.

Even for folks with a dose like 2u – its sometimes hard to know for sure if you've pressed the plunger in all the way and even harder to detect wet fur as you're working with just a few drops of liquid.

So, the main reasons for diluting insulin are:

- Ability to administer small doses (especially fraction doses)
- Greater accuracy on doses
- More consistent dosing (my 1.5 not necessarily another caregiver's 1.5)

Step One: How to order diluting supplies.

First, remember that this information pertains only to Eli Lilly Humulin insulins (NPH or N, Lente or L, Ultralente or U). Eli Lilly actually supplies insulin diluent as well as sterile mixing vials to you free of charge. However, they will not send the supplies to you directly – your veterinarian must order the supplies for you (in some cases folks have had their pharmacy request the supplies without difficulty). Don't expect your vet or pharmacy to have diluting supplies in stock – make your request long before you're ready to start diluting.

Your veterinarian must know which insulin you are using so that the correct diluent is ordered – and can simply call **Eli Lilly at 1-317-276-1610** to order both the diluent and the sterile mixing vials. Both the diluent and the vials can come as a 10-pack – ask your vet or pharmacist to order 10 of each so that you will be set for a while. If you don't specify a quantity, you get whatever they feel like throwing in the box (in one case 2 bottles of diluent and 8 mixing vials – not as helpful).

I had an order for diluent and vials take less than a week to get shipped to my vet. However, many folks have had lost or delayed shipments. If your supplies have not arrived in a timely manner, have your vet or pharmacist call to track down your shipment.

Step Two: How to determine what dilution ratio works for your cat's dose.

Here are some examples of formulas to calculate your insulin to diluent ratio. You should discuss with your vet what is the best ratio for your cat's dose (especially if that dose changes from day to day, as would sliding scale dosing).

1:1 ratio allows you to measure doses in halves (.5, 1.5, 2.5, etc.)

1 part INSULIN + 1 part DILUENT = 2 parts DILUTED INSULIN

E.g. current dose is 1.5 units and you dilute with a 1:1 ratio, your DILUTED INSULIN dose is 3 units.

$1.5 \times 2 = 3$ UNITS DILUTED INSULIN

1:3 ratio allows you to measure doses in quarters (.25, .5, .75, etc.)

1 part INSULIN + 3 parts DILUENT = 4 parts DILUTED INSULIN

E.g. current dose is 2.25 units and you dilute with a 1:3 ratio, your DILUTED INSULIN dose is 9 units.

$2.25 \times 4 = 9$ UNITS DILUTED INSULIN

1:9 ratio allows you to measure doses in tenths (0.1, 0.2, 0.3, etc.)

1 part INSULIN + 9 parts DILUENT = 10 parts DILUTED INSULIN

E.g. current dose is .1 units and you diluted with a 1:9 ratio, your DILUTED INSULIN dose is 1 unit.

$.1 \times 10 = 1$ UNITS DILUTED INSULIN

Step Three: Dilute!

There are many different methods used by diluters, so the info below may not be the way you currently dilute. However, when we got ready to dilute it was the easiest process to go through (and the only one I could figure out LOL) so we've put it in this primer.

First, set yourself up in a clean, quiet area where you won't be distracted. Its important not to be interrupted while mixing the diluted insulin as there are too many little mistakes that could happen.

Put one bottle diluent, one mixing bottle and your insulin on your work surface. Get a piece of paper and pencil to keep notes and an insulin syringe for the measuring.

On your paper make 2 columns, "insulin" and "diluent".

These instructions will now direct you on how to do a 1:9 ratio, or 1 unit diluted insulin = 1/10 unit straight insulin using a 3/10cc insulin syringe.

The 1:9 ratio makes math pretty easy and is useful for small doses.

What you want to do ultimately is mix 1 syringe (30 units) of straight insulin with 9 syringe (270 units) of diluent. **Don't worry about the units - just think of it as syringes and its easier.** This way the instructions work for folks using syringes that hold other amounts too.

These instructions will now direct you on how to do a 1:3 ratio, or 1 unit diluted insulin = 1/4 unit straight insulin using a 3cc insulin syringe.

The 1:3 ratio allows us to measure doses in 0.25 units. So we wanted 1 part insulin to 3 parts diluent to make 4 parts diluted insulin total.

We used the 3cc syringe for this as it holds a lot more insulin (300 units) so you don't need to refill syringes as often. Less chance of error losing count as you mix your insulin and more accurate syringes as you have to draw up fewer to achieve the same results as the 3/10cc way.

Our vet gave us a handful of 3cc syringes. If your vet does not have these available for you, you may need a prescription to obtain them. I strongly suggest using a larger syringe so that there is less chance for error.

We drew up 200 units of insulin in the 3cc syringe (the "2" tick mark on the syringe). We then drew up 200 units of diluent 3 times in the same syringe. **With these syringes you will get much larger air bubbles.** Make sure to draw the insulin and diluent up slowly so as to minimize the air bubbles.

Here's the specifics steps:

Draw up a syringe of insulin. Do the usual removal of bubbles that you would do at shot time. Its best to draw up slowly and expel from the needle slowly. Its tempting to go faster since you're drawing up more but this might damage the insulin.

Poke the full syringe's needle into the top of the mixing jar and expel, slowly, all the insulin. Draw up a full syringe of air from the jar (this helps maintain the air pressure within the vial)**.

***Note: Another suggestion is to take a second syringe and pull the plunger out completely, then pop the syringe into the mixing jar. This "plunger-less" syringe allows the air that is being displaced by the liquid to escape the vial. So there would be no need to draw up a full syringe of air each time. Your choice, whatever is easiest for you.*

Make one tick mark under the "insulin" column on your paper.

Using the same needle or a fresh one, expel a syringe of air into the diluent jar and draw up a syringe of diluent. Again, remove the bubbles as you normally would

Poke the needle into the mixing jar and expel the diluent into the jar. Again, draw up a syringe of air to maintain air pressure.

Make one tick mark under the "diluent" column on your paper. This is important as someone will almost always disturb you and/or you'll forget where you are in the counting process. You don't want to have to go through this all twice, do you?

Continue drawing up syringefuls of insulin and diluent and adding them to the mixing jar, withdrawing air from the jar each time to maintain air pressure. Do this until you have the right number of tick marks in both columns.

You have now gone through one cycle of diluting - congratulations! Make sure to estimate how much diluted insulin you will need beforehand. Make all that you need and that you think will fit in the bottle (the mixing vial will hold 1,000 units of liquid), bearing in mind that diluted insulin will have the same shelf life as straight insulin. So plan for 30-45 days usage from a mixed batch, just as you would for a bottle of straight humulin.

It is recommended to use a new bottle of diluent and new mixing jar each time you mix up a new batch of diluted insulin.

Be sure to label the bottles of diluent, mixed diluent/insulin and the straight insulin so that no one will mistakenly use the wrong one at the wrong time. Some folks put a skull and crossbones on the straight insulin and hide it in the back of the frig somewhere. Its important to label each bottle so that if someone other than the normal caregivers are responsible for a shot there is no confusion.

Advanced: Q&A from newbie diluters.

Here's a sampling of questions and answers others have had about diluting. If you're question isn't covered here, please make sure to post it to the FDMB so that someone can help you out.

Also, because its important enough to repeat: this document should act as a starting point for your research into researching whether or not to dilute insulin for your kitty's dose. It is strongly recommended that you start this research (or any research that involves changing treatment protocol) in partnership with your veterinarian. This document in no way is meant to take the place of the essential discussions you should have with your kitty's vet.

Q: How long will diluted mixture keep, refrigerated?

A: About a month or 100 pokes - just like straight humulin insulin.

Q: Someone mentioned getting a 3cc syringe and a 6cc syringe?

A: This is another diluting method, see web links for more info.

Q: You used 1:9 rather than 1:3, how did you determine that ratio?

A: 1:9 allows you to measure tiny amounts of insulin, like .1 or .2 units that were required.

Q: Does diluent need to be refrigerated like insulin?

A: No, straight diluent can set at room temperature. Once its "insulin" you need to refrigerate.

Q: I want to do 1 part insulin to 3 parts diluent, so a "straight" dose of 1.75 units would become 7 units "diluted"?

A: Yes, that's correct.

Q: And for 1.5 units straight, I would draw up 6 units diluted? Or for 1.25 units straight I'd draw up 5 units diluted?

A: Yes, that's correct for both cases.

Here's some more helpful links that have info on diluting insulin as well:

[Sugarcat Simon's site](#) - a wealth of information on diluting

[The FDMB](#) (Feline Diabetes Message Board) - post your questions here for responses from diluting veterans

And the number to order diluent and diluting supplies:

Eli Lilly at 1-317-276-1610

Remember, your veterinarian or pharmacist must order the supplies – they are shipped free of charge.