

## Research Focus: Comparison of growth in neutered Domestic Shorthair kittens with growth in sexually-intact Cats

**Alex German, Professor of Small Animal Medicine at the University of Liverpool**

**Sally Everitt:**

Hello and welcome to this research focus podcast from RCVS Knowledge. During these podcasts, we'll be covering all aspects of veterinary clinical research from getting involved in research in practice, to discussing published papers and evidence with particular emphasis on how we can integrate them into our clinical practice.

Hello, my name is Sally Everitt, and today I'm delighted to be talking to Alex German about his involvement in the research paper entitled Comparison of growth in neutered Domestic Shorthair kittens with growth in sexually-intact Cats. Alex, as many of you will know, is Professor of Small Animal Medicine at the University of Liverpool, and his main research interest is obesity. Welcome, Alex. Before we start discussing the paper, could we perhaps just put some context around this research?

**Alex German:**

Yes, of course. And Sally, it's great to be here. Thank you for inviting me.

**Sally Everitt:**

Thank you.

**Alex German:**

So this is one of actually four papers that we've had so far, which have been looking at the development and validation of so-called growth standards for puppies and kittens. So the first two papers were puppies, the third was actually one in kittens where we actually developed some standards for sexually intact individuals. And this fourth paper is then one that's actually looking at neutered cats. And of course this one's particularly important because of course most pet cats are neutered during growth.

**Sally Everitt:**

Growth. Yeah.

**Alex German:**

Okay. So what we were keen to do here was to actually look at what impact neutering has on cats and kittens as they grow. Partly to decide then whether the original standards for intact cats would be appropriate, and if not, what adjustments might we need to make to have a tool for vets in practice?

**Sally Everitt:**

Yeah, that makes sense. So going back to this paper, the title is Comparison of growth in neutered Domestic Short-haired kittens with growth in sexually-intact cats. It's a really important subject, but it's quite a complex paper that includes data from two separate studies. Perhaps we could just start by outlining those two studies.

**Alex German:**

Yeah. Yeah, so there were two studies. There's a big data study and then there's an experimental study. And if I may, we'll maybe talk about the first, the big data study first, and then we can come on to the second. So in the first study what we did was model growth patterns using data that we'd acquired from cats that attended Banfield clinics. That's a network of over 900 vet hospitals across North America. So a key advantage of this approach was that the population is absolutely massive. We're talking millions of weight records from millions of cats, and that means you can really filter down that data into a population of interest. And that's what we did in this particular study. Okay.

So we only included data from cats that we knew were healthy in their early life. That's up to four years of age and they were all in ideal condition. So we effectively really did narrow that list down. In order to actually look at the impact of neutering, what we actually did was divide the cats into quartiles. So we had four groups and that was based on the age that they were neutered at. And so ultimately we ended up because with eight groups, so we have four quartiles for male and four quartiles for female. Okay. I should point out that the quartiles were very slightly different for male and female, but not significantly so. So as an example, quartile one was up to 20 weeks of age for males and it was 21 in females, but statistically that made no difference. But generally speaking, we've got groups broadly classified on the age that they're neutered.

**Sally Everitt:**

I think one thing that's worth pulling out here is when they said ideal body weight, they were actually only divided quite broadly into sort of underweight ideal and overweight. They weren't actually on a sort of nine point body conditions.

**Alex German:**

Yes, there was, well actually many of the records were based on a five point score, but it was easier just to divide that.

**Sally Everitt:**

Subtract yeah.

**Alex German:**

So basically anyone that was recorded as underweight or overweight was excluded.

**Sally Everitt:**

Excluded. Yeah.

**Alex German:**

Also, if in the text that the vet wrote there was any indication that they were overweight or underweight, even if they'd not recorded it in the condition score box, that was included as well. It basically means you end up filtering a lot of data out, but because it was such a big population to begin with, there's still plenty to work with. Okay, so we've got all this data. So what did we do? So we performed both a visual and a statistical analysis of essentially weight changes. And I think at this point I should emphasize that we're talking about growth, but we're actually using body weight measures and weight change as a proxy for growth.

**Sally Everitt:**

You're not measuring these cats and saying they technically got bigger.

**Alex German:**

No. And that's important.

**Sally Everitt:**

Yeah.

**Alex German:**

And it comes on to why we did the second study. The reason being, of course, it will capture what I call physiological growth. So normal development where we're having an increase in stature as a result of skeleton and soft tissue growing appropriately. But of course if you have extra fat gain, which would be inappropriate, it would capture that as well. And it can't separate those two. So we're talking growth, but it's probably better to think in terms of weight gain, if that makes sense.

**Sally Everitt:**

Yeah.

**Alex German:**

Okay. So we did this visual and statistical assessment and that mainly used what we call Z scores, another complexity, but really think of a Z score as just a comparison of what happens in a neutered cat versus a sexually intact cat. So it's just looking at the difference. Okay. And hopefully be able to share some of the figures so people can see this.

But basically key findings were that whatever age you neutered kittens at, there was extra weight gained compared with a sexually intact cat. Didn't matter what age. However, that gain was greater in female compared with male cats and the effect was actually less marked if you neutered later on, particularly after seven months of age. So those key findings is yes, neutering has an impact whatever age, but bear in mind it's greater in female kittens and that the impact seems to be less marked if you neutering much, much later after seven months of age. Okay. So that's our first study. Now because we're of course just looking at body weight and we cannot separate the physiological sort of stature gain from body fat, it was then necessary to do the second study,

**Sally Everitt:**

Second study.

**Alex German:**

As well.

**Sally Everitt:**

Yeah.

**Alex German:**

And this was this experimental study.

**Sally Everitt:**

Yeah.

**Alex German:**

Okay. And here what we did was we looked at the impact that neutering had on body composition. So that's just proportions of body fat, lean and bone within essentially the animal. And we took zoometric measurements, that's just basically using tape measures to look at body shape. And we're wanting to know what effect did neutering have on those two

variables. For this study, we only looked at female kittens, so it was a little bit limited there, and it was only kittens neutered at 19 weeks of age. That's equivalent to group one in the first study.

**Sally Everitt:**

So this was the lower end one.

**Alex German:**

Yeah. Sure.

**Sally Everitt:**

And that was the group which had the most marked change.

**Alex German:**

Exactly. Yes. So it was certainly, well, neutered group four has the least marked change,

**Sally Everitt:**

It's not changed.

**Alex German:**

But certainly at that age there was a more marked change than later on. That's fair. So there were 22 kittens and we paired them up and 11 of them were neutered at 19 weeks and their pair remained intact through their growth. And we looked at body composition using dual-energy x-ray absorptiometry or DEXA, which is a very precise and accurate measure of composition. And as I say, we use tape measures to measure various parts of the body.

**Sally Everitt:**

So in this study we said that in the last one we're looking at weight gain,

**Alex German:**

Correct.

**Sally Everitt:**

And here we are genuinely looking at growth and fat. And so we,

**Alex German:**

Exactly. We're kind of asking the question, what is that gain? Is it physiological? Is it just normal growth? They're just growing faster and getting bigger or are they growing fatter or a bit of both? Of course. So what did we find here? Well, basically looking at the DEXA results before and after neutering, there is a small and statistically significant increase in the lean mass.

**Sally Everitt:**

Yeah.

**Alex German:**

So they are larger overall, but the vast majority of any tissue gained was body fat. So that wouldn't necessarily be physiologically normal, if that makes sense. And that was mirrored in the zoometric measurements. The kittens particularly had a larger abdominal girth and a bigger rib cage. It's suggested particularly in the trunk, they've had that deposition of fat.

Okay. So if we take these all together, we're suggesting that weight gain after neutering is mainly body fat. And my concern there therefore would be it wouldn't be just normal physiological growth that we can ignore. Okay.

**Sally Everitt:**

Okay. So overall taking the two studies together, what would you say are the conclusions that we can draw from this study?

**Alex German:**

Okay, good. So first point, neutering can affect pattern of growth or weight gain and particularly fat gain in kittens at any age. But the effect varies according to sex and the age that the kittens neutered at and remember female greater than male. And if you're neutering later, much later, then the effect is less marked. Okay. And because it seems to be body fat gain rather than normal tissue gain, I would say that that would not be physiological.

**Sally Everitt:**

Yeah.

**Alex German:**

So if we come back to the original aim of the study was to look at growth standards, it wouldn't be appropriate to develop standards specifically for neutered cats because of course it's not representing what would happen normally.

**Sally Everitt:**

Well, it might normally in terms of statistically normally in that that's what neutered cats are doing,

**Alex German:**

You could argue physiologically,

**Sally Everitt:**

But not physiologically,

**Alex German:**

If the natural status is not to have them neutered. And we can come onto that in a moment. Instead, what I would suggest is that you can use the standards developed for sexually intact cats.

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**Alex German:**

And the advantage of doing that is that if you then see deviations in the pattern of growth, particularly gains, you can actually spot that early and do something about it. So in some respect, using the sexually intact ones really would help us to spot these changes.

**Sally Everitt:**

So what we're aiming to do is to keep the neutered kittens, whatever age they're neutered at as close as possible to the growth chart,

**Alex German:**

Yeah. Yes.

**Sally Everitt:**

For the sexually intact cat.

**Alex German:**

Yeah. Yeah. And I should emphasize for the sexually intact kittens that were done in study three, they were also all healthy,

**Alex German:**

Throughout their growth up to four years of age. And again, were always reported to be an ideal weight. So it's not like these were sort of stray cats that were underweight or had illnesses and things like that. We know those standards are based on healthy data, cat data.

**Sally Everitt:**

So I suppose that the real crucial question that we come to and people in practice are going to ask is from this study, should we be starting to think about recommendations about age of neutering?

**Alex German:**

That's a very good question and I guess I should emphasize first that the study itself wasn't designed say to compare impact of prepubertal neutering with post pubertal neutering per se. So we're not arguing what's right or wrong for that. The aim instead remember was to look at what impact can neutering have on our patterns of weight gain and growth and what should we do to monitor it. So it was a different question. And we've got to remember of course that decisions about what age you would neuter an individual cat is very nuanced and you have to take into account many health and welfare factors. For example, it's recognized that prepubertal neutering might be beneficial for population control, particularly in stray cats. So there's lots of factors you need to take into account.

**Alex German:**

Of course, that said, with the current results in mind, I don't think we should ignore the fact that neutering later seems to have less of an impact on weight, fat gain during this period, most notably in female kittens after sort of seven months. So I'm not saying you do neuter that age, but I think it could be something you should take into account as an additional variable when making your decisions.

**Sally Everitt:**

Decisions. Yeah.

**Alex German:**

And nonetheless, whatever age you neuter at, I think I would say growth monitoring is the tool really we can do to make sure this doesn't become a problem.

**Sally Everitt:**

So whatever age you're neutering puppies and kittens, to be fair, get them back into the practice, monitor the weight carefully, especially in the couple of months after neutering and make any adaptations to diet that are necessary to keep them on the correct growth trajectory.

**Alex German:**

Yeah. It would go if you did decide for various reasons early neutering was appropriate or later neutering was appropriate, I would still recommend you do that to ensure that you're assessing the individual.

**Sally Everitt:**

Yeah. And that's a really practical thing that people could do in practice. And the nurses and the vets can work together with the owner and convince them they're all doing the best for the animal. So that leads us onto, so what does this mean in practice about neutering in the round?

**Alex German:**

Sure. Yeah. Again, we are neuter for various reasons and most cats are neutered. Many dogs are neutered as well. But we have to bear in mind that additional fat gain can happen at any age and we need therefore to be looking out for it.

**Alex German:**

And the question I suppose practically comes, how can we do this? You might think about perhaps using body condition score. The trouble with body condition scoring is it's quite insensitive and it varies depending on individuals. And if you remember in the first study, we actually only looked at cats that were reported to be an ideal weight.

**Alex German:**

So my concern is, and we still saw these weight gain effects occurring, so my concern would be that that tool would not be sensitive enough to spot the changes we're seeing. So instead I would strongly recommend using growth charts,

**Alex German:**

To monitor how kittens are developing and puppies for that matter because there are puppy charts available and that's the good news bit here. We have charts now available that can be used free of charge at any time by anyone. How often do you hear that, I guess. The puppy ones are available. Actually for puppies, there's also an electronic tool in the website and there'll hopefully be one for kittens in due course, which just makes things a bit easier. Okay. So if you start that out in practice, first time you see a kitten or a puppy, I would start getting weights and start them off on the chart. Either the paper or electronic version. As you mentioned already, particularly after neutering, I'd make sure we get some very frequent weight measurements because you can then rapidly spot if something is changing and take remedial action. It might mean adjusting food intake, for example, probably the most likely thing. And that allows us to be proactive and to make the changes before they occur.

**Sally Everitt:**

And my way of using the growth charts, tell me if I'm wrong here, is that you're tracking hopefully along one of the centile lines.

**Alex German:**

Absolutely, yeah.

**Sally Everitt:**

There may be a little bit of variation, but if it goes above more than one centile line further away, that's the time, either side, that's the time to start looking for reasons and taking action.

**Alex German:**

Yeah, they're just showing you average changes and so you might have individuals that will bounce around. Some are very close, some bounce around more, and a little bit of bounce is allowed.

**Sally Everitt:**

Yeah.

**Alex German:**

Certainly I tend to, in my own puppies, kittens I've weighed them every week and be very precise, but you don't have to be as precise as that. And certainly if they go up towards two centiles, that's a definite intervention.

**Sally Everitt:**

Yeah.

**Alex German:**

But for neutering, I think any change up towards one centile for me would be something I would suggest an adjustment.

**Sally Everitt:**

Brilliant. Thank you very much, Alex. That's very interesting. And I'm sure we'll have given our listeners not only a much greater understanding of the research, but also how we can apply these findings in practice. If anyone would like further details of the study, we'll provide links to the published paper, to the growth charts on the website. RCVS Knowledge also have a spotlight feature, bringing together evidence on all sorts of different factors that can affect neutering called benefits and risks of neutering. So you might be interested to look at that. If you have enjoyed this podcast and would like to find out more about veterinary clinical research and evidence in practice, please have a look at the evidence and library sections on our website. For more podcasts from RCVS Knowledge, find us on your favorite podcast platform.

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