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## BRIEF COMMUNICATION: Variability in growth rates of goat kids on 16 New Zealand dairy goat farms

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### Introduction

Average daily weight gains (ADG) in early life are associated with health, welfare and future production potential of dairy animals. While this has yet to be established for goats, research in cows demonstrates a positive relationship between growth in early life and milk production (Shamay et al. 2005, Soberon et al. 2012). Early growth rates are largely determined by the management practices from birth onwards. It is therefore unsurprising that large differences in ADG under different management systems have been reported. In lambs, Mahgoub et al. (2000) reported a large range in ADG (84-154 g/day). Similarly, in calves, Bartlett et al. (2006) reported ADGs ranging from 251 g/day to 703 g/day. The ADGs reported in goats have not been as variable (152-170 g/day: Galina et al. 1995; 167-173 g/day: Goetsch et al. 2001); however, these were small, controlled studies. To our knowledge, no research has yet quantified variability in the ADG of goat kids on a large, multi-farm scale. Therefore, the aim of this study was to describe the variation in growth rates on multiple dairy goat farms in the Waikato region of NZ, providing a benchmark for dairy goat farmers.

### Materials and methods

This study was approved by AgResearch Ltd, Ruakura Animal Ethics Committee (13478). Sixteen Dairy Goat Cooperative (DGC) farmers from the Waikato region (NZ) agreed to participate in an on-going three year study. Between May and August 2015, 1269 Saanen Alpine cross kids (between 70 and 83 kids/farm) were enrolled. Kids were weighed four times: at enrolment (between 24 and 48 h after birth), two weeks after enrolment, at weaning, and two weeks after weaning. Kids were weighed near mid-day to minimise the effect of gut fill differences. For each kid, ADG was calculated between each weigh point. Descriptive data were summarised by farm (PROC UNIVARIATE, SAS 9.2), and are presented as means  $\pm$  SD (n = 16). Where appropriate, individual kid data is presented and discussed (n = 1269).

### Results and discussion

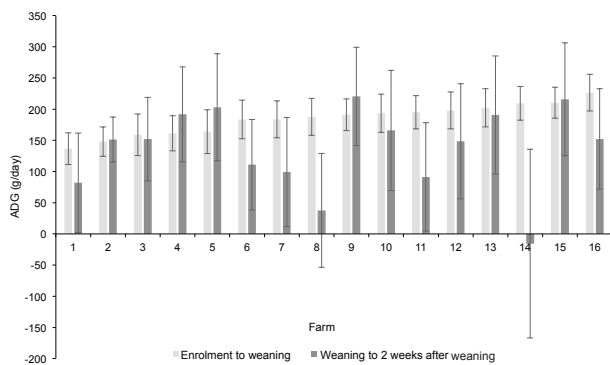
Table 1 summarises the mean weights at each time point on the 16 farms. The weights were variable across farms, even at the early weigh points. For example, the smallest kid at enrolment was 1.4 kg and the largest was

6.3 kg. When kids were weighed two weeks later, the lowest weight recorded was 2.9 kg and the highest was 13.5 kg. While birth weight will account for some weight gain variation early in life (calves: Donovan et al. 1998), colostrum management is likely a greater contributor (goat kids: Abdou et al. 2014; lambs: Massimini et al. 2006). How colostrum was delivered (e.g. dam, bottle), timing of delivery (e.g. immediately vs. up to 24 h after birth) and type of colostrum (e.g. caprine, bovine, bovine-based replacement product) differed on the 16 farms. Adequate colostrum intake after birth is known to be important in developing a young ruminant's immune system (Hurley & Theil 2011); without this development, disease risk increases (O'Brien & Sherman 1993), which subsequently may decrease growth rates (Massimini et al. 2006).

Weaning weights were variable, even among farms with similar weaning ages. For example, the farm with the lowest weaning weights (14.7  $\pm$  2.2 kg) weaned at 10.0  $\pm$  0.9 weeks old, while the farm with the highest weaning weights (24.2 kg  $\pm$  3.0 kg) weaned at 11.2  $\pm$  0.3 weeks old. This suggests that factors other than age at weaning impact growth at this critical time. Overall energy intake pre-weaning (Bartlett et al. 2006), dictated by the quality and quantity of feed provided, is a determinant of young ruminant growth (Mahgoub et al. 2000). Most farms offered milk *ad libitum*, while two restricted feedings to twice a day; types of milk fed included whey, goat milk, and cow milk powders, as well as fresh goat and cow milk. All farmers provided hard feeds, but the type provided, as well as the timing of its provision varied amongst farms.

From enrolment to weaning, ADG (Table 1) were consistent with pre-weaning ADG previously reported (e.g. 167-173 g/day: Goetsch et al. 2001). Interestingly, the variability across farms was more pronounced in the period between weaning and two weeks after weaning (Table 1). Five farms achieved consistent ADG after weaning compared to before weaning, and three of these farms achieved post-weaning ADGs > 200 g/day (Figure 1). However, ADG on the remaining 11 farms decreased after weaning. Of these, five farms experienced large decreases in ADG, achieving growth of < 100 g/day, and one farm had a negative ADG. While this latter farm reported cases of pneumonia, reduced ADG or even weight loss occurring after weaning is well documented regardless of health status (calves: Sweeney et al. 2010; goat kids: Ugur et al. 2004).

**Figure 1** Mean ( $\pm$  SD) average daily gain (ADG) of goat kids ( $n = 80 \pm 3$  per farm) on 16 New Zealand dairy goat farms from enrolment until weaning (light grey) and weaning until 2 weeks after weaning (dark grey).



**Table 1** Mean ( $\pm$  SD) age, weight and average daily gain (ADG) of goat kids on New Zealand dairy goat farms ( $n=16$ ) at four weigh points.

|                          | Weigh point   |                           |                 |                         |
|--------------------------|---------------|---------------------------|-----------------|-------------------------|
|                          | Enrolment     | Two weeks after enrolment | Weaning         | Two weeks after weaning |
| Age (days)               | 1.6 $\pm$ 0.4 | 15.9 $\pm$ 4.0            | 87.2 $\pm$ 13.0 | 101.3 $\pm$ 13.0        |
| Weight (kg)              | 3.7 $\pm$ 0.6 | 6.2 $\pm$ 0.9             | 19.2 $\pm$ 2.7  | 21.3 $\pm$ 3.2          |
| ADG (g/day) <sup>1</sup> | -             | 177 $\pm$ 32              | 180 $\pm$ 40    | 137 $\pm$ 66            |
| ADG (g/day) <sup>2</sup> | -             | -                         | 184 $\pm$ 24    | 177 $\pm$ 23            |

<sup>1</sup>calculated between each weigh point

<sup>2</sup>calculated relative to enrolment weigh point

This growth lag may be a consequence of stress induced by coping with a new diet (Magistrelli et al. 2013), or due to inadequate rumen development from insufficient hard feed consumption prior to weaning (Khan et al. 2007).

The findings of this study indicate that there is large variability in growth rates of dairy goat kids on NZ farms. Further analysis will aim to quantify how farm-specific factors (e.g. weight at birth, colostrum/milk feeding management, weaning management), may be causing these differences in ADG. It should be noted that one farm consistently achieved ADG > 200 g/day from birth through to two weeks after weaning. This provides a benchmark for NZ dairy goat farmers and suggests that high, stable weight gains, immediately following weaning, are possible.

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