

# SELECTING FOR CALF:COW RATIO SENSIBLE OR NOT?

by Japie van der Westhuizen:  
SA Stud Book and  
Animal Improvement Association

Since the calf to cow weight ratio is dependent on weights of two different animals it is essential to look deeper into the factors influencing them.



It has gone as far as some people using differences in these ratios among breeds and herds within breeds to compare differences in efficiency of cow herds. A critical first step should be to proof the objectivity or even defining the trait, prior to linking it to higher (or lower) efficiency. It therefore warrants considering the trait definition first. In general, the trait is described by means of a percentage or proportion of the calf weight (at weaning) in relation to that of the dam (recorded at the same time).

#### UNDERSTANDING THE DYNAMICS OF COW AND CALF WEIGHT CHANGES DURING THE SUCKLING PHASE.

Since the calf to cow weight ratio is dependent on weights of two different animals it is essential to look deeper into the factors influencing them.

It is well known that the weight of the suckling calf is mainly influenced by:

- the birth weight (especially at a very young age),
- the effect of the dam's maternal environment, mainly due to quantity and quality of her milk, and
- the own ability of the calf to grow. These factors are furthermore obviously influenced by environmental factors that might impact on any of them.

Environment can furthermore be defined as the total environment, namely physical, farm, season, camp, treatment, feeding regime and others. Although the expectancy is that the calf will follow a typical growth curve as part of its response to the nutrition it receives from the dam and from other sources, **the dam's weight change during suckling is the added dynamic in assessing the ratio of calf to dam weight.**

The expected cow weight changes can be linked to the **days in milk after the birth of the calf**. Initially there will be a weight loss as the expectant feed intake will not make up for the energy drainage due to milk production. After peak milk production (60 – 120 days in milk) the expectancy will be that the dam will start picking up weight (obviously given the environmental constraints). These expected weight changes in the cow and calf have serious implications for the way that "Cow Efficiency" is defined.

#### BODY WEIGHT, WHAT IS IT TELLING US ABOUT EFFICIENCIES AND CAN WE SIMPLY DIVIDE BY THE ACTUAL BODY WEIGHT WHEN COMPARING DAMS?

It is well established that body weight is a major indicator of the maintenance requirement of an animal. It is, however, not as simple as is sometimes being perceived. Not only is the relationship between body weight and

**maintenance requirement not a one-to-one relationship** (the maintenance requirements of a 700 Kg animal is not twice that of a 350Kg animal) but the state and function of the animal will also influence the real maintenance needs (eg. a lactating or animal gaining weight will have a different maintenance requirement compared to the requirements of others). **Maintenance** is also sometimes defined differently and individual animals also differ (within species or breed) in terms of these needs. In essence, the intake of feed (especially the energy intake) determines the level that the animal will be comfortable with to maintain basic body functions (basal metabolism), being able to adapt to the environmental conditions (extra need to maintain core body temperature, walk to feed and water, deal with parasites, etc.) and being able to take in above maintenance to perform in such a manner to be profitable (needs for reproduction, milk production and growth or increase in body fat).

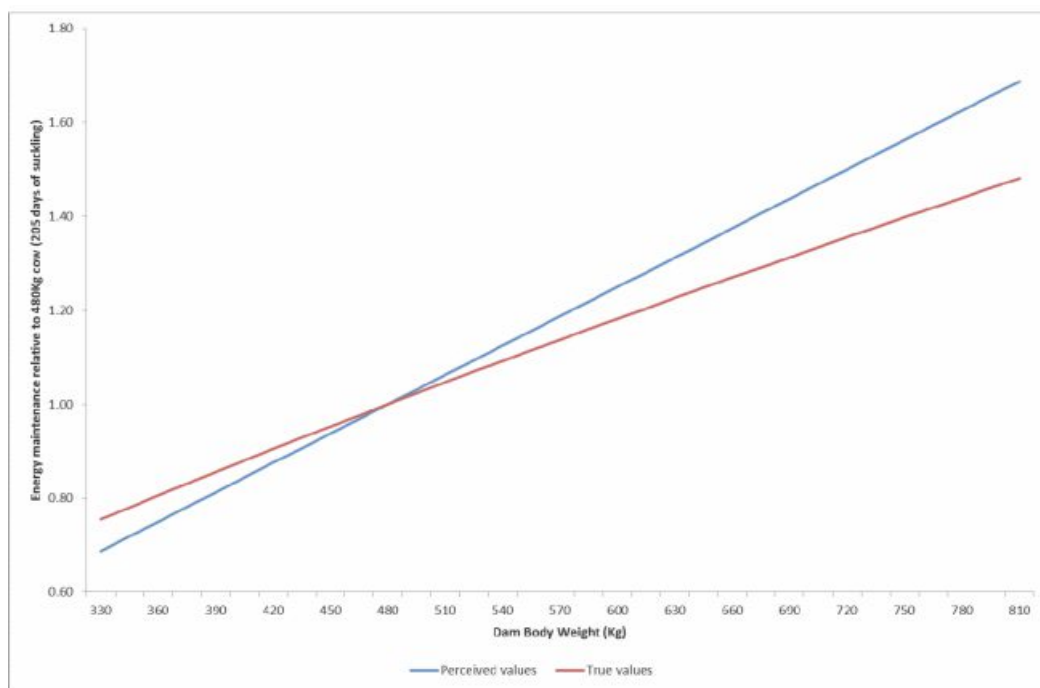
#### What is this telling us?

Although live **body weight** is the prime indicator for maintenance requirements and therefore points to the basic feed intake needed to be productive, **other factors** also need to be considered.

Furthermore, the accepted role that body weight should play should be linked to a descriptor of maintenance requirements such as comparing animals based on their "metabolic weights", rather than actual weights.

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**The most accepted norm for this is body weight raised to the power of 0.75.** In the mentioned example the metabolic weights of the 700 Kg and 350Kg cows will be  $(7000.75$  and  $3500.75)$  136Kg and 81Kg, respectively. **Given that a cow needs a certain amount of energy daily, based on her metabolic weight and that has to be maintained over the total period while suckling her calf, the perceived maintenance needs and the needs based on metabolic weight therefore differs tremendously.** Figure 1 shows the relative comparison of the energy intake needs of a beef cow, weighing 480Kg and suckling her calf for 205 days, firstly based on the wrongly perceived idea that body weight is the indicator versus the more correct metabolic weight indicator.



**Figure 1.** Energy intake needed for maintenance of a 480 Kg beef cow while suckling a calf for 205 days. Comparing two methods of calculation. Relative values.

The **big message** of Figure 1 is that all energy requirements of cows heavier than the (example) 480Kg cow are over-estimated by the assumptions based on actual body weight. All lighter cows are under-estimated, using true body weight.

The implications of these wrong assumptions are that light dams are unfairly favoured in the simple way of comparing cows for 'cow efficiency' based on 205 days weight of calves divided by their dam's true weight.

#### **COW WEIGHT CHANGES DURING THE SUCKLING PHASE AND THE IMPACT ON COW EFFICIENCY ASSUMPTIONS. WHAT IS REALISTIC?**

It is also well known that cows will lose weight during early lactation. This is mainly due to the known lactation curve causing dams to be in a negative

energy status as they are unable to take in enough energy to make up for the loss due to milk production. This is even worse in drier years (or where rainy season started late) and for young females that have not yet reached maturity. Generally, the weight of dams at weaning of their calves are used as indicators of 'cow efficiency'. The assumption is therefore that these dams will be in the same body condition state when compared for their efficiencies. Although the age of the calf is considered in the calculation, the days in milk (and its effect on the dam's weight) will not be considered. If it furthermore given that it could be normal practice to weigh weaners between 150 and 270 days of age (according to the Logix Beef guidelines), the young calves get credit for growth to 205 days whilst the older ones will be discriminated against, when calculation 'cow efficiency' of their dams.

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Figure 2 is an attempt to show three different scenarios, namely a calf weighed at 150 (Scenario 1), 205 (Scenario 2) and 270 (Scenario 3) days of age (same calf, same dam) and where these calculations were used in the dam's efficiency measurements based on the corrected calf weights and her own body weight.

**Figure 2.** Changes in body weight of a typical dam, her suckling calf and the resultant ratios obtained when calculating the perceived 'cow efficiency' at different ages of the calf.

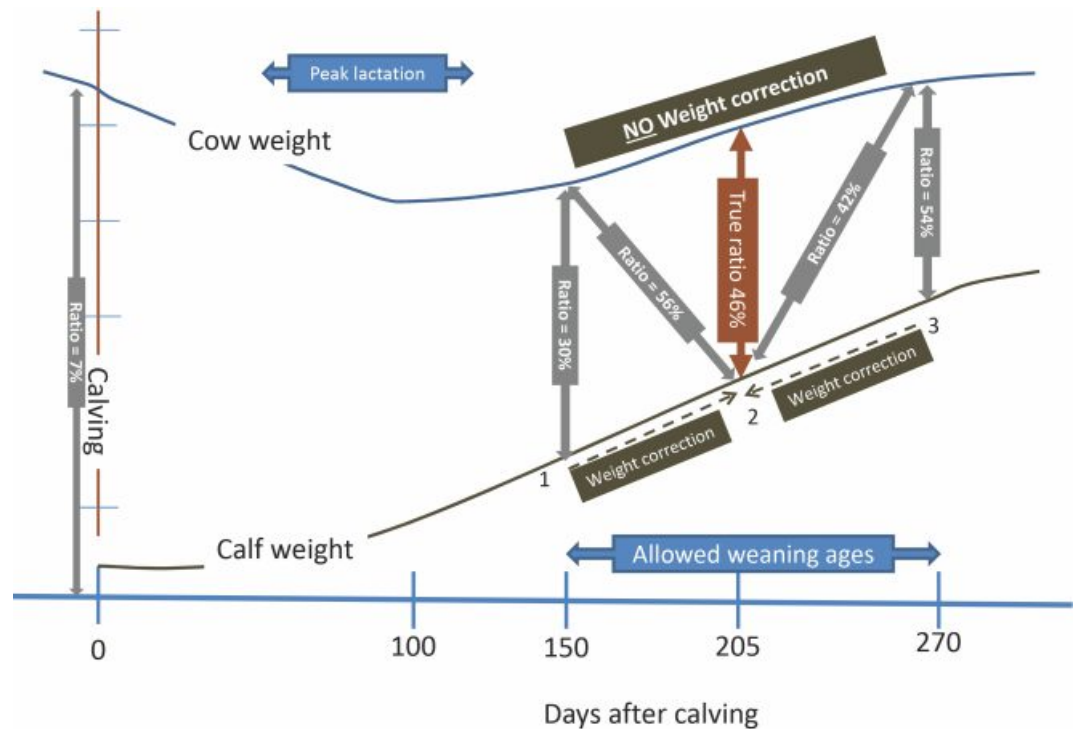
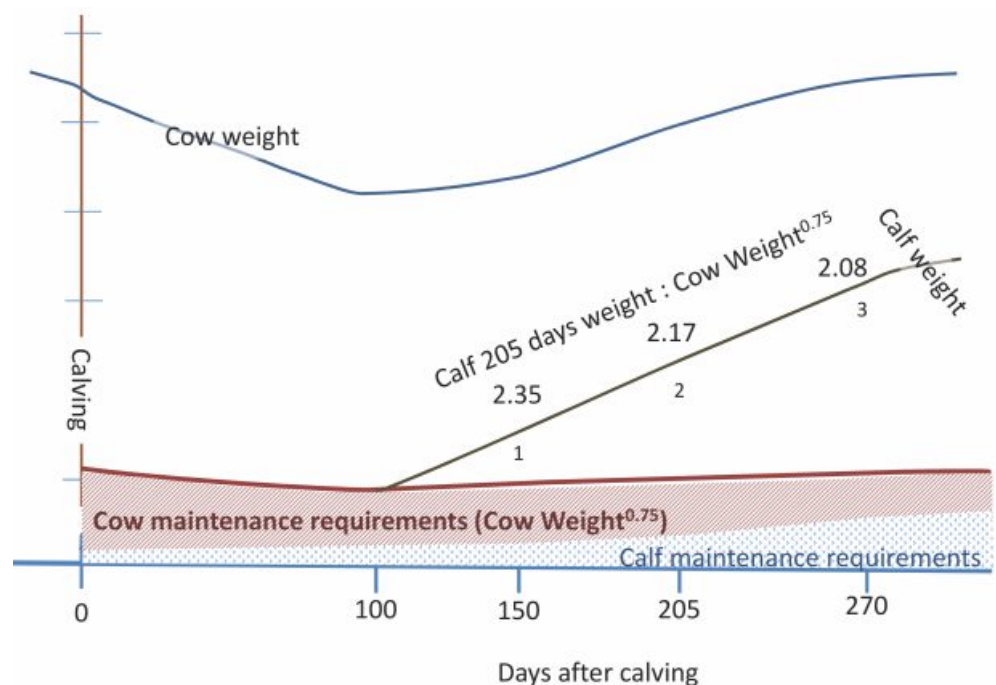


Figure 2 depicts the expected change in body weight of the dam from about 500Kg to a low of 450Kg at her peak milk production (losing a few body condition score points) and then gradually recovering. The calf weight approximately 7% of its dam at birth and exactly 46% at 205 days of age (as is depicted in Scenario 2). If, for some reason, the calf's weight at 150 days (Scenario 1) was used in the calculation, the resultant calculated ratio would have been 56%. The other side of the coin is the discrimination against a dam where her calf was weaned at 270 days of age (Scenario 3), resulting in a ratio of only 42%. Allowance for the changes in the body weight of the dam and calf weights at the given ages, would have resulted in ratios of 30%, 46% and 54%, respectively.

These examples show the futility of considering the calf to cow body weight ratios as dam efficiencies where calves were weighed at different ages and changes in cow weights during lactation nor body condition were not accounted for.

Even in the cases where the dam's metabolic body weight (body weight  $0.75$ ) is considered, these ratios also change, merely because of the age of the calf at recording. Figure 2, depicts the same three scenarios but where the metabolic weight of the dam is used in the calculation.



**Figure 3.** Changes in the maintenance requirements of the dam, her calf and the ratios of calf weight on dam metabolic weight recorded at 150, 205 and 270 days of age of the calf, respectively.

### ARE OLDER DAMS LESS EFFICIENT? AGE OF THE DAM, A FURTHER COMPLICATION.

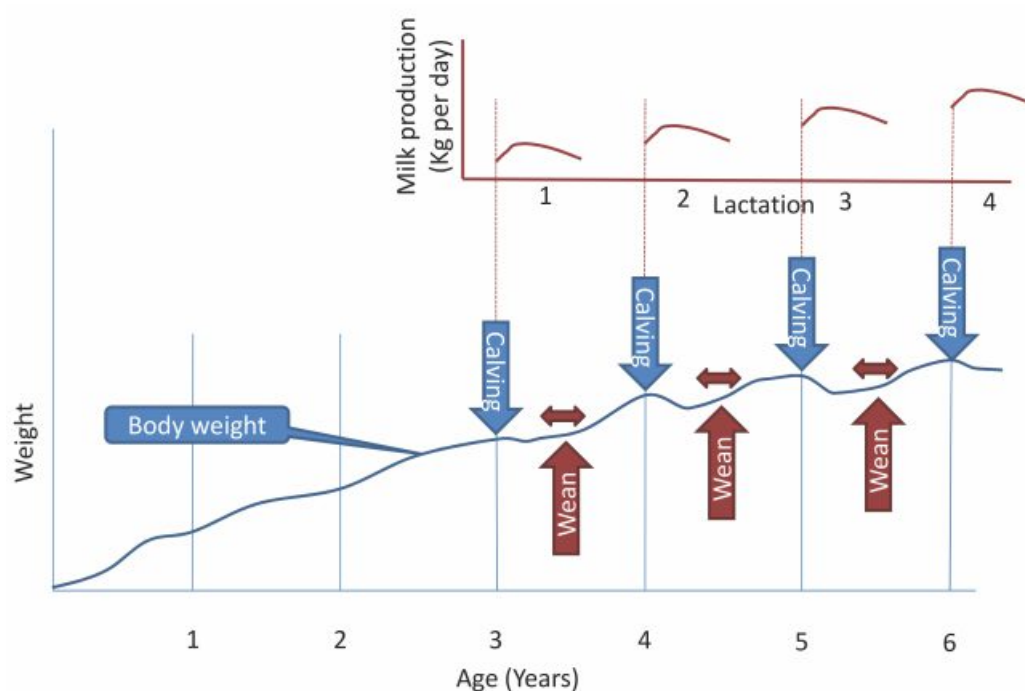
One of the severe limitations of using straight forward **phenotypic** (recording on animals) measurements is the (perceived) assumption that they reflect the differences in genetic merit amongst animals.

This is not true as it is well established that variations in measurements among animals are also mainly caused by their

responses on the effect the environmental differences. Even if animals differ genetically, these genetic differences are of little value if they do not reflect performance differences in their offspring. For these reasons methodology was developed to predict the genetic merit of individual animals based on their phenotypic recordings relative to their contemporaries (other animals that are subjected to exactly the same environmental factors, such as birth place, year and season of birth, treatment, etc.), the part of the differences that can be

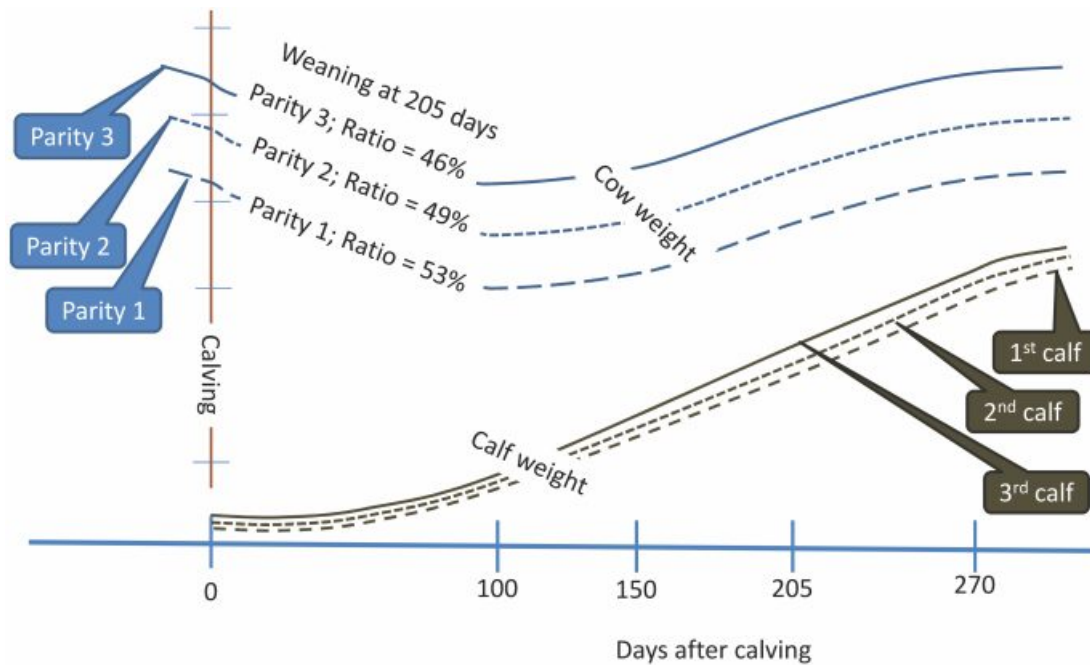
ascribed to genetic merit that can be transferred to offspring (also defined as the heritability of such a trait) and comparing the phenotypic recordings of sibs of all animals in terms of their respective contemporaries. **These BLUP breeding values** therefore assist in comparing all animals on equal footing.

To return to the **pitfalls** of using phenotypic measurements in comparing cows for 'cow efficiency'. The **cow weight changes** as well as her **milk production** during each parity are depicted in **Figure 4**.



**Figure 4.** Changes in body weight and milk production of a beef cow during the first four parities.

Based on **Figure 4**, **Figure 5** gives an example where the same cow is compared for 'cow efficiency' over the first three parities. Given that she calved the first time between two and three years of age, it is well known that she will only reach mature weight at the age of five to six years. The expectancy will be that her body weight (at a given body condition) will still increase as she becomes older. It is also known that generally calf weaning weights will also increase as a dam's milk production increases towards maturity. **The three scenarios in Figures 4 and 5 depict the cases where the same cow weans calves during her first three parities and all weights were recorded when these calves were 205 days of age.**



**Figure 5.** Calf:Cow weight ratios at 205 days calf age in the first three parities of the same cow.

As can be seen from **Figure 5**, differences in ratios are likely due to changes in the expected body weights of dams and their calves due to the age of these dams at calving.

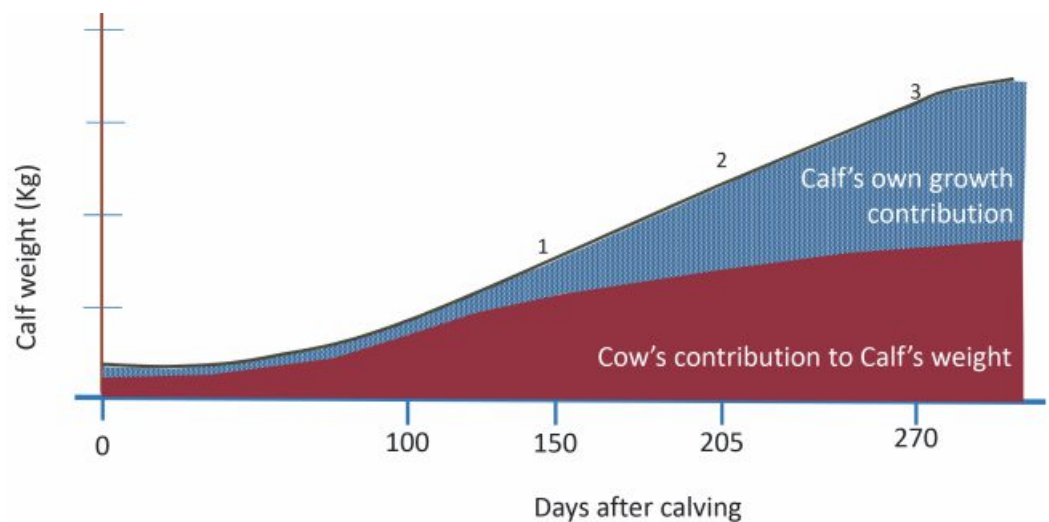
**Due to these differences, phenotypic ratios of 205 days of age calf to cow body weight are of little value when comparing the differences in 'efficiencies' among dams.**

### SOME MORE COMPLICATIONS

Although some of the major complications of using the calf to dam's body weight in the calculation of cow efficiencies were described, even **more factors contribute towards wrong assumptions when a simple division of two weights are used.**

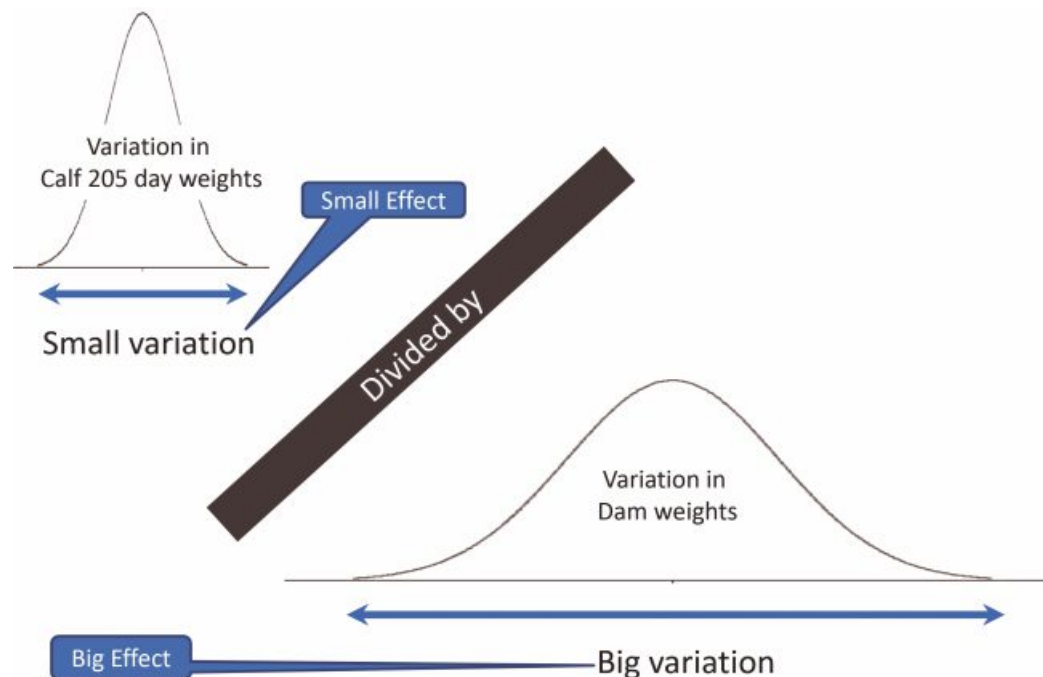
**These include:**

- **Sex of the calf.** Bull calves are heavier at weaning (and birth) than females. Differences can not be linked to efficiency of the dam.
- **During the first 100 days or so,** the calf is basically a monogastric that gradually changes into a ruminant. Young calves therefore rely purely on their dam's milk whereas older ones must rely on their intake of other feed (mostly grass). Irrespective therefore of the age effect at weight recording, as described earlier, this furthermore complicates efficiency comparisons among cows. Figure 6 depicts the effects of the dam and the calf's own growth ability on the calf's weight. Even after the calf is weaned, the dam's contribution can be seen as a 'carry over effect'.



**Figure 6.** The contribution of the dam and the calf's own ability on the calf's weight change during suckling.

- **Ratio values are complicated.** The 'cow efficiency' definitions usually work with the division of one value by another. Generally, the 'winner' in terms of the biggest contribution towards differences among animals (their ranking), will be the factor with the biggest variation. This is illustrated in Figure 7.



**Figure 7.** The impact of dividing with cow weight in differing body weight variations in 205 days calf weights and cow weights.

This implies that 'cow' efficiency values will, in the biggest majority of cases, simply favour dams with lower body weights. Given the earlier descriptions, this is not always true.

- Real efficiencies are driven by reproduction efficiency. **Basically, the biggest loss in terms of maintenance will be barren cows.** They are still consuming feed to maintain themselves without producing any products. Simple differences in calf to cow weight ratios can not make up for these losses.

#### COMBINED SELECTION INDICES, THE BETTER SOLUTION.

Although outside the scope of this article, the combination of traits contributing towards profit and loss in beef production included in a selection index is a much better solution to distinguish between the efficiency levels of different cows. The logix Beef COW VALUE is such an index. It uses BLUP breeding values of beef cattle in combination with the relative economic value of the included traits to predict the genetic merit of cows and bulls to produce efficient offspring. Values are basically expressed in Kg or Rand per Hectare.

Given the pitfalls of using simple ratios in determining 'cow efficiency', the use of the defined property should be discouraged. There are more **appropriate** and more accurate (and therefore safer) measures to be used for this purpose. ■