



The effect of nt821 on Santa Gertrudis bulls in a *Growth Test*

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Introduction

The nt821 mutation in the myostatin (MSTN) gene leads to double muscling in cattle, characterized by excessive muscle growth and reduced subcutaneous fat. This mutation is inherited as a partially recessive trait which shows incomplete penetrance, meaning carrier animals (heterozygotes) may exhibit some or all characteristics associated with this gene to varying degrees. While carrier bulls often have a selection advantage due to good muscling and heavier weaners, carrier cows face disadvantages, including increased calving difficulty due to heavier birth weights, less overall body fat and potential negative impacts on fertility and overall

health. The growth of nt821-carrier bulls and nt821-free bulls were compared in a growth test.

Materials and Methods

The study involved 36 Santa Gertrudis bulls, all of which completed a standard 84-day Phase D21 growth test at the Santarific Santa Stud near Bloemfontein, between 16 July and 8 October 2025. Bulls were sourced from multiple breeders and were genomically tested for myostatin mutations, including the nt821 variant, and for the estimation of GEBVs. The nt821 mutation was present in 13 bulls, while 23 bulls were free of this mutation.

Results and Discussion

Table 1: Comparison of phenotypic traits (Average and SD) measured in a growth test of free and carrier bulls. No differences are significant, due to low numbers and partial recessiveness of nt821.

	nt821 Free	nt821 Carrier	Difference
Number of bulls	23	13	
Dam age (months)	76 ± 24	60 ± 17	-16 months
Birth weight (kg)	38 ± 3	40 ± 4	+2kg
Weaning weight (kg)	262 ± 39	274 ± 31	+12kg
Age at start of 84d test (d)	289 ± 23	291 ± 19	+2 days
Weight at start of test (kg)	310 ± 39	322 ± 25	+12kg
Weight at end of test (kg)	462 ± 52	483 ± 33	+21kg
ADG (g/day)	1816 ± 255	1920 ± 235	+104g/day
ADA	1138 ± 109	1183 ± 76	+45
Kleiber Ratio	18.2 ± 2	18.6 ± 2	+0.5
Height (mm)	1154 ± 34	1168 ± 36	+14mm
Length (mm)	1400 ± 42	1414 ± 41	+14mm
Skin thickness (mm)	16.7 ± 2	15.8 ± 1	-1.0mm
Scrotum circumference (mm)	338 ± 24	344 ± 34	+ 6mm
12th Rib Eye Muscle Area (cm ²)	67 ± 8	73 ± 6	+6cm ²
12th Rib Fat depth (mm)	4.8 ± 0.9	4.5 ± 1.0	-0.3mm
Rump Fat depth (mm)	5.7 ± 0.9	5.3 ± 1.1	-0.4mm
Marbling (%)	1.5 ± 0.5	1.5 ± 0.5	-0.06%

Carrier bulls (nt821 carriers) demonstrated superior performance in several growth parameters compared to non-carrier bulls:

- Weaning Weight: Carrier calves weighed, on average, 12 kg more at weaning.
- Average Daily Gain (ADG): Carriers had an ADG approximately 104 g/day higher than non-carriers.
- Body Measurements: Carriers were, on average, taller and longer than non-carriers.

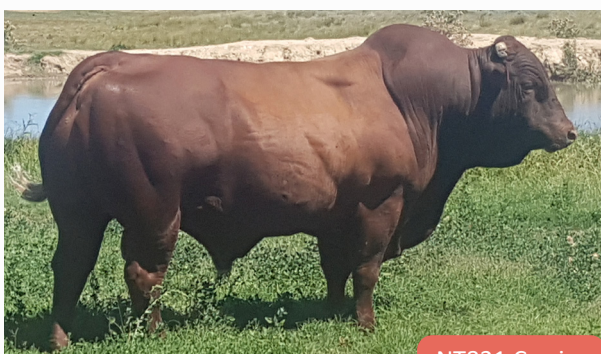
However, these advantages were accompanied by certain disadvantages:

- Birth Weight: Carrier calves had an average birth weight of 40 kg, compared to 38 kg for non-carriers, potentially increasing the risk of dystocia, especially in heifers.
- Fat Reserves: Carriers exhibited lower

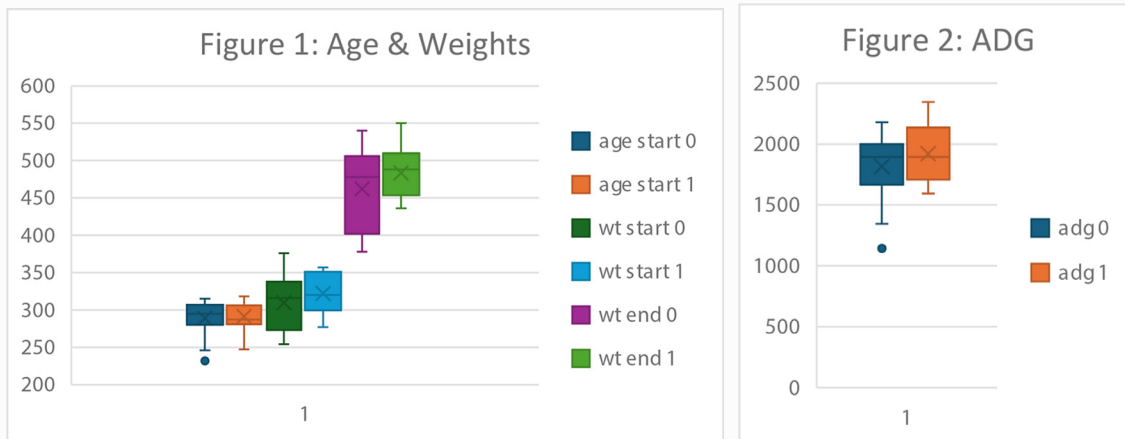
subcutaneous fat and marbling, which could be detrimental for cows in extensive production systems, particularly during droughts or after calving.

- Dam Age: The dams of carrier calves were, on average, 16 months younger than those of non-carrier calves, which may be associated with increased calving difficulties and lower survival rates in carrier cows.

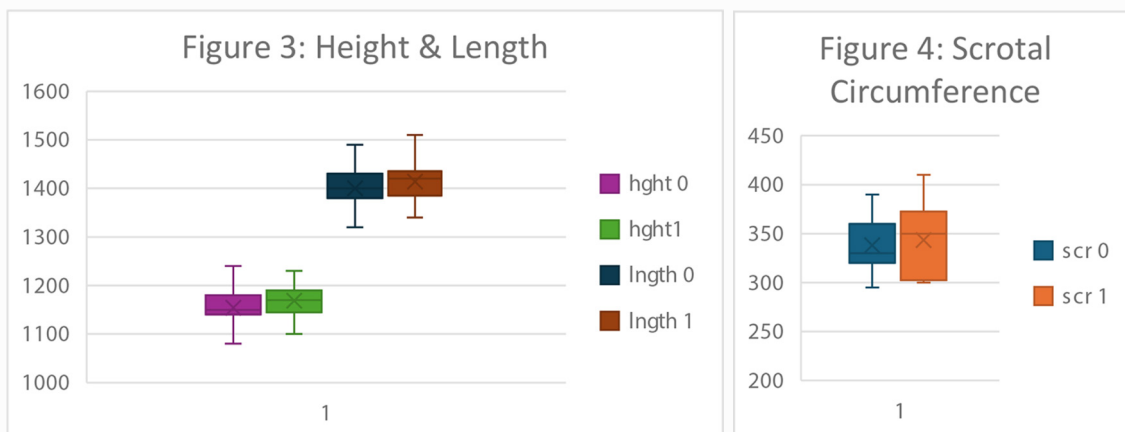
The age at which the 2 groups started the test are the same, although carriers (indicated with 1) were slightly heavier than free animals (indicated



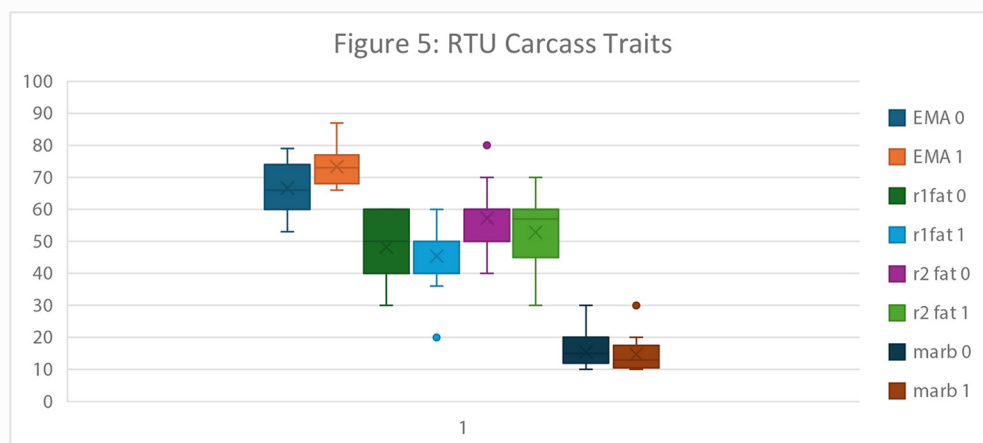
by 0). At the end of the test, the carrier group tended to be heavier (Figure 1) and have a better ADG (Figure 2).



From Figure 3, the height and length of the two groups are similar, although the averages of the carrier group are slightly higher. Scrotal Circumference (Figure 4) shows that the group of carrier bulls are more diverse than the free group, even though they are in a smaller group. The nt821 mutation is partially recessive, which means animals may show some or all effects at different levels. Scrotal circumference of some of the bulls in the carrier group were affected and they had smaller testes, but others were clearly not affected.

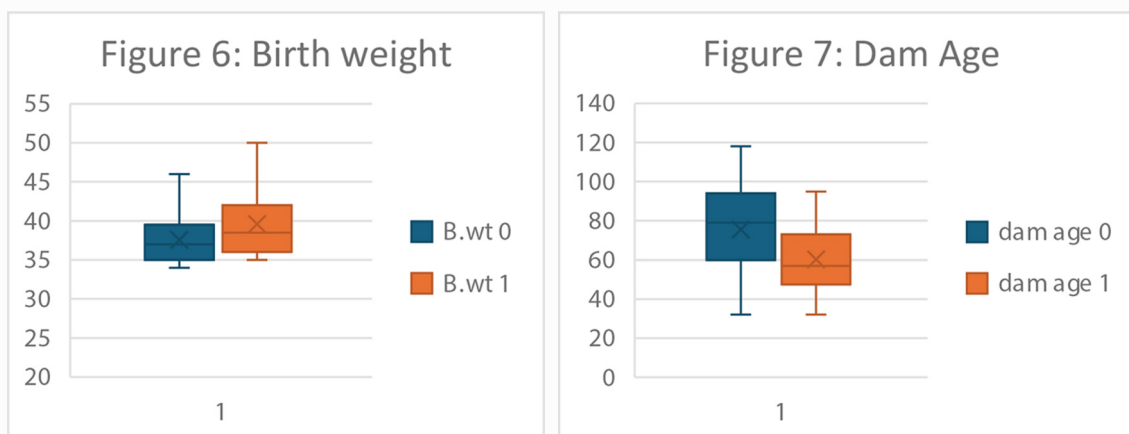


From Figure 5 typical results can be seen on the RTU scans: Carriers tend to have larger eye muscle areas (EMA) and tend to be at the lower end for fat and marbling.



r1: 12th rib; r2: rump

Lower fat reserves (Figure 5) and higher birth weights (Figure 6) are detrimental for females on the veld, usually causing carrier females to be culled sooner than free females. This might be the reason for the lower average age of the carrier bulls' dams (Figure 7). It is unknown what the status of the dams are.



When comparing the GEBVs of the two groups, the carrier group's GEBVs for Birth Direct indicated on average significantly heavier birth weights (86 versus 95 GEBV), while GEBV Eye Muscle Area indicated significantly larger values (124 vs 104 GEBV). However, the GEBV Fat for the carrier group was significantly lower (94 versus 108).

Conclusion

The nt821 mutation confers a selection advantage in bulls due to enhanced growth performance. However, the associated disadvantages, particularly for females, underscore the importance of managing this mutation within breeding programs. While carrier bulls may be advantageous for meat production, the potential negative effects on fertility, calving ease, and overall health in females necessitate careful consideration.

