

Feed restriction and compensatory growth of *Archachatina marginata* (Swainson, 1821)



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Abstract

In order to study the ability of the giant African snails of the species *Archachatina marginata* to compensate for a growth retardation caused by a periodic protein and energy deficit, they were fed for 70 days with feeds containing respectively 85% and 70% less protein and energy than the control. Despite remarkable weight growth during the refeeding phase, which also lasted 70 days, the previously restricted snails were unable to fully compensate for their growth retardation.

Introduction

- The giant African snail of the species *Archachatina marginata* is one of the non-woody natural resources highly valued by people for its flesh rich in protein and iron and low in fat.
- *Archachatina marginata* is seriously threatened by overexploitation due to several factors: collection of immature subjects, massive and excessive use of agricultural pesticides and uncontrolled use of bush fires.
- *Archachatina marginata* offers the possibility of captive breeding with good zootechnical results, provided you have a rich and balanced diet.
- The permanent availability of a rich and balanced diet for prosperous and sustainable livestock production is highly uncertain, particularly among poor households in rural areas.
- Need to develop reliable and reproducible strategies for the efficient use of feed resources at the scale of small breeders in marginalized areas.
- **Research question:** Can giant African snails of the species *Archachatina marginata*, previously subjected to a restrictive diet for a certain period, compensate their weight growth's delay, if feeding conditions return to normal?

Materials and methods

- 90 African giant snails of the species *Archachatina marginata* weighing an average of 52.48 ± 9.03 g with an average shell length of 6.83 ± 1.38 cm and an average diameter of 4.27 ± 0.67 cm were used.
- After an adaptation period of 10 days, the snails are distributed randomly into three batches of 30 animals in semi-buried enclosures made of cement blocks and fine mesh netting.
- Snails are fed collectively for 70 days with a flourey type feed comprising 20.26%; 17.18% and 14.43% crude protein and 2976 kcal; 2540 kcal and 2089 kcal metabolizable energy per kg of dry matter.
- After the feed restriction phase, all batches of snails are fed for another 70 days, corresponding to the re-feeding phase, at the same level (100%) as the control batch.



The composition of the feed ration for each batch and at each phase of the test is shown in Table 1.

Table 1: Composition of the different feed rations of snails

Ingredients (%)	Feed rations		
	Lot 1 (control): 100%	Lot 2: 85%	Lot 3: 70%
Maize	45,00	30,00	12,00
soybean meal	17,00	08,00	02,00
Palm kernel meal	05,30	02,50	10,00
Fishmeal	05,00	03,00	--
Wheat bran	15,00	10,00	13,00
Rice bran	01,00	01,00	06,50
Corn bran	--	24,00	35,00
Malt brewery residues	--	10,00	10,00
Oyster shell	10,00	10,00	10,00
CMV	0,20	0,20	0,20
Sodium chloride	0,10	0,10	0,10
Lysine	0,60	0,50	0,50
Methionine	0,30	0,20	0,20
Di-calcium phosphate	0,50	0,50	0,50
Total	100,00	100,00	100,00
CP (%)	20,26	17,18	14,43
ME (Kcal/kg MS)	2976	2540	2089
CF (%)	5,13	8,16	11,26
Ca (%)	4,83	4,77	4,63
P (%)	0,76	0,65	0,68

CMV: Concentrated Mineral Vitamin; CP: Crude Protein; ME: Metabolizable Energy; CF: Crude Fiber; Ca: Calcium; P: Phosphor

Results

- The energy and protein restriction of the ration of around 15% and 30% caused in *Archachatina marginata* snails an average daily consumption of dry matter of around 4.6% and 8% higher than that of the controls who consumed 1.04 g
- The average daily consumption of dry matter was about 1.5 g per head almost identical in all snails at the end of the re-feeding phase (figure 1).
- With 0.25 g and 0.18 g respectively, the batches of snails subjected to a ration deficient in energy and protein of the order of 15% and 30% respectively displayed a significantly lower average daily weight gain ($p < 0.01$) of 32.43% and 51.35% to that of the controls.
- The batches of snails which had been previously fed respectively with 85% and 70% of the ration of the control

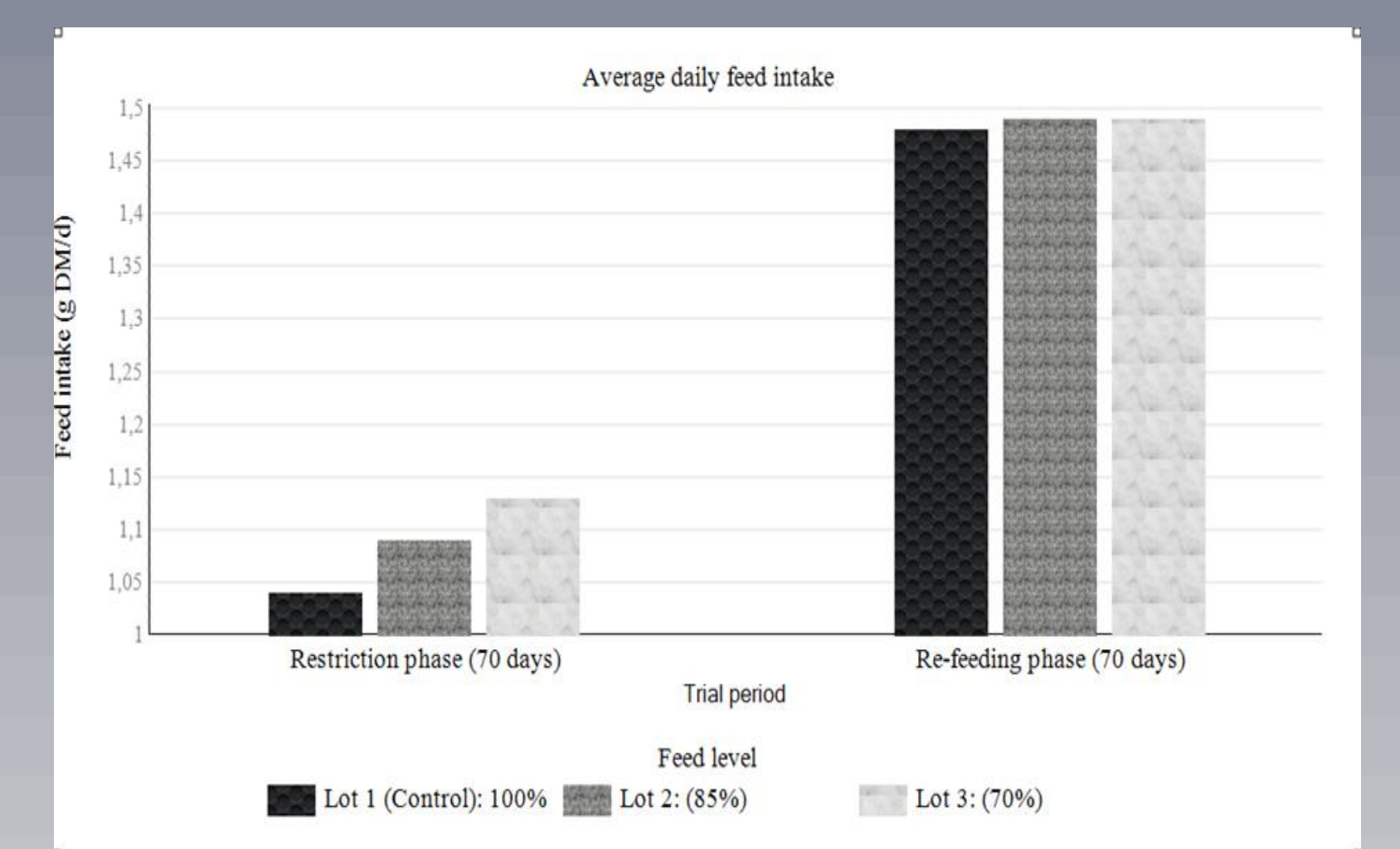


Figure 1: Feed consumption of snails during the trial period

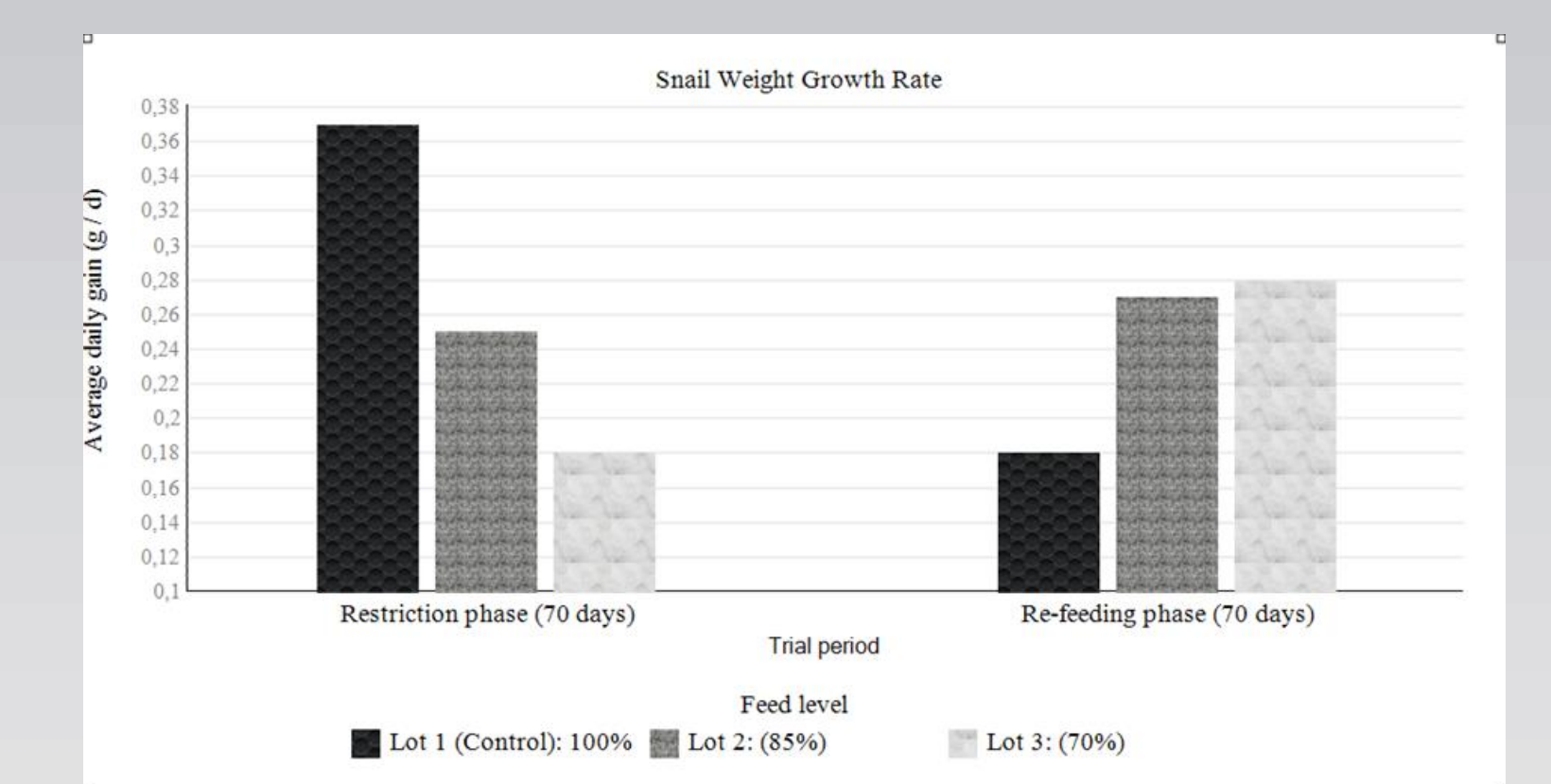


Figure 2: Average daily weight gain per snail (n = 30) during the trial period

batch, recorded with 0.27 g and 0.28 g a respective mean daily gain of 50% and 55% significantly ($p < 0, 05$) higher than the control batch at the end of the re-feeding phase (Figure 2).

- Snails increased their shell length by 17.39%, 18.22% and 18.68% which was found to be inversely proportional to the level of feeding after the restriction phase. In the same order, the shell diameter increased by 14.55%, 14.42% and 14.68%.
- At the end of the re-feeding phase, the respective increases were 8.77%, 8.51% and 8.12% for the length and 7.74%, 9.55% and 9.4% for the diameter of the snail shell (Table 2).
- Shell development was slowed by approximately 50% between the feed restriction phase and the re-feeding phase

Table 2: Measurement of the shell of giant African snails of the species *Archachatina marginata*

Feed level	Test phases											
	Restriction phase (10 weeks)						Re-feeding phase (10 weeks)					
	Length (cm)			Diameter (cm)			Length (cm)			Diameter (cm)		
	L ₀	L ₁₀	%	D ₀	D ₁₀	%	L ₁₀	L ₂₀	%	D ₁₀	D ₂₀	%
Lot1 (100%)	6.9 ^a ± 0.49	8.1 ^a ± 0.54	17.39 ^a	4.4 ^a ± 0.24	5.04 ^a ± 0.27	14.55 ^a	8.1 ^a ± 0.54	8.81 ^a ± 0.51	8.77 ^a	5.04 ^a ± 0.27	5.43 ^a ± 0.26	7.74 ^a
Lot2 (85%)	6.86 ^a ± 0.46	8.11 ^a ± 0.43	18.22 ^a	4.3 ^a ± 0.28	4.92 ^a ± 0.32	14.42 ^a	8.11 ^a ± 0.43	8.80 ^a ± 0.25	8.51 ^a	4.92 ^a ± 0.32	5.39 ^a ± 0.31	9.55 ^a
Lot3 (70%)	6.85 ^a ± 0.51	8.13 ^a ± 0.5	18.69 ^a	4.36 ^a ± 0.26	5 ^a ± 0.29	14.68 ^a	8.13 ^a ± 0.5	8.79 ^a ± 0.46	8.12 ^a	5 ^a ± 0.29	5.47 ^a ± 0.3	9.4 ^a

Values in the same column with the same superscript letters are not significantly different at the 5% threshold. L0: Length at the start of the restriction; L10: Length at end of restriction (10 weeks); D0: Diameter at the start of the restriction; D10: Diameter at the end of the restriction (10 weeks); L20: Length at the end of re-feeding (20 weeks); D20: Diameter at the end of re-feeding (20 weeks); %: Increase

Conclusion

- Qualitative and periodic dietary restriction of giant African snails of the species *Archachatina marginata* has shown to be a promising strategy for the efficient use of the increasingly scarce feed resources;
- The more severe the restriction, the more the snails exhibited a significantly higher growth rate during subsequent re-feeding;
- The delay in weight growth caused by an undernourishment of the order of 15% and 30% in protein and energy for 70 days was only compensated by 61.92% and 48.23% after a re-feeding period of 70 days.

Acknowledgments

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