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Compensatory growth in Nubian female goats in Sudan
Effect on performance (A)

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Abstract: Two groups of female goat kids less than one year in age, Nubian ecotype (15 kids/ group) and of the same initial weight (16.5 kg/kid) were subjected to two dietary levels of energy for 105 days, the first group was offered the highest energy diet (11.5 Mj ME/kcl) while the second group was given the lowest dietary energy diet (8.5 Mj ME/kcl). Through this term of the experiment (105 days) kids of the second group were found just to maintain their weight. Then seven kids from the second group was offered the highest energy diet (11.5 MjME/kcl) to reach the final weight obtained by the first group, it spent 175 days to reach that weight. These kids which were raised on the lowest dietary energy level (8.5 MjME/kg) were used to study the effect of compensatory growth on the performance of the female goat kids. Weekly, daily rate of gains and total dry matter intake were significantly (P< 0.001) lower in the compensating female goats than the first group.

Keywords: Compensatory Growth, Female Nubian Goats' Performance.

النمو التعويضي في إناث الماعز النوبي في السودان
الأثر على الأداء (أ)

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المستخلص: استخدمت مجموعتين من إناث الماعز النوبي السوداني لدراسة أثر النمو التعويضي على أداء الماعز النوبي السوداني (15 جدي لكل مجموعة وذات وزن ابتدائي 16.5 كيلوجرام) لمدة 105يوم. المجموعة الأولى أعطيت علف ذو طاقة أعلى (11.5 ميجاجول طاقة ممثله) بينما أعطيت المجموعة الثانية علف ذو طاقة أدنى (8.5 ميجاجول طاقة ممثله). خلال هذه الفترة حافظ جديان المجموعة الثانية على أوزانهم بدون زيادة محسوسة. تم اختيار 7 جديان من المجموعة الثانية وتقديم العلف ذو الطاقة العليا (11.5) لهم للوصول للوزن النهائي الذي وصلته جديان المجموعة الأولى. استغرقت هذه المجموعة 175 يوم للوصول لذلك الوزن. هذه الجديان السبعة استخدمت لدراسة أثر النمو التعويضي على الأداء.
أظهرت النتائج أن اكتساب الوزن اليومي والأسبوعي والمأكول الكلى للمادة الجافة انخفض معنويا عن المجموعة الأولى.

الكلمات المفتاحية: النمو التعويضي - أداء إناث الماعز النوبي.

1- INTRODUCTION

Compensatory growth is the ability of an animal to undergo accelerated growth and enhanced efficiency upon realimentation following a prior period of restricted feeding (Hornick et al., 2000). Although this naturally occurring accelerated growth phenomenon has evolved naturally across many species, it has been extensively incorporated into animal production systems, particularly beef systems, whereby feed input costs may be reduced (Ashfield et al., 2014).

In particular there is limited information on variation in compensatory growth response between contrasting breed types, for example, breeds which differ in maturation rate (early versus late maturing breed type). As a period of dietary restriction may alter body composition (Keogh et al., 2015a), The intensity and effectiveness of compensatory growth are influenced by various factors, encompassing the degree and duration of feed restriction, re-feeding period, as well as the animal's sex and genotype (Andersen et al., 2005 and Miszura et al (2021). For instance, a short-term and not too severe feed restriction may lead to more effective compensatory growth (Menegat et al 2020). In addition, the effectiveness of compensatory growth is influenced by the animal's stage of growth, which may have a synergistic effect on compensatory growth when puberty occurs concurrently with re-feeding (Coleman and Evans (1986).

This study was undertaken to examine the effect of the compensatory growth on the performance of female Nubian goats.

2- MATERIALS AND METHODS

Experimental animals: Thirty female Nubian goats were used in this experiment. Animals were selected according to their age (9—12 month) and weight which was approximately 16.5 Kg. Goats were ear-tagged and given an adaptation period of four weeks. During this period goats were fed groundnut halum and a mixture containing equal percentages of assigned experimental rations *ad libitum*. Spraying with an acricide solution against ectoparasites and deworming with thiobenzol as a drench solution was performed, the thiobenzol treatment was repeated after 15 days. Immediately after the adaptation period the animals were individually weighed and then randomly divided into two groups (A& B) of similar number and weight and each group was separately penned.

Feeds and feeding: Tow iso-nitrogenous diets, contains two levels of dietary energy (11.5 and 8.5Mj/KgDM) were used. The ingredient proportions and calculated chemical analysis of experimental diets are given in Table (1).During the feeding period animals were fed the assigned diets *ad libitum*.

Conduct of the experiment: The experiment was divided into two terms, first term which was lasted in 105 days, and second term in which seven goats from the second group (B) were refed with the highest dietary energy diet (11.5Mj/KgDM).These goats were kept until they reach the final weight obtained by the first group (A), they spent 175 days to reach that weight.

Data collection: Performance data which include, feed intake, live weight gain and feed conversion efficiency was calculated.

Statistical analysis: The data was analyzed by student t-test according to (Snedecor and Cochran, 1980).

3- RESULTS

Performance data: As shown in Table (2), there was no significant difference in initial weight and final live weight which was the determined the target weight. Total live weight was slightly lower in the compensated group, while the weekly rate of gain and daily weight gain were significantly ($P< 0.001$) decreased in the compensated group than in the first group. Figs 1 and 2 clearly show live weight growth and daily gain of the first and the compensated goat groups. Total dry matter intake and daily feed intakes were significantly ($P< 0.001$) lower in the compensated group than in the first group. In fact the compensated group consumed 50% lower dry matter than the first group. When the dry matter intake was plotted in a graph Fig 3, the compensated group in the first term of the experiment consumed more dry

matter than the first group, subsequently their dry matter intake dropped to about 50% of the first group. Feed conversion ratio was significantly ($P< 0.001$) superior in the compensated group compared with the first group. In fact the compensated group was 172% superior in feed conversion efficiency than the normally growing group.

DISCUSSION

Feedlot performance: compensated female goat kids had lower weekly and daily rate of weight gain than the normally growing ones. These could be due to the reduced feed intake of the compensated group also the metabolizable energy of the feed is only maintaining the kid's body weight. These results disagreed with those of Toukourou and Peters (1999) who studied the impact of feed restriction on the growth performance of goat kids and found no difference in body weight gain among the restricted and control goat groups. Also Ehoche *et al.* (1992) worked with zebu bulls and found that during first and mid period of restriction, restricted bulls had lower weight gain than the control ones. But during the final period of their experiment live weight was significantly ($P<0.05$) higher in restricted bulls than in the control ones. Thornton *et al.* (1979) studied compensatory growth in sheep and found rapid gains during compensatory growth which were associated with an increased feed intake.

This discrepancy might be related to type of animals, length of recovery period, severity and duration of restriction period and type of realimentation diet.

Recent research held by Tianyu Deng et al (2024) on beef cattle found that body Weight difference diminished progressively during the nutritional recovery period.

Their results agreed with results obtain here.

Feed intake: compensated female goat kids had significantly ($P<0.01$) lower feed intake than the basal group. In fact the compensated kids ate 50% lower than the normally fed kids.

Many workers in different animal species find that compensated animal groups had lower dry mater intake as Keady, Keane and Waters et al (2021) who work on steers.

They found that during feed restriction, steers had lower dry matter intake and greater, feed conversion ratio.

On the other hand Ehoche *et al.* (1992) studied the growth performance and carcass characteristics following feed restriction and realimentation in zebu bulls and found that daily dry matter intake was higher in restricted bulls than in normally grown ones. Also Rayan *et al.* (1993a) found that during realimentation, steers that were previously restricted had greater feed intake than non-restricted control animals. These results were at variance with the present result. Type of animals, diet composition, severity and duration of restriction might be the reasons.

Feed conversion efficiency: compensated female goat kids had highly superior feed conversion efficiency than continuously fed kids. The improved feed conversion efficiency in this study might be due to the reduced feed intake. The findings in this study agreed with the results of Ehoche *et al.* (1992) who studied the growth performance and carcass characteristic following feed restriction and realimentation in

zebu bulls and found that efficiency of feed utilization was significantly greater in restricted bulls than in continuously fed bulls. Enhanced growth efficiency during compensatory growth has been reported in several studies as Turgeon *et al.* (1986) who worked in lambs and Abdalla *et al* (1988) who worked in calves.

Also Keady, Keane and Waters et al (2021) found that during feed restriction, steers had greater feed conversion ratio. However, upon re-alimentation, average daily gain and feed efficiency of sheep re-alimented animals were greater than those maintained continually, Addah et al (2017).

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Table (1): Ingredients proportion and chemical composition of Experimental diets.

Item %		A	B
Physical Composition (As fed)	Sorghum grain	40	0
	Wheat bran	15	4
	Groundnut cake	15	4
	Groundnut hulls	17.8	54.8
	Urea	0.2	3.2
	Molasses	10	32
	Lime stone	1	1
	Common salt	1	1
Percentage Chemical composition (DM)	Moisture	6.2	5.08
	Crude protein	17.48	17.89
	Crude fiber	16.5	22.3
	Ether extract	2.43	1.68
	Ash	14.3	16.65
	Calculated Metabolizable	11.55	8.50
	Energy (Mj/Kg DM)*		

*** Calculated according to Ministry of Agriculture, Fisheries and Food, London, U.K. (1975).**

Table (2): Effect of compensatory growth on feedlot performance.

Item	Basal group (A)	Compensating group (B)	P
Number of animals per lot	15	7	-
Period to attain target weight (days)	105	175	-
Initial weight (Kg)	16.55±0.43	16.76± 1.6	N.S.
Finial weight (Kg)	25.67±1.01	25.32±1.11	N.S.
Total live weight gain (Kg/head)	9.12 ±0.41	8.44±0.92	N.S.
Weekly rate of gain (Kg/head)	0.61 ± 0.003	0.34±0.037	0.001
Daily rate of gain (g/head)	87.14±1.87	48.57±0.166	0.001
Total dry matter intake (K/head)	121.86±0.30	65.39±0.175	0.001
Feed intake (Kg/head/day)	1.161±0.043	0.374±0.025	0.001
Feed on version ratio (Kg DMI/Kg gain)	13.36±0.67	7.75±1.10	0.001

P= probability, N.S = Not significant.

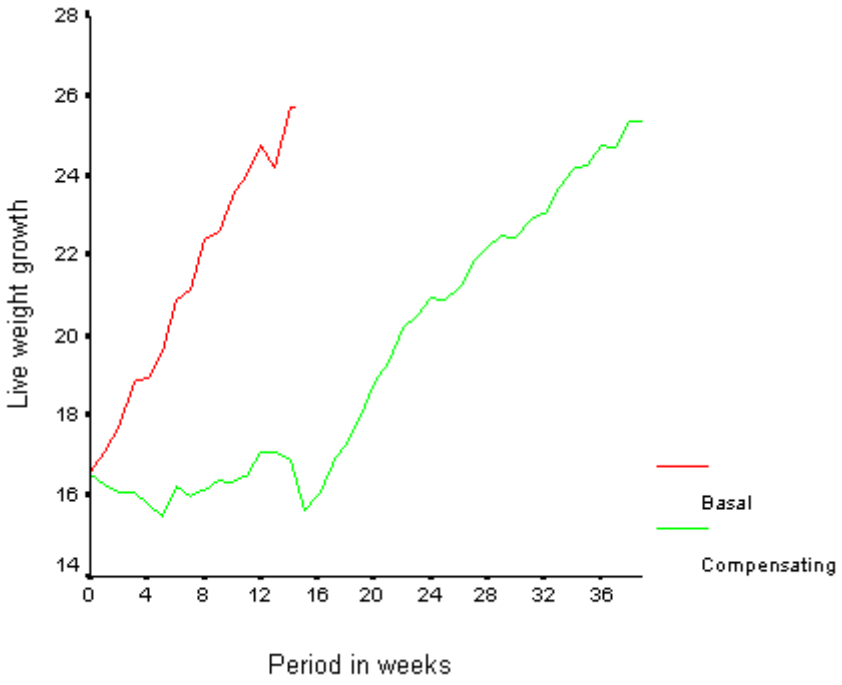

Fig.1.Effect of compensatory growth on live weight growth.

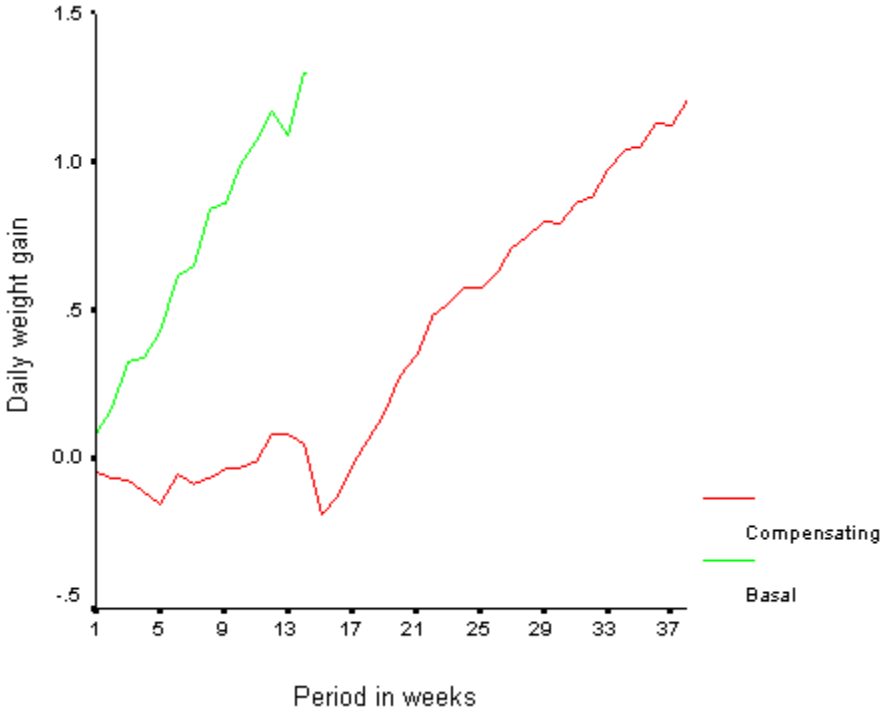

Fig.2.Effect of compensatory growth on daily weight gain.

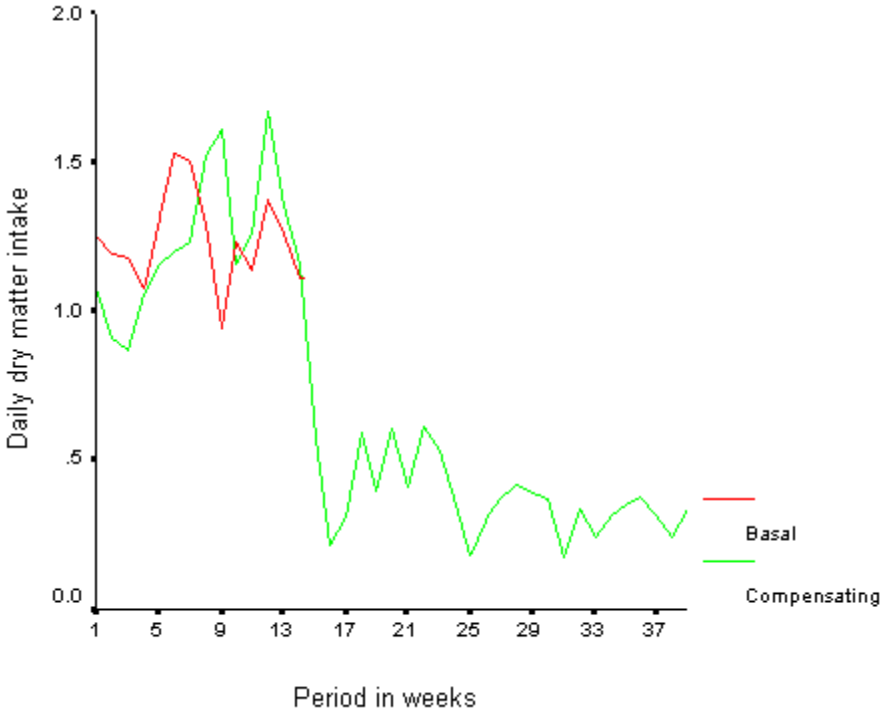

Fig.3.Effect of compensatory growth on daily dry matter intake.