

THE EFFECT OF DIETARY PROTEIN DEGRADABILITY ON THE PERFORMANCE OF SAANEN DAIRY GOATS

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ABSTRACT

Title: The effect of dietary protein degradability on the performance of Saanen dairy goats
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The goat is a significant domestic animal throughout the world today. With an estimated world goat population of 590 million goats in 1991 (FAO, 1991 as cited by Haenlein, 1996) it is impossible to consider the goat as insignificant. The need for milk, and it seems particularly goat's milk, is obvious if one considers the increase in dairy goat populations over the past 20 years. Across the globe the dairy goat population has increased by 52% while in developing and developed countries, there has been an increase of 56% and 17%, respectively (Haenlein, 2000).

The goat dairy industry in South Africa is still very underdeveloped, yet it holds tremendous potential for the entrepreneur willing to take the risk and do the job correctly. With the present South African financial situation the opportunities that exist for exporting value added products to countries with stronger currencies is a market with extraordinary potential. In New Zealand, the national herd consists of approximately 16000 dairy goats and 90% of the milk produced is turned to powdered milk and then exported to the East, a valuable source of foreign currency. In South Africa, the same potential exists and with some vision and hard work the dairy goat industry can make a valuable contribution to generating foreign currency.

Research into the protein requirements and particularly protein degradability requirements of dairy goats is scarce, yet in recent years there has been an increased interest in the effect of protein supplementation to lactating animals (Mishra & Rai, 1996). In the work of Mishra & Rai (1996) there were benefits obtained from the use of different rumen degradable proteins for lactating dairy goat does. The does on the highly degradable protein diet had a better feed intake while the does on the low degradable protein diet gave a higher milk production. Other research on this field of study has also delivered positive results with more than one species of lactating animal that had increased levels of UDP in the diet (Robinson *et al.*, 1991 and Christensen *et al.*, 1993).

Loerch *et al.* (1995) suggested that improved production by making use of rumen undegradable proteins would have no effect if crude protein were not a limiting factor in production. Pailan & Kaur (1995) and Mishra & Rai (1996) did research on lowered CP levels with increased UDP levels in lactating dairy does. They used of three diets, with the one having a 20% lower CP value but an

increased level of UDP (40-45% of total CP). From this work it was concluded that a decreased CP level and an increased level of UDP is able to sustain production when compared with diets with a higher CP value.

The current study consists of two trials. In the first trial the effect of weaning age and dietary protein degradability on the growth of Saanen kids was investigated. In the second trial the effect of dietary protein degradability on the production of lactating Saanen does was investigated.

Fifty-eight Saanen kids were divided into groups to determine the effect of weaning age (42 vs. 70 days) on animal performance. Within the weaning day treatments, the kids were again divided into two dietary treatments. One group received a low UDP creep diet (LC) and the other a high UDP creep diet (HC). The two creep diets were formulated with rumen degradable: undegradable protein (RDP : UDP) ratios of 70:30 and 60: 40, referred to as LC and HC, respectively. However, the results from the degradability trial indicated no difference in RDP: UDP ratios for the low and high creep (72:28 and 73:27 respectively) diets. At 15.66 ± 3.09 kg the kids were taken off the creep diet and put on the growth diet. At this transition, the kids in each of the 4 established treatments were again randomly divided into two dietary treatments, a high or a low UDP growth diet, resulting in a total of eight treatments for the trial. The two growth diets were formulated with RDP: UDP ratios of 70:30 and 60:40, referred to as low growth (LG) and high growth (HG) respectively. Results from the degradability trial indicated RDP: UDP ratios for the LG and HG of 73:27 and 68:32 respectively. The growth trial was conducted over 140 days and feed intake, bodyweight change and feed conversion efficiency were compared for each of the 8 treatments.

From the trial with the Saanen kids it was concluded that weaning dairy goat kids at 42 days of age when feed intake was 240 g/day resulted in similar growth rates when compared with weaning at 70 days. The two creep diets did not differ in RDP: UDP ratios and thus no conclusion can be made regarding the influence of the creep diets on the growth of Saanen kids from 20 to 80 days of age. The two growth diets did in fact differ from one another, in terms of RDP: UDP however, protein degradability had no influence on the performance of the Saanen kids from 80 to 140 days of age.

Twenty-one lactating Saanen does were randomly assigned to one of three experimental diets. The treatments had two RDP: UDP ratios and two crude protein (CP) levels. Treatments were formulated to be 1) RDP: UDP = 70:30, CP = 20 % 2) RDP: UDP = 62:38, CP = 20% and 3) RDP: UDP = 62:38, CP = 18.3%. In the production trial the does were milked for 120 days, during which milk yield, milk composition, bodyweight change, feed intake and feed conversion efficiency were compared between the treatments. In the digestibility and nitrogen metabolism trial, 18 does varying from 84 to 110 days

in lactation, were used to compare the experimental diets. Furthermore, the experimental diets were compared in a degradability and rate of passage trial using cannulated Dohne merino wethers.

Results from the degradability trial indicated that the low UDP, low protein high UDP and high UDP diets had RDP: UDP ratios of 82:18, 78:22 and 79:21 respectively, and that the dietary protein degradability did not differ significantly between diets. Results from the production trial indicated that there was a significant difference in feed intake, dry matter (DM) intake and bodyweight. The does on the low UDP diet had significantly higher feed intakes and DM intakes and were significantly heavier at the end of the trial period. As the diets didn't differ in protein degradability other factors must have influenced the intakes between diets. Palatability may have influenced feed and DM intake, as the low protein high UDP and high UDP diets both contained higher levels of fishmeal. No significant differences in milk production, milk composition or milk production efficiency were observed. Besides the fact that the diets did not differ in effective protein degradability, large variations in milk production between animals and low numbers of animals per treatment limited the ability to measure a difference between the treatments. Results from the digestibility trial varied between diets with the low UDP diet having a significantly lower digestibility overall than the other two diets. Reasons for the difference in digestibility could be due to the difference in rate of passage (low UDP = 0.064/hour versus the 0.044-0.045/hour of the low protein and high UDP diets respectively) and the high ADF value of the low UDP diet. Because no difference in effective protein degradability existed between the diets it is not possible to make an accurate conclusion on whether or not the dietary protein degradability had an influence on production parameters tested in this trial.

OPSOMMING

Titel: Die effek van dieet proteïen degradeerbaarheid op die prestasie van Saanen melkbokke.
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Huidiglik is die bok 'n belangrike gedomestikeerde dier dwarsoor die wêreld. Aangesien die wêreldwye bokpopulasie in 1991 op 590 miljoen geraam is (FAO, soos aangehaal deur Haenlein, 1996), is dit onmoontlik om die bok as onbelangrik te beskou. Die behoefte aan melk, en dan veral bokmelk, is duidelik as mens die toename in bokpopulasies oor die afgelope 20 jaar in ag neem. Wêreldwyd het die melkbokpopulasie met 52% toegeneem, terwyl dit in ontwikkelende en ontwikkelde lande met 56% en 17% onderskeidelik, toegeneem het (Haenlein, 2000).

Ten spyte van die feit dat die bokmelk-industrie in Suid-Afrika nog baie onderontwikkel is, is daar geweldige potensiaal vir die entrepreneur wat bereid is om 'n risiko te loop en die taak korrek aan te pak. Binne die huidige Suid-Afrikaanse finansiële situasie bestaan daar veral geleenthede om waardetoegevoegde produkte na lande waarvan die wisselkoers sterker is, uit te voer. In Nieu Zeeland is die nasionale kudde ongeveer 16000 melkbokke en 90% van die geproduseerde melk word verwerk na poeiermelk en uitgevoer na die Ooste. In Suid-Afrika bestaan dieselfde potensiaal en met die korrekte visie en harde werk kan die melkbok-industrie 'n belangrike bydra lewer om buitelandse valuta te verdien.

Alhoewel navorsing aangaande die proteïen-degradeerbaarheidsbehoefte van melkbokke skaars is, bestaan daar die afgelope paar jaar 'n toenemende belangstelling in die effek van proteïen suplementering aan lakterende diere (Mishra & Rai, 1996). In die werk van Mishra & Rai (1996) is die voordele om verskillende rumen degraderende proteïenvlakke in lakterende melkbokke te gebruik, aangetoon. Ooie op 'n hoogs degradeerbare proteïen-dieet het beter voerinnames getoon, terwyl die ooie op 'n laag degradeerbare proteïen-dieet hoër melkproduksies gelewer het. Navorsing van hierdie aard op ander lakterende spesies het ook positiewe resultate met 'n toename in verbyvloei-proteïen in die dieet gelewer (Robinson *et al.*, 1991 en Christensen *et al.*, 1993).

Loerch *et al.* (1995) het voorgestel dat 'n verbeterde produksie, deur gebruik te maak van verbyvloei-proteïen, geen effek sal hê as ruproteïen (RP) nie 'n beperkende faktor i.t.v produksie is nie. Beide Pallan & Kaur (1995) & Mishra en Rai (1996) het navorsing gedoen op die invloed van

verlaagde RP-vlakke en verhoogde nie-degradeerbare proteïen (NDP) vlakke in die diëte van lakterende melkooie. Daar is gebruik gemaak van drie diëte, waarvan die een dieet 'n 20% laer RP-inhoud, maar 'n verhoogde NDP-vlak (40-45% van totale RP) gehad het. Vanuit hierdie werk is die gevolgtrekking gemaak dat 'n verlaging in RP-vlak en 'n verhoging in NDP-vlak dieselfde produksie kan onderhou, soos met 'n hoër RP-inhoud.

Die huidige navorsing bestaan uit twee proewe. In die eerste proef is die effek van speenouderdom en dieet-proteïen-degradeerbaarheid op die groei van Saanen-lammers ondersoek. In die tweede proef is die effek van dieet-proteïen-degradeerbaarheid op die produksie van lakterende Saanen melkbokke ondersoek.

Agt-en-vyftig Saanen-lammers is verdeel in twee speenouderdom-behandelings, nl. 'n 42 dae (42) en 'n 70 dae (70) speenouderdom. Binne hierdie speenouderdom-behandelings is die lammers verder verdeel in twee dieet-behandelings. Die een groep het 'n lae NDP kruiprantsoen (LK) en die ander 'n hoë NDP kruiprantsoen (HK) ontvang. Die twee kruiprantsoene was geformuleer om rumen degradeerbare proteïen (RDP): NDP verhoudings van 70:30 (LK) en 60:40 (HK) te bevat, maar die resultate van die degradeerbaarheidsproef het aangetoon RDP: NDP verhoudings van 77:23 (LK) en 78:22 (HK). Die lammers is vanaf die kruipdieet oorgeplaas op 'n groeidiëet by 'n gemiddelde lewende massa van 15.99 ± 3.09 kg. Tydens hierdie oorplasing is die lammers van die vier bestaande handelings verdeel in 'n verdere twee dieetbehandelings, nl. 'n hoë of 'n lae NDP groei-dieet (LG en HG onderskeidelik), met die gevolg dat 'n totaal van agt handelings in hierdie proef bestaan het. Die twee groeidiëte is geformuleer met RDP: NDP verhoudings van 70: 30 (LG) en 60: 40 (HG) onderskeidelik, maar die resultate van die degradeerbaarheidsproef het aangetoon RDP: NDP verhoudings van 78:22 (LG) en 72:28 (HG). Die groeiproef is uitgevoer oor 140 dae en voerinname, verandering in liggaamsgewig en voeromsettingsdoeltreffendheid (VOD) is vergelyk tussen die agt handelings.

Uit die lammerproef is die gevolgtrekking gemaak dat boklammers wat op 42 dae gespeen is, wanneer voerinname 240g/dag is, soortgelyke resultate i.t.v. groeitempo lewer as lammers wat op 70 dae gespeen is. Die twee kruiprantsoene het nie van mekaar in RDP: NDP verskil nie en dus kan geen gevolgtrekking gemaak word omtrent die invloed van dieet-proteïen-degradeerbaarheid op die groei van Saanen boklammers van 20 tot 80 dae ouderdom. Die twee groei diëte het van mekaar verskil in RDP: NDP maar dieet-proteïen-degradeerbaarheid het geen invloed op die groei van die Saanen boklammers van 80 tot 140 dae ouderdom gehad nie.

Een-en-twintig lakterende Saanen-ooie is ewekansig in drie groepe. Die handelings het twee RDP: NDP-verhoudings en twee ruproteïen (RP) -peile ingesluit. Behandelings was 1) RDP: NDP = 70:30,

RP = 20% 2) RDP: NDP = 62:38, RP = 20% en 3) RDP: NDP = 62:38, RP = 18.3%. Tydens hierdie produksieproef is die ooie vir 120 dae gemelk en die melkopbrengs, melksamestelling, verandering in liggaamsgewig, voerinnname en VOD bepaal en vergelyk tussen behandelings. In die verterings- en stikstofmetabolismeproef is 18 ooie gebruik om die diëte te vergelyk. Verder is die diëte ook vergelyk in 'n degraderings- en deurvloeitempoproef met gekannuleerde Dohne merino hamels.

Dieet-proteïen-degradeerbaarheid waardes verkry uit die degradeerbaarheidsproef het aangedui dat die bepaalde RDP: NDP verhoudings was 82:18, 78:22 en 79:21 vir die lae NDP, lae proteïen hoë NDP en hoë NDP diëte, en dat daar geen verskil in dieet-proteïen-degradeerbaarheid was tussen die drie rantsoene. Resultate van die produksieproef dui daarop dat daar verskille in voerinnname, droëmaterialinnname, en liggaamsgewig tussen die drie rantsoene was. Die ooie op die laer NDP rantsoen het 'n hoë voer en DM innname gehad en was swaarder na 120 dae in die proef as die ooie in die ander twee behandelings. Redes vir hierdie verskille is nie as gevolg van dieet-proteïen-degradeerbaarheid nie. Die smaaklikheid kon dalk 'n rol gespeel het omdat dat die twee hoë NDP rantsoene hoër vlakke van vismeel gehad het. Daar was geen verskil in melkproduksie, melksamestelling en melkproduksiedoeltreffendheid tussen die drie behandelings. Resultate van die verteringsproef het tussen die laer NDP-rantsoen en die ander twee rantsoene gevarieer. Die rede vir die verskil in verteerbaarheid mag wees a.g.v. verskillende deurvloeitempo's (laer NDP = 0.064/uur teenoor 0.044 – 0.045/uur vir die lae proteïen en hoë proteïenrantsoene) en die ADF waarde wat van die lae NDP rantsoen verskil het van die ander twee rantsoene. Omdat die resultate van die degradeerbaarheidsproef aangedui het dat daar geen verskil in dieet-proteïen-degradeerbaarheid was nie is dit nie moontlik om 'n gevolgtrekking te maak rondom die invloed van dieet-proteïen-degradeerbaarheid op die produksie van lakterende Saanen melkbokke nie.