

**Effects of goat phenotype score on milk
characteristics and blood parameters of
indigenous and improved dairy goats in South**

by

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DECLARATION

I declare that this thesis for the PhD (Animal Science) degree at the University of Pretoria has not been submitted by me for a degree at any other university

Signed: 01 October 2011

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Our special prayer to The Almighty God in whom we have entrusted our hope, our faith and our love in his capacity of father, of provider and of protector; He who has, today, made his glory shines upon the orphan that I am; the lonely orphan I have always been.

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ABSTRACT

The aim of this study was to develop and examine the validity of using a phenotype scoring system (PTS), a new concept, in evaluating milk yield and constituents in different goat genotypes (Indigenous, British Alpines, Saanen and Toggenburg) raised in small scale production systems. Strategic decisions of small scale African farmers are mostly based on visual appraisal or body condition scoring (BCS) of their animals. BCS has been highly recommended as a means to evaluate both the energy and the health status of animals, especially in beef farming, but this method has been criticized for being too simple and too subjective because its evaluation is often done too late after the damage has already happened. Phenotype scoring (an approach which includes breed, udder size and BCS of the animal) is presented in this study as a better tool to evaluate milk yield in different goat genotypes raised under free range conditions. This has also been a good opportunity firstly to indicate which, among the three dairy breeds of goat under discussion, can adapt best to the African small scale farming system; secondly to review the relevance of some blood metabolites in characterizing milk production in different goat breeds and thirdly to study the milking capacity of the indigenous compared to the dairy goats raised under small scale production systems in South Africa.

Thirty-two goats (8 Indigenous, 8 British Alpines, 8 Saanen and 8 Toggenburg) were raised in a free range system at the ARC-Irene experimental farm close to Pretoria. The experiment was a completely randomized experimental design with eight replicates per treatment group. Blood samples were collected by jugular venipuncture into 10 ml heparinised tubes in the morning before feeding on a weekly basis over a period of two months. Blood plasma was immediately aspirated after centrifugation (3000G), kept on ice and brought to the laboratory for the analysis of glucose, cholesterol, urea nitrogen (BUN) and free fatty acid (FFA) concentrations.

Immediately after, all does were entirely milked (followed by 1ml oxytocin IM injection and the kids taken away for a period of four hours) before a second milking session took place to measure the daily milk yield of the does. Milk samples were analyzed for lactose, milk proteins, milk fat, milk urea-nitrogen (MUN) and milk

somatic cell count (SCC). In addition body condition score (BCS), age and data related to the goat genotype (breed, udder characteristics) were recorded.

Results confirmed that milk yield from dairy goats was higher ($p < 0.001$) than the milk yield of indigenous goats during the entire period of study. Milk lactose values recorded in this study (between 3.9 and 4.9%) were the most stable constituent in goat's milk. Milk protein concentration (between 3.1 and 4.5%) was significantly higher in the indigenous than in dairy breeds, especially in week one and from week four onwards. Milk fat values (between 3.3 and 7.7%) displayed a decline in all breeds; but as from week three, the fat in milk of indigenous does increased and from week five onwards, it remained significantly higher ($p < 0.001$) compared to that of dairy breeds. In conclusion, the superiority of dairy breeds in milk yield was proven while the quality of indigenous goat milk was recognized.

Studies on the characterization of milk production in different breeds revealed that the Toggenburg was superior to the other breeds, followed by the British Alpines and the Saanen; but the British Alpines showed a better adaptability to the environment followed by the Toggenburg and the Saanen. The latter could not produce milk without feed supplementation and lost most body condition as compared to the other breeds.

Statistical analyses indicated that breed influenced milk yield, milk fat and the protein content of milk (especially in the Saanen and Toggenburg goats). BCS influenced fat content, lactose, milk proteins, MUN and SCC and also milk yield. Udder size influenced milk proteins and milk yield while udder attachment was associated with milk yield only.

These results show that PTS, because it takes into account BCS, breed and udder size, is a better tool for predicting milk yield of goats herded in small scale farming systems. Africans interested in dairy goat farming should adopt PTS as a means to evaluate milk yield especially since milk is sold per volume and not by quality in Africa.

Finally, milk from the indigenous goats is superior in terms of lactose, fat and protein content. The latter quality attributes can be used as selection criteria since the milk industry pays premiums for the fat and protein content of milk.

SUMMARY

In Africa, the Indigenous goats are the most expanded breed of goat found in rural areas. This breed is generally raised under unfavourable environmental conditions which have largely contributed to promote a poor public image associated to goats. In South Africa more especially, several milk goat breeds (Saanen, Toggenburg and British Alpines) are also raised at present. In general the African goat farmers do not know exactly what to do with their goats which are left on their own, thriving and scavenging as much as they can in the backyard.

In Chapter 1 of this study, the aim, objectives, motivation, hypotheses and research questions have been outlined.

In general, literature on goat milk constituents is scanty; just as it is on the blood metabolites involved in goat milk production; Chapter 2 is, in essence a summary of the relevant literature and a short review on the PTS.

The research methodology used in this study was a simulation of the way goats are raised in the small scale farming system of tropical Africa. Details on the materials and methods used are described in Chapter 3.

In this study, dairy breeds produced quantitatively more milk than the indigenous does, while milk from the indigenous does was of better quality. Results are presented in Chapter 4.

In Chapter 5, results on the blood metabolites involved in milk production are presented separately; but as recommended by Rowlands (1980), they are discussed in conjunction with the other blood metabolites implicated in the specific physiological process involved.

The correlations between the phenotypic characteristics and firstly, the milk constituents and secondly, the blood parameters, are explained in Chapter 6.

A general conclusion is drawn in Chapter 7 while the list of references, the bibliographic material as well as the addendum of the raw data used in this study are available at the end of the thesis.



LIST OF ACRONYMS

AA	Amino acids
AI	Artificial insemination
BA	British Alpines
BCS	Body condition scor (e) (-ing)
BUN	Blood urea nitrogen
CP	Crude protein
CHO	Cholesterol
D	Dairy
DM	Dry matter
FA	Fatty acids
FFA	Free fatty acids
GLU	Glucose
IND	Indigenous
IM	Intramuscular (injection)
IR	Infrared
LAC	Lactose
MCT	Medium-chain triacylglycerols
MFA	Milk fatty acids
MUN	Milk urea nitrogen
MY	Milk yield
EFA	Non-esterified fatty acids
NBR	Number
NPN	Non-protein nitrogen
PMO	Pasteurized milk ordinance
PROT	Protein
PUFA	Poly-unsaturated fatty acids
PTS	Phenotype scoring system
RDP	Rumen degradable Proteins
RUP	Rumen un-degradable Proteins



SCC	Somatic cell count
SC	Subcutaneous (injection)
SNN	Saanen
SUP	supplement
TOG	Toggenburg
Uat	Udder attachment
UDP-Galactose	Uridine-DiPhosphate Galactose
Usz	Udder size
USA	United States of America
VFA	Volatile fatty acids
vs	Versus

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