NOTA BREVE

# MYOFIBRILLAR PROTEINS IN BOER GOAT BUCKS: A CORRELATION STUDY UNDER TWO FEEDING LEVELS

## PROTEÍNAS MIOFIBRILLARES EN CABRITOS BOER: UN ESTUDIO DE CORRELACIONES BAJO DOS NIVELES DE ALIMENTACIÓN

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ADDITIONAL KEYWORDS

Undernutrition. Muscle structure.

PALABRAS CLAVE ADICIONALES

Subnutrición. Estructura del músculo.

## SUMMARY

A study was conducted in order to establish correlation coefficients between five myofibrillar proteins in study: Myosin Heavy Chains (MHC), Actin, Protein C, α Actinin and Tropomyosin + Troponin T. Fifteen Boer goat bucks, were divided in two experimental groups. Underfed group (RG; n= 8) was fed winter *Themeda trianda* hay and the control group (CG; n= 7) fed a diet of hay plus supplement. Semi membranous muscle was sampled and myofibrillar protein profiles were determined by SDS page electrophoresis. In both groups, strong correlation coefficients were determined between α Actinin and Actin, α Actinin and Protein C and α Actinin and Tropomyosin + Troponin T. α Actinin seems to be a very important key protein in the establishment of muscle structure in both fed and underfed situations.

## RESUMEN

Se realizó un estudio para establecer los coeficientes de correlación entre 5 proteínas miofibrilares: Miosina de cadenas largas (MHC), Actina, Proteína C, α Actinina y Tropomyosina + Troponina T. Quince cabritos Boer se dividieron en dos grupos, uno subalimentado (RG; n= 8) que consumió heno de invierno de *Themeda trianda* y grupo control (C; n= 7) que consumió una dieta del mismo heno más suplementación (71 p.100) más 22 p.100 de maíz, 5,5 p.100 de melazas y 1,5 p.100 de urea. Se muestreó el músculo semimembranoso y se determinaron los perfiles de las proteínas miofibrilares, mediante, electroforesis en lámina SDS. En ambos grupos, se encontraron altos coeficientes de correlación entre α Actinina y Actina, α Actinina and Proteína C y α Actinina y Tropomyosina + Troponina T. La α Actinina parece ser una proteína clave muy importante para el establecimiento de la estructura del músculo, tanto en situaciones de nutrición como de subnutrición.

## INTRODUCTION

Undernutrition is one of the major setbacks of animal production in the

tropics (Collins-Lusweti, 2000). Although our results in laboratory rats demonstrated that myofibrillar protein profiles were not affected by under-nutrition (Almeida *et al.*, 2002), the opposite was verified for ruminants, namely goat bucks (Almeida *et al.*, 2004). With this work we aim to establish a relation between the several myofibrillar proteins of Boer goats under the same two feeding regimens: fed and underfed, through a correlation study in order to study the physiological implications of such correlations.

## MATERIAL AND METHODS

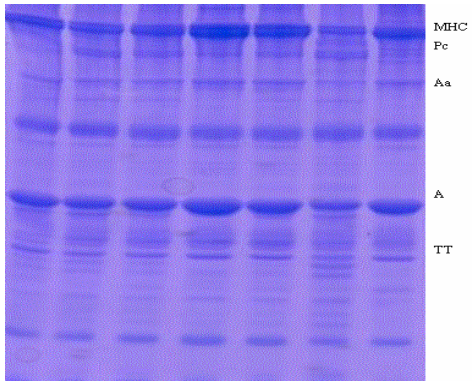
Fifteen Boer Goat intact bucks aged six months (28 +/-0.2 kg) were used. Animals were divided in two groups: CG (n= 7; Control group) and RG (n= 8; Underfed). RG animals daily received 500 g of red grass (*Themeda trianda*) hay, cut in the local dry season. CG animals received 600 g of red grass hay, plus 170 g of maize, 44 g of Molasses and 15 g of Urea per day. Feed composition is depicted on **table I**. Animals were kept in individual pens. After 28 days animals were slaughtered and semimembranous muscle sampled Muscle samples were prepared using the methods described by Parrish Jr. *et al.* (1973) for myofibrillar protein extraction. Electrophoresis of myofibrillar proteins was done on SDS-PAGE electrophoretic gels at 160 V. Gels were fixed with methanol and acetic acid for 30 min, and stained with Coomassie R350 (1.0g per litre). Gels were analysed for band areas of the following myofibrillar proteins: Myosin heavy chains, Protein C, α - Actinin, Tropomyosin + Troponin T, Actin and also the injected BSA, in a Kodak Digital Science Gel analyser, according to the methods described by Claeys *et al.* (1995). For each experimental group, correlations

***Table I.*** *Feed Composition.* (Composición de los alimentos).

| | Hay | Maize | Molasses | Urea |
|---|---|---|---|---|
| Dry Matter[1] | 91.6 | 90.0 | 74 | 99.0 |
| Crude Protein[2] | 3.8 | 9.1 | 4.9 | 285.7 |
| Crude Fiber[2] | 41.0 | 7.8 | - | - |
| Ash[2] | 10.3 | 1.6 | 8.6 | - |
| Ether Extract[2] | 1.6 | 2.5 | - | - |
| NFE[2] | 43.3 | 79.0 | 87.9 | - |
| Gross Energy[3] | 1508 | 1583 | 1309 | 897 |

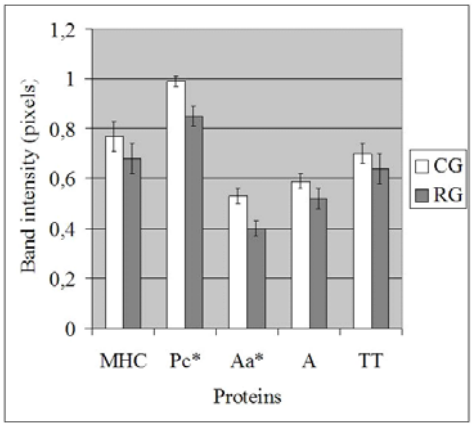
NFE–Nitrogen Free Extratives; DM – Dry Matter

[1]percent; [2]percent DM; [3]kJ/100g.




MHC – Myosin Heavy chains; A – Actin; Pc – Protein C; Aa - a Actinin; TT – Tropomyosin + Troponin T

***Figure 1.*** *Myofibrillar protein electrophoresis gel of boer goat semimembranous muscle.* (Gel de electroforesis de proteínas miofibrilares).




MHC – Myosin Heavy chains; A – Actin; Pc – Protein C; Aa - α Actinin; TT – Tropomyosin + Troponin T; *indicates statistical significance. Adapted from Almeida *et al.* (2004).

***Figure 2.*** *Myofibrillar protein profiles of boer goat semimembranous muscle.* (Perfil de proteínas miofibrilares del músculo semimembranoso de cabritos boer).

between myofibrillar proteins were established.

## RESULTS AND DISCUSSION

Electrophoretic gels such as the one depicted in **figure 1** were obtained. Our results indicate that underfed animals had less quantities of Protein C and α actinin (see **figure 2**) indicating a disruption of muscle structure at the levels of second third half of the A band - protein C and Z-line matrix - α actinin (Almeida *et al.*, 2004).

Although several studies are available regarding the degradation of myofibrillar protein profiles under weight loss (Solomon & Goldberg, 1996; Fiorotto *et al.*, 2000), as well as studies indicating changes in myofibrillar protein profiles (Almeida *et al.*, 2004), the general notion is that myofibrillar protein tend to maintain an equilibrium throughout weight loss that maintain muscle structure (Almeida *et al.*, 2002). The assessment of such equilibrium could be obtained by a correlation study.

***Table II.*** *Correlation coefficients between Myofibrillar proteins in Boer goats.* (Coeficientes de correlación entre proteínas miofibrilares de cabritos Boer).

| CG group | MHC | Actin | Protein C | α Actinin | TT |
|---|---|---|---|---|---|
| MHC | 1 | | | | |
| Actin | -0,39 | 1 | | | |
| Protein C | 0,17 | 0,67 | 1 | | |
| α Actinin | -0,17 | 0,73 | 0,70 | 1 | |
| TT | 0,60 | 0,17 | 0,28 | 0,71 | 1 |
| RG group | MHC | Actin | Protein C | α Actinin | TT |
| MHC | 1 | | | | |
| Actin | 0,11 | 1 | | | |
| Protein C | 0,16 | 0,30 | 1 | | |
| α Actinin | 0,40 | 0,72 | 0,69 | 1 | |
| TT | -0,18 | 0,21 | 0,24 | 0,74 | 1 |

MHC – Myosin Heavy Chains ; TT – Tropomyosin + Troponin T.

Correlation results obtained are depicted in **table II**. High correlations (coefficient of at least 0.7) were obtained between α Actinin and Protein C, α Actinin and Actin and α Actinin and Tropomyosin + Troponin T. All other correlations had coefficients lower than 0.5. Our results clearly demonstrate a close relation between α Actinin and the following proteins: Protein C, Actin and Tropomyosin + Troponin T. These results contrast with the lack of significant correlations observed between other proteins with a more prominent role in muscle contractibility such as Myosin and Actin. They also contrast with very low correlations between myosin and all other proteins (coefficients from –0.4 to 0.4).

These results indicate that a close link is established between α Actinin and other minor proteins such as Protein C, Troponin and Tropomyosin but also with major protein Actin. Apparently however no relation is established between Protein C and Actin or between Protein C and Tropomyosin + Troponin T or between Actin and Tropomyosin + Troponin T. Therefore α Actinin seems to be a very important key protein in the establishment of muscle structure in and hence seems to be of physiological significance in muscle function and role.

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