MUSCLE FIBRE TYPES OF CHIANINA YOUNG BULLS FED WITH TWO DIETS*

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1.Introduction

The total fibre number in mammalian skeletal muscles is fixed at born (Staun, 1963; Handel and Stickland, 1987). The proportion between fibre types, on the contrary, changes with age and can be influenced by external environmental factors as the feeding. The physiological and metabolic capacities of the muscle can change during life of animal by modifying the diet level. Recent studies carried out on Chianina young bulls (Barone *et al.*, 1994, 1995) pointed outthe importance of diet on Longissimus dorsi (LD) and Semimembranosus (Sm) muscle fibre size and the possibility to modify the percentage distribution of fibre type. Klosowski *et al.* (1992) observed a significant higher percentage of FG and FOG and lower of SO in Sm and Semitendinosus muscle in bull calves fed with a hay based diet *vs* silage based diet, and no effect on LD muscle.

This study is a part of a larger project where the meat of Chianina bulls is investigated under several aspects. In this paper we refer to the effect of diet and muscle on the size of fibre and on the distribution of fibre type in Chianina bulls calves, 18 months old.

2.Material and Methods

The trial was carried out on two groups of 11 bulls of Chianina breed who received two diets: 'diet A' and 'diet M' = 0.82 *vs* 0.76 Meat FU/kg DM, respectively. The animals were slaughtered at 18 months of age. The breeding conditions in Trimarchi *et al.* (1995) are reported. Single tissue samples were taken 1 h after slaughter from *Caput longum tricipitis brachii* (CLoTB) *Semimembranosus* (Sm) and *Longissimus dorsi* (LD) muscles. The samples were immediately frozen in liquid nitrogen and stored at -80 °C until the determination of morphometric parameters. On sections of 12 μm the ATPase activity (discriminating among slow or fast contraction) and metabolic activity (glicolitic or oxidative) of each fibre type was detected using the method of Matassino *et al.* (1992). For each fibre type, using an image analyser (MOP Videoplan), the area, perimeter, and diameter (maximum and minimum) were measured. The distribution of each fibre type was calculated as a percentage of the total number of fibres and as percentage of the area that each fibre type recovered in the muscle.

The statistical analysis was performed using the following model:

$$y_{ijkl} = \mu + a_i + b_j + g_k + (ab)_{ij} + (ag)_{ik} + (bg)_{jk} + e_{ijkl}$$

were μ = estimate of overall least square means; a_i = fixed effect of the ith muscle (M) (i= 1,2,3); b_j= fixed effect of jth diet (D) (j = 1,2); g_k= fixed effect of kth fibre type (FT) (k = 1, 2,3); $(ab)_{ij}$ =interaction between M and diet; $(ag)_{ik}$ = interaction between M and FT; $(bg)_{jk}$=interaction between D and FT; e_{ijkl} = random error.

The significance between the mean values was evaluated by using the Student *t* test.

3.Results and discussion

Among the factors enclosed in the ANOVA model, the *fibre type* takes the higher percentage of variability: 54 per cent for the proportion of fibre types, 35 for the area and perimeter and 28 for the diameters. The ANOVA shows a significant interaction 'muscle x fibre type' and 'diet x fibre type' for the area and diameters. The interaction could be attributed to the different behaviour of FG and FOG in relation to muscles and diets. In fact, the SO size statistically is not different between muscles or diets but (figure I):

(a) the FG fibre is larger in the diet A (P<0,001) and is different between three muscles (bigger in the LD and lower in the CLoTB)

(b) the FOG fibre is significatively smaller in the Sm and is not different between CLoTB and LD.

Barone *et al.* (1995) on the Sm of Chianina bulls from 6 to 24 months of age showed that a less energetic diet (0.76 *vs* 0.94 MeatFU/kg DM) induces an increase of the area of fast fibre higher than the slow one.

The $\chi 2$ test shows no significant relationship between muscle and percent distribution of fibre types: the LD muscle contain a well-balanced mixture of fibres (39 per cent of FG, 35 of FOG and 26 of SO) according to the results of Barone *et al.* (1994) and Olson *et al.* (1994), the Sm muscle has 57 per cent of FG fibre, 28 of FOG and 15 of SO, the CLoTB has 50 of FG, 26 of FOG and 24 of SO. This different distribution of fibre types among muscles enables the muscle to be versatile. The Sm, extensor of hind limb region, could have more fast fibres because more involved into movement; on the contrary, CLoTB, muscle of the proximal forelimb region is less involved in 'fast answer'.

Johnston *et al.* (1981) reported that higher the energy level higher the percentage of fibres connected with the glicolitic metabolism.This study doesn't show any effect of the diet on distribution of fibres.

4. Conclusions

The present study suggests that these different diets cannot affect the distribution of fibre types, but the animals who are fed with a more energetic diet (0.82 *vs* 0.76 MeatFU/kg DM) have a larger glicolitic fibre (both FG and FOG). Among the muscles examined, the Sm has more fast fibres according to the movement function, whereas LD, involved in respiratory movements and neck's movements, has a well-balanced mixture of fibre types.

5. References

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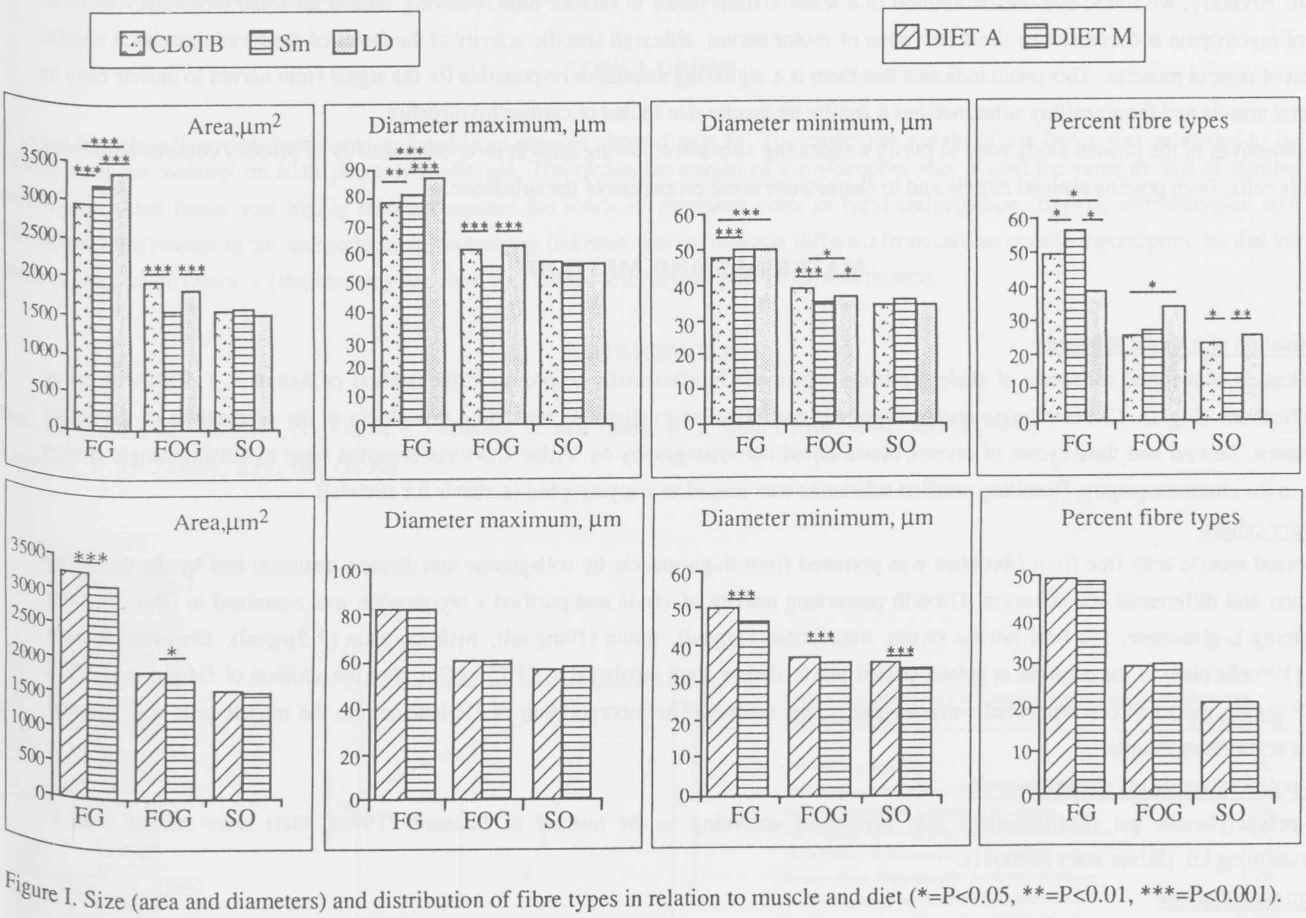

Figure I. Size (area and diameters) and distribution of fibre types in relation to muscle and diet (*=P<0.05, **=P<0.01, ***=P<0.001).