

# FEEDING AFFECTED THE NEUTRAL AND POLAR LIPID COMPOSITION OF MUSCLE IN FOALS

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**Abstract – Two groups of crossbred foals were slaughtered at 4 and 12 months, respectively. First were naturally suckled and the second were naturally suckled and then concentrate-fed from 7 to 12 months. Meat from suckling foals was leaner and provided the highest content of total and n-3 polyunsaturated fatty acid (PUFA). By contrast, meat from finished foals was fatter accumulating 16:0 and monounsaturated fatty acids in the neutral lipids. Linolenic acid was preferentially deposited in neutral lipids, but linoleic acid and all long chain PUFAs were incorporated into the polar lipid fraction.**

**Key Words – Horse, lipid fractions, long chain fatty acids, n-3 fatty acids.**

## I. INTRODUCTION

Muscle fat content and its fatty acid (FA) composition are related to the nutritional value, sensory attributes and technological quality of meat. Meat FA composition is strongly influenced by fatness level, as well as genetic and dietary factors [1]. Muscle lipids are composed of neutral (NL) and polar lipids (PL). The former consists primarily of triacylglycerols which are essential components of mammalian energy homeostasis, and their content in meat is directly related to the total fat level. By contrast, phospholipids are involved in membrane structure and cell functions, and their content is relatively constant. In the present work both lipid fractions have been characterized and the effect of age and associated feeding of horses studied. The information obtained will improve the understanding of FA deposition preferences into lipid fractions and will provide reliable compositional data to evaluate horse-meat as an alternative food source.

## II. MATERIALS AND METHODS

Two groups of crossbred horses were compared: **1)** foals managed under grazing condition and naturally suckled from birth to slaughter at 4 months of age (n=8), and **2)** foals managed under grazing conditions and naturally suckled from birth to 7 months when they were concentrate-finished and slaughtered at 12 months of age (n=7). Lipids were extracted from 1.5 g of freeze-dried *Longissimus thoracis et lumborum* muscle using chloroform-methanol (2:1, v/v) [2], and fractionated into NL and PL using solid-phase extraction (SPE) silica gel cartridges [3]. Prior to sequential base- and acid-catalyzed transesterification, the internal standard (23:0) was added. FA methyl esters (FAME) were analyzed by GC using 100 m SP2560 [4] and SLB-IL111 columns [5]. For identification, commercial standards, silver ion SPE fractions [4,6], and retention times and elution orders reported in the literature [7,8] were used. Statistical analysis was carried out using IBM SPSS Statistics 22 for Windows.

## III. RESULTS AND DISCUSSION

The total FAME content in the NL fraction was significantly higher (2449 mg/100g of meat) in fattened compared to suckling foals (588 mg/100g of meat;  $P < 0.001$ ). Conversely, the PL fraction remained fairly constant at 0.390 % of muscle weight in both groups, and it represented a higher percentage of the total lipids in suckling (39.9 %) than in fattened (13.7 %) foals. FA composition of the NL fraction was largely influenced by the diet, while the FA composition of the PL was slightly modified (Figure 1). NL fraction of suckling foals showed positive relationships with short-chain saturated FA (<15C), branched-chain FA, non-conjugated dienes, *trans*-FA, and some individual n-3 polyunsaturated FA (PUFA; 16:3 and 18:3), while the NL fraction of fattened foals was related to 16:0, the major *cis*- and *trans*-monounsaturated FA (MUFA), and ruminic acid. Meanwhile, 18:0, 11*c*-18:1, 18:2*n*-6 (linoleic acid; LA), and all long-chain PUFA were principally incorporated in PLs. Higher linolenic acid (LNA) content was found NL compared to PL fraction in agreement with the data reported by Sarriés *et al.* [9] related to the comparison of horse muscle and subcutaneous fat.

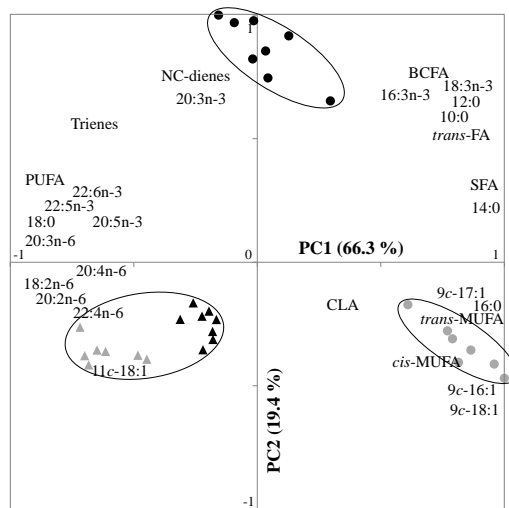


Figure 1. Loading variables and foal muscle neutral (suckling ●, fattened ●) and polar (suckling ▲, fattened ▲) lipid distribution defined by principal component (PC) 1 and 2.

FA, fatty acids; SFA, saturated fatty acids; BCFA, branched-chain fatty acids; MUFA, monounsaturated fatty acids; CLA, conjugated linoleic acids; NC, non-conjugated; PUFA, polyunsaturated fatty acids; *c*, *cis*.

#### IV. CONCLUSION

Samples from suckling foals were the leanest, and provided the highest content of PUFA and n-3 PUFA. By contrast, the meat from fattened foals had a higher muscle fat content and accumulated 16:0 and total MUFA in the NL fraction. LNA was preferentially deposited in the NLs, but LA and long-chain PUFAs were incorporated into the PLs suggesting their biological role in cell membranes. High PUFA content of foal meat, LNA in NL and long-chain n-3 PUFAs in PL fraction could make this meat a good source of n-3 FAs compared to other species.

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