

Role of muscle phospholipids in reducing carcass fatness and improved tenderness of meat in lambs

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Phospholipids in cell membranes have range of activities, and play an important role in cellular metabolism and functions of membrane proteins. We have recently shown the dietary long chain n-3 fatty acids (FA) were preferentially deposited in muscle structural phospholipids (1) and altered plasma lipoprotein metabolism and carcass fatness in lambs (2). In this study, we have examined the effects of rapidly degradable or slowly degradable dietary protein supplements with or without a rapidly fermentable dietary energy source on carcass weight (CW), fatness and meat tenderness in relation to the type of FA deposited in the skeletal muscle. Thirty-eight crossbred (Dorset Horn x Merino) cryptorchid lambs (9 months) were allocated by stratified randomization to six treatment groups. All lamb consumed a basal diet of oat chaff: lucerne chaff (80:20) ad libitum. A control group (**BAS**) received no supplement and others received barley (**BAR**), fishmeal + barley (**FMB**), lupin + barley (**LUB**), fishmeal (**FM**) or lupins (**LUP**) at the rates shown below for eight weeks and lambs were slaughtered for the determination of carcass traits, muscle FA composition and meat (longissimus muscle) tenderness.

| Diet | BAS | BAR | FMB | LUB | FM | LUP |
|----------------------------|-------------------|-------------------|-------------------|--------------------|-------------------|-------------------|
| Supp Rate (g/d) | Nil | 358 | 84 + 179 | 179 + 179 | 168 | 358 |
| Hot CW (kg) | 20.9 ^a | 21.1 ^a | 23.6 ^b | 24.9 ^{bc} | 23.5 ^b | 25.8 ^c |
| GR fat depth (mm) | 10.3 ^a | 10.4 ^a | 10.2 ^a | 13.6 ^b | 10.0 ^a | 15.7 ^b |
| LC omega-3 FA ¹ | 35 ^a | 41 ^a | 72 ^b | 33 ^a | 74 ^b | 35 ^a |
| Omega-6 FA ¹ | 165 ^{ab} | 174 ^{bc} | 162 ^{ab} | 194 ^{cd} | 141 ^a | 209 ^d |
| War-Bratz (kg) | 3.9 ^a | 4.8 ^{ab} | 4.1 ^a | 4.7 ^{ab} | 3.9 ^a | 5.7 ^b |

¹Values are expressed in mg/100 g of meat sample and are an average of six (lambs) observations.

Lambs fed FM and LUP with or without BAR had heavier ($P < 0.01$) hot CW than lambs fed BAR or BAS. With GR (total muscle + fat tissue depth at 12th rib, 110 mm from the midline; GR) as an indicator, FMB and FM produced leaner carcasses ($P < 0.01$) than LUB and LUP lambs. Long chain n-3 FA in longissimus muscle were substantially higher ($P < 0.001$) with FMB and FM compared with all others; while n-6 FA was increased ($P < 0.003$) by LUB and LUP only. Tenderness of meat measured by Warner-Bratzler shear force indicate that meat was tougher ($P < 0.05$) with LUP, although the carcasses were larger and contained more fat. From these relationships it is postulated that lipid-derived intermediate products (eg phosphoinositides, prostaglandins, diacylglycerols) generated from muscle phospholipid in n-3 FA enriched lambs, may act as mediators in protein synthesis and development of new sarcomeres in skeletal muscle, thus enhancing the rate of lean (muscle) gain without resulting in reduced tenderness.

1. Ponnampalam EN, Sinclair AJ, Egan AR, Blakeley SJ, Leury BJ. Effect of diets containing n-3 fatty acids on muscle long-chain n-3 fatty acid content in lambs fed low- and medium-quality roughage diets. *J Anim Sci* 2001; 79: 698–06.
2. Ponnampalam EN, Sinclair AJ, Egan AR, Blakeley SJ, Li D, Leury BJ. Effect of dietary modification of muscle long-chain n-3 fatty acid on plasma insulin and lipid metabolites, carcass traits, and fat deposition in lambs. *J Anim Sci* 2001; 79: 895–03.