

# Effect of long-term betaine supplementation on chemical and physical characteristics of three muscles from the Alentejano pig

José M Martins,<sup>a,b,\*†</sup> José A Neves,<sup>a†</sup> Amadeu Freitas<sup>a</sup> and José L Tirapicos<sup>c</sup>

## Abstract

**BACKGROUND:** The use of betaine as a dietary supplement to reduce fat deposition and increase lean muscle mass in pigs is increasing. However, there is no available information on its effect on the physical and chemical (i.e. fatty acid (FA) profile) characteristics of pork.

**RESULTS:** The effects of long-term betaine intake (1 g betaine kg<sup>-1</sup> diet for 20 weeks) on the chemical and physical characteristics of *Musculus longissimus dorsi*, *M. biceps femoris* and *M. semimembranosus* from the Alentejano pig were investigated. The contents of total protein, intramuscular lipids (neutral and polar), myoglobin and total collagen as well as the water-holding capacity, physical colour characteristics and FA profile of the three muscles were determined. With the exception of a significant increase in the intramuscular lipid content of *M. longissimus dorsi* and *M. biceps femoris*, betaine supplementation did not influence muscle chemical and colour characteristics or body fat deposition.

**CONCLUSION:** These data suggest that long-term betaine supplementation selectively increases intramuscular lipid deposition (a trait related to meat quality) while not affecting other chemical (including the atheroprotective FA profile) and physical characteristics of the Alentejano pig muscles studied.

© 2012 Society of Chemical Industry

**Keywords:** betaine; *M. longissimus dorsi*; *M. biceps femoris*; *M. semimembranosus*; intramuscular fatty acids; Alentejano pig

## INTRODUCTION

Betaine (*N,N,N*-trimethylglycine) is used in dietary supplements in human and animal nutrition. Mammals use betaine primarily as an osmolyte to assist cell volume regulation in most tissues<sup>1</sup> and as a methyl donor for the remethylation of homocysteine to methionine.<sup>2</sup> In pigs, this chemically stable and non-toxic product has been increasingly used as a dietary supplement to reduce fat deposition and increase lean muscle mass,<sup>3</sup> but its efficacy is inconsistent. In fact, there are studies that report a reduction in body fat,<sup>3,4</sup> while others report an increase<sup>5</sup> or no effect.<sup>6,7</sup> Some studies also suggest that betaine increases the *Musculus longissimus dorsi* area in pigs,<sup>8</sup> whereas others report a decrease.<sup>5</sup>

The Alentejano (AL) pig is an autochthonous breed reared in the southern region of Portugal and genetically similar to the Iberian pig. This obese breed,<sup>9</sup> generally slaughtered at high body weights (~150 kg), is characterised by slow growth rates and high lipogenic activity at early stages of development.<sup>10</sup> When traditionally finished under free-range conditions, the AL pig is fed with acorns and grass during winter months. Its fat and intramuscular lipids have high amounts of oleic acid (C18:1),<sup>11,12</sup> closely related to the feed fatty acid (FA) composition, and are considered less deleterious to human health than fat and pork rich in saturated FAs.<sup>13–15</sup> Considered ideal for the manufacture of high-quality dry-cured products,<sup>11</sup> this kind of carcass was for decades the main source of meat products in the diet of people living in the Alentejo region. Nowadays, a production

system based on producing fresh meat for human consumption throughout the year is being increasingly used. Iberian pig meat for fresh consumption can be established as a quality alternative to the lean pig meat commonly consumed in Europe. These pigs are reared outdoors and fed with balanced mixed diets and natural resources (pasture grazing), with no growth promoters and antibiotics, and are slaughtered at lower body weights (90–110 kg) than those normally used for dry-cured product manufacture.<sup>16</sup> Meanwhile, the precocious lipogenic activity of the AL breed results in low lean/fat carcass ratio and low commercial lean cut yield, compromising the economic viability of this alternative production system. Therefore betaine could be used to reduce overall fat deposition, with a beneficial impact on the commercial value of the AL carcass. Still, very

\* Correspondence to: José M Martins, Departamento de Zootecnia, Universidade de Évora, P-7002-554 Évora, Portugal. E-mail: jmartins@uevora.pt

† Both authors contributed equally to this work.

a Departamento de Zootecnia, Universidade de Évora, P-7002-554 Évora, Portugal

b Laboratório de Metabolismo Animal, ICAAM/Universidade de Évora, P-7002-554 Évora, Portugal

c Departamento de Medicina Veterinária, Universidade de Évora, P-7002-554 Évora, Portugal