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Evaluation of fatty acid profile in subcutaneous adipose tissue of indigenous and crossbred pigs

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Pig meat (pork) is the most consumed meat in the world with an average of 15 kg/person/year (FAO – Food Balance Sheets 2007), and has started receiving increased acceptability in India because of social mobility and economic affluence. Fatty acid composition is an important factor in determining nutritional quality of meat and deserves considerable attention due to its important role in human health (Raes *et al*. 2004). Incidentally, fatty acid composition of pig muscle and adipose tissue varies with several factors like fatness, body weight (Fischer *et al*. 2006), age, dietary energy and fatty acid content (Missortten *et al*. 2008), sex (Biedermann *et al*. 2000), *de novo* synthesis of fatty acids (Leibetseder 1996), and genetic background (Kasprzyk 2007). Although fatty acid profile of pork produced from exotic pig breeds is largely known, the same is almost absent in Indian scenario where indigenous pig makes the most of pork production followed by crossbred. Therefore, present attempt was made to evaluate the fatty acid composition of pork produced from indigenous pigs like Ghungroo and Assam local as well as crossbreds namely Hampshire × Ghungroo, Hampshire × Niang Megha and Hampshire × Assam local, to generate baseline data.

Adipose tissue samples of animals belonging to 3 genetic groups, namely Ghungroo (G), Assam Local (AL) and crossbred (CB) (6 numbers/genetic group), were collected from organized slaughter houses and local markets in and around Guwahati, Assam. Fatty acid methyl esters (FAME) were derived by direct method following O'Fallon *et al*. (2007) with modifications. The fatty acid composition of adipose tissue was determined by capillary GC on a HP-88, 100 m × 0.25 mm × 0.20 µm capillary column installed on a gas chromatograph equipped with a flame ionization detector. The initial oven temperature was kept at 140 °C and held for 5 min. Subsequently, it was increased to 240 °C @ 4 °C per min, and then held for 20 min. Helium was used as carrier gas @ of 0.5 mL per min, and the column head pressure was maintained at 280 kPa. Both the injector and detector were set at 260 °C. The split ratio was 30:1. Identification of peaks was accomplished by using purified standard (Sigma Aldrich). Fatty acids were identified by comparing their retention times with respect to the internal standard (C13:0). Duplicate GC results were averaged. Statistical analysis was done using SPSS 16.0.

The percentage of saturated and unsaturated fatty acids was 34.63 and 62.24 overall (Table 1). When compared between genetic groups, saturated fatty acids content was marginally higher in Ghungroo pigs (34.99%) than crossbred (34.73%) and Assam local (34.15%) (Table 1). With respect to unsaturated fatty acids content, it was more in Assam local pigs (63.10%), followed by crossbred (61.92%) and Ghungroo (61.72%) (Table 1). The observed percentage of saturated fatty acids content in adipose tissue of pigs across different genetic groups (34.63%) was lower than in genetic group like White Duroc × Erhualian (Yang *et al*. 2010), but higher than in Iberian pigs (Monica *et al*. 2009). Unsaturated fatty acids content (62.24%) across different genetic groups was less than that of in Slovenian pigs (Furman *et al*. 2010), but higher than White Duroc × Erhualian (Yang *et al*. 2010).

Among the unsaturated fatty acids, oleic acid was highest followed by linoleic acid in all the 3 genetic groups (Table 1). Further, oleic and linoleic acid content of all the groups were comparable to that of Large White × Meishan cross pigs (Monziols *et al*. 2007). However, linoleic acid content was higher than Large white × Landrace × Duroc cross pigs (He *et al*. 2005). Among the studied genetic groups, oleic acid content was highest in Assam local pigs (44.57%), while linoleic acid was highest in crossbred pigs (Table 1). Palmitoleic acid, a mono-unsaturated fatty acid, was in higher amount ($P<0.05$) in Ghungroo pigs (4.02%) compared to Assam local (2.86%) and crossbred (2.55%). The palmitoleic acid content of Ghungroo pigs was higher than White Duroc

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Table 1. Composition of fatty acids in subcutaneous adipose tissue of different genetic groups of pig

Genetic group	Fatty acids composition (g/100 g of fatty acid)							
	Saturated fatty acids			Unsaturated fatty acids				
	Myristic acid (C14:0)	Palmitic acid (C16:0)	Stearic acid (C18:0)	Palmitoleic acid (C16:1)	Oleic acid (C18:1 c9)	Linoleic acid (C18:2 c9, 12)	Linolenic acid (C18:3 c9, 12, 15)	Conjugated linoleic acid (CLA) (c9, t11)
G	1.22±0.20	23.70±1.11	10.07±1.57	4.02±0.83[a]	42.15±0.69	13.42±2.22	2.06±0.62	0.07±0.02
AL	1.49±0.10	23.61±1.27	9.05±1.39	2.86±0.35[b]	44.57±2.07	13.44±2.46	2.16±0.20	0.07±0.01
CB	1.53±0.16	24.13±1.19	9.07±1.09	2.55±0.31[b]	40.76±1.02	17.10±2.15	1.42±0.27	0.09±0.01
Overall	1.42±0.09	23.83±0.65	9.38±0.73	3.11±0.33	42.39±0.83	14.81±1.30	1.85±0.23	0.08±0.01

Ghungroo (G), Assam local (AL), crossbred (CB); means with different superscript within a column differ significantly (P<0.01).

× Chinese Erhualian cross (Yang *et al*. 2010), but similar to indigenous Slovenian pig breed (Furman *et al*. 2010). Conjugated linoleic acid (CLA) which has many health benefits in human (Wood *et al*. 2008), was less in all the 3 groups, e.g. as compared to 0.18% in Large white × Landrace × Duroc cross pigs (He *et al*. 2005). However, linolenic acid, the other essential fatty acid, was higher in all the genetic groups as compared to CLA. Linolenic acid content was lower than Duroc and Yorkshire cross pigs (Scott *et al*. 1981), but comparable to that of Large White × Meishan cross pigs (Monziols *et al*. 2007), and higher than Large White × Landrace × Duroc cross pigs (He *et al*. 2005) and indigenous Slovenian pig breed (Furman *et al*. 2010).

Among the saturated fatty acids, palmitic acid was found to be highest across genetic groups, followed by stearic and myristic acid (Table 1). Palmitic acid content found in Ghungroo, Assam local and crossbred pigs was comparable to that of Large White × Landrace × Duroc cross pigs (He *et al*. 2005) and White Duroc × Chinese Erhualian cross (Yang *et al*. 2010). Myristic acid content of all the 3 genetic groups were similar to that of Large White × Landrace × Duroc cross pigs (He *et al*. 2005), White Duroc × Chinese Erhualian cross (Yang *et al*. 2010) and indigenous Slovenian pig breed (Furman *et al*. 2010). The observed higher level of C16 and C18 saturated and monounsaturated fatty acids as compared to C14 and CLA might be due to the products of synthesis in the animal and inter-conversions between them (Wood *et al*. 2008).

SUMMARY

In the present study, fatty acid profile of subcutaneous adipose tissue of indigenous and crossbred pigs were evaluated. Saturated fatty acid content was substantially high across genetic groups. Among the saturated fatty acids, palmitic acid was higher followed by stearic acid. Among the unsaturated fatty acids, oleic acid was highest followed by linoleic acid, palmitoleic acid and linolenic acid. Poly-unsaturated fatty acids constituted more than quarter of the total unsaturated fatty acids. All the 3 genetic groups which are predominantly used for pork production in north east India, had a low content of essential fatty acid (CLA).

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