FATTY ACID PROFILE OF MURRAH BUFFALO MILK FAT

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ABSTRACT

Milk fatty acid composition of Murrah buffaloes was determined in present study. Samples were collected from 10 lactating buffaloes and were analysed for fatty acid profile using AOCS official method. Murrah milk fat was having 71.6% saturated fatty acids (SFA), 27.97% unsaturated fatty acids. C16:0, C18:1c, C18:0, C14:0 and C12:0 were the five most abundant fatty acid (82.5% of total fatty acids) in the Murrah milk. Palmitic acid, myristic acid (14:0) and stearic acid (18:0) together constituted approximately 85.8% of saturated fatty acids by weight. Short chain fatty acids (C4:0, C6:0), medium chain fatty acids (C8:0, C10:0, C12:0), and long chain fatty acids (C16:0, C18:0, C16:1, C18:2) were 1.82, 4.56 and 49.96 g/100 g respectively. Mono-unsaturated fatty acid were 26.79% of the fatty acids in milk, mostly oleic acid (18:1). Poly-unsaturated fatty acids constitute about 1.18% by weight of the total fatty acids. Linoleic acid (18:2) and α-linolenic acid (18:3) accounted for 0.88 and 0.30% by weight of the total fatty acids.

Keywords: *Bubalus bubalis*, buffaloes, fatty acid, Murrah buffalo, milk, PUFA, SFA

INTRODUCTION

India is a global leader in world's milk production. Out of total milk production in India *i.e.* 187.7 MT (2018-19), approximately 50% is contributed by the Buffalo. Further, India is producer of about 70% of world's buffalo milk. Hence buffaloes are the major dairy animals in India, while majority of world's milk comes from cows. Buffalo population in India is about 109.8 million (20th livestock census 2019), highest among any country in the world. Presently there are 17 recognised (under NBAGR) buffaloes breeds in the country and Murrah is considered to be the best milk producer among them. In Punjab and Haryana, Murrah is also called as "Black Gold" which indicate worth of this breed for the farmers. Jet black colour with occasional white marking on switch of tail and tightly curled short horns are typical features of the Murrah buffalo. Hisar, Rohtak, Gurgaon and Jind district of Haryana and Delhi are considered to be the main breeding tract of Murrah. Now a days this breed is also being reared in almost all parts of the country. Murrah breed does have global presence also (Brazil, Bulgaria, Malaysia, Philippines, Sri Lanka and Vietnam). The milk yield of Murrah ranges from 1,000 to

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2,000 kg (avg. 1,700 kg) per lactation with 6.9 to 8.3% (avg. 7.3%) fat. Buffalo milk is rich source of nutrient for human nutrition. It has higher content of fat and protein than that of cow milk. Hence, it is more suitable for making milk products like ghee, butter, cheese, yoghurt, ice-cream etc.

India is having a largest consumer base for the milk and its product. Due to increasing urbanisation and income level there is growing number of health conscious consumers. In particular they are concerned about fatty acid composition of the food. As fatty acid may have potential beneficial or negative effect on human health. In general milk fat contains about 65% saturated, 30% monosaturated and 5% polyunsaturated fatty acids. Fatty acids including omega -3 fatty acids, conjugated linoleic acid (CLA) and butyric acid are found good for human health (Molkentin, 2000). Although milk carry trace amount of CLA, but it effectively prevents cancer and diabetes, apart from promoting immune development, growth and overall health (Anwar and Romziah, 2008). In total CLA of milk, CLA (C18:2 9-cis, 11-trans) isomer alone account for 75 to 90% (Bauman *et al*., 2000), and has anti-carcinogenic activity (Parodi, 1999).

Contrastingly, saturated fatty acids in diet are responsible for elevated blood cholesterol and cardiac disease. Moreover, fatty acids such as lauric, myristic and palmitic acids (C12:0, C14:0 and C16:0, respectively) are known as hypercholesterolemia fatty acids (HCFA) causing cardiovascular disease. These HCFA constitute about 44% of the total milk fatty acids. Due to higher proportion of saturated fatty acids in relation to mono and poly unsaturated fatty acids, milk fat has been criticised (Kennelly, 1996). In contrast, Clandinin *et al.* (2000) reported that given availability of C18:2 n-6, palmitic acid (C16:0) may become harmless. Stearic acid (C18:0) is principally neutral, whereas oleic, linoleic and α-linolenic acids are regarded as cardio protective (Djousse *et al*., 2001; Bemelmans *et al*., 2002).

It has been known that the composition of milk fatty acids is dependent on several factors such as breed, genetic variation, stage of lactation, health and feed composition. To our knowledge few reports of milk fatty acid composition of Murrah buffaloes in India are available. Owing to the importance of Murrah buffalo in Indian milk industry the present study was conducted to evaluate the fatty acid composition of the Murrah buffaloes.

MATERIALS AND METHODS

The study was carried out at Indian Grassland and Fodder Research Institute, Jhansi (UP). This study is undertaken on lactating Murrah buffaloes (body weight 500 to 550 kg). Animals were maintained under uniform management conditions. Stall feeding was followed with *ad libitum* green fodder and concentrate mixture at the rate of 1 kg/2 kg of milk production as recommended by Ranjhan (1994) for lactating buffaloes under tropical conditions. Drinking water was provided twice daily. Buffaloes were offered with wheat straw, sorghum, and concentrate mixture during the month when milk samples were collected for fatty acid analysis. Concentrate mixture was prepared using barely, mustard cake and wheat bran in equal proportion and adding common salt and mineral mixture at the rate of 1 kg per 100 kg of concentrate.

Fresh milk samples were collected fortnightly in the evening from the lactating buffaloes (n=154) throughout their lactation and were analysed for fat, SNF, protein and lactose using automatic analyser. For fatty acid profile

estimation samples were collected from 10 multiparous lactating buffaloes during the month of January. At sampling time, average days of lactation were 131 days ranging from 82 to 182 days. Fat was separated from each of the milk samples collected. Milk fat samples were analysed for milk fatty acid profile at CSIR- Central Food Technological Research Institute, Mysore, India, using AOCS official method 1998, Ce 1-62 and Ce2-66.

RESULTS AND DISCUSSION

Standard lactation milk yield in Murrah buffalo (n=154) was recorded as 1882±18.45 kg with daily average milk yield 6.52±0.08 kg, fat % 7.2±0.11%, SNF 9.42±0.11%, protein 3.9±0.05% and lactose 5.5±0.03%.

Total 22 fatty acids of different saturation levels were identified in milk fat of Murrah, out of which 13 were saturated fatty acids (SFA) and 9 were unsaturated fatty acids (USFA) (Table 1). Quantitatively 71.6% were saturated fatty acids (SFA), 26.79% were monosaturated fatty acids (MUFA) and 1.18% were poly unsaturated fatty acids (PUFA). While 1.17% of fatty acids were un-identified (Table 2). The five most abundant fatty acids which accounted for more than 82.5% of total fatty acids in Murrah buffalo were *viz.* palmitic acid (35.3%), oleic acid (18.8%), stearic acid (13.2%), myristic acid (12.9%) and lauric acid (2.3%).

Similar results were reported in Egyptian (Soliman *et al*., 1979) and Italian buffalo (Secchiari *et al*., 2004). Egyptian buffalo milk had 71.7% SFA and 28.3% USFA. Further in concurrence with our study, Vidu *et al.* (2015) also reported that palmitic and oleic acid are most representative fatty acid in buffalo milk. Slightly lower saturated fatty acid content (70.41%) have been reported in Nili Ravi buffalo (Qureshi *et al*., 2015). While, higher SFA than Murrah have been reported in Bhadawari buffalo (Kushwaha *et al*., 2018). Variation in the fatty acid profile in buffalo milk might be due to different geographical locality, breed, stage of lactation, feed, season etc. Fatty acids in the milk also found to be affected due to variation in rumen microflora (Coroian, 2009; Mihaylova *et al*., 2007).

Majority of fatty acids in Murrah milk were saturated (71.6%) and ranged from 53.3 g/100 g to 91.7 g/100 g quantitatively. The three most representative saturated fatty acids (SFA) were palmitic acid (35.3/100 g), stearic acid (13.2/100 g) and myristic acid (12.9/100 g). Of the saturated fatty acids, 4.05% are short chain fatty acids (C4:0-C10:0). Palmitic acid (C4:0) constituted almost half (49.3%) of total saturated fatty acids. This finding is in line with the previous reports (Fernandes *et al.* 2007; Talpur 2007; Varricchio *et al*., 2007; Menard *et al*., 2010). The sum of three hypercholestrremic FAs (HCFAs- C12:0, C14:0 and C16:0) was 50.54 g/100 g. Hypercholesterolemic average values obtained in our study are higher than reported previously for Murrah in a range of 32.48 to 42.9% (Fernandes *et al*., 2007).

Proportion of unsaturated fatty acids (UFAs) in Murrah milk was 27.97%. Mono-unsaturated fatty acids in milk were predominated with oleic acid (18:1) accounting for 18.8% by weight of the total fatty acids and 70.2% of total MUFA. Similarly, in Italian buffalo proportion of MUFA was reported as 29.3% (Polidori *et al*., 1997), while it was 27.2% in Pakistan buffalo (Talpur *et al*., 2008). In general oleic acid proportion is predominant in MUFA (more than 80%), and it act as an important energy source. In Mediterranean buffaloes (Pegolo *et al*., 2017) quite similar oleic acid content has been reported, while Ren *et al.*

Table 1. Average fatty acid composition (%) of Murrah buffaloes milk fat.

Fatty acid (common name)	Isomer	Type	Min	Max	Mean (%)	SE
Butyric acid	4:0	Saturated	0.5	1.5	1.01	0.09
Caproic acid	6:0	Saturated	0.5	1.5	0.81	0.08
Caprylic acid	8:0	Saturated	0.4	1.2	0.67	0.06
Capric acid	10:0	Saturated	1.1	2.6	1.56	0.12
Lauric acid	12:0	Saturated	1.8	3.6	2.33	0.15
Myristic acid	14:0	Saturated	9.8	19.4	12.88	0.82
Myristoleic acid	14:1	Mono unsaturated	0.9	1.9	1.27	0.08
Pentadecanoic acid	15:0	Saturated	1.0	1.8	1.30	0.07
Pentadecenoic acid	15:1	Mono unsaturated	0.3	0.4	0.33	0.02
Palmictic acid	16:0	saturated	28.5	40.5	35.33	1.03
Palmitoleic acid	16:1	Mono unsaturated	0.9	1.9	1.39	0.09
Heptadecanoic acid	17:0	Saturated	0.4	0.8	0.47	0.04
Heptadecenoic acid	17:1	Mono unsaturated	0.5	0.7	0.61	0.02
Stearic acid	18:0	Saturated	8.0	17.5	13.24	0.82
Trans isomer (18:1)	18:1t	Mono unsaturated	2.7	4.3	3.57	0.16
Oleic acid	18:1	Mono unsaturated	12.4	25.0	18.81	1.10
Linoleic acid	18:2	Polyunsaturated	0.6	1.0	0.88	0.03
Linolenic acid	18:3	Polyunsaturated	0.3	0.3	0.30	0.00
Arachidic acid	20:0	Saturated	0.4	0.8	0.58	0.05
Eicosanoic acid	20:0	Saturated	0.6	1.1	0.78	0.05
Behenic acid	22:0	Saturated	0.3	0.9	0.64	0.07
Erucic acid	22:1	Monounsaturated	0.4	1.5	0.81	0.12
Unidentified	-	-	1.0	1.6	1.17	0.06

Table 2. Concentration of fatty acids group-wise (%by weight) in Murrah milk.

Fatty acid group	Average %
Saturated fatty acid (SFA)	71.60
Unsaturated fatty acids (USFA)	27.97
Mono unsaturated fatty acids (MUFA)	26.79
Poly unsaturated fatty acids (PUFA)	1.18
USFA: SFA	0.39
N-6 (Omega 6)	0.3
N-3 (Omega 3)	0.8
N-3: N-6	0.37

(2015) reported higher content of oleic acid (21.1%) in Murrah milk than in this study.

Poly-unsaturated fatty acids (Omega-6 and Omega-3) are called as essential fatty acid, as they are not synthesized in the body hence, they must come from the food we eat. In Murrah buffalo milk average concentration of omega-6 (Linoleic acid) and omega-3 (Linolenic acid) were 0.88 and 0.30%, respectively. Approximately 3.6% of the fatty acids in milk are trans fatty acids with one or more trans-double bonds.

Average concentration of short chain fatty acids (SCFAs: C4:0, C:6:0), medium chain fatty acids (MCFAs: C8:0, C10:0, C12:0), and long chain fatty acids (LCFAs: C16:0, C18:0, C16:1, C18:2) were 1.82, 4.56 and 49.96 g/100 g respectively. Proportion of short chain and medium chain fatty acid are lower while long chain fatty acids are higher than reported in Bhadawari buffalo in previous report (Kushwaha *et al*., 2018). The ratio of USFA/SFA is a good indicator of the nutritional quality of milk (Konuspayeva *et al*., 2008). In the present study, the ratio of USFA/SFA is 0.39 which is comparable with 0.30 and 0.32 value recorded for cow's and goat's milk, respectively (Cardak *et al*., 2003).

The results reveal the proportion of various saturated and unsaturated fatty acids in Murrah buffalo milk fat. Further it is also indicated that fatty acid profile of Murrah buffalo is comparable with other buffalo breeds worldwide.

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