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Original Research Article

Study of Nutritional Profile Mapping of Carcasses of Black Bengal Goats

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A B S T R A C T

A study was conducted to investigate the nutritional profile mapping of black bengal goat (bbg) in terms of fatty acid profile, conjugated linoleic acid (CLA), mineral concentration, amino acid profile and vitamin content of different cuts of bbg carcasses. The observations in terms of different fatty acid ratio including n6/n3 ratio were found optimum in different cuts of bbg. There was no significant difference between cis and trans form. In mineral concentration, the highest concentration of K would be achieved from chevon followed by P, Na, Mg, Ca and Fe. In regard to specific amino acids, glutamic acid, lysine, leucin and aspartic acid were found most abundant. In the present study, vitamin B complex mainly thiamine, riboflavin and niacin were studied and niacin seemed to be most abundant amongst the other two vitamins studied.

Introduction

Goat meat is a valuable source of high quality protein having lower level of total fat and cholesterol with respect to other red meat. The diet of an average Indian is cereal based and lacks nutrient rich foods in daily diet, which results in nutritional deficiencies.

About 30% of the Indian population suffers from malnutrition (Kumar and Joshi, 1999). Accurate nutritional composition and data in this regard are essential in communicating nutritional information to consumers in a form of total mapping of a particular carcass on the basis of wholesale cuts (Cobiac *et al.*, 2003). Non-availability of such information for the meat consumers and sellers specially in India has stimulated for nutritional mapping considering its wide acceptance, popularization and national importance.

Materials and Methods

Estimation of fatty acid by Gas Chromatography

The fatty acid composition of the FAME was determined by capillary GC on a HP-88,100mx0.25mmx0.20micrometer capillary column (Agilent Technologies).Helium was used as the carrier gas at a flow rate of 0.5ml/min. and the column head pressure was 280 K Pa. Both the injector and the detector were set at 260^{O}C. The split ratio was 30:1. Fatty acids were identified by comparing their retention times with the

fatty acid methyl standards and quantified using internal standard (C13:0).

Estimation of Cholesterol

The method of Folch *et al.,* (1957) was used to extract lipid from raw and cooked meat samples. Lipid extractions were performed using the original extraction ratio of 2 parts chloroform and one part methanol (2:1,v/v) sample.

The mixture was homogenized, centrifuged (10min, 3000rpm) and filtered using filter paper Whatman No-42 and separated by centrifugation (10min, 3000rpm). The upper aqueous phase was eliminated.

The remaining volume of the bottom layer having cholesterol was recorded. The cholesterol concentration were calculated from the constructed standard curve taking into account the dilution factor.

Estimation of Total Mineral Profile

The ash was analysed after dissolving in 50% HCl and boiled for few min. and after volume make up, different micro and macro elements were estimated using Atomic Absorption Spectrophotometer.

Estimation of Amino acid profile

The concentration of amino acid in meat protein were determined using an automatic amino acid analyzer. Sulphur containing amino acid cystein and methionine were determined as cystinic acid and methionine sulfone respectively.

Estimation of Vitamins

Thiamine, Riboflavin and Niacin content of goat meat from different carcass cuts were estimated using HPLC methods.

Results and Discussion

Fatty acid profile

The fatty acid profiles in different cuts of black bengal goat are presented in table-1. The results showed that fatty acids were quite uniformly distributed in all the wholesale cuts of black bengal goat carcass. In the present study the percentage of SFA (saturated fatty acid) ranged between 43% to 49%. The highest concentration of SFA was noted in neck and shoulder, while least in the loin area. PUFA was found highest in leg cuts and lower in loin, breast and shank portion of the carcass. Fatty acid composition plays an important role in the judgement of meat quality. It is also related to differences in sensory attributes and in the nutritional value for human consumption. The fatty acid composition of fats determines its degree of saturation and therefore significantly affects its quality (Solaiman *et al.,* 2011).

Meat flavour is also influenced by fatty acid composition (Melton, 1990). The observations in the present study was in conformity with the above findings, where Longissimus thoracis muscle was representative of loin and rack, while Biceps femoris was the muscle from leg.

However, the differences were non-significant ($p<0.01$) while comparing the ratio of SFA/MUFA, SFA/PUFA and n6/n3, irrespective of the cuts. The profile of long chain fatty acid of goat meat showed C18:0 being relatively high (Casey *et al.,* 1988).The similar observations were observed in the present study.

CLA (Conjugated linoleic acid)

It consists of a group of geometric and positional isomers of linoleic acid.

Table.1 Fatty acid profile (percentage of total fatty acids) of different cuts of Black Bengal goat

	Carcass cut up parts/components				
Traits	**Leg**	**Loin**	**Rack**	**Neck &Shoulder**	**Breast &Shank**
Saturated Fatty acids(SFA)	46.27 ±3.26	43.15± 2.98	49.43± 3.32	49.95 ±3.24	49.23 ±3.42
MUFA	32.41 ±3.07	31.89 ±3.15	30.22± 3.24	30.49 ±3.13	29.86 ±3.21
PUFA	21.24 ±2.41	20.75 ±2.61	20.86± 2.31	19.57± 3.89	19.25 ±2.87

Table.2 Conjugated linoleic acid (CLA) content (percentage of total fatty acid) and vitamin content of different cuts of Black Bengal Goats

	Carcass cut up parts/components				
Traits	**Leg**	**Loin**	**Rack**	**Neck &Shoulder**	**Breast &Shank**
Cis-9,trans-11 CLA (C18:2)	0.32±0.057	0.33±0.048	0.30± 0.019	0.31 ±0.067	0.30 ± 0.019
Trans-10, cis-12CLA (C18:2)	0.06± 0.008	0.05 ±0.005	0.5 ±0.003	0.06 ±0.006	0.05± 0.003
Cis-9,cis-11CLA (C18:2)	0.07± 0.014	0.06± 0.012	0.07± 0.013	0.06 ±0.016	0.06 ±0.014
Trans-9,trans-11CLA (C18:2)	0.14 ±0.024	0.13± 0.015	0.10± 0.012	0.15± 0.024	0.13 ±0.038
Vitamins(mg/100g)					
Thiamine	0.12 ±0.12	0.09± 0.14	0.11± 0.16	0.08± 0.13	0.07± 0.11
Riboflavin	0.52± 0.17	0.57± 0.14	0.49± 0.16	0.52± 0.12	0.48± 0.17
Niacin	3.75 ±0.23	3.62 ±0.21	3.58 ±0.19	3.54± 0.20	3.48± 0.17

The presence of CLA in different cut up parts of black bengal goat are presented in Table-2.All the four types of CLA were available in uniformity in all the cuts signifying all the cuts are equal with respect to CLA in bbg carcass, specially cis-9 and trans-11.CLA (C18:2) have highest in quantity than that of other CLAs in all the wholesale cuts of bbg.

Meat from ruminants have higher levels of CLA than meat from non-ruminants. Paengkoum *et al.,* (2013) reported that the concentration of PUFA and CLA isomers were non-significantly (P>0.05) different.

Mineral concentration of different cuts of black bengal goat (bbg)

The concentration of various minerals in different cuts of bbg carcass ranges from 0.03 to 362.14 mg /100g. The dry matter on % basis was an average of 21-22%in the cuts. Thus goat meat is very good source of K (Potassium), P (Phosphorus), Na (Sodium), Mg (Magnesium), Ca (Calcium), Fe (Iron) and Zn (Zinc) besides other certain minerals. Animal protein is an important source of micronutrients due to the fact that some of them are exclusively present in meat or their bioavailability is much higher

than from plant sources (Nohr and Biesalski, 2007). Meat and liver (100g/day) can cover up to 50% of the RDA (recommended daily allowance) for iron, Zn, Se, Vit. $B_{12,}$ B_1, B_2, B_6 and 100% of Vit A. In spite of all these, there are some variations in reports on mineral and trace elements concentration of chevon. The differences in concentration of minerals in different carcass muscles were reported by Mioc *et al.*, (2000).

Amino acid profile of different cuts of bbg

The profile of amino acid showed that all cuts of bbg carcass were equally same as a source of amino acid. The carcass can be provided with this information so that all the cuts can be equally preferred and thus it could be used for easy marketing of meat cuts with equal emphasis, where protein or amino acid need and supplementation is only a matter of consideration. The amino acid (a.a.) profile is very important in terms of meat composition, especially that of the indispensable a.a. Boer goat meat had significantly higher concentration of 11 out of 18 measured aa than mutton (Sheridan *et.al*.,2003). In the present study, out of 18 away, 8 were found to be higher concentration in bbg carcass irrespective of carcass cut up parts. When comparision was done between cuts, the leg muscle possess, the highest concentration of essential a.a., followed by other cuts like neck & shoulder, rack & loin and breast &shank. This observation could be an important clue for the consumers for selecting meat cuts as a source of protein. The loin and breast muscles were found to be best in respect of protein content (Biswas *et al.*, 2010).

Vitamin profile of different cuts of bbg

In the present study of Vit. B complex, Thaimine, Riboflavin and Niacin have been studied in all the wholesale cuts of goat carcass. Niacin was found to be in highest concentration followed by Riboflavin and Thaimine (Table-2).Casey *et al.,* (2003) also reported similar ranges of vitamin content in goat meat.

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