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Goat Meat: No Less Source of Protein in Comparison to Other Meat for Human Consumption

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Abstract

For normal body metabolism and maintenance of life, nutrients at appropriate quantities have to be ingested by animals as well as human beings. Proteins are one of the vital nutrients required by the individual body. Vegetable proteins are as good as animal proteins; however, a single plant does not serve every essential nutrient needed by the living body. Therefore, a variety of plants and vegetables has to be ingested to meet the requirements. Goat meat is a good source of animal protein, and it is widely consumed by people in developing countries ever since it has no religious taboo. However, goat meat consumption is a lot less in the western sides and most of the developed countries. The nutrients content in goat meat is undervalued, which needs to be emphasized to encourage its consumption. Spreading awareness in different parts of the world, that are less accustomed to goat meat, for health benefits along with improved trade policies for rationalized goat meat cost would substantially enhance the availability and preference of consumers for goat meat. Furthermore, goat meat has the ability to capture growing organic meat industry. In current chapter, valuable properties of goat meat along with different factors affecting the demand of goat meat have been discussed.

Keywords: animal protein, goat meat, developed countries, consumers, quality nutrition

1. Introduction

This chapter describes the desirable quality of goat meat (also known as chevon) over the other products, i.e., chicken, beef, and pork. Meat is considered as complete food having a different variety of nutrients required by the individual. Protein is one of the macronutrients necessary in a large amount that serves as a building block of the body, components of blood biochemical and enzymes taking part in the metabolic reactions. A single animal protein found in meat can be more satisfactory than a single protein present in plants; therefore, a person may require to ingest a variety of plants to meet the body requirements. Most people in the West are not exposed to the goat meat industry and are not aware of the same health benefits. Meanwhile, the reasons for less consumption of goat meat could be the availability of other meat types like poultry, fish, beef, and pork [1, 2]. A study conducted by [3] showed that the rising prices of sheep and goat meat lead to a decline in its demand. Another reason for less consumption of goat meat could be unfamiliarity and the intense flavor [4]. Despite that, people from developing countries have more likeness towards goat meat.

Investigations of [5] suggested that migrants from such developing nations towards West, prefer goat meat which may be one of the reasons of increased goat meat demand in concerned areas. It is a noticeable point that Boer, Kiko and Black Bengal goat breeds are known for their high quality meat production among other breeds [6].

Unanimously buyers have become more well-being cognizant and are currently mindful and more prepared with relevant data regarding the food's impact, including meat they burn-through. The expanded purchaser mindfulness has brought about the rise of a consumer class that requests restorative nourishments. Chevron has more or less the same concentration of protein; however, contrasted with other red meats like beef and sheep, it has lower fat (especially the saturated fat) and cholesterol content [7, 8] yet, a higher polyunsaturated unsaturated fat (PUFA) [9, 10]. The composition, regarding the fat substance and unsaturated fat profile, makes chevon more restorative meat than other red meats. Subsequently, chevon can fill in a unique market specialty. As an immediate outcome of its leanness and a desirable unsaturated fat profile, chevon's recognition of the worldwide meat market is expanding as well-being cognizant buyers favor less fatty and more interested in the lean meat product [6, 7]. Humans' global population is likely to develop to nine billion by 2050 [11, 12]. The need for expanded population necessity is a requirement for supportable and efficient meat and its related products. This prediction of populace intervened increment in animal inferred protein's interest for human utilization makes a massive opening for goat meat to enter a supply chain of meat and other protein items [13].

The producer has to look for the consumer's demand and awareness of the health risk of consuming different kinds of meat. Numerous customers need information and introduction to goat meat items and their health benefits. This unawareness of the goat meat has led to lower consumption, which is further an obstacle faced by the business [14]. Studies propose that customer interest in purchasing the products builds up when they know the product's nutritional supply and health benefits [15, 16]. Research done by [3] in the United States reported that the family spends a 1.6 CHF (Confoederatio Helvetica Franc) more on sheep and goat meat when the head of the family has a university degree, which indicated that education has a positive impact on goat meat consumptions. Educational achievement is a principle determinant in food utilization decisions and is connected emphatically with substantial nutritional intake [17].

Sheep and goat raised under general conditions on regular fields produced healthy meat over other red meat [18, 19]. Since goats are mostly reared on a natural niche, they can cope with the harsh conditions; therefore, they receive less medication and are not usually fed with feed additives and other chemicals as promoters. The meat we get could be considered organic in comparison to other meat items. Furthermore, farmers are seen to make use of mixed lots of sheep and goats for better utilization of available environmental resources [5]. Goats may well proliferate under low concentrate supply which lessens competition for food grains to other farm animals [20]. As instruction emphatically corresponds with the consciousness of these perspectives related to food utilization [21, 22], family units with a well-educated family head will, in general, have more appeal and demand for sheep and goat meat.

2. Materials and methods: research methodology

Most of the literature findings for this chapter was done by referring reputed and reliable sources. A thorough search was made to find suitable articles from various search engines. Furthermore, it is essential to know the general and a specific protocol followed by scientific work. Due to the differences in the protocol and the concentration of chemicals involved in the analysis, the reading obtained from one method could be different from the reading attained with another technique. Knowing the

procedure monitored would help the readers understand the work better and help make a scientific comparison. A protocol developed by the Association of Official Analytical Chemists [23] is generally followed to estimate the major nutrients present in the sample. However, it is vital to know the appropriate procedure depending on the nature of the sample. When meat samples are concerned, the animal body's water content may range from 50 to 95%. Therefore, it is crucial to know the moisture level in the meat sample ever since the moisture concentration is inversely proportional to the sample's dry matter concentration. The crude protein level in the sample is assessed indirectly by determining the nitrogen content, which is then multiplied by the factor 6.25, considering that protein contains about 16% nitrogen.

The fat content of the animal body is variable, and fat increases with age. The fat concentration in the sample can be estimated by solvent extraction method [24]. The extracted total fats can be further esterified and saponified following the technique of AOCS [25]. The chloroform-methanol method can also extract the total lipid concentration in the sample [26]. The meat sample's fatty acid concentrations can be measured using gas chromatography directly by synthesizing fatty acid methyl ester. Nevertheless, there are few more techniques available for the estimation of fatty acid in the sample. The total ash is estimated following the AOAC method, where a sample is ignited at 600°C in a muffle furnace for about 4 hours. Major minerals like calcium and phosphorous concentration in the sample are estimated following the titrimetric method by AOAC and Talapatra *et al.* [27]. The minor and trace minerals are analyzed using Atomic absorption spectrophotometer [23]. Proteins are made of amino acids. The individual amino acid content in the meat samples is determined using ion-exchange chromatography of the acid-hydrolyzed protein [23] and Chromatographic determination of amino acids by using automatic recording equipment [28]. When it comes to statistical analysis of the data, Analysis of Variance of compare means and General linear model is the most common practice. For data comparison, a probability of $p < 0.05$ was considered statistically significant in most of the cases, and $p < 0.01$ could be labelled as a trend.

3. Nutritional value of goat meat

The moisture content of goat meat ranges from 62.13 to 78.3%; protein, 15.31–24.83%; fat, 0.80–21.24% (**Table 1**). The protein content could vary from the portion of sampling from the carcass and the age of animals at slaughter. The ash content is in the range of 0.43 and 3.51%. Overall, the compositions of chevon (goat meat) and mutton (sheep meat) are comparable concerning moisture, protein, and ash contents [45].

Breed	Meat slice	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	References
Desert goat	<i>Semimembranosus</i> muscle	75.04	20.8	2.8	1.23	[29]
Saanen × Angora	Loin	71.43 M	20.71 M	6.79 M	0.98 M	[30]
		70.32 F	20.68F	8.0F	0.96F	
Saanen × Angora	Leg	74.24 M	20.77 M	4.02 M	1.03 M	[30]
		73.93F	20.76F	4.33F	1.02F	
Saanen × Angora	Remainder	72.67 M	20.32 M	6.07 M	0.95 M	[30]
		71.90F	20.16F	6.97F	0.95F	
Nubian × Florida native	Loin	75.4	21.5	2.1		[31]
Spanish × Florida native	Loin	75.2	21.8	2.2		[31]

Breed	Meat slice	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	References
Florida native.	Loin	74.1	21.8	3.1		[31]
Castrated Boer	<i>Semimembranosus</i> muscle	76.21	19.74	1.51	0.93	[32]
Boer bucks	<i>Semimembranosus</i> muscle	77.54	19.31	0.80	0.94	[32]
Castrated feral bucks	<i>Semimembranosus</i> muscle	74.90	20.13	1.36	0.99	[32]
Feral bucks	<i>Semimembranosus</i> muscle	75.98	19.07	1.33	1.07	[32]
Non-descriptive	neck, forequarter, hind quarter, back, and flank	74.37	21.52	3.29	1.23	[33]
White Improved breed	m. adductor	76.47	20.21	2.28	1.13	[34]
Pure Boer	<i>Longissimusdorsi</i>	72.35	24.53	3.06	0.98	[35]
$\frac{3}{4}$ Boer + $\frac{1}{4}$ SPRD	<i>Longissimusdorsi</i>	72.01	25.22	2.76	0.98	[35]
$\frac{1}{2}$ Boer + $\frac{1}{2}$ SPRD	<i>Longissimusdorsi</i>	72.48	24.40	2.73	0.97	[35]
$\frac{1}{2}$ Anglo + $\frac{1}{2}$ SPRD	<i>Longissimusdorsi</i>	72.79	24.18	2.44	0.99	[35]
Black Bengal	Mixed muscle	72.79	21.90	3.72	1.15	[36]
Crossbred	Mixed muscle	73.46	20.85	4.51	1.08	[37]
Non descriptive (<7 m, age)	Mixed muscle	78.3	15.31	1.77	1.2	[37]
Non descriptive (8–10 m, age)	Mixed muscle	75.7	18.43	2.71	1.31	[37]
Non descriptive (>11 m, age)	Mixed muscle	73.8	20.3	3.07	1.63	[37]
Egyptian Baladi goat kids.	<i>Longissimusdorsi</i>	75.32	19.97	3.28	1.13	[38]
Black Bengal	<i>Longissimusdorsi</i>	75.1	20.9	2.54	1.09	[39]
Black Bengal	<i>Longissimusdorsi</i>	74.5	21.2	2.95	1.07	[40]
Non-descriptive	Mixed muscle	75.55	20.32	1.66	0.43	[41]
Black Bengal	Meat and fat minced	76.66	24.54	4.14	0.95	[42]
Crossbred	Longissimuslum borum muscle	75.2	19.7	1.57	3.51	[43]
Black Bengal	<i>Biceps femoris</i>	73.70	19.25	2.82	1.04	[44]
Black Bengal	<i>Deltoid</i>	71.22	21.82	3.08	1.10	[44]
Black Bengal	<i>Longissimusdorsi</i>	70.76	23.20	3.54	1.08	[44]
Black Bengal	<i>Trapezius</i>	73.25	18.95	2.32	1.05	[44]

Table 1.
Proximate composition of goat meat.

Minerals	Boer goat with low energy diet (LE, 9.9 MJ/kg DM) for 56d	Boer goat with high energy diet (HE, 12.1 MJ/kg DM) for 56d	(mg/100 g) of LD muscle of Egypt Baladi goat kids	<i>Biceps femoris</i> Black Bengal goats	<i>Deltoid</i> Black Bengal goats	<i>Longissimusdorsi</i> Black Bengal goats	<i>Trapezius</i> Black Bengal goats
Ca	880.84	946.55	12.35				
I	41.68	43.38					
K	141.57	130.88	240.22				
Mg	32.51	35.36	21.41	0.51 ± .025a	0.62 ± .009	0.73 ± .010	0.42 ± .010
Na	56.73	49.83	69.17				
P	631.97	653.69					
Cu	0.20	0.14		8.37 ± .064a	7.57 ± .022	6.95 ± .017	5.15 ± .028
Fe	1.19	1.78	2.97				
Pb	0.013	0.016					
Zn				90.9 ± .881a	83.1 ± .369	80.8 ± .860	67.6 ± .294
Mn				8.6 ± .147a	7.3 ± .129	7.2 ± .108	5.5 ± .108
References	[46]	[46]	[38]	[44]	[44]	[44]	[44]

Table 2.
Minerals concentration in chevon.

Cooked meat (85 g each)	Calories	Fat (g)	Saturated fat (g)	Cholesterol (mg)	Protein (g)	Iron (mg)
Chevon	122	2.8	0.79	63.8	23	3.2
Chicken	162	6.3	1.7	76.0	25	1.5
Beef	179	7.9	3.0	73.1	25	2.9
Pork	180	8.2	2.9	73.2	25	2.7
Lamb	175	8.1	2.9	78.2	24	1.4

Table 3.
Nutritional value of meat from different species [29].

The major minerals Ca and P, and other minor minerals concentration in chevon are given in **Table 2** and are inconstant. Chevon is a good source of calcium (Ca), phosphorous (P), potassium (K) and has a fair amount of iron (Fe), iodine (I), sodium (Na), zinc (Zn), magnesium. Chevon has a low calorie, low fat and low cholesterol item than chicken, pork, beef, and mutton (**Table 3**).

The fatty acids and their fraction in meat can vary, and it can be altered by the inclusion of good quality fats as a supplement in the animal ration. High animal fat consumption, especially from red meat, could raise overall blood cholesterol, especially LDL cholesterol levels. Nutritional profession and therapists often encouraged lower consumption of red meat than lean meats to control blood cholesterol levels and, consequently, diminished the danger of illness. Considering its high dietary benefit and its more prominent unsaturated to saturated fat proportion, chevon can conceivably improve the well-being of human populaces against unhealthiness with a much-decreased danger of causing stoutness and its related metabolic illnesses, for example, insulin resistance, type II diabetes mellitus, cardiovascular diseases and metabolic disorder [46, 47]. Therefore, the chevon business can exploit the developing interest in accepted food [48]. This interest in natural nutrition is mostly roused by the purchasers' well-being concerns [49]. Natural food can be characterized as ordinary food things liberated from engineered synthetic compounds, such as anti-microbials, fertilizers, herbicides, pesticides, and genetically adjusted living organisms [50]. Moreover, goat meat and meat products can give food security to the expanding total populace while limiting adverse effects on the climate and well-being since the advancement of natural food creation is generally determined by the possibility of supportability and ecological concerns [30].

4. Goat meat: a good supplier of nutrients, especially protein

Plant-based proteins are frequently low in SFA, and therefore, they are endorsed as an option for animal-origin proteins. Be that as it may, the caloric expenditure of around one day's protein consumption from a plant-origin is multiple times higher than if derived from lean meat. Studies intended to advance and keep up weight reduction in overweight grown-ups demonstrate that proteins from lean red meat, poultry, or fish all help substantial bodyweight. Momentum research further proposes that protein-based diets are all the more satisfying contrasted with carbohydrate-based food sources. This demonstrates that taking macronutrient blend to support a higher level of calories from protein is related to higher satiation and lean mass. Higher protein intake for overweight people has likewise been appeared to support weight reduction more successfully than carbohydrate-rich eating regimens [29].

Amino acids fractions	Boer goat with high energy diet for 56d	g/100 g of M. longissimuslumborum muscle of South African indigeneous kids	g/100 g of M. longissimuslumborum muscle of South African indigeneous castrates	(g/16gN) of LD muscle of Egyptian Baladi goat kids
Aspartic acid	2.03	7.65	8.01	5.58
Threonine	0.9	4.64	4.67	4.65
Serine	0.58	3.76	3.89	4.15
Glutamic acid	3.16	13.43	13.80	16.89
Proline	0.74	3.15	3.32	4.11
Glycine	1.68	3.76	3.93	5.28
Alanine	1.28	4.83	5.03	6.53
Valine	1.19	3.97	4.06	4.58
Methionine	0.49	2.22	2.29	3.04
Isoleucine	0.49	3.93	3.86	4.36
Leucine	1.75	7.03	7.10	8.52
Tyrosine	0.63	3.07	3.24	2.42
Phenylalanine	0.91	3.63	3.43	4.29
Histidine	0.63	2.26	2.48	2.68
Lysine	1.76	8.36	7.52	8.94
Arginine	1.44	5.53	5.67	5.80
Cystine	0.30	0.92	0.92	1.07
Tryptophan	0.22	0.99	0.79	Not determined
References	[46]	[47]	[47]	[38]

Table 4.
Amino acids composition of chevon.

The protein composition, i.e., amino acids make up of chevon, is given in **Table 4**. Goat meat is a good source of arginine, leucine, isoleucine, methionine, lysine, and threonine. It also has a fair amount of aspartic acids and glutamic acids among others amino acids.

5. Way forward for boosting Goat meat

Despite of remarkable role of goats in livelihood of developing country’s households, channels of marketing for goat are mostly informal unlike in other livestock species [51]. Other meat animals production and marketing channels have been improved with progress of time much more than goat production and marketing [52]. Most of the goat meat produced and consumed locally in developing nations and major production never meets global trade [6]. Thus, lack of organized production, marketing and consumption pattern may be considered as the major reasons for poor goat meat familiarity in Western world. Nevertheless, high nutritional value of chevon makes it stand out from the list of other red meats. Goat meat has the value to capture the increasing organic food market [48]. An improved marketing strategy of highlighting the value of goat meat, its role to build the households

Figure 1.
Goat meat promotion factors. Source: Photo by authors.

of developing nations along with better utilization of “green resources” might help in upgrading trade of goat meat in Western world. In addition to that, standardizing the farming procedures, quality assurance, and quality products supply in channelized markets are expected to boost goat meat industry (**Figure 1**) in folds in upcoming era of more health concerned consumers.

6. Conclusions

Animal protein demand has risen due to the increased human population. Adequate protein is useful in developing a lean body as it is more satisfying than carbohydrate origin food. Animal protein also controls food craving as it is bulky and satiating for the body. Goat meat can be one of the critical sources of animal protein. It has protein as good as other animal meat and meat products. Additionally, it has good amount of health promoting PUFA and other vital nutrients for humans.

Spreading awareness about constructive and beneficial effects of goat meat in direct or indirect ways may be considered as the first stepping stone towards enhancing quality meat supply to the Western world. Nevertheless, consumer preference has gradually shifted towards quality products than merely opting quantity as they became aware of ill effects of consuming more calories per gram of protein as in the case of vegetable origin proteins.

Better husbandry practices, trade policies, rationalized cost of chevon through enhanced distribution channels, graded goat meats, and friendly marketing policies will bring substantial changes in goat meat availability and preference in different parts of the world, especially in Western world.

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