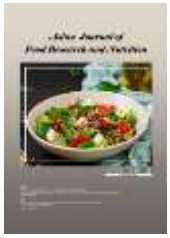

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Effect of Rearing Techniques and Gender on the Consumer Preferences and Amino Acid Profiles of Beef from Different Parts of Cattle

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

This study provides comparative information to the consumer preferences and processing sectors about amino acid and consumer preferences of free range grown and Truka cattle. The aim was to compare nutritional quality of male and female Truka and free range grown cattle. Biochemical qualitative and quantitative spectrophotometric methods of analysis were employed to ensure total accuracy of the results. The percentage level of amino acid that were mostly found in the skin of dorsal (back) parts of Male Truka cattle such as glycine, alanine, serine, leucine, lysine and arginine were as follows: (4210mg%), (6290mg%), (4190mg%), (8190mg%), (9390mg%) and (6550mg%), respectively. However, Most of the essential amino acid, saturated mono fatty acid and high protein content were found at various parts of female Truka cattle. From a nutritional point of view, the studied beef (cattle) had a good protein, due to their richness in essential amino acids. The present study provided new insights on the organoleptic quality and the nutritional value of Truka cattle. Therefore, both male and female Truka contain the high level of protein and essential amino acid.

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Keywords: Rearing technique and gender of Free range grown and Truka cattle; amino acid and consumer preferences.

1. INTRODUCTION

1.1 Background of the Study

"The value of meat is measured in terms of the major chemical component amino acid. It has been shown, for example, that an estimated 7 million people currently either avoid red meat or are vegetarians" [1]. "The concerns about public health in industrialized countries, where coronary heart disease and other "diseases of affluence are common," have led to recommendations to the public to modify their diet popularized as Dietary Guidelines" [2]. "Meat, particularly beef, has sometimes been mentioned in this regard. These guidelines particularly recommend a reduction in fat consumption, especially saturated fatty acids (SFA) and consequently, even if incorrectly, in red meat. This has led – in some sections of their populations – to a relative increase in the consumption of poultry and fish at the expense of red meat" [3].

Meat is very nutritious and animal protein is regarded as complete protein since it contains all the essential amino acids.

There are many suggestions in the literature [4] for healthy daily diet with different species of meat usage. The inelastic nature of the demand for food (meat and meat products) is reflected in the main determinants of meat consumption: Gross domestic product (GDP) and its distribution among the population; standard of living; market structure; international trade intensity; individual consumer behaviour [5] and socio-economic factors. There are three main categories of factors that influence meat consumption:

1. "Commercial and political factors, Trade liberalization, and Globalization Political issues related to the Common Agricultural Policy" [6]
2. Production, industrialization of production, Livestock farming, Production problems, Falsification of Meat and meat products [7], and
3. Consumer behaviour.

"The last category of determinants that influence meat consumption includes socio-economic factors, such as: standard of living, Urbanization, changes in eating habits and Individual consumer behavior" [8]. "Individual consumer behaviour plays the most important role in the buying and eating of meat products. Several factors influence consumer behaviour, such as personal characteristics, cultural factors, social factors, psychological factors, etc. Personal characteristics" are defined by [9]. "The main personal factors influencing individual consumer behaviour are gender, age and level of education. Employment, income and lifestyle also play a role in consumer behaviour. Consumer behaviour is determined by population incomes. When people have higher incomes, or lower prices, they tend to consume more food, especially meat" [10]. "People with higher incomes tend to maintain a healthier lifestyle and prefer to consume beef, as it is nutritionally superior" [11]. "Higher consumer income can have a positive impact on quality of life, quality of health care, and a reduced risk of obesity, as well as other health diseases" [9]. "According to Gender also plays a role in meat consumption. Women are more likely to avoid red meat than men, and prefer white meat, particularly chicken [12]. Age is another demographic factor that influences meat consumption. In the European Union, it is estimated that 21% of the population will be over 65 years of age" [13]. "This segment perceives meat consumption differently than other age groups" [14]. "The size of households is also a demographic factor that affects meat consumption" [15]. "The level of education is another demographic factor in meat consumption. Today, consumers are more educated, which allows them to quickly and accurately interpret information in advertisements or information in product labeling" [14]. "Lifestyle plays a role in personal influences and is affected by general factors affecting meat and meat products consumption. divided consumers into four groups based on their consumers' lifestyles. Culture plays an important role in shaping consumer behaviour and setting standards and rules for the facts that influence the choice of the food type" [16]. Meat and meat products need to be emphasised in terms of their symbolic importance [17] or their tradition based on cultural and religious elements (Rituals, Myth, Taboos, etc.) In certain cultures, there has been a shift in the way animals are killed; meat is presented on the table and what is considered to be edible and non-edible in recent years. According to [18], "there are also cultures in which meat is seen as an instrument of

hierarchical consolidation or social integration of the population". "Subcultures within the culture are also formed and divided into 4 groups: ethnic group, religious group, racial group, geographical area" [19].

Consumer behaviour on the meat and meat products market can be also influenced by social factors. Social factors – consumer groups, family, the role of the individual in society, etc., have a significant impact on the resulting consumer behaviour [20]. In the context of consumer behaviour on the meat market, opinion leaders have an important role in terms of marketing. The family also plays an important role in the consumer's behaviour in the process of purchase and consumption of meat. With regard to social factors, it is also important to point out that consumers also demonstrate their position in society by the consumption of individual types of meat and meat products [21]. The percentage of meat protein component varies extensively in different types of meats [22]. The protein digestibility-corrected amino acid scores (PDCAAS) which depict the protein digestibility reveals that meat has high score of 0.92 as compared to other protein sources including lentils, pinto beans, peas, and chickpeas scoring 0.57–0.71 [23].

Amino acids serve as the building blocks of the proteins. Studies revealed that the main reason for the differences in essential amino acid proportion lies with the breed; animal age and muscle location. Previous research studies reported that contents of valine, isoleucine, phenylalanine, arginine, and methionine in the animal meat increased with its age [24].

Their composition could also be affected by the application of processing techniques including heat and ionization radiations, but only when the severe prolonged mode of these conditions is being applied [25]. Smoking and salting of the meat have also played its role in this regard. Apart from the effect of the processing conditions, the storage has also imparted its effect on amino acids, in case of canned meat [26].

Therefore, knowledge concerning the exact amino acid of the meat is extremely important. However, little information exists about the composition of farm animal species meats. A lot of unsubstantiated claims about which part of cattle meat should be consumed due to perceived health concerns now pervade the Nigerian society. Hence, amino acid of meats from different parts of cattle play a role in the acceptance of the product and health of the consumers. This is due to their influence on sensory properties like textures, colour, and flavour. Therefore, investigating amino acid of different parts of cattle meat will help increase the awareness of the nutritional capabilities.

This results from this study gave a valuable insight on the clarification on the essentials of effect of rearing techniques and gender on the amino acid type for normal cattle meat growth and development. The function of these range from the source of energy, transport and absorption of vitamins, protection of organs, physical and thermal insulation, hormone precursors in the cattle, and they are extremely important in texture, flavour, palatability, colour and preservation of cattle meat.

The scope of the work involved the effect of rearing techniques and gender of the consumer preferences and amino acid profiles of different parts of cattle as it relates to human diet; as consumers are increasingly interested in meat consumption [27].

2. MATERIALS AND METHODS

2.1 Materials

The equipment and chemical used for this work were gotten from Department of Food Science and Technology Laboratory, University of Nnamdi Azikiwe Nigeria.

2.2 Collection of Sample and Preparation of Sample

Cattle meat was purchased from Amansea Awka Market in Anambra State Nigeria. They were transported within an hour in a cooler made from Polyethylene terephthalate (plastic) and packed with iced block. The cattle meat samples were separated into the lean and skin of different part of cattle. Transported to Enugu laboratory for analysis.

2.3 Research Design

Field study and laboratory experiments were conducted

2.3.1 Field study

Questionnaire and oral interview were used here to evaluate consumer's preference for meat from different parts of cattle.

2.3.2 Laboratory experimental design

The research design used in this study is a factorial experiment of 2X2X12 giving a total of 48 samples. The main factor, sub-factor and sub-sub-factor are as follows:

Main factor: Type of rearing and feeding:

i. Home-grown in a confined enclave and is known in *Fufulde* language as *Truka*;
ii. Free-ranged open grazing type.

Sub-factor: Sex

i. Male;
ii. Female.

Sub-sub-factor: Cattle parts (Table 1)

The resulting 48 samples from the 2 X 2 X 12 are shown in Table 2.

Table 1. Parts of cattle from which meat sourced

No	Parts of cattle
1	Skin-cut from dorsal (back) parts of cattle
2	Skin-cut from ventral (stomach) parts of cattle
3	Red-meat cut from the thigh of fore-limb
4	Red-meat cut from the thigh of hind-limb
5	Marbled Red-meat cuts from cattle
6	Cuts from cattle stomach
7	Cuts from cattle small intestine
8	Cuts from cattle large intestine
9	Cuts from cattle liver
10	Cuts from cattle kidney
11	Cuts from cattle lungs
12	Cuts from reproductive organs

Table 2. Meat samples from 2 X 2 X 12 factorial experiments

No	Sample description
1	Skin-cut from dorsal (back) parts of Male Truka cattle
2	Skin-cut from dorsal (back) parts of Female Truka cattle
3	Skin-cut from dorsal (back) parts of Male Free-range grown cattle
4	Skin-cut from dorsal (back) parts of Female Free-range grown cattle
5	Skin-cut from ventral (front) parts of Male Truka cattle
6	Skin-cut from ventral (front) parts of Female Truka cattle
7	Skin-cut from ventral (front) parts of Male Free-range grown cattle
8	Skin-cut from ventral (front) parts of Female Free-range grown cattle
9	Red-meat cut from the thigh of fore-limb (hand) of Male Truka cattle
10	Red-meat cut from the thigh of fore-limb (hand) of Female Truka cattle
11	Red-meat cut from the thigh of fore-limb (hand) of Male Free-range grown cattle
12	Red-meat cut from the thigh of fore-limb (hand) of Female Free-range grown cattle
13	Red-meat cut from the thigh of hind-limb (leg) of Male Truka cattle
14	Red-meat cut from the thigh of hind-limb (leg) of Female Truka cattle
15	Red-meat cut from the thigh of hind-limb (leg) of Male Free-range grown cattle
16	Red-meat cut from the thigh of hind-limb (leg) of Female Free-range grown cattle
17	Marbled Red-meat cuts from Male Truka cattle
18	Marbled Red-meat cuts from Female Truka cattle
19	Marbled Red-meat cuts from Male Free-range grown cattle
20	Marbled Red-meat cuts from Female Free-range grown cattle
21	Cuts from stomach of Male Truka cattle
22	Cuts from stomach of Female Truka cattle
23	Cuts from stomach of Male Free-range grown cattle
24	Cuts from stomach of Female Free-range grown cattle
25	Cuts from small intestine of Male Truka cattle
26	Cuts from small intestine of Female Truka cattle
27	Cuts from small intestine of Male Free-range grown cattle
28	Cuts from small intestine of Female Free-range grown cattle

No	Sample description
29	Cuts from large intestine of Male Truka cattle
30	Cuts from large intestine of Female Truka cattle
31	Cuts from large intestine of Male Free-range grown cattle
32	Cuts from large intestine of Female Free-range grown cattle
33	Cuts from liver of Male Truka cattle
34	Cuts from liver of Female Truka cattle
35	Cuts from liver of Male Free-range grown cattle
36	Cuts from liver of Female Free-range grown cattle
37	Cuts from kidney of Male Truka cattle
38	Cuts from kidney of Female Truka cattle
39	Cuts from kidney of Male Free-range grown cattle
40	Cuts from kidney of Female Free-range grown cattle
41	Cuts from lungs of Male Truka cattle
42	Cuts from lungs of Female Truka cattle
43	Cuts from lungs of Male Free-range grown cattle
44	Cuts from lungs of Female Free-range grown cattle
45	Cuts from testis (Male) Truka cattle
46	Cuts from vagina (Female) Truka cattle
47	Cuts from testis (Male) Free-range grown cattle
48	Cuts from vagina (Female) Free-range grown cattle

Table 3. Parts of cattle for lipid and amino acid profile analyses

No	Sample description
1	Skin-cut from dorsal (back) parts of Male Truka cattle
2	Skin-cut from dorsal (back) parts of Female Truka cattle
3	Skin-cut from dorsal (back) parts of Male Free-range grown cattle
4	Skin-cut from dorsal (back) parts of Female Free-range grown cattle
5	Red-meat cut from the thigh of hind-limb (leg) of Male Truka cattle
6	Red-meat cut from the thigh of hind-limb (leg) of Female Truka cattle
7	Red-meat cut from the thigh of hind-limb (leg) of Male Free-range grown cattle
8	Red-meat cut from the thigh of hind-limb (leg) of Female Free-range grown cattle
9	Cuts from liver of Male Truka cattle
10	Cuts from liver of Female Truka cattle
11	Cuts from liver of Male Free-range grown cattle
12	Cuts from liver of Female Free-range grown cattle
13	Cuts from kidney of Male Truka cattle
14	Cuts from kidney of Female Truka cattle
15	Cuts from kidney of Male Free-range grown cattle
16	Cuts from kidney of Female Free-range grown cattle

Table 4. Gradient Program Employed for the Separation of PTC-Amino Acids

	Time Flow rate		
(min)	(mL/min)	% Eluent A	% Eluent B
0	1.0	90	10
12.0	1.0	70	30
20.0	1.0	52	48
22.0	1.0	0	100
24.0	1.0	0	100
30.0	1.5	0	100
37.0	1.0	90	10

2.4 Methods of Experimental Analyses

The procedure used for amino acid was HPLC apparatus

The HPLC equipment consisted of a Spectra Physics (San Jose, CA) HPLC apparatus comprising an 8700 XR ternary pump, a 20-µL Rheodyne (Cotati, CA) injection loop, an SP8792 column heater, a 8440 XR UV-vis detector, and a 4290 integrator linked via Labnet to a computer running WINner 8086 software (operating system, MS.DOS version 3.2). For separation, a 250- × 4.6-mm column packed with 5-µm Spherisorb $C_{1\ 8}$ (Sugelabor, Madrid, Spain) was used. while modification of the method [28].

2.4.1 Preparation of samples and standards

Prior to derivatization, sample proteins were hydrolyzed as follows. A 0.1-g lyophilized sample was weighed into a 16- × 125-mm screw-cap Pyrex (Barcelona, Spain) tube, 15 mL of 6N hydrochloric acid was added, and the tube was throughly flushed with N_2, quickly capped, and placed in an oven at 110°C for 24 h [17]. After hydrolysis, the tube contents were vacuum filtered (Whatman #541, Maidstone, England) to remove solids, the filtrate was made up to 25 mL with water, and an aliquot of this solution was further filtered through a 0.50-µm pore-size membrane (Millipore, Madrid, Spain). A standard solution containing 1.25 µmol/mL of each amino acid in 0.1N hydrochloric acid was created.

2.4.2 Derivatization procedure

The procedure used was a modification of the method of [28]. A standard solution (5, 10, 15, or 20 µL) or 50 µL of sample solution was pipetted into a 10- × 5-mm tube and dried in vacuo at 65°C. To the residue, 30 µL of methanol-water-Phenylisothiocianate (2:2:1 [v/v]) was added and then removed in vacuo at 65°C. Next, 30 µL of the derivatizing reagent methanol-water-Phenylisothiocianate (7:1:1:1 [v/v]) was added, and the tube was agitated and left to stand at room temperature for 20 min. Finally, the solvents were removed under a nitrogen stream, and the tube was sealed and stored at 4°C, pending analysis. Prior to injection, 150 µL of diluent consisting of 5mm sodium phosphate with 5% acetonitrile was added to each tube.

2.4.3 Chromatographic procedure

Chromatography was carried out at a constant temperature of 30°C using a gradient elut ion as follows. Eluant A was an aqueous buffer prepared by adding 0.5 mL/L Triethylamine to 0.14M sodium acetate and titrating it to pH 6.20 with glacial acetic acid; eluant B was acetonitrile-water (60:40 [v/v]). The gradient program is shown in Table 4.

3. RESULTS AND DISCUSSION

3.1 Results of Field Survey on Consumers of Beef

Table 5 gives the sociocultural status as well as perceptions, likes and dislikes of consumers about beef. From the 50 (fifty) respondents at Ogbete main market, Enugu the findings included: Majority of beef consumers preferred meat from cattle reared at home known as *Truka*, Majority of beef consumers preferred bull meat (Male cattle) irrespective of its parts, Beef from male *Truka* (Bull) is the choice of majority. Majority preferred male testis parts of *Truka* due to its perceived nutritional value. The taste content of female vagina of free range and *Truka* grown cattle is lesser than male testis of *Truka* and free range grown cattle.

3.2 Amino acid Contents of Meat-cuts from Different Parts of *Truka and* Home-grown Cattle

3.2.1 Essential amino acid contents (mg/100g) of meat-cuts from different parts of *Truka and* home-grown cattle

Table 6 gives the essential amino acid contents of meat-cuts from different parts of *Truka* and Free range grown cattle.

The high percentage level of phenylalanine (5240),(5240),(5730) and(4930) were mostly found in the male, female (dorsal skin and hind limb) part of free range grown cattle, female (liver and kidney) part of *Truka* grown cattle respectively. Therefore, female and male dorsal skin, fore hind limbs parts of *Truka* grown cattle has less phenylalanine as well as male and female kidney parts of free range grown cattle. The phenylalanine amino acid is an essential amino acid that is important for growth and development as well as the production of several neurotransmitters and hormones. Some studies suggest this amino acid could promote weight loss, reduce chronic pain and protect against depression [29].

Table 5. Percentage frequency distribution of respondents' status and meat preference

No	Factors	Sub-factors	Frequency	% Frequency
I.	Age group	21-25	1	2.22
		26 – 30	15	33.33
		31 – 40	4	8.89
		41-50	15	33.33
		51-60yrs	10	22.22
		Total	45	100
II	Marital status	Married	50	100
		Separated	None	
		Divorced	None	
		Total	50	100
III.	Academic qualification	FSLC $ WAEC	49	98
		Others	1	2
		Total	50	100
IV.	Occupation	Trader	48	96
		Others	2	4
		Total	50	100
V.	Reason for preference of cow meat	nutritional value	47	94
		Others	3	6
		Total	50	100
VI.	Preference for female cow meat than male cow meat	Number of people that preferred male cow meat	50	100
		Others	0	
		Total	50	100
VII.	Cow meat of preference	Truka	50	100
		Free ranging ones	none	
		Total	50	100
VIII.	Cow meat part of preference	Lean meat	10	20
		Liver	15	30
		Leg	15	30
		Head	10	20
		Total	50	100
IX.	Preferred processing/preservation method	Freezing & Drying	45	90
		Others	5	10
		Total	50	100

The highest percentage level of valine(4900),(1900),(4490) and(2780) were mostly found in the female: dorsal skin, hind limb, parts of free range grown cattle and female liver, kidney part of Truka grown cattle respectively. Therefore male kidney part of *Truka* grown cattle has less valine content as well as dorsal male part of free range grown cattle.Valine is essential for mental focus, muscle coordination, and emotional calm(33). People may use valine supplements for muscle growth, tissue repair, and energy. Deficiency may cause insomnia and reduced mental function [30].

The highest percentage level of tryptophan (8560), (8550), (1660) and (8550) were mostly found in the female dorsal skin, hind limbs, liver parts of free range grown cattle and female kidney part of *Truka* grown cattle respectively. Therefore male free range and Truka grown cattle has low tryptophan amino acid content. Female Truka and free range should be eating periodically to avoid heart disease. The body uses tryptophan to help make melatonin and serotonin. Melatonin helps regulate the sleep-wake cycle, and serotonin is thought to help regulate appetite, sleep, mood, and pain. The liver can also use tryptophan to produce niacin (vitamin B3), which is needed for energy metabolism and DNA production [31].

The highest percentage level of threonine (4390), (4580), (4680) and (4380) were mostly found in the male dorsal skin part of *Truka,* female hind

limb part of Truka, female liver part of free range grown cattle, female kidney part of *Truka* respectively. Therefore, male dorsal skin, hind limb, liver as well as kidney part of *Truka* grown cattle has low threonine amino acid content and should not be consumed periodically. Threonine, pronounced three-uh-neen is one of nine essential amino acids your body needs to function properly. Aiding in maintaining healthy skin, teeth, collagen, elastin, and muscle tissue, it also helps with digestion, metabolism and preventing fat buildup in the liver [32].

The methionine level (5650), (5080), (8480) and (4500) were mostly found in the female dorsal skin, hind limb, liver and part of free range grown cattle respectively. Therefore male and female dorsal skin, liver, kidney and hind limb part of *Truka* grown cattle has low content of methionine and should be consumed periodically. Methionine is an antioxidant. It may help protect the body from damage caused by ionizing radiation.

The leucine level (8190), (7840), (7070) and (6650) were mostly found in the male dorsal skin cut part of *Truka*, female hind limb and liver part of Truka, male kidney part of free range grown cattle respectively. Therefore female dorsal skin, liver, kidney part of free range grown cattle as well as hind limb has low content of leucine and should be avoided. Leucine may help in healing skin and bones. It may increase muscle growth and lean body mass. It may increase production of human growth hormone (HGH). It may help control blood sugar [33].

The percentage level of lysine(9390),(6850), (9720) and (4390) were mostly found in the male (dorsal skin and hind limb) Part of Truka grown cattle, female liver part of free range, female kidney part of Truka respectively. Therefore female and male dorsal skin, liver as well as hind limb of free range and Truka grown cattle has low content of lysine. Lysine appears to help the body absorb calcium, and it plays an important role in the formation of collagen, a substance important for bones and connective tissues including skin, tendons, and cartilage. Most people get enough lysine in their diet [34].

The percentage level of isoleucine (4290), (4980), (4450) and (2850) were mostly found in the male (dorsal skin) part of Truka, female (hind limb and liver) part of free range grown cattle and male kidney part of free range grown cattle respectively. Therefore, female dorsal skin, hind limb, liver as well as kidney part of *Truka* grown cattle has low isoleucine content. It may help control blood sugar. It may also boost energy and endurance. It's also said to help speed healing of injured muscles. Isoleucine may also help muscle development and lean body mass [35]. However, essential amino acid whose value was very low were mostly found in the free ranging grown cattle. Meat is a necessary source of essential amino acid for a healthy and balanced diet [36]. Amino acids (AAs) play an essential role in the assessment of meat nutritional value [37]. Thus, they are extremely involved in sensory qualitative determination, by the formation of precursors responsible for taste and flavour during cooking [38] however, samples obtained from free ranging grown cattle from a quantitative point of view, they were higher than those reported by [39]. This difference was probably due to the grazing abundance. Moreover, the results showed that genotype has strongly influenced the meat protein value. This may be due to the forest-based pasture system, which was characterized by a diet that mainly includes the oak corns rich in the nitrogenous matter. Several studies have already shown the beneficial effect of oak corns on the nutritional value of meat [40].

3.2.2 Non-essential amino acid (mg/100g)contents of meat-cuts from different parts of *Truka and* home-grown cattle

Table 7 gives the non-essential amino acid contents of meat-cuts from different parts of *Truka* and Free range grown cattle.

The percentage level of glycine (4120), (3770),(3750) and (3640)were mostly found in the male skin part of *Truka,* female hind limb part of free rang grown cattle, male liver part of *Truka* and male kidney part of free range respectively. Therefore male kidney, liver, hind limb and dorsal skin part of free range has low content of glycine and should be eaten with great care.). More glycine may help support heart and liver health, improve sleep, reduce diabetes risk, and reduce muscle loss. Glycine acts as neurotransmitter in central nervous system and it has many roles such as antioxidant, anti-inflammatory, cryoprotective, and immunomodulatory in peripheral and nervous tissues [41].

Table 6. Essential amino acid contents (mg/100g) of meat-cuts from different parts of home-grown and free range-grown cattle

No	Different meat-cuts parts of cattle	Methionine	Leucine	Lysine	Isoleucine	Phenylalanine	Valine	Tryptophan	Threonine
1	Male Truka Dorsal skin cut	1090	8190	9390	4290	3090	4190	1090	4390
2	Female Truka Dorsal skin cut	1100	7.01	6320	4100	5160	4090	1040	4190
3	Male Free range (FR) Dorsal skin	1080	5050	3460	2980	5240	4900	8560	3790
4	Female FR Dorsal skin cut	5650	7690	6320	1840	5160	1290	750	4250
5	Male Truka Hind-limb Red meat	1500	7650	6850	1850	3740	1750	1790	3570
6	Female Truka Hind-limb Red meat	1560	7840	4850	1490	3600	1180	0460	4580
7	Male FR Hind-limb Red meat	1110	7720	5080	4100	5190	1560	280	4500
8	Female FR Hind-limb Red meat	5080	7050	3460	4980	5240	1900	8550	3790
9	Male Truka Liver meat cut	1300	6740	1350	2740	2740	1640	1800	1690
10	Female Truka Liver meat cut	1290	7070	6320	4190	5730	4490	1040	4380
11	Male FR Liver meat cut	1500	2470	9720	1560	1490	1480	1120	4680
12	Female FR Liver meat cut	8480	5330	6470	4450	4000	1330	1660	3890
13	Male Truka Kidney meat cut	1490	6640	3830	2370	1470	1650	120	1680
14	Female Truka Kidney meat cut	1080	1790	4390	2390	4980	2780	8550	4380
15	Male Free range Kidney meat cut	1500	6650	3850	2850	1750	2750	1790	1580
16	Female Free range Kidney meat cut	4500	1980	4680	4470	460	0650	1050	3570

Table 7. Non-essential amino acid contents (mg/100g) of meat-cuts from different parts of home-grown and free range-grown cattle

No	Different meatn-cuts parts of cattle	Glycine	Alanine	Proline	Serine	Aspartic acid	Glutamic acid	Histidine	Arginine	Tyrosine	Cystine
1	Male Truka Dorsal skin cut	4210	6290	3080	4190	650	14470	3100	6550	2920	1420
2	Female Truka Dorsal skin cut	3890	3490	4580	4070	1150	14010	2280	4970	3300	1390
3	Male Free range (FR) Dorsal skin	3770	4140	4190	4160	600	15920	1010	7070	3040	2600
4	Female FR Dorsal skin cut	1.380	1490	4140	1380	1490	14480	580	1090	3300	4290
5	Male Truka Hind-limb Red meat	1230	1850	3690	1570	1890	13750	760	2740	2920	3740
6	Female Truka Hind-limb Red meat	1480	1850	4780	1750	1490	14760	990	2900	3390	1070
7	Male FR Hind-limb Red meat	3290	3190	1790	1100	1150	12460	890	4980	3090	1290
8	Female FR Hind-limb Red meat	3770	4140	1190	1160	1570	14920	1010	2840	3040	2600
9	Male Truka Liver meat cut	3750	2640	1740	1890	4570	12680	740	3840	2740	1080
10	Female Truka Liver meat cut	3500	3060	4080	4190	1150	44620	2890	4290	3070	1160
11	Male FR Liver meat cut	1790	680	1030	1880	3370	13390	3640	6550	2790	0420
12	Female FR Liver meat cut	2170	4940	4780	2970	2290	21380	2850	3850	2400	1490
13	Male Truka Kidney meat cut	2640	1640	3030	2640	650	10830	3360	2400	2920	1040
14	Female Truka Kidney meat cut	2740	3590	2900	2670	4780	11740	2840	2670	3040	2600
15	Male Free range Kidney meat cut	3640	2740	1690	1740	9790	11650	1760	1550	920	2740
16	Female Free range Kidney meat cut	1640	2290	1270	1330	1640	15570	370	1780	840	1440

The level of alanine (6290), (440), (4940) and (3590) were mostly found in the male dorsal skin part of *Truka,* female hind limb, liver and kidney part of free range grown cattle respectively .Therefore female kidney, liver, dorsal skin and hind limb part of *Truka* remains the most preferable due to its alanine low content. Alanine is an amino acid that is used to make proteins. It is used to break down tryptophan and vitamin B-6. It is a source of energy for muscles and the central nervous system. It strengthens the immune system and helps the body use sugars. What are the risks of taking beta-alanine supplements? Some people have reported tingling of the skin after taking large doses of beta-alanine. Beta-alanine may interact with some heart medications and with drugs for erectile dysfunction [42].

The level of proline(4580),(4780), (4780) and (3030) were mostly in the female (dorsal skin and hind limb,) part of female *Truka*, female liver part of free range and male kidney part of free range grown cattle respectively. Therefore male kidney and liver part of *Truka* contain low percentage level of proline and should be eaten with great care to avoid skin damage. Proline plays important roles in protein synthesis and structure, metabolism (particularly the synthesis of arginine, polyamines, and glutamate via pyrroline-5-carboxylate), and nutrition, as well as wound healing, antioxidative reactions, and immune responses. Functions of proline include helping form collagen, regenerating cartilage, forming connective tissue, repairing skin damage and wounds, healing the gut lining, and repairing joints [43].

The percentage level of serine (4190), (1750), (4190) and (2670) were mostly found in the male dorsal skin part of *Truka*, female hind limb, liver and kidney part of *Truka* respectively. Therefore male and female kidney, liver, dorsal skin and hind limbs part of free range cattle lacks serine amino acid content.D-serine also sends chemical signals in the brain. This might help with schizophrenia and other brain conditions.

The aspartic level (1490), (1890), (4570) and (9970) were mostly found in the female skin part of free range grown cattle, male hind limb, liver and kidney part of *Truka* grown cattle respectively. The lowest content of aspartic acid were mostly found in dorsal skin, liver, kidney as well as hind limb male part of free range grown cattle. Some athletes claim aspartic acid improves stamina. It may enhance your immune system. Aspartic acid may protect you from toxins and neural and brain disorders. It may help treat chronic fatigue. They found no safety concerns and concluded that this supplement is safe to consume for at least 90 days. On the other hand, another study found that two of 10 men taking D-aspartic acid reported irritability, headaches and nervousness [44].

The histidine level (3100),(1010),(2850) and(3360)were mostly found in the male dorsal skin part of *Truka,* female hind limbs and liver part of free range grown cattle, male kidney part of Truka grown cattle respectively. Therefore male kidney and liver part of free range grown cattle has the lowest percentage of histidine. Histidine is an amino acid most people get from food. It's used in growth, repair of damaged tissues, and making blood cells. It helps protect nerve cells. It's used by the body to make histamine. High amounts of histidine in the body may result in unwanted side effects. Excess histidine consumption (> 32g/day) has been reported to cause headaches, weakness, fatigue, nausea, anorexia, depression, and memory failure [45].

The glutamic acid level (15920), (14920), (21380) and (15570) were mostly found in the dorsal skin of male part of free range grown cattle, female hind limbs, liver and kidney part of free range grown cattle respectively, both male and female kidney, liver, hind limb as well as dorsal skin has low content of glutamic acid.In the body it turns into glutamate. This is a chemical that helps nerve cells in the brain send and receive information from other cells. It may be involved in learning and memory. It may help people with hypochlorhydria (low stomach acid) or achlorhydria (no stomach acid). The common side effects observed with the use of Glutamic acid are: Allergic reactions, Abdominal cramps, Slow wound healing, Bleeding, Skin thinning, Mood changes, Swelling of throat and Skin burning Sensation [46].

The level of arginine (7070), (4980), (6550) and 2670 were mostly found in the male skin, hind limb, liver part of free range grown cattle and female kidney part of Truka grown cattle respectively. Therefore, the lowest content of arginine were mostly found in the dorsal skin, kidney, liver and hind limb male part of *Truka*. And it remains the most preferable parts.L-arginine is considered to be generally safe. It might be effective at lowering blood pressure, reducing the symptoms of angina and PAD , and treating erectile dysfunction due to a physical

cause. However, if you take a blood pressure drug, talk to your doctor before using L-arginine.In clinical trials, arginine has been used safely with minor side effects for up to three months. Possible side effects include abdominal pain and bloating, diarrhea, and gout. It may also cause a worsening of breathing in people with asthma. Arginine may interact with certain medications that lower blood pressure [47].

The level of tyrosine (3300),(3390),(3070) and (3040) were mostly found in the female dorsal skin part of both free range and *Truka*, female hind limb, liver and kidney part of *Truka* grown cattle respectively. Both male free range and male kidney, lung, liver as well as dorsal skin part of Truka has low content of tryosine and should be consumed periodically with great caution.Tyrosine also helps produce melanin, the pigment responsible for hair and skin colour. It helps in the function of organs responsible for making and regulating hormones, including the adrenal, thyroid, and pituitary glands. It is involved in the structure of almost every protein in the body. Common side effects of L-Tyrosine may include: nausea, heartburn, headache joint pain; or and feeling tired [48].

The level of cystine (4290), (3740), (1160) and (2740) were mostly found in the female dorsal skin part of the free range, male hind limb part of *Truka,* female liver part of *Truka* and male kidney part of free range grown cattle respectively. Therefore, male kidney, liver, dorsal skin as well as hind limb has low content of cystine.Cystine may play a role in the normal growth rate of hair. Cysteine may also help reduce the effects of aging on the skin. It may help healing after surgery or burns and protect the skin from radiation injury. Cystine may help burn fat and increase muscle mass. Side effect of cystine are : Anxiety, chest pain, confusion cough, dizziness lightheadedness, drowsiness, fainting, fast heartbeat and feeling of warmth [49].

4. CONCLUSION

The meats have an important role in human nutrition because of their nutritive value. the preferences for meat consumption, the effect of rearing technique, consumer preferences and amino acid profile from different part of types of cattle were ascertain. indeed, increasing consumer interest is being shown in the energetic and nutritional values of food, as well as in the role played by correct diet in a healthy lifestyle.

This work entails that meat and meat products have significant role in fulfillment and maintenance of human health. Studies indicated that strong nutritional composition (fats, proteins and carbohydrates) with minerals; vitamins and other functional compounds have a preventive role against major and minor nutrients deficiency diseases. This food material must be included as important proportion in balanced diet to meet the required health benefits. Amino acids are beneficial for growth and building of muscles in humans. Thus, intake of meat in balanced proportion must be according to the prescription of nutritionist and health practitioners. The meats have an important role in human nutrition because of their nutritive value. the value of meat is measured in terms of the major chemical components such as proteins, fats, carbohydrates, minerals and fatty acids contents .indeed, increasing consumer interest is being shown in the energetic and nutritional values of food, as well as in the role played by correct diet in a healthy lifestyle.

the following are some of the side effects of non-essential amino acid such as gastrointestinal distress, such as bloating, abdominal pain, diarrhea, increased risk of gout (buildup of uric acid in the body, leading to joint inflammation),unhealthy drop in blood pressure, changes in eating patterns and need for your kidneys to work harder to maintain balance.

Finally from nutritional point of view female parts of *truka* grown cattle remains the best meat due to amino acid.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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