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Nutritional Evaluation of Meat Biryani – a Popular and Most Consumed Delicacy

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ABSTRACT

Biryani is a delicious energy dense dish that is revealed pan India. The aim of this study was to analyze the nutrient content of biryani (chicken, mutton and beef) and to understand the nutritional composition along with fatty acid and amino acid composition. The nutritional analysis of biryani indicates that the energy content was 434.656 ± 13.76 K.Cal / 100g, with 18.30 ± 2.90g/100g fat and 16.54 ± 3.93 g/100g protein content. The saturated, unsaturated and trans fat (%) content was 37.08 ± 9.44, 61.64 ± 9.61 and 1.28 ± 0.35% respectively. There was presence of essential amino acids along with semi essential amino acids. As per statistics, biryani is the most consumed food through online orders as well as restaurant dining, and consumers have to be cautious about the high calorie and fat content of biryani.

Keywords: *Biryani, Nutritional content, Energy dense, Fatty acids, Amino acids*

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INTRODUCTION

Biryani is a classic mouth-watering dish that needs no introduction in India, and many parts of the world. Though it may appear to be a dish indigenous to India, in reality the dish originated quite far away. Biryani is derived from the Persian word Birian, which means 'fried before cooking' and Birinj, the Persian word for rice. While there are multiple theories about how biryani made its way to India, it is generally accepted that it originated in West Asia (Achaya, 2009). The evolution of biryani spans many centuries, many cultures, many ingredients and many cooking styles. From an army dish to a dish fit for royalty, the biryani today is a pan-India culinary favourite. Its many varieties reflect the local tastes, traditions and gastronomic histories of their regions of evolution (Pratibha, 1998).

There are many local and hyper local variations evolved in distinctive styles of biryani preparation. One of the famous variation of Biryani is the Hyderabadi Biryani, which originated as a blend of Mughlai and Iranian cuisine from the kitchens of the Nizam, rulers of the historic Hyderabad State. Hyderabadi Biryani is a staple part of the Indian Cuisine and is made with various ingredients like basmati rice, goat or chicken or buffalo meat, yogurt, spices, onions, coriander leaves, lemon, saffron and fried caramelized onions used as garnish (Asema, 1995). Hyderabadis not only popularised their trademark biryani in every nook and corner of the world, but also consumes it with equal enthusiasm. Statistics reveal that the city of Nizams is one of the highest consumers of biryani. Data analysis from food delivery apps reported that Biryani was the most popular dish ordered and consumed on regular basis, and consumption of this special dish doubles on special occasions like new year day, festivals, Wimbledon or cricket matches etc. (Prachi, 2019; Krishnan et al. 2018). The aim of this work was to estimate the nutritional content, fatty acids and amino acids content of different Biryani variants available in Hyderabad and Secunderabad, where it is consumed on a regular basis.

MATERIALS AND METHODS

The biryani samples were collected from famous biryani outlets (3 popular brands) of the city as well as from the not so popular (3 local) outlets. Three variants of biryani (chicken biryani, mutton biryani and beef biryani) were collected from popular and local outlets of the twin cities. Two regular packs of biryani were procured from each outlet. The meat pieces of each variety was chopped to fine pieces with a stainless steel knife and the entire biryani was homogenised in a laboratory blender (Waring Commercial Blender, WCG75, Torrington, CT) at a medium speed for 2 min. A fresh homogenized blend was used for estimating the moisture content of the biryani samples and the remaining portion was spread on stainless steel trays for drying at 60°C for 6h in a pre-heated (60°C) tray drier. The dehydrated blend was cooled to room temperature (35°C), powdered again and vacuum packed in a Metalized Polyethylene Terephthalate (MPET) with OTR of 0.95 cc/m2/day and WVTR of 1.2 g/m2/day and stored at room temperature i.e., 35 °C±4 for further analysis. Each variant of the biryani sample (chicken biryani, mutton biryani and beef biryani) was analyzed separately and mean ± standard deviation (Fatty acids & Amino acids) and range (Proximate composition) of the nutrients is presented in results.

Proximate analysis: Moisture content of the fresh biryani blend was determined by IS 1155:1968/4333(2):2002 method. Protein content was estimated as per AOAC 992.23. –Generic Combustion method, 20th Edition, using Leco FP-528 Nitrogen Analyzer. Fat content was estimated as crude hexane extract of the dehydrated biryani blend using automatic Gerhardt Soxtherm extraction unit (AOAC 2003.06). Crude fiber content of the samples was determined by the procedure given by Association of Official Analytical Chemists (AOAC 962.09). Total ash was determined using IS 1155:1968 (Reaffirmed 2010) procedure. Energy and carbohydrate content was calculated by difference method (AOAC, 2006). Moisture was analysed on a fresh basis and the rest of the nutrients were estimated on dry matter basis in triplicates.

Total fat and fatty acid analysis: Fatty acids were analysed by AOAC (2001. 996.06) and Shaik *et al*. (2017) methods. The isolated fat was trans-esterified using 0.5 M methonolic KOH to form fatty acid methyl esters (FAME). Fatty acids were estimated by Gas Chromatograph (7890B of Agilent Technologies) equipped with flame ionization detector and Agilent - DB-FFAP column (nitroterephthalic-acid-modified polyethylene glycol (PEG) of high polarity for the analysis of volatile fatty acids). The temperature of the column was maintained at initial temperature of 100°C for 5 min, raised to 240°C at the rate of 4°C /min. Nitrogen was used as carrier gas at a column flow rate

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of 1.0 ml/min. Detector temperature was maintained at 280°C. Standards used were 47885-U Supelco® 37 Component FAME Mix, 10 mg/mL in methylene chloride. Individual trans-fatty acids standards, Supelco trans-9-Eliadic methyl ester, 10 mg/ml in heptane, trans-9, 12-Octadecadienoic (linoleliadic) methyl ester and trans-11-Vaccenic methyl ester, were used. Sample fatty acid composition was compared with standard fatty acid composition and percentages were calculated by normalization of peak areas. Fatty acid chromatograms of each biryani variant is given in Fig.2, and mean ± SD of all variations together is given in Table.2.

Estimation of amino acids: Amino acid content was estimated as described by Wang et al. (2010). The samples were hydrolyzed by a standardized procedure for 22 h at 110 °C. After hydrolysis, the mixture was filtered and evaporated to dryness under vacuum. The hydrolysates were reconstituted with mobile phase and was further filtered through a 0.50-µm pore-size membrane (Millipore, Madrid, Spain). The analysis was performed on an Agilent 1260 Infinity HPLC system, equipped with a µ-degasser (G1379B), 1260 binary pump (G1312B), 1260 standard autosampler (G1329B), 1260 thermostated column compartment (G1316A), 1260 diode array and multiple wavelength detector (G1315C), and a Zorbax Eclipse-AAA column (250 mm x 4.6 mm, L x ID) particle size 5µm) (Agilent Technologies, Santa Clara, CA). The hydrolyzed samples were automatically derivatised with OPA (o-phthalaldehyde for primary amino acids) and FMOC (9- fluorenylmethyl chloroformate (FMOC) for secondary amino acids) by programming the auto sampler. After derivatisation, 0.5µl of each sample was injected into a Zorbax Eclipse-AAA column at 55 °C, with detection at λ1 = 338 nm and λ2 = 262 nm. The separation was performed at a flow rate of 0.7ml/min. The amounts of individual amino acids were expressed as mg/100g protein in each sample. Amino acid chromatograms of each biryani variant is given in Fig.3, and mean ± SD of all variations together is given in Table.3.

Statistical analysis: All the analysis was carried out in triplicates in all the popular and local brands. General linear model (GLM) procedure in Statistical Analysis System Software (SAS version 9.1, Statistical Analysis System Institute, Inc. Cary, NC) was used for all the analysis. Mean, standard deviation and f ratio was calculated and difference within each nutrient component was tested at a 95 % confidence interval.

RESULTS AND DISCUSSION

The results of nutrient composition of Biryani are presented in

Table 1: Nutrient Composition of Biryani

Nutrient Content	Mean ± SD	Range
Moisture (g / 100g)	61.04 ± 1.45*	58.61 – 62.02
Ash (g / 100g)	6.03 ± 2.12*	3.90 - 9.16
Protein (g / 100g)	16.54 ± 3.93NS	13.10 – 23.26
Fat (g / 100g)	18.30 ± 2.90NS	13.19 – 20.03
Fiber (g / 100g)	1.06 ± 0.22*	0.69 – 1.24
Carbohydrates (g / 100g)	50.96 ± 6.58*	41.02 – 58.82
Energy (K. Cal / 100g)	434.656 ± 13.76	415.87 – 447.59

The f-ratio value is 60.80. The p-value is < .00001. The result is significant at p < .01.

The results indicate that moisture content of biryani ranged between 58.61 to 62.02 g/100g, indicating good moistness in the sample. Ash content of Biryani content ranged between 3.90 to 9.16g/100g, while crude fiber was between 0.69 to 1.24g/100g. Protein and fat content ranged between 13.10 to 23.26g/100g and 13.19 to 20.03g/100g respectively. Energy content of Biryani was between 415.87 to 447.59 Kcal/100g, indicating that Biryani is a very energy dense food. Satija et al. (2015) in a study on comparison of food portions consumed between obese and normal-weight individuals reported that obese people consumed larger portions of carbohydrates (phulkas, chapatis, dosas, biryani), fats (chicken fry) etc. Popkin (2001) predicted that fats, simple sugars, processed foods and animal products will become the predominant sources of energy in developing countries as wealth increases. Energy dense (415.87 to 447.59 Kcal/100g) foods like biryani could become a cause for obesity too, if consumed on at frequent intervals. Various studies by Vijayapushpam et al. (2003); Keshari and Mishra, (2016); Vaida, (2013) reported that more than 75% of households in Hyderabad consume processed and convenience foods (which includes Biryani consumption), for various reasons like convenience, time saving, disappearance of joint families and joint kitchens, dual responsibilities of mothers, constrain on resources, frequent eating in restaurants, online food purchases etc. Consumption of fast foods from pizzas to biryani was 59% among adolescents, 21% among children in Hyderabad (Raghunath et al. 2007) and that the consumption of meals outside home has doubled in the past decade (Griffiths and Bentley, 2001).

Results of fatty acids profile of the biryani samples (Table.2 and Fig.1) tested show that the total saturated fat (%) content was 37.08 ± 9.44 with highest amount of Palmitic Acid (C16:0), followed by stearic acid (C18:0). The unsaturated fat content was 61.64 ± 9.61 with dominant fatty acids like Oleic Acid (C18:1n9cis) and Linoleic Acid (C18:2n6cis).

Table 2: Fatty Acid Composition of Biryani

Fat & Fatty Acid	Fatty Acid	Mean ± SD
Total Fat (%)	--	18.30 ± 2.90
Lauric Acid	C12:0	0.15 ± 0.15
Myristic Acid	C14:0	1.58 ± 1.11
Pentadecanoic Acid	C15:0	0.16 ± 0.18
Palmitic Acid	C16:0	27.52 ± 8.82
Palmitoleic acid	C16:1	1.20 ± 1.07
Heptadecanoic acid	C17:0	0.28 ±0.27
Stearic Acid	C18:0	6.20 ± 2.04
Oleic Acid	C18:1n9cis	33.37 ± 8.48
Elaidic Acid	C18:1,n9 trans	1.16 ± 0.27
Linoleic Acid	C18:2n6cis	27.56 ± 15.02
Linolelidic acid	C18:2,n6Trans	0.13 ± 0.13
α-Linolenic acid	C18:3	0.34 ± 0.13
Arachidic Acid	C20:0	0.30 ± 0.05
Docosadienoic Acid	C22:2	0.08 ± 0.17

Trans fats like Elaidic Acid (C18:1, n9 trans) and Linolelidic acid (C18:2, n6Trans) were present to an extent of 1.28 ± 0.35%. There was presence of trace amounts of fatty acids like Pentadecanoic acid (a rare saturated fatty acid present in hydrogenated mutton fat), Palmitoleic acid, (omega-7 monounsaturated fatty acid biosynthesized from palmitic acid) and Docosadienoic acid (natural ω-6 PUFA, known as an agonist of free fatty acid receptor 4/GPR120, which strongly inhibits secretion of ghrelin) (Lu et al. 2012). Grehlin is known as 'hunger hormone', as it stimulates appetite, increases food intake and promotes fat storage. Cummings et al. (2001) reported that, ghrelin when administered to humans increased food intake by up to 30% through its action on hypothalamus, an area of the brain crucial in the control of appetite. Presence of these fatty acids in trace amounts could be one among many reasons for obesity and other weight gain associated health issues, among biryani consumers.

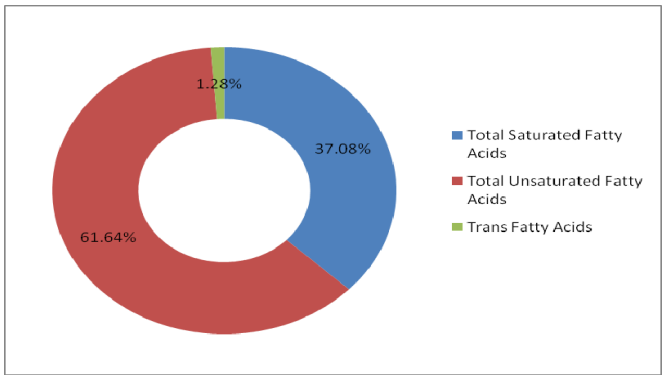

Fig. 1: Total fatty acid composition of the biryani samples

The biryani samples contained essential amino acids, which the human body cannot synthesize like Leucine, Lysine, Methionine, Phenylalanine, Threonine and Valine in the range of 1.27 ± 0.70 to 3.80 ± 2.28 g/100gms (Table 3). Semi-essential amino acids like cysteine, tyrosine, and arginine are present in the range of 0.44 ± 0.15 to 6.48 ± 4.67 g/100gms. During formulations of protein rich food products, biological value of the proteins depends on the balance of amino acid (Gorissen et al. 2018). The biryani samples are a good source of essential amino acids, due to the presence of meat as a major source of protein. The pattern of meat consumption in India depends considerably on culture, tradition and urbanization (Devi et al. 2014), and a study by Thammi Raju and Suryanarayana, (2005) reported that meat consumption patterns of Andhra Pradesh, India revealed that the most preferred meat was chicken (50.0%), followed by mutton (25.0%) and fish (25.0%) in forms of curry, fry or biryani. A study by Kiran et al. (2018) reported that preference of consumer towards gravy type, dry type and biryani type product was found to be 55%, 18.5% and 26.5% respectively. Gravy type product was most preferred, followed by biryani type and dry type meat products.

Energy-dense foods like biryani are often high in refined grains and added fats (Kant and Graubard, 2005), are palatable, affordable, and convenient. However, they are associated with increased energy intakes and poor diet quality on frequent consumption. Additionally, energy-dense diets may contribute to insulin resistance by their higher levels of saturated fats, which have been shown to be related to impaired insulin sensitivity (Ledikwe et al. 2006; Jason et al. 2007). In recent decades, researchers have observed an increased intake of sugar, oils and highly processed food in Indian diets (Meenakshi, 2016, Law et al. 2019), with more apparent changes identified in urban India (Luhar et al. 2018, Baker., 2014; Moodie et al. 2013; Thow et al. 2016). With the rapid growth of the modern global food retail sector, the consumption of packaged and processed foods has become more common in much of the world (Popkin, 2014), with biryani being one of the most purchased processed food commodity. Sudershan and Subba Rao, (2008) reported that biryani is healthier than any junk food and young generation prefers to eat Biryani for its cooked meat in rice of homogenous flavor in aromatic meat broth, spices and sweet flavors. However moderation in consumption of the delicacy is always equated with better health.

Table 3: Amino acid composition of Biryani samples

Amino Acid (g/100gms)	Mean ± SD
L-Alanine	2.36 ± 1.10
L-Arginine	0.44 ± 0.15
L-Aspartic acid	3.55 ± 3.17
L-Cystine	1.87 ± 1.27
L-Glutamic acid	9.79 ± 6.94
L-Glycine	4.32 ± 1.91
L-Histidine	1.52 ± 0.68
L-Isoleucine	1.91 ± 1.25
L-Leucine	1.84 ± 1.48
L-Lysine	3.80 ± 2.28
L-Methionine	2.40 ± 1.85
L-Phenylalanine	1.27 ± 0.70
L-Proline	4.98 ± 5.40
L-Serine	2.31 ± 1.46
L-Threonine	2.01 ± 1.50
L-Tyrosine	6.48 ± 4.67
L-Valine	1.64 ± 0.76

CONCLUSION

Consumption of high levels of energy and fats have been associated with increased risk of diet-related non-communicable diseases like obesity and coronary heart disease etc. In 2018-2019, biryani was most ordered (once every 3.5 seconds) online through food apps in India, with highest demand for Hyderabadi biryani. The results indicate that biryani is energy dense food with high calories and fat, along with essential amino acids. Consumption of such energy dense foods frequently can lead problems associated with weigh gain and related health issues. Hence the classic delicacy "Biryani" may be consumed in moderation for better health.

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ETHICS STATEMENT: Not applicable

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