

# NUTRITIONAL ASPECTS OF READY-TO-EAT AND HOMEMADE FOOD PRODUCTS WITH EMPHASIS ON FATTY ACID PROFILING OF READY-TO-EAT FOOD USING GC-FID TECHNIQUE- A COMPARATIVE STUDY

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## Abstract

Rapid growth of street fast food is a boon for changing lifestyle of urban people. However, its nutritional aspect is also a matter of concern. The objective of the present study was hence to assess the nutrient components of RTE as well as homemade food. A total of 20 RTE food samples from streets were collected from different locations of Delhi town in aseptic containers and immediately transferred to the laboratory for proximate analysis. In terms of nutrient contribution, the highest energy content was found in Kachori (545.8 kcal/100g). Highest level of protein was detected in Chicken Roll at 30.5 g per serving. Maximum amount of fat was also found in Chhole bhature (30.5 g/plat) and trans-fat (4.0%) in Gulab jamun. Highest level of carbohydrate was detected in Sandwich (Bread) at 53.6 g per serving of sample. High amount of fibre (4.35) was observed in green chutney. The high values of Total Polar compounds in frying oil (31.8%) were observed in the oil used by street vendors. From this study it was concluded that homemade food is good in all aspects considering the food safety, hygiene, and nutrition, providing an appreciable amount of nutrients.

**Keywords:** RTE food, Homemade food, Portion, Energy contain, Fat contain.

## Introduction

Food safety is as an integral part of food security. In recent, it is defined by the Food Systems Summit (2021) and its previous versions, that "Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (von Braun et al., 2021). Street foods are enjoying increasing patronage due to industrialization which is forcing many city dwellers to eat their major daily meals out of home. Street food vending is a common feature of most cities and towns in developing countries. Aside provision of ready-made instant meals at relatively inexpensive prices, urban dwellers is attached to street foods because of its gustatory attributes. These attributes

are linked to the culinary skills of the vendors (Alimi, 2016). Ready-to-eat is defined as the food which is pre-prepared and can be eaten right from the tray. Ready-to-eat (RTE) foods, such as cooked meats and poultry, cold vegetable dishes in sauce, noodles, and fried rice, are very popular as they are intended for direct consumption (Yu et al., 2020). These types of food are consumed in the same state in which it was sold or distributed (Bae et al., 2010). It does not include hulling, peeling, or washing by the consumer and are considered safe to consume without further cooking (Bae et al., 2010). However, consumption of unsafe or contaminated food can cause both acute and chronic illness particularly for the sensitive or pregnant consumers (Kinsey, 2005). The oils used for frying of food by the food vendors are also not of good quality. The restaurants and vendors heat the oil for long time and repeatedly use this oil for frying of fast food and other deep-fried food resulting in increased the toxic compounds of oil such as total polar compounds, Ghobadi, Saeed, et al (2018). The presence of the toxic compounds in oil can affect the consumer's health. The notification of FSSAI has specified the limits of Total polar compounds in oil below 15% in unused or fresh vegetable oil and below 25% in used oils, more than 25% in used oils shall not be taken in use further, FSSAI (2011). This is the matter of concern and need improvements in food quality, hygiene practices and the food chain in terms of processing, and storage of foodstuffs. It is clear with the above discussed fact that, the food safety, security, and nutrition are discussed all over the country but the actual scenario in regard of safety measures is unknown. Through conducting this study targeting all eateries outlets we can have a picture of the actual status of food safety and nutrition in food stuff available in market consumed by all age groups of consumers. A very few studies have been available on these aspects. Many researchers used the different type of the modelling to identify the health or other effect of issue in real life [Kalra et al. (2022a), Bhagat et al. 2022, Poswal et al. (2022a), Boadh et al. (2022a), Poswal et al. (2022b), Karla et al. (2022b), Poswal et al. (2022c), Poswal et al. (2022d), Boadh et al. (2022b), Boadh et al., (2022c), Boadh et al. (2022d), Karla et al. (2022c), Poswal et al. (2022e), Neelofar et al., (2022), Aarya et al., (2022), Mangla et al., (2022), Rajoria et al. (2015)]. Therefore, keeping the above in view the present work aims to investigate the nutritional and fatty acid composition profiles of the collected ready to eat food products from different locations of New Delhi-NCR.

## Material and methods

### Chemical & Reagents

Fatty acid methyl ester (FAME) standards were obtained from Supelco (Bellefonte, PA, USA). A standard solution of Na (1000 µg/mL) was procured from AccuStandard (New Haven, CT, USA). Hydrochloric acid was purchased from Samchun (Seoul, Korea). D-(-)-Fructose (≥99 %), D-(+)-glucose (≥99.5 %), sucrose (≥99.5 %), D-lactose monohydrate (≥98 %), and D-(+)-maltose monohydrate (≥99 %) were obtained from Sigma-Aldrich (Buchs, Switzerland). HPLC grade water and acetonitrile were purchased from Avantor Performance Materials (Center Valley, PA, USA), Silica gel 60, (Adsorbent) Silica gel 60 (Adsorbent) - particle size 0.063-0.200 mm (70-230 mesh ASTM), Petroleum ether, Sea-sand - Analytical reagent grade, Spray reagent- Molybdophosphoric acid, 10% in alcohol, Sulphuric Acid & Sodium hydroxide, all other reagents were of analytical grade.

### Sample Collection

A total of 20 different types of samples of food were randomly collected from local markets in different locations of Delhi and New-Delhi (NCR) India between a time frame of October, 2019 to December, 2020. As far as the samples are concerned, total of 100 samples i.e. 5 samples of each RTE were collected. Out of 20 types, one category was of frying oils used at food eateries for frying of food. All the collected samples were transported to the laboratory same day and were also stored in a refrigerator or freezer till further processing. The homemade samples of each food products were used for comparison with street food samples. Table.1 summarized the description of collected different types of food products.

Table-1: Description of Sampling Sites

S.No.	Food item	Location	Latitude & Longitude	Description
1	Bhel puri	Southex	28°34'24.22"N & 77°13'18.81"E	Prepared from puffed rice and sev (a fried snack shaped like thin noodles made from besan flour) mixed with potatoes, onions, chat masala and chutney and a mixture of other fried snacks as the base of the snack.
2	Bread Pakora	Kamla Nagar	28°40'51.93"N & 77°12'16.59"E	Bread pakora is made by frying a slice of bread in a spiced batter. The batter is made by mixing gram flour and spices. The bread is then dipped into the batter and fried. When one side is golden-brown, the bread is flipped and fried on the other side. Bread pakora is often served with chutney, like tamarind or cilantro-lime.
3	Burger Aloo Tikki	Kamla Nagar	28°40'51.93"N & 77°12'16.59"E	Burger Aloo tikki is made up of baked and fried potato patties. These fried patties are sandwiched in burger buns with sliced onions, tomatoes, spices and chutneys.
4	Chaat	Greater Kailash	28°32'54.83"N & 77°14'16.26"E	The original chaat is a mixture of potato pieces, crisp fried bread dahivada or dahibhalla, gram or chickpeas and tangy-salty spices, with sour Indian chili and saunth (dried ginger and tamarind sauce), fresh green coriander leaves and yogurt for garnish.
5	Cheese Burger	District Centre Janak Puri	28.6296°N, 77.0802°E	Cheese burger is a traditional sandwich made up of cooked ground meat or vegetable patty between the two buns topped with vegetables and sauces and a slice of chesse.
6	Chicken Momos	ChankyaPuri	28°35'50.06"N & 77°11'25.45"E	Momo- also known as momo-cha are bite-size dumplings made with a spoonful of stuffing wrapped in dough. They are usually steamed, though they are sometimes fried or steam-fried. Meat or vegetables fillings become succulent as it produces an intensively flavoured broth sealed inside the wrappers.
7	Choley Bhature	Kamla Nagar	28°40'51.93"N & 77°12'16.59"E	It is a combination of chana masala (spicy white chickpeas) and bhatura/puri, a fried bread made from maida.
8	Chowmein (Chicken)	Chankyapuri	28°35'50.06"N & 77°11'25.45"E	Chow mein (/ˈtʃəʊ ˈmeɪn/ and /ˈtʃəʊ ˈmiːn/, simplified Chinese: 炒面; traditional Chinese: 炒麵; Pinyin: chǎomiàn) is a dish of Chinese stir-fried noodles with vegetables and sometimes meat or tofu.

9	Chutney	Kamla nagar, Sarojni nagar, Chanakya puri, Moolchand, Chandni Chowk	28°40'51.93"N & 77°12'16.59"E	Chutney is a ground paste of vegetables, and green or red chilly.
10	Dal Makhani	Laxmi nagar market	28°63'26"N, 77.2802°E	Dal Makhani is made up of whole urad dal and cooked at slow heat for long time. The spices, butter and cream is added to give rich flavour.
11	Fried Rice	Kamla Nagar	28°40'51.93"N & 77°12'16.59"E	Fried rice is a dish of cooked rice that has been stir-fried in a wok or a frying pan and is usually mixed with other ingredients such as eggs, vegetables, seafood, or meat. It is often eaten by itself or as an accompaniment to another dish.
12	GolGappe	Sarojni Nagar	28°34'38.16"N & 77°11'46.76"E	Gupchup consists of a round hollow puri (a deep-fried crisp flatbread), filled with a mixture of flavored water (known as imlipani), tamarind chutney, chili powder, chaat masala, potato mash, onion, or chickpeas.[
13	Kachori	Gol market, CP	28.6304° N, 77.2177° E	Kachori is a deep fried round shaped food made up of maida.
14	Parantha	Moolchand, South Delhi	28°33'48.90"N & 77°14'2.54"E	Parathas are one of the most popular unleavened flatbreads in the Indian subcontinent, made by baking or cooking whole-wheat dough on a tava, and finishing off with shallow-frying
15	Pasta	Karol Bagh	28°39'18.16"N & 77°11'19.75"E	Pasta (US: /'pɑːstə/, UK: /'pæstə/; Italian pronunciation: [ˈpasta]) is a type of food typically made from an unleavened dough of wheat flour mixed with water or eggs, and formed into sheets or other shapes, then cooked by boiling or baking.
16	Roll(Chicken)	Huazkhas	28°32'52.40"N & 77°12'11.25"E	Chicken Roll is cooked chicken meat wrapped in a chapatti made up of maida and spiced up with vegetables, spices sauces and chutneys.
17	Samosa	Sarojni Nagar	28°34'38.16"N & 77°11'46.76"E	A samosa is a fried or baked pastry with a savoury filling, including ingredients such as spiced potatoes, onions, and peas. It may take different forms, including triangular, cone, or half-moon shapes, depending on the region Samosas are often accompanied by chutney, and have origins in medieval times or earlier.
18	Sandwich	Moti nagar	28°39'44.67"N & 77°8'28.01"E	A sandwich is a food typically consisting of vegetables, sliced cheese or meat, placed on or between slices of bread, or more generally any dish wherein bread serves as a container or wrapper for another food type.

19.	Gulab Jamun	Dwarka	28.5852° N, 77.0715° E	Balls of khoya and maida are prepared and fried in oil. After frying dipped in sugar solution.
20.	Frying oils	Street vendor, Dhaba, Restaurant, Hotels of Delhi and Home frying oil	28°40'51.93"N & 77°12'16.59"E  28.5852° N, 77.0715° E  28°39'18.16"N & 77°11'19.75"E	Oil used for frying of food products.
* (N =5 )				

## Proximate analysis

### Moisture content

The moisture content of the samples was determined using method ISO 712:2009 followed by owoso and ogunmoyela (2001). Briefly, 6 g of the sample was weighed into a previously weighed crucible. The crucible with sample taken was transferred into the oven set at 100°C to dry to a constant weight for 24 h overnight. At the end of the 24 h, the crucible with the sample was removed from the oven and transferred to desiccator and allowed to cool for 10 min and weighed. The moisture content was calculated as percentage using formula:

$$\text{Moisture\%} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Weight of Sample}} \times 100$$

### Ash content

10 g of the sample was weighed into a porcelain crucible. This was transferred into the muffle furnace set at 550 C and left for 1 h. About this time it had turned to white Ash. The crucible and its content were cooled to about 100° C in the air, then upto room temperature in the dessicator and weighed. This was done in duplicate. The percentage ash was then calculated according to the method of AOAC 923.03

$$\text{Ash Content (per 100g sample)} = \frac{\text{Weight of Ash}}{\text{Weight of Sample}} \times 100$$

### Crude fibre

The crude fibre is determined as per the standard method IS: 10226 (Part I):1982.

2g of dried fat free food material was mixed with 200mL of sulphuric acid for 30min with bumping chips followed by filtration and washing until no longer acidic. Now, again boil with 200mL of sodium hydroxide solution for 30min, filtered and wash with 25mL of boiling 1.25% H<sub>2</sub>SO<sub>4</sub>, three 50mL portions of water and 25mL alcohol. Remove the residue and transfer to China dish (W<sub>1</sub>). Dry the residue for 2h at 130 ± 2°C. Cool the dish in a desiccator and weigh (W<sub>2</sub>). Ignite for 30min at 600 ± 15°C. Cool in a desiccator and reweighed (W<sub>3</sub>) (Madhu et al., 2017), (AOAC, 1990),

$$\text{Crude fibre\%} = \frac{(W_2 - W_1) - (W_3 - W_1)}{\text{Weight of Sample}} \times 100$$

### Protein analysis

The protein content in the samples was estimated according to the standard AOAC (1990) method. 20 ml of concentrated sulphuric acid was introduced into the micro-kjeldahl flask containing 2 g of ground sample. Two kjeldahl catalyst tablets were added and digested for 4 h, cool overnight in a fume cupboard and the contents diluted with water to 250 cm. A distillation unit was then used and the percentage nitrogen determined using below equation.

### Crude Protein

$$= \frac{(\text{Titre value of sample} - \text{Titre value of blank}) \text{ Normality of Sulphuric acid} \times 14 \times 100 \times \text{Dilution factor}}{\text{Weight of Sample}} \times 6.25$$

Where, 6.25 is conversion factor

### Fat analysis

5 g of moisture free sample was immersed with 200 ml of boiling 0.255N sulphuric acid. The mixture was boiled for 30 min keeping the volume constant by the end of this period and filtered through a muslin cloth and residue was washed with hot water till free from acid. The material was then transferred to the same beaker and 200 ml of boiling 0.313N NaOH was added. After boiling for 30 min as before the mixture was filtered through muslin cloth. The residue was washed with hot water till it become free from alkali and then washed with some alcohol and ether. It was then transferred to a crucible dried over night at 80-100°C and weighed (we). The crucible was heated in a muffle furnace at 600°C for 2-3 h, cooled and weighed again (wa) (AOAC 2019)

$$\text{Crude Fat} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Weight of Sample}} \times 100$$

### Carbohydrate analysis

The value obtained by subtracting the sum of the percentages of moisture, ash, Fat and protein from 100 represents primarily the amount of available carbohydrate substances (Ademola et al., 2011).

### Salt content

To determine the salt content in the samples, 2-3 g of the food sample was weighed into a pre-weighed furnace-proof crucible. It was kept until ashing in a 600°C furnace overnight. When the sample had cooled, the ash was dissolved in water and was transferred quantitatively in a 50 ml volumetric flask. After making up to volume of 50 ml, the solution obtained was transferred into an Erlenmeyer flask. Later, 1 ml of potassium chromate indicator solution was added and the solutions was titrated drop wise with the addition of 0.1 N silver nitrate solutions until the colour of the solution changed to a reddish brown. A blank test was carried out in parallel using 50 ml of distilled water instead of the sample solution. The blank value did not exceed 0.2 ml of silver nitrate (AOAC, 2012). The chloride content in the sample was calculated using the formula.

$$\text{Chloride content} = \frac{V_s \times N \times 58.5 \times 100}{\text{Weight of Sample} \times 1000}$$

V<sub>s</sub>=Volume of Silver Nitrate

N=Normality of Silver Nitrate

### Energy (Kcal/100g)

Energy content of each was determined by multiplying the values obtained for protein, fat and available carbohydrate by (4:9:4) respectively and adding up the values (Indrayan et al., 2005).

$$\text{Energy (Kcal per 100g)} = 4 (\text{Carbohydrate \%} + \text{Protein \%}) + 9 (\text{Fat \%})$$

### Energy from fat (Kcal/100g)

Energy content specifically from fat was determined by multiplying the values obtained for fat by multiplying it with 9.

$$\text{Energy from fat (Kcal per 100g)} = 9 (\text{Fat \%})$$

### Determination of total polar compounds in frying oil:

The method determines the extent to which fats and oils deteriorate when used for frying. These fats and oils can be separated by the process of Silica Gel based column chromatography into polar and non-polar components.

#### (I) Preparation of Sample

Oils were warmed to temperature slightly above melting point and mix thoroughly such as to avoid overheating. Impurities which were visible were removed by filtration.

#### (ii) Preparation of Column:

Column was prepared using 30 mL (approx.) of petroleum ether-ether (87+13). A wad of cotton wool was placed in bottom of column and air was removed by pressing with glass rod. Slurry of 25gm silica gel and approx 80 mL petroleum ether-ether (87+13) in 100 mL glass beaker was prepared. Slurry was poured into column using glass funnel. Stop clock was started and solvent was drained to 10cm above silica gel. Silica gel is levelled by tapping the column. Approx 4gm of sea-sand was added through funnel into column. Solvent was drained to sand layer. Only non-polar fraction was used to determine polar components by difference. Flow rate is adjusted such that 150 mL passes through column within 60-70 min. As shown in fig. 1. After elution, washing was done for any substance adhering to outlet of column into round-bottom flask with petroleum ether-ether (87 + 13). In same manner, polar components were eluted into second 250 mL round-bottom flask with 150 mL ether.

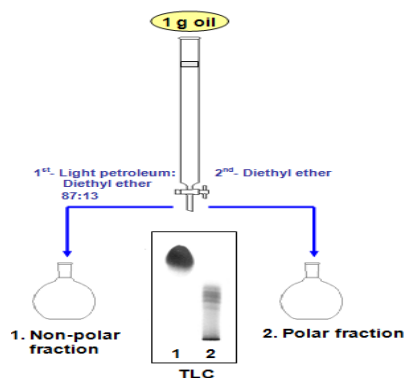
Calculate polar components, as percent (w/v) with formula:

$$\text{Polar components, \%} = (E-A/A) * 100$$

Where A = non polar fraction (in gm);

E= test portion (in gm) in 20 mL aliquot .

Fig. 1 Separation of polar compounds by silica column chromatography



## Determination of Fatty Acid profile using Gas chromatography flame ionization detector (GC-FID) of ready-to-eat food

For the determination of fatty acid composition in ready to eat food products the gas chromatograph equipped with a flame ionization detector was used. The analysis was split injection and helium was used as a carrier gas. The injector and detector temperatures were 250°C and 260°C, respectively. The temperature was programmed at 100°C for 0 min, raised from 100 to 150°C by a rate of 10° C min<sup>-1</sup>, and held constant at 150°C for 0 min. Then it raised from 150 to 195°C by a rate of 2°C min<sup>-1</sup> and held constant at 195°C for 5 min. Then it raised from 195 to 210°C by a rate of 1°C min<sup>-1</sup> and held constant at 210°C for 0 min and finally raised from 210 to 240°C by a rate of 10° C min<sup>-1</sup> and held constant at 240°C for 5 min. The duration of the analysis was altogether 55.50 min. The injection volumes were 1.0 µL. The peak areas and retention times were calculated (Sinanoglou et al., 2013).

### Statistical analysis

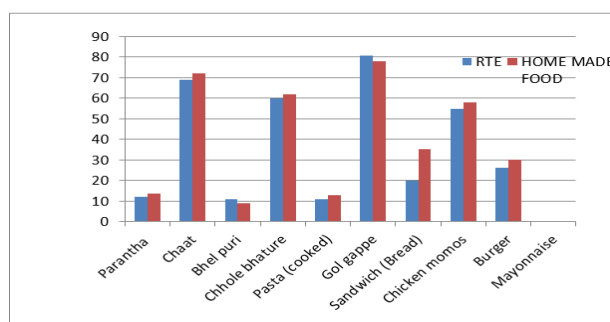
The ANOVA statistical method was used to analyse and compare the data from the above tests performed in various food samples. The data obtained from the analysis during study were subjected to the Analysis of Variance (ANOVA) using GenStat package (12.1 versions). The separation of means was carried out using Duncan's Multiple Range test at 5% level of probability (P<0.05).

## Result and discussion

### Moisture content

The results of the moisture content of the ready to eat food products are shown in Figure 1. The range of the moisture content between the all RTE food samples was recorded between 80% to 11% . Therefore, study revealed that the moisture content was significantly (p<0.05) higher in the all the samples collected from street vendor as compared to homemade food products except burger, chicken momos, pasta, chole bhature, chaat and parantha respectively. The study revealed that the moisture content of street fast foods as well as homemade food varied greatly depending upon the types of food, their composition, cooking methods and consumers' choice. Among, street foods, Golgappe attains higher moisture content (80.88%) whereas in the minimum moisture content was showed by Fried Rice (10.8%). In fried food deep frying or frying lessen the moisture content in food. The study done by Osakue, O. P., et al has reported that when a food is fried in any frying medium the water molecules are replaced by oil after penetration of oil in food and food becomes more delicious. But the food eateries and the street vended food have comparatively high moisture than homemade food. The reason for high moisture in fried food could be to increase the yield of food and business (Osakue, O. P., et al) This study showed that the moisture content in homemade food was comparatively low in all food because of proper cooking, handling and hygiene.

Fig. 1 a & b. Moisture Content Of RTE V/S Homemade Food



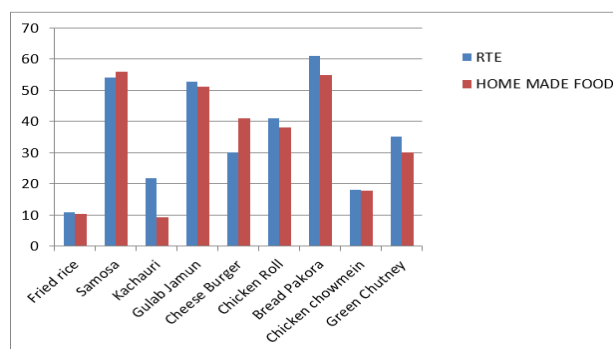


Table 2: Moisture Content Of RTE V/S Homemade Food

S.No.	Food item	Moisture content (%)	
		RTE	Home Made
1	Parantha	12.2	13.5
2	Chaat	69	72
3	Bhel puri	11	9
4	Chhole bhature	60	62
5	Pasta (cooked)	11	13
6	Gol gappe	80.88	78
7	Sandwich (Bread)	20	35
8	Chicken momos	55	58
9	Burger	26	30
10	Mayonnaise	0.1	0
11	Fried rice	10.8	10.3
12	Samosa	54	56
13	Kachauri	21.91	9.26
14	Gulab Jamun	52.8	51
15	Cheese Burger	30	41
16	Chicken Roll	41	38
17	Bread Pakora	61	55
18	Chicken chowmein	18	17.8
19	Green Chutney	35.19	30.15

\* (No. of samples each food item -5 )

### Ash content

Ash is the residue of mineral and inorganic left after moisture, volatile compounds and organics have been removed from food. Results of study indicated that among RTE foods Sandwich, Burger, Chhole bhature, Gulab jamun, Fried rice and Kachauri had considerable amount of ash (Table 1). Their ash content per serving was found to be 5.1 g, 5.0 g, 4.5g, 4.0 g, 3.8 g and 3.08 g respectively. However, among homemade food products Sandwich, Chhole bhature, Fried rice and burger has substantial amount of ash content. Ash content in food can be an indication of how much processing has taken place as natural foods have a lower ash content compared to more processed food (Sipahioglu and Barringer, 2003). Similar kind of results were observed in previous study performed by Rani and Srivastava, (2017).

Table-3:- Ash content of RTE v/s Homemade food

S.No.	Food item	Ash content (g)	
		RTE	Home Made
1	Parantha	1.4	1.1
2	Chaat	1.1	0.9
3	Bhel puri	0.1	0.1
4	Chhole bhature	4.5	4.2
5	Pasta (cooked)	1.8	1.5
6	Gol gappe	0.84	0.75
7	Sandwich (Bread)	5.1	4.7
8	Chicken momos	0.5	0.39
9	Burger	5	4.5
10	Mayonnaise	1.57	1.31
11	Fried rice	3.8	3.92
12	Samosa	1	0.93
13	Kachauri	3.08	1.95
14	Gulab Jamun	4	3.2
15	Cheese Burger	0.6	0.58
16	Chicken Roll	4	2.9
17	Bread Pakora	0.7	0.55
18	Chicken Chowmein	2.8	2.5

19	Green Chutney	0.73	0.68
* (No. of samples each food item -5 )			

### Crude Fibre

The indigestible cellulose, pentose, lignins and other compounds present in food are termed as crude fibre (Rani and Srivastava, 2017). Appropriate amount of fiber intake has lots of health advantages which are laxation and lower risk of cardiovascular related health problems (Busuttil-Griffin et al., 2015). The Dietary guidelines for Americans recommendations to eat fruits, vegetables and whole grains which are rich in fiber and earlier evident in research. Results of proximate analysis showed that RTE foods like Bhelpuri and Mayonnaise have no fibre or roughage whereas Chaat and Golgappe has considerably low fibre content. Sampled foods were generally made from processed food grain or refined wheat flour which resulted in loss of fibre content as they are present in outer parts of food grains which are removed by processing (Joel and MZ, 2011). However, some street fast food such as Paratha, Chhole bhature and Sandwich have appreciable amount of fibre as they made from either whole grains or vegetables which are rich source of fibre. Only the green chutney which is prepared by raw vegetables found to have the good amount of fibre. However, in present work most of the homemade food items were found to be rich in fibre content due to the raw material used in these preparations.

Table-4:- Crude Fibre content of RTE v/s Homemade food

S.No.	Food item	Crude Fibre content (g)	
		RTE	Home Made
1	Parantha	2.5	2.80
2	Chaat	0.2	2.07
3	Bhel puri	Nil	Nil
4	Chhole bhature	4.0	4.2
5	Pasta (cooked)	0.3	0.27
6	Gol gappe	0.20	0.15
7	Sandwich (Bread)	49	47
8	Chicken momos	0.3	0.25
9	Burger	1.4	1.6
10	Mayonnaise	Nil	Nil
11	Fried rice	0.06	0.09
12	Samosa	1.7	1.5
13	Kachauri	3.42	3.08
14	Gulab Jamun	0.55	0.63
15	Cheese Burger	1.2	1.1

16	Chicken Roll	0.15	0.12
17	Bread Pakora	0.9	1.2
18.	Chicken Chowmein	1.99	2.89
19.	Green Chutney	4.35	4.55
* (No. of samples each food item -5 )			

Table 3: Crude Fibre Content Of RTE V/S Homemade Food

### Protein Analysis

The Indian dietary guidelines (NIN, 2011) recommends that 10%-15% calorie should be from protein. Among 17 sample highest level of protein was detected in Chicken Roll (30.5 g/100g) followed by Chicken momos (25.2 g/100g) as meat is always a rich source of protein (Moe et al., 2011). Sandwich (10.6), and Burger (11.4) also had significant amount of protein. Perserving approximately 20% of energy was provided by protein of these fast food. Although, present results showed considerable presence of proteins in RTE but still Home made food items are leading in providing the protein content to the human diet (Abeshu et al., 2016).

Table-5:- Protein analysis of RTE v/s Homemade food

S.No.	Food item	Protein content (g/100g)	
		RTE	Home Made
1	Parantha	4.95	8
2	Chaat	7.5	8.6
3	Bhel puri	8.8	20
4	Chhole bhature	3.2	11.26
5	Pasta (cooked)	4.6	5.8
6	Gol gappe	0.21	0.56
7	Sandwich (Bread)	10.6	11
8	Chicken momos	25.2	25.2
9	Burger	11.4	10.11
10	Mayonnaise	1.2	1.25
11	Fried rice	6.2	6.8
12	Samosa	4.65	4.7
13	Kachauri	6.4	10
14	Gulab Jamun	4.1	5.2
15	Cheese Burger	7	15.5

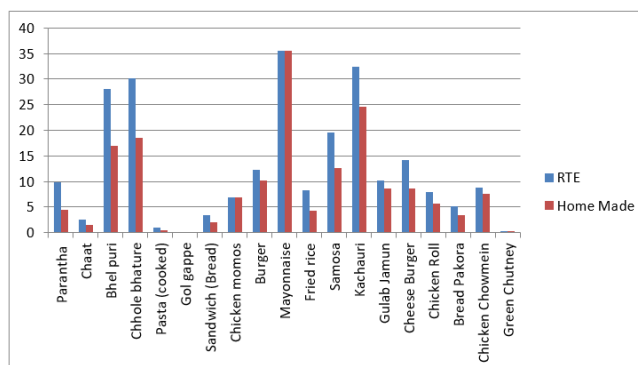
16	Chicken Roll	30.5	31
17	Bread Pakora	12.25	10.2
18.	Chicken Chowmein	28.9	29.22
19.	Green Chutney	0.26	1.2
* (No. of samples each food item -5 )			

Figure 4: Protein Analysis Of RTE V/S Home Made Food

### Fat content

The Indian dietary guidelines (NIN, 2011) recommends that 20-30 percent of calories should be from total fat. Among RTE foods per serving maximum amount of fats was found in Mayonnaise (35.5g) followed by Kachauri (32.5g), Chhole Bhature (30.2g) and Bhel puri (28.1g). However homemade mayonnaise was also having similar fat as in RTE. Other than mayonnaise, in homemade foods Kachori contributed the maximum amount of fat content (24.5g). Bhelpuri and Golgappe contains least amount of fat (28.1g and 0.2g respectively) as compare to other street foods. However, there homemade replica showed lesser amount of fat content i.e., 17g and 0.11g respectively. Total fat contribution of Kachauri to the total energy per serving found to be approximately 7%, whereas homemade kachauri only 5% of fat contribution indicating the lesser calorific values among homemade foods. Fats are commonly judged to have a negative health impact as they lead to increased serum cholesterol levels and a higher risk of coronary heart disease and all recommendations stress the importance to limit the intake of food items rich in fat (Wahrburg, 2004).

Fig. 2 Fat Content Of RTE V/S Homemade Food



### Carbohydrate content

NIN recommends 50%-60% of the total energy intake from carbohydrates (Rani and Srivastava, 2017). Among selected food samples Pasta (cooked), Parantha, Fried rice, Sandwich, Kachauri rich in carbohydrate content. Highest level of carbohydrate was detected in Pasta (cooked) at 81.5 g per serving of sample which contributed approximately 23% of the total energy content perserving followed by Parantha (71.6 g, 18% of total energy), Fried rice (70.9 g, 18.5 of total energy) and Sandwich (60.8 g, 19% of total energy). Chhole Bhature was found with the minimum amount of carbohydrate i.e. 2.08 g. Among home made food items similar kind of results were obtained with elevated values. Similar kind of studies were conducted by Rani and Srivastava, 2017, stating that food items prepared from whole grain were found to be rich in carbohydrate content. Higher consumption of

carbohydrate rich food items decreases the incidence of, and mortality from, cardiovascular diseases (Bechthold et al., 2019), type 2 diabetes (Y. Wang et al., 2019), and some cancers (Zhang et al., 2020).

Table-7:- Carbohydrate content of RTE v/s Homemade food

S.No.	Food item	Carbohydrate content (g/100g)	
		RTE	Home Made
1	Parantha	71.65	72.84
2	Chaat	19.8	16.94
3	Bhel puri	52	53.9
4	Chhole bhature	2.08	3.98
5	Pasta (cooked)	81.55	79.18
6	Gol gappe	17.87	20.58
7	Sandwich (Bread)	60.8	47.3
8	Chicken momos	12.4	9.51
9	Burger	45.38	45.16
10	Mayonnaise	71.53	61.84
11	Fried rice	70.9	74.73
12	Samosa	20.79	25.81
13	Kachauri	36.11	54.23
14	Gulab Jamun	28.9	32.04
15	Cheese Burger	48.28	34.36
16	Chicken Roll	16.6	22.42
17	Bread Pakora	20.83	30.81
18	Chicken chowmein	41.4	42.88
19	Green Chutney	63.52	67.69
* (No. of samples each food item -5 )			

### Salt content

Intake of salt is a biological imperative; however, excessive salt intake is associated with high blood pressure. As this effect likely drives cardiovascular morbidity and mortality, excessive salt intake is estimated to cause ~5 million deaths per annum worldwide (Hunter et al., 2022). While comparing the sodium content in RTE and

homemade foods, the sodium content was significantly greater in RTE as compared to homemade food. Among RTE food sample, chhole bhature were found to have maximum amount of salt concentration whereas pasta contains least amount of NaCl (Figure 7). If we talk about homemade food items, maximum amount of salt was again acquired by chhole bhature while chaat serves the least amount of it. However, 4 out of the 20 types of food did not have any significant difference in the sodium content between the RTE and homemade foods. Choi and Kim, (2020), shows the sodium content in HMR was significantly higher than that in restaurant foods however in the soup and stew groups, the sodium contents in HMR were not significantly different from restaurant foods. These results suggest that a noticeable difference does not exist in the sodium content between HMR and restaurant foods.

Table-8:- Salt content of RTE v/s Homemade food

S.No.	Food item	Salt content (g/100g)	
		RTE	Home Made
1	Parantha	0.56	0.50
2	Chaat	0.25	0.11
3	Bhel puri	0.16	0.16
4	Chhole bhature	2.56	1.88
5	Pasta (cooked)	0.10	0.12
6	Gol gappe	0.36	0.23
7	Sandwich (Bread)	0.65	0.30
8	Chicken momos	1.10	1.10
9	Burger	1.95	1.56
10	Mayonnaise	Nil	Nil
11	Fried rice	0.54	0.47
12	Samosa	2.25	0.63
13	Kachauri	0.87	0.75
14	Gulab Jamun	Nil	Nil
15	Cheese Burger	0.68	0.62
16	Chicken Roll	1.56	1.45
17	Bread Pakora	1.02	0.84
18.	Chicken Chowmein	1.99	1.3
19.	Green chutney	2.88	1.78
* (No. of samples each food item -5 )			

## Energy content

The National Institute of Nutrition (NIN) 2010 dietary guidelines recommend that the RDA for energy is about 2,320 kcal per day for a sedentary man and 2,100 kcal per day for a sedentary woman and 1,900 kcal for children age groups 10-12 yrs (Rani and Srivastava, 2017). The data obtained showed that energy content in the 17 food samples in kcal per serving of sample was in the range 1.8 to 572 (Figure 8).

The highest energy content among RTE was found in Mayonnaise (477.64 kcal /100 g) followed by Kachauri (462.54 kcal /100 g), Pasta (354.05 kcal /100 g), Cheese Bargar (348.2 kcal/plat) whereas. Gol gappe contains least amount of energy i.e. 74.12 Kcal/100g. Homemade food items contain some amount of fat but not more than RTE which suggest that homemade food items are comparatively less harmful in comparison with RTE. The close association between an excessive intake of saturated fats and trans fats increased the risk of NCD and RTE food provide more of the fat content than prescribed limit (Choi and Kim, 2020).

Table-9:- Energy content of RTE v/s Homemade food

S.No	Food item	Energy content (Kcal/100g)			
		RTE		Home Made	
		Energy (Kcal/100 g)	Energy from fat (Kcal/100g)	Energy (Kcal/100 g)	Energy from fat (Kcal/100g)
1	Parantha	394.6	88.2	364.4	41.04
2	Chaat	132.6	23.4	116.2	14.04
3	Bhel puri	496.1	252.9	448.6	153
4	Chhole bhature	293.1	271.98	228	167.04
5	Pasta (cooked)	354.05	9.45	344.6	4.68
6	Gol gappe	74.12	1.8	85.55	0.99
7	Sandwich (Bread)	317.1	31.5	251.2	18
8	Chicken momos	212.5	62.1	200.94	62.1
9	Burger	337.1	109.98	313.15	92.07
10	Mayonnaise	477.64	320.4	572.76	320.4
11	Fried rice	383.1	74.7	364.37	38.25
12	Samosa	277.8	176.04	235.08	113.04
13	Kachauri	462.54	292.5	477.96	221.04
14	Gulab Jamun	223.8	91.8	226	77.04
15	Cheese Burger	348.2	127.08	276.48	77.04
16	Chicken Roll	259.5	71.1	264.8	51.12

17	Bread Pakora	179.3	46.98	195	30.96
* (No. of samples each food item -5 and results are mean value )					

### Determination of Total Polar compounds:

The total polar compounds are more polar than the triglyceroides in oils & fat, formed as a result of repeated frying. Usually the total polar compounds are considered as an indicator of the quality of frying oils. Results of total polar compounds showed that the value of TPC in home frying oil was found under acceptance range (4.28) while the higher value was observed in the frying oil used by street vendors (31.8) followed by Dhaba (30.4) as shown in Table... The study conducted on frying oils of restaurants from Yilmaz et.al(2011) confirmed the high value of TPC in oils in samples.

Table 10: Total Polar Compound In Frying Oils

Location/Source	I	II	III	IV	V	Average (Mean Value)
Hotel	15.96	17.36	16.49	15.26	16.32	16.28
Restaurant	20.98	19.93	18.55	20.15	19.23	19.76
Dhaba	29.2	30.10	31.8	30.2	29.9	30.24
Street Vendor	30.20	31.91	32.60	31.5	30.26	31.28
Home	3.60	5.22	5.14	3.29	4.12	4.28

### GC-FID analysis of ready-to-eat food

GC-FID analysis of RTE foods for estimating the fatty acid content showed presence of different fats and trans-fat, the chromatograms in Fig. a, b, c & d showed the chromatogram peaks of the fatty acid profile in RTE. Maximum amount of saturated fatty acids was found in Gulab jamun followed by bread pakora, samosa, choley bhature and kachori respectively while minimum amount was estimated in fried rice. Golgappe and fried rice was found to have maximum amount of MUFA content whereas, minimum amount of PUFA and transfatty acid was observed in gulabjamun. GC-FID Chromatograms for Fatty acid profile of ready to eat food from street as shown in Figure . However, no trans-fat was observed in parantha, chaat, bhelpuri, golgappe, sandwich, fried rice & chicken roll (Table-2). Recent evidence indicates that trans fats promote inflammation and increased activity of the tumor necrosis factor (TNF) system (Mozaffarian et al., 2006)

Table-11: - Fatty Acid Profile Of RTE (% Fatty Acid)

S. No.	Food samples	Saturated Fatty Acid	Monounsaturated fatty acid (MUFA)	PUFA (Poly Unsaturated Fatty acid)	Trans Fatty Acid
1	Parantha	46.96	41.45	11.59	0
2	Chaat	49.92	39.77	10.31	0

3	Bhel puri	36.76	51.82	11.42	0
4	Chhole bhature	53.23	36.26	10.51	1.83
5	Golgappe	34.99	52.48	12.53	0
6	Sandwich (Bread)	47.65	41.76	10.59	0
7	Chicken momos	52.34	38.81	8.85	0.30
8	Burger	46.80	33.33	19.87	1.10
9	Mayonnaise	53.57	38.54	7.89	2.58
10	Fried rice	25.34	38.87	35.79	0
11	Samosa	53.57	38.54	7.89	2.58
12	Kachauri	52.34	38.81	8.85	0.30
13	Gulab Jamun	66.80	30.01	3.19	4.04
14	Chicken Roll	51.13	37.04	11.83	0
15	Bread Pakora	55.89	34.58	9.52	1.75
*(No. of samples each food item -5 and results are mean value )					

Figure 3: A, B, C, D: GC-FID Chromatograms For Fatty Acid Profile Of Ready To Eat Food From Street.

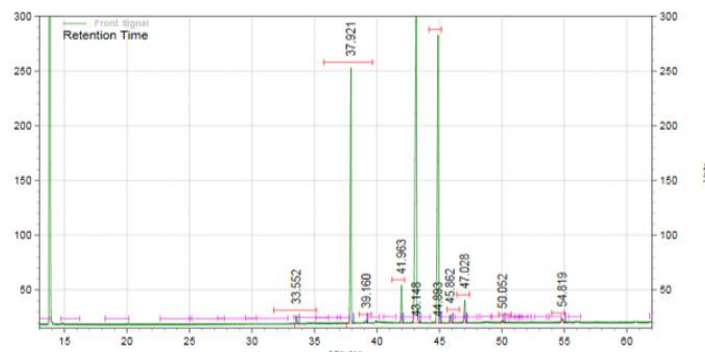


Figure 3. A

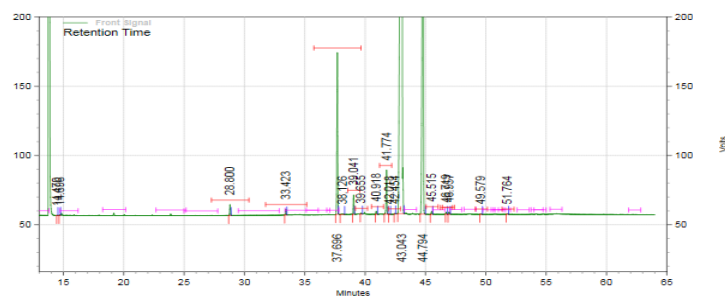


Figure 3. B

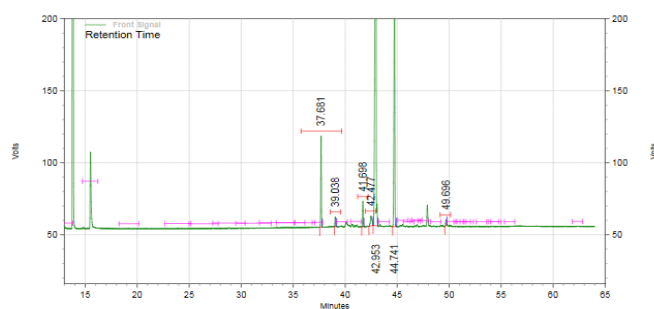


Figure 3. C

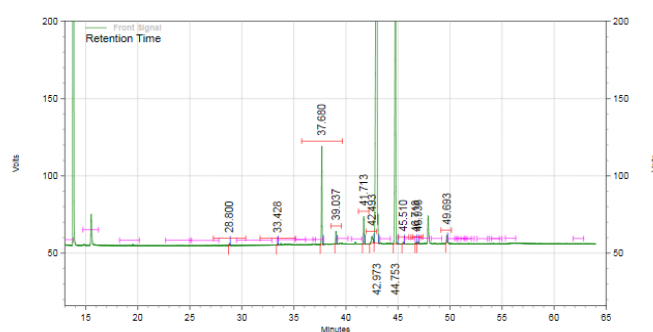


Figure 3. D

## Conclusion

The food samples from market which are readily available for consumption and homemade food were analysed and results showed that the quality in terms of nutrition is somewhere compromised. The fat, , salt (sodium), ash, moisture, protein, fibre and energy contents in food have received a lot of attention from consumers because the intake levels of these nutrients have a substantial effect on human health. This study is the first to determine the fatty acid content of RTE foods. The findings of this study showed that the total saturated and total trans fatty acid contents in RTEs are similar or higher than those of the homemade foods. The other parameters such as protein, fibre, and carbohydrates were low in RTE in comparison to homemade food. The presence of high salt, low protein, low fibre, high number of calories, saturated fat and trans-fat somewhere imperils the health of human. From this study it was concluded that, homemade food provides an appreciable amount of recommended nutrients. Consumption of a substantial quantity of the homemade food as well as right combination of the quality and quantity of food is a right way to live a healthy life.

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