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Paratha, the cooked dough: Functional and healthy food through the utilization of leaves of mulberry, *Morus alba* (L)

Vitthalrao Bhimasha Khyade

Abstract
The present attempt is dealing with preparation of paratha through utilization of leaves of mulberry, *Morus alba* (L) and it's assessment for the health parameters. The ingredients used for paratha are whole meal wheat flour; white wheat flour; salt; dried cooked leaves of mulberry, *Morus alba* (L); curry leaves; rapeseed oil and fresh extract of leaves of mulberry, *Morus alba* (L). The percentages of cooked leaves of mulberry, *Morus alba* (L) in five different groups of paratha include: 0.00; 05.00; 10.00; 15.00 and 20.00. The contents of proteins; polyphenols; the abilities of scavenging DPPH, ABTS and abilities of reduction of Fe^{3+} and chelation of Fe^{2+} in the five groups of paratha in the attempt were found significantly improved through the increase in the contents of fresh extract of leaves of mulberry, *Morus alba* (L). The fresh extract of leaves of mulberry, *Morus alba* (L) through the paratha is going to serve as a functional food and may be useful in the prevention of different diseases. Human being ought to remember about mulberry, *Morus alba* (L) and try to use it in the diet of in every-day. The present attempt demonstrated rich polyphenol contents in the mulberry leaf extract obtained on a semi-technical scale, which results in antioxidant activity of final functional food preparation in the form of paratha. Mulberry paratha significantly improves the health-promoting qualities of food preparations. The United Nations is observing 2021 as the International Year of Fruits and Vegetables (IYFV). This is excellent opportunity for the leaves of mulberry, *Morus alba* (L) to designate itself as the "Vegetable Source for Human Consumption"; to highlight the vital role in human nutrition and food security, as well as urging efforts to improve sustainable production.

Keywords: antioxidant properties, traditional plant, flat bread, functional food, polyphenols

1. Introduction
The most important nutrients for human health are the phytochemicals such as polyphenols, flavonoids, and carotenoids in vegetables. Disease prevention is achieved through the antioxidant rich diets (Gunathilake, *et al*, 2016) [42]. The free radicals are known to be a significant contributor to many degenerative diseases (examples: cancer, cardiovascular diseases, and diabetes). The antioxidants through the diet serve to protect against free radicals (like reactive oxygen species) for the human body. The provision of antioxidants through the diet that could work to quench (or to neutralize) the spectrum of oxidative damage (Prior, 2015) [43] deserve significance and exert a healthy influence. The balanced diet for human being should be rich in green leafy vegetables. This is because, the leafy vegetables represent essential nutritional constituents in any balanced diet, and contain a range of health improving phytochemicals (Gunathilake, *et al*, 2016) [42]. The common leafy vegetables consumed in the Baramati region are the *Centella asiatica* (L); *Cassia auriculata* (L); *Gymnema lactiferum* (L); *Olax zeylanica* (L); *Sesbania granadiflora* (L) and *Passiflora edulis* (L). These leafy vegetables are also are famous as edible leaves and widely consumed as leafy vegetables in India, Sri Lanka and other tropical countries. The leafy vegetables derived from the *Centella asiatica* (L); *Cassia auriculata* (L); *Gymnema lactiferum* (L); *Olax zeylanica* (L); *Sesbania granadiflora* (L) and *Passiflora edulis* (L) possess strong antioxidative properties (Gunathilake, *et al*, 2016; Gunathilake, *et al*, 2018) [42, 44]. The challenge lies in the discovery of synergies of food sources that there would be more than additive effects of consuming the them through the meal.
According to the World Health Organization (WHO), near about eighty percent of world population is in need of the use of complimentary therapies, a major part of which

are derived from the plants including, mulberry, *Morus alba* (L.). The berry fruits of mulberry, *Morus alba* (L) are the sweet, hanging fruits from a genus of deciduous trees that grow in a variety of temperate areas all over the world. The mulberry, *Morus alba* (L.) thought to possibly have originated in China. The mulberry trees have spread throughout the world and are highly praised for their unique flavor and impressive composition of nutrients. In fact, most varieties of trees of mulberry found in different parts of the world are considered to be the native from those areas, as they are widespread. The nomenclature in the scientific naming system for the trees of mulberries varies and depend on which the species one is looking at. The most common types of the trees of mulberry are *Morus australis* (L) and *Morus nigra* (L). But there are other delicious varieties of trees of mulberry as well. In terms of appearance, the berry fruits of mulberry grow very fast when they are young. The growth of berry fruits of mulberry tree gradually slow as their color changes from white or green to pink or red, and eventually settling on dark purple or even black. The sweet taste and the flavor makes these berry fruits of mulberry tree ideal for sherbets, jams, jellies, fruit tarts, pies, wines, teas, and cordials. In some countries, the flavors of the mulberry varieties differ. The berry fruits of American mulberry tree and the black mulberry tree are considered to have the most powerful flavor and are widely sought after. Interestingly, the tree of mulberry, *Morus alba* (L) has another important resource, besides providing people with delicious berries and that is its leaves. The leaves of mulberry, *Morus alba* (L) are the only known food source for the life of larval instars of silkworm, *Bombyx mori* (L). The mulberry, *Morus alba* (L.) is recognized as white mulberry. It is a fast growing, small to medium-sized mulberry tree which grows to 10–20 m tall. The species, *Morus alba* (L.) is native to northern China. It is widely cultivated and naturalized elsewhere (United States, Mexico, Australia, Kyrgyzstan, Argentina, etc.). The genus Morus contains more than fifteen species of deciduous plants commonly called mulberry. The most popular species of mulberry tree include *Morus alba* (L); *Morus nigra* (L); *Morus rubra* (L); *Morus australis*; *Morus atropurpurea* (L); *Morus cathayana* (L); *Morus notabilis* (L) and *Morus mesozygia* (L). All these species of mulberry tree are economically important. The leaves of these mulberry tree species are extensively used in sericulture (Rutuja Ashok Kadam, *et al*., 2019) [45]. The berry fruits of mulberry tree are rich in the nutrients that are important for human health, including iron, riboflavin, vitamin C, vitamin K, potassium, phosphorous, and calcium. The berry fruits of mulberry tree also contain a significant amount of dietary fiber and a wide range of organic compounds, including phytonutrients, zeaxanthin, resveratrol, anthocyanins, lutein, and various polyphenolic compounds. Apart from this, many nutritional benefits and medicinal values are attributed to this plant. The leaves contain high amount of protein and the nutritional scientists in India suggested the use of dry leaf powder for making parathas, one of the most popular Indian food items. In the countries like Korea and Japan, using the leaves and fruits of mulberry tree as their functional foods. They are used in the preparation of tea and ice creams. The tree of mulberry, *Morus alba* (L) has significant influence in lowering glucose and cholesterol in the blood. The China is the country for exploration of mulberry tree as traditional medicinal plant. The medicinal properties of tree of mulberry, *Morus alba* (L) are due to the presence of many bioactive components such as flavonoids, polyphenols, alkaloids, terpenoids, steroids etc. in this plant (Srivastava, *et al*., 2003; Andallu and Varadacharyulu, 2003; Asano, *et al*., 2001). Different parts of mulberry tree (root bark, stem bark, leaves and fruits) have been extensively studied for their various health benefits, including antioxidative, hypolipidemic, antihyperglycemic, and antiatherogenic effects (Harauma *et al*., 2007).

The pace of life of the modern human being has greatly influenced by the global warming. There is impact of changing environment on diet and lifestyle of residents of developing countries. The modern human being is looking for ways to prevent diseases. The specific functionality of the any addition of herbal material in the functional food of organism is decisive and depend on the available system of the environment. Most of the phytochemicals exert positive influence on blood sugar, insulin sensitivity, and dyslipidaemia in human being (Mohamed, 2014) [2]. The so called white mulberry, *Morus alba* (L.) belong to an extensive group of trees, the use of which in Far Eastern Medicine is already a centuries-old tradition (Bugała, 2009; Jeszka, *et al*., 2009; Yang, *et al*., 2010) [10, 11, 27]. The leaves of mulberry, *Morus alba* (L) have been used as a therapeutic agent. Nowadays, in alternative type of medicine, the berry fruits, bark and young sprouts of mulberry, *Morus alba* (L) are used (Jiang, *et al*., 2013; Kobus-Cisowska, *et al*., 2013; Yadav, *et al*., 2014) [12, 13, 14].

The paratha is a flat-bread serving as functional food for the population of the Indian subcontinent. In countries like India, Sri Lanka, Pakistan, Nepal and Bangladesh, wheat is the traditional staple. The paratha is prevalent throughout areas of India, Sri Lanka, Pakistan, Nepal and Bangladesh. Paratha is a combination of two or more components in the form of flour into a new functional food entity. Nijjar (1968) reported the earlier references to paratha in his book Panjāb under the sultāns, 1000-1526 A.D. when he writes that parauthas were common with the nobility and aristocracy in the Punjab. The cooking of Punjabi and North Indians are mostly in the form of parathas (Banerji, 2010). Paratha, the most popular unleavened flat bread is made by baking or cooking whole wheat dough on a iron pan (tava), and finishing off with shallow frying. Paratha is thicker and more substantial than other food preparations like chapatis or rotis. Perhaps the most common stuffing for parathas is mashed, spiced leafy vegetable material followed perhaps by dal (lentils). Many other alternatives exist such as leaf vegetables, radishes, cauliflower or paneer. A paratha (especially a stuffed one) can be eaten simply with a pat of butter spread on top or with chutney, pickles, ketchup, dahi or a raita or with meat or vegetable curries. Some roll the paratha into a tube and eat it with tea, often dipping the paratha. With reference to composition, paratha often contains whole wheat flour; leafy vegetables (either in mixed form or in single form) and spices. Day by day, the available sources of leafy vegetables are not going to complete the demand of modern human being. Raising the mulberry garden only for larval instars of silkworm may hamper the life quality of human being in future. Let us think about “Efficient Use of Available System of Knowledge of Mulberry for the qualitative functional food for human being”. The possibility of introducing paratha into a range of functional food may be an interesting and challenging alternative.

On this much background the present attempt on "Utilization of leaves of mulberry, *Morus alba* (L) for the preparation of healthy food, Paratha, the cooked dough" has been planned.

2. Material and Method

The attempt had been completed through the steps like: (1). Collection of requirements; (2). Preparation of dried mulberry leaves and extractives from them; (3). Designing the plan of experiment; (4). Processing for Mulberry Paratha; (5). Biochemical Assessment of Paratha; (6). Sensory Evaluation and (7). Statistical Analysis.

(1). Collection of Requirements

The individual components of the paratha; the leaves of mulberry, *Morus alba* (L); Kitchen-wares and the laboratory instruments are the requirements for the present attempt. Whole Meal Wheat flour (maida), White Wheat Flour, common salt, curry leaves, Herbs de Provence and rapeseed oil are required for the preparation of paratha. The blend of herbs de Provence (rosemary, basil, thyme, sage, peppermint, summer savory, oregano, marjoram) and blended curry leaves spice were from Baramati city of India. Wholemeal wheat flour and white wheat flour were procured from Balaji Traders Pune India. The iodized salt and rapeseed oil were procured through local sailor from Malegaon Colony of Baramati. The kitchen wares used for processing the paratha and the laboratory instruments used for biochemical analysis of paratha belong to Dr. APIS of Shrikrupa residence, Teachers Society of Malegaon Colony Tal. Baramati Dist. Pune.

(2). Preparation of mulberry leaves and extractives from them

The leaves of mulberry, *Morus alba* (L) (variety: Baramatiwali) were collected by hand from the experimental plantation of the Sericulture Unit, Malegaon Sheti Farm, Agricultural Development Trust Baramati, Shardanagar, (Malegaon Khurd) Post Box No - 35, Baramati, Pune 413 115, Maharashtra, India. The leaves were stored in freezer at +5 °C before use. The fresh leaves of mulberry, *Morus alba* (L) (variety: Baramatiwali) were collected through plucking, early in the morning (7.0 – 8.0 a.m.). Fifty percent of the leaves were utilized for the preparation of dried powder and remaining fifty percent of them for the preparation of extractive. The mulberry, leaves were processed for drying through the use of drying chamber (30 °C). Dried leaves were stored closed at room temperature. and used to extract preparation. Dried leaves as a component of flat bread were ground using domestic mixture.

The aqueous extractive of leaves of mulberry, *Morus alba* (L) (variety: Baramatiwali) was obtained in semi-technical scale by a combination of processes: continuous extraction (water at 80-90 °C through the countercurrent distribution method. The Countercurrent distribution (CCD, is technology belongs to analytical chemistry. It was developed by Lyman C. Craig in the 1940s (Moore, Stanford, 1978) [46]. The shredded leaves: water 1:10 (w/w) to obtain 2-4% dry matter after filtration); vacuum concentration (in periodic spherical evaporators at 75 °C, pressure 0.6-0.8 atm.); spray drying (air 180-190 °C to obtain powder of 96-98% of dry matter).

(3). Designing the plan of experiment (table – 1 and Fig.1 A, B, C, D,E)

Whole Meal Wheat flour (maida), White Wheat Flour, common salt, curry leaves, Herbs de Provence and rapeseed oil are required for the preparation of paratha. The quantities of the requirements for the preparation of paratha in present attempt are in percentage. The percent quantity of Whole Meal Wheat flour (maida), White Wheat Flour, common salt, curry leaves, Herbs de Provence and rapeseed oil are fifty percent; ten percent; 0.1 percent; 0.1 percent; 0.2 percent and 7.8 percent respectively. The dried powder of leaves of mulberry, *Morus alba* (L) mixed in the above content was five percent (table – 1). The drinking water was used to make the dough. The parathas were planned to prepare in five groups (types) through the addition of aqueous extractives of fresh leaves of mulberry, *Morus alba* (L) in the above content.

Table 1: Experimental design (Percentage of ingredient material utilized) for the preparation of mulberry paratha in the attempt.

Sr. No.	Ingredient Material Group	Whole Meal Wheat flour	White Wheat Flour	salt	Dried Mulberry Leaves	Mulberry Leaf Extract	Curry Leaves	Herbs de Provence	Rapeseed oil
1	A	50	10	0.1	0	00	0.1	02	7.8
2	B	45	10	0.1	5	05	0.1	02	7.8
3	C	40	10	0.1	5	10	0.1	02	7.8
4	D	35	10	0.1	5	15	0.1	02	7.8
5	E	30	10	0.1	5	20	0.1	02	7.8

The paratha of group (type): "A" was with zero percent of aqueous extractives of fresh leaves of mulberry, *Morus alba* (L).
The paratha of group (type): "B" was with five percent of aqueous extractives of fresh leaves of mulberry, *Morus alba* (L).
The paratha of group (type): "C" was with ten percent of aqueous extractives of fresh leaves of mulberry, *Morus alba* (L).
The paratha of group (type): "D" was with fifteen percent of aqueous extractives of fresh leaves of mulberry, *Morus alba* (L).
The paratha of group (type): "E" was with twenty percent of aqueous extractives of fresh leaves of mulberry, *Morus alba* (L).

(4). Processing for Mulberry Paratha

Through the utilization of required material with respective quantity (table-1), five different variants of the doughs were prepared according to aqueous extractives of leaves of mulberry, *Morus alba* (L). The ingredients were mixed with water. The dough was kneaded by hand to obtain a uniform consistency. The dough was then covered with cotton cloth. It was left for half an hour. The respective dough was divided into ten smaller pieces approximately of equal volume. Each piece of dough was rolled out into a thin cake. It was smeared with oil and folded in half to get a triangle. The resulted matter was used to fry on a Teflon-coated pan at 180 ^{o}C temperature for five minutes.

(5). Biochemical Assessment of Dough and Paratha

The biochemical parameters of the assay sample of dough and paratha from all the five groups in the attempt include: dry matter; ash content; fat content; protein content; total

phenol content; DPPH scavenging activity; ABTS scavenging activity; Fe^{3+} reducing capability; Fe^{2+} chelating capability and sensory evaluation.

(5.a). Dry Matter of the Dough and Paratha

The dry matter assay of the dough and paratha was carried out through the method explained by Shaikh, *et al*. (2007) [16]. One gram of sample (from each group of dough and paratha) was weighed separately and accurately through the use of electronic balance. All the samples were kept for drying in a laboratory oven (Herbatherm, Thermo Scientific) at 105 °C to constant weight. The method was based on a weighting out of known quantity of sample (accuracy of 0.001) followed by drying in a laboratory oven (Herbatherm, Thermo Scientific) at 105 °C to get constant weight. The results were expressed in percent of water content.

(5.b).Fat Content of the Dough and Paratha

The content of fat (percentage) in the assay sample of dough and paratha of the five groups in the attempt was estimated through the method explained by Shaikh, *et al*. (2007) [16]. The five grams of assay sample was separated from each sample separately. The assay sample was then transferred into the thimble. It was then processed for drying and followed by continuous extraction with petroleum ether in the Soxhlet extractor. The flask with a mixture of fat and ether was subjected to evaporation, and then dried. Finally, the resultant material was weighed on electronic balance.

(5.c).Protein Contents of Dough and Paratha

For the estimation of protein content, known quantity of sample was processed for fragmentation followed by homogenization in chilled in chilled distilled water. Clean & sterilized morter & pestle were used for tissue homogenization. Each tissue assay sample was processed for keeping at 37ºC for twenty four hours in the solution of sodium hydroxide of normal (1.0 N) strength. The resulting solution was utilized as assay sample. Well esteemed method of Lowery, *et al*. (1951) [47] was utilized for estimation of protein (total) content in each assay sample of dough and paratha from each group of the attempt. Bioassay of total proteins from assay sample was carried in triplicate (for assay sample three test tubes were taken). One ml assay sample was transferred to each test tube. Addition of 5.0 ml Lower‘s ―C solution was made in each of the test tube mixed well and kept for 15 min to allow the formation of copper protein complex. A blank was also prepared simultaneously. After 15 min, 0.5 ml Folin‘s phenol regent was added to each tube and mixed well. Then they were allowed to develop colour for 30 min at room temperature. After it, the optical density was recorded at 660 nm on spectrophotometer. The results were replicated three times. The protein concentration of assay sample was calculated by referring the optical density obtained for sample and by using standard graph and expressed in the unit as µg proteins per mg tissue.

(5.d).Total Phenol Contents of the Dough and Paratha

The biochemical method explained by Siger, A. (2010) [18] was used for the estimation of total phenol contents in the dough sample and paratha sample from each froup in the attempt. The total phenolic compound content in assay sample was spectrophotometrically determined with the Folin–Ciocalteu procedure through reading the optical density (absorbance) at 765 nm against a methanol as a blank. As a control a solvent of sample was used. The results were expressed as milligrams of total phenol content per gram dry matter for gallic acid (GAE).

(5.e).DPPH Scavenging Activity of the Dough and Paratha

The DPPH is a common abbreviation designated to organic chemical compound “2,2-diphenyl-1-picrylhydrazyl”. It is a dark-colored crystalline powder. It is composed of stable free-radical molecules. Free radical scavenging activity of assay samples of five different types of dough and parathas in the attempt were measured by 1, 1- diphenyl-2-picryl hydrazyl (DPPH). The DPPH solution of 0.1 mM strength in ethanol was prepared. For each assay sample, six different concentrations (5, 10, 15, 20, 25, 30 µg/ml) in ethanol were prepared. One ml of DPPH solution (0.1 mM strength in ethanol) was added in three ml of each concentration of assay sample. Here, only those concentrations of assay sample responsible for making them soluble in ethanol are used. And their various concentrations were prepared by dilution method (Vaidyaratnam, Varier, 2002) [48].

The mixture was shaken vigorously. It was allowed to stand at room temperature for half an hour. The optical density (absorbance) reading for each content was measured at 517 nm through using spectrophotometer (UV-VIS Shimadzu) (Ahmed, *et al*., 2013) [49]. The reference standard compound being used was ascorbic acid. The IC 50 value of the assay sample was calculated through the use of Log dose inhibition curve. The IC 50 value is the concentration of assay sample required to inhibit fifty percent of the free radicals of DPPH. Lower optical density (absorbance) readings for each content of the reaction mixture indicated higher free radical activity (Koleva, *et al*., 2002). The percent DPPH scavenging influence for each assay sample was calculated by using following equation:

$$\left[\frac{\text{Sample O. D.} - \text{Blank O. D.}}{\text{Control O. D.}}\right] \text{X} \frac{100}{1}$$

(5.f). ABTS Scavenging Activity of the Dough and Paratha

ABTS is a common abbreviation designated to organic chemical compound 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid). It is a chemical compound utilized to observe the reaction kinetics of specific enzymes. The method explained by Amarowicz, *et al*. (2002) [19] was used for the determination of ABTS scavenging activity of assay sample. The method is based on the spectrophotometric measurement of the change in optical density (absorbance) at λ=734 nm. The solution of ABTS was prepared the day before utilization. The solution of Potassium Persulfate ($K_2S_2O_8$) and the solution of ABTS were mixed (1:0.5, v/v). This mixture was allowed to keep in darkness for at least 12-16 hrs. On the next day, methanol was used to dilute this mixture for the optical density (absorbance) of 0.700 (±0.020). A solvent of the assay sample was used as a control. The ABTS Scavenging Activity of the assay sample was calculated through the following formula: Percentage of ABTS Scavenging Activity (Percent):

$$= \left[\frac{Control\ O.D. - Sample\ O.D.}{Control\ O.D.}\right] X \frac{100}{1}$$

(5.g).Fe^{3+} Reducing Capability of the Dough and Paratha
Method of Re, *et al*. (1999) was used for the bioassay of Fe^{3+} reducing capability of assay samples. This method is based on the colorimetric measurement of the concentration of Prussian blue which is formed in an Fe^{2+} reaction. This Fe^{2+} reaction is derived from the reduction of Fe^{3+}. The optical density (absorbance) of the content was measured at λ=700nm as mentioned by Re, *et al*. (1999)

(6) The Sensory Evaluation of the Dough and Paratha
Sensory evaluation of paratha evaluation of paratha was performed through use helping hands of hundred individuals studying in the S. Y. B. Sc. Class (Academic Year: 2018 – 2019) at Shardabai Pawar Mahila Mahavidyalaya, Shardanagar Tal. Baramati Dist. Pune India. The sensoric laboratory in equal ambient conditions of Dr. APIS was utilized for this attempt on sensory evaluation of the mulberry paratha. This method belongs to in Tang, *et al.* (2002) [21]. The quality assessment method was with a 10 cm linear scale, non-structured with no boundary marks (highlights: appearance, color, ardiov, smell, texture, overall rating); assessment of preferences using a 9-point hedonic scale with verbal expressions: like very much (9), like a lot (8), rather like (7), quite like (6), neither like, nor dislike (5), dislike a little (4), rather dislike (3), dislike very much (2), highly dislike (1). All individuals were instructed before analysis. Notes were listed on cards according to personal feelings. For quality assessment individuals had to mark graphically the level of desirability. Analysis of results was based on the distance measured on the axis of desirability for each highlight. For assessment of preferences, the individuals had to match one of 9 records for each sample. Each single sensoric evaluation lasted about 10-15 min. Samples were served at a ready-to-eat temperature.

(7). Statistical Analysis
The whole experimentation was repeated for three times. This was for the purpose to get the consistent results. The data was collected and it was subjected for statistical analysis. The statistical parameters considered in the attempt include: mean, standard deviation, percent variation and student "t" – test. Standard statistical methods of analysis prescribed by Norman and Bailey (1955) and explained by Vitthalrao B. Khyade and Manfred Eigen (2018) were followed.

3. Results and Discussion
The results on the attempt on the study entitled "Utilization of leaves of mulberry, *Morus alba* (L) for the preparation of healthy food, Paratha, the cooked dough" are summarized in table- 2, 3, 4, 5 and presented in Fig.2, 3, 4 (A), 4 (B), 5 (A) and 5 (B).
Biologically active herbal ingredients affect the antioxidative system and cardiovascular properties of the human body. This is well documented both in model system and animal studies (Lee, *et al*., 2007; Flaczyk, *et al*., 2013; Tsuduki, *et al*., 2013; Jeszka-Skowron, *et al*., 2014) [25, 23,26 24]. The percentagewise composition of parathas was found variously effected.
The percentage of water in the paratha of group A, B, C, D and E was found measured 28.786 (±3.421); 28.75 (±3.824); 28.772 (±4.643); 28.875 (±3.798) and 28.867 (±5.917) units respectively (table -2).

Table 2: Percentage of water, Ash, Fat and Protein in the five groups of mulberry paratha in the attempt.

Paratha Group	Water	Ash	Fat	Protein
A	28.786** (±3.421)	8.239* (±1.526)	13.162* (±1.843)	3.114* (±0.589)
B	28.759** (±3.824)	8.241** (±1.335)	15.088** (±1.206)	18.683* (±1.786)
C	28.772* (±4.643)	8.987* (±1.431)	13.483* (±1.926)	21.066* (±2.427)
D	28.875** (±3.798)	9.094*** (±1.448)	13.322*** (±1.567)	29.241*** (±4.617)
E	28.867** (±5.917)	9.096*** (±1.146)	12.519** (±1.394)	33.572** (±7.614)

-Each figure is the mean of the three replications.
-Figure with ± sign in the bracket is standard deviation. * : P<0.05;** : P<0.005; ***: P<0.01

Ash content of foodstuff represents the total mineral contents in. Determination of the ash content is having many significant advantages. For example, ash is a part of proximate analysis for analysis of nutritional parameters of the foodstuffs. Ashing is the first step in preparing a food sample for specific elemental analysis. Because certain foods are high in particular minerals, ash content becomes important. One can usually expect a consistency in the quantity estimated from assay sample prepared from animal source foodstuffs. The quantities of ash contents of plant origin food stuff are variable. The percentage of ash in the paratha of group A, B, C, D and E was found measured 8.239 (±1.526); 8.241 (±1.335); 8.987 (±1.431); 9.094 (±1.448) and 9.096 (±1.146) units respectively (table -2).
The percentage of fat in the paratha of group A, B, C, D and E was found measured 13.162 (±1.843); 15.088 (±1.206); 13.483 (±1.926); 13.322 (±1.567) and 12.519 (±1.394) units respectively (table -2).
The percentage of total proteins in the paratha of group A, B, C, D and E was found measured 3.114 (±0.589); 18.683 (±1.786); 21.066 (±2.427); 29.24 (±4.617) and 33.572 (±7.614) units respectively (table -2). The contribution of protein in variants has been estimated at from 3.114 percent to 33.572 percent. The paratha of group "A" in the attempt was without the aqueous mulberry leaves extractives (AMLE). Addition of aqueous mulberry leaves extractives (AMLE) in the pre-required material was found improving the quality of paratha through significant contribution of proteins. Addition of aqueous mulberry leaves extractives (AMLE) in the pre-required material in present reporting upward trend of improvement in the protein contents in functional food (paratha). The variability in the ash, fat and water content of the paratha groups in the attempt could be associated with the increase in the protein contents. The increase in the aqueous mulberry leaf extractives (AMLE) in the materials required for paratha in the present attempt was found reported into increase in the protein, fat and ash contents of parathas. Protein contents of paratha deserve significantly improved quality.
The polyphenol contents in the dough and paratha of group "A" was found measured 2.654 (±0.913) and 1.429 (±0.057) units respectively (table- 3 and fig. 3). The paratha is the processed product of dough. The processing involve mixing the required material through the use of water; kneading the

dough by hand for consistency; keeping it with covered by cotton cloth for half an hour; rolling the pieces of dough into a thin cake; smearing with oil; folding in half to get a triangular shape and frying on a Teflon-coated pan at 180 ºC temperature for five minutes. The process of frying on a Teflon-coated pan at 180ºC temperature for five minutes is the only step responsible to change the dough into paratha. Other steps in the process of preparation of paratha are physical. In the type "A" paratha, there was 46.156 percent decrease in the polyphenol contents in comparasion with dough. The type "A" paratha was without the ingredients of leaves of mulberry, *Morus alba* (L). The polyphenol contents in the dough and paratha of group "B" was found measured 2.963 (±0.764) and 2.917 (±0.034) units respectively (table- 3 and fig. 3). In the type "B" paratha, there was 01.552 percent decrease in the polyphenol contents in comparasion with dough. The type "B" paratha was derived from the dough with five percent dried powder and five percent of aqueous mulberry leaf extractives (AMLE). The polyphenol contents in the dough and paratha of group "C" was found measured 3.225 (±0.853) and 3.156 (±0.034) units respectively (table- 3 and fig. 3). In the type "C" paratha, there was 02.139 percent decrease in the polyphenol contents in comparison with dough. The type "C" paratha was derived from the dough with five percent dried powder and ten percent of aqueous mulberry leaf extractives (AMLE). The polyphenol contents in the dough and paratha of group "D" was found measured 4.023 (±0.911) and 3.645 (±0.056) units respectively (table- 3 and fig. 3). In the type "D" paratha, there was 01.552 percent decrease in the polyphenol contents in comparasion with dough. The type "D" paratha was derived from the dough with five percent dried powder and fifteen percent of aqueous mulberry leaf extractives (AMLE). The polyphenol contents in the dough and paratha of group "E" was found measured 4.358 (±0.843) and 3.889 (±0.197) units respectively (table- 3 and fig. 3). In the type "E" paratha, there was 01.552 percent decrease in the polyphenol contents in comparasion with dough. The type "E" paratha was derived from the dough with five percent dried powder and twenty percent of aqueous mulberry leaf extractives (AMLE).

Table 3: Polyphenol contents of the five groups of mulberry paratha in the attempt.

Paratha Group	Polyphenol contents (mg GAE/gm dry matter of Dough)	Polyphenol contents (mg GAE/gm dry matter of Paratha)	Percent Change
A	2.654** (±0.913)	1.429* (±0.057)	- 46.156
B	2.963** (±0.764)	2.917** (±0.034)	- 01.552
C	3.225* (±0.853)	3.156* (±0.078)	- 02.139
D	4.023* (±0.911)	3.645* (±0.056)	- 09.395
E	4.358*** (±0.843)	3.889** (±0.197)	- 10.761

-Each figure is the mean of the three replications.
-Figure with ± sign in the bracket is standard deviation. * : $P<0.05$;** : $P<0.005$; ***: $P<0.01$

The paratha is the processed product of dough. The processing involve mixing the required ingredients through the use of water; kneading the dough by hand for consistency; keeping it with covered by cotton cloth for half an hour; rolling the pieces of dough into a thin cake; smearing with oil; folding in half to get a triangular shape and frying on a Teflon-coated pan at 180 ºC temperature for five minutes. The process of frying on a Teflon-coated pan at 180ºC temperature for five minutes is the only step responsible to change the dough into paratha. Other steps in the process of preparation of paratha are physical. The process of frying the thin sheets of dough for paratha is reducing the polyphenol contents. It is well known fact that polyphenolic compounds are heat unstable compounds. High-temperature processes could damage (Lim, *et al*., 2011) [29]. Addition of the mulberry leaf powder and "Aqueous Mulberry Leaf Extractive (AMLE)" in the initial material for preparation of dough in the present attempt making the paratha with significant quantity of the polyphenols. The contents of leaves of mulberry, *Morus alba* (L) is a recommendable source of phenolics for paratha type of functional food for human health.

The DPPH scavenging ability of the dough and paratha of group "A" was found measured 8.533 (±0.274) and 6.123 (±0.639) units respectively (table- 4 and fig. 4.A and 4.B). In the type "A" paratha, there was 28.243 percent decrease in the ability of DPPH scavenging in comparison with dough. The scavenging DPPH scavenging ability of the dough and paratha of group "B" was found measured 13.462 (±1.078) and 8.795 (±0.917) units respectively (table- 4 and fig. 4.A and 4.B). In the type "B" paratha, there was 34.66 percent decrease in the ability of DPPH scavenging in comparison with dough. The scavenging DPPH scavenging ability of the dough and paratha of group "C" was found measured 13.912 (±1.114) and 10.631 (±1.213) units respectively (table- 4 and fig. 4.A and 4.B). In the type "C" paratha, there was 23.583 percent decrease in the ability of DPPH scavenging in comparison with dough. The scavenging DPPH scavenging ability of the dough and paratha of group "D" was found measured 14.789 (±1.927) and 11.346 (±2.018) units respectively (table- 4 and fig. 4.A and 4.B). In the type "D" paratha, there was 23.281 percent decrease in the ability of DPPH scavenging in comparison with dough.

The scavenging DPPH scavenging ability of the dough and paratha of group "E" was found measured 17.134 (±2.891) and 13.366 (±2.687) units respectively (table- 4 and fig. 4.A and 4.B). In the type "E" paratha, there was 21.991 percent decrease in the ability of DPPH scavenging in comparison with dough. DPPH (2,2-diphenyl-1-picrylhydrazyl) is a well known radical. It is a trap (scavenger) for other radicals. Therefore, rate reduction of a chemical reaction upon addition of DPPH is used as an indicator of the radical nature of that reaction. At 520 nm, the DPPH deserve deep violet color in solution. This is because of a strong absorption band centered at about 520 nm for the DPPH. In neutralized condition, this DPPH becomes colorless or pale yellow in color. This property of DPPH allows visual monitoring of the reaction, and the number of initial radicals can be counted from the change in the optical absorption at 520 nm or in the EPR signal of the DPPH.

In the process of reduction reaction, reducing agent transfers electrons to another substance. After the transfer of electron, the given substance is labeled as "oxidized". As it gives

electrons, it is also called an electron donor. Electron donors can also form charge transfer complexes with electron acceptors. Reductants serve to play a key role in tissue. The ferrous ions [Fe^{2+}] and ferric ions [Fe^{3+}] are good reducing agents. Recently there has been growing interest in research into the role of plant derived antioxidants in food and human health. The beneficial influence of many foodstuffs and beverages including fruits, vegetables, tea, coffee, and cacao on human health has been recently recognized to originate from their antioxidant activity. For this purpose, the most commonly method used in vitro determination of reducing capacity of pure food constituents or plant extracts is [Fe^{3+}] reducing ability. Ferric reducing ability of plasma (FRAP, also Ferric ion reducing antioxidant power) is an antioxidant capacity assay that uses Trolox as a standard. This assay is often used to measure the antioxidant capacity of foods, beverages and nutritional supplements containing polyphenols. Abilities of reduction of ferric ions [Fe^{3+}] in the dough and paratha of "A" group in the present was found measured 0.618 (±0.006) and 0.656 (±0.007) units respectively. Abilities of reduction of ferric ions [Fe^{3+}] in the dough and paratha of "B" group in the present was found measured 0.721 (±0.007) and 0.732 (±0.234) units respectively. Abilities of reduction of ferric ions [Fe^{3+}] in the dough and paratha of "C" group in the present was found measured 0.871 (±0.004) and 0.888 (±0.005) units respectively. Abilities of reduction of ferric ions [Fe^{3+}] in the dough and paratha of "D" group in the present was found measured 0.817 (±0.013) and 0.881(±0.0080) units respectively. Abilities of reduction of ferric ions [Fe^{3+}] in the dough and paratha of "E" group in the present was found measured 0.858 (±0.011) and 0.869 (±0.014) units respectively (table – 5).

The process of frying the functional food material caused a reduction in scavenging activity of DPPH as pointed out by Katsube *et al*.(2009). There is loss of water in the process of frying. The loss of water is through condensation with the absorption of oil, theoretically, were expected to increase the polyphenols concentration. Practically, the present attempt is reporting loss of polyphenols. Indeed, one could even notice a slight increase in it. This phenomenon can be explained by the formation of melanoidal compounds during the Maillard reaction. The chemical reaction between the reducing sugars and amino acids yields the Maillard Reaction Products (MRP). The intermediate compounds (may be called as reactive intermediates) are formed through many of pathways. They can yield both volatile flavour components and brown melanoidins of higher molecular weight. The formation of these compounds is expected and desirable through the heating or cooking of many food products, like: meat, coffee, bread, ..etc. The occurrence of these compounds in food products during storage is undesirable. These compounds are responsible to a reduction of food products in quality. According to Holtekjolen, *et al*. (2008) [33]; Katsube, *et al*. (2009) [32] and Jing & Kitts (2912), Maillard Reaction Products (MRP) Maillard reaction products (MRP) can cause increasing ABTS inhibition (Holtekjolen, *et al*., 2008; Katsube, *et al*., 2009; Jing & Kitts, 2912) [33, 32]. This is particularly reported in the type "A" paratha in the present attempt. In comparison with the dough, the polyphenol contents in the type "A" paratha in the present attempt were found reduced about 46.156 percent. Analysis of dough and paratha both for ABTS and DPPH tests allow the determination of the antioxidant activity. According to Monika Przeor and Ewa Flaczyk (2016) [50], the difference between these tests is the antioxidant system to which it is applicable. The ABTS test is based on cation radical, which is applicable to hydrophilic and lipophilic systems, whilst the DPPH assay refers to the radical dissolved in organic media and is applicable to hydrophobic antioxidant systems.

Table 4: Sensory evaluation of the paratha prepared from the dough with mulberry leaf powder and aqueous mulberry leaf extractives (AMLE) (Method: Nine Point Hedonic Scale With Verbal Expression and writing on the paper).

Paratha Group Parameters	A	B	C	D	E
Appearance	36.9 (±4.385)	45.0 (±6.152)	49.5 (±5.946)	41.6 (±4.943)	36.0 (±4.611)
Colour	37.8 (±4.436)	47.7 (±4.892)	45.0 (±4.473)	48.6 (±5.774)	36.0 (±5.182)
Smell	38.7 (±4.385)	40.5 (±5.786)	41.4 (±2.724)	36.0 (±4.385)	31.5 (±4.783)
Taste	29.7 (±5.753)	37.8 (±4.336)	40.5 (±4.385)	36.0 (±4.277)	35.1 (±4.984)
Fragility	32.4 (±4.o69)	40.5 (±4.365)	43.2 (±5.118)	38.7 (±4.598)	31.5 (±5.885)
Overall Grading	32.4 (±6.954)	40.5 (±3.337)	43.2 (±5.238)	38.8 (±5.186)	31.5 (±5.139)

Sensory evaluation of the designed flat bread Paratha was produced in five variants with different amounts of aqueous mulberry leaf extractives (AMLE) replaced the wholemeal flour. The aqueous mulberry leaf extractives (AMLE) provided a specific flavor and smell for the product, which was masked by curry and herbs de Provence. The spices increased the antioxidant levels in the final product and also affected the color (yellow). Wholemeal flour also increased the nutritional value of product (Silván, *et al*., 2005; Rzedzicki and Kasprzak, 2009) [41].

Parathas in the present attempt were evaluated by a group of hundred individuals (table-6 and Fig. 6). A linear ten centimeter scale aimed to show the desirability and the quality of the parathas. However, the nine point hedonic scale (Like Extremely; Like Very Much; Like Moderately; Like Slightly; Neither Like nor Dislike; Dislike Slightly; Dislike Moderately; Dislike Very Much; Dislike Extremely) was to illustrate the desirability for each variant of paratha by fitting the verbal expressions to scale (Tang, *et al*., 2002) [21].

Conclusion

Increase in the temperature get effected into the reduction in the polyphenol contents of functional food. The applied frying process had a destructive influence on the polyphenols, the content of which in the final product was statistically significantly lower. Increase in the mulberry leaf powder and aqueous mulberry leaf extractives (AMLE) in the dough exert significant influence on the paraathas with reference to antioxidation. The study should extend for evaluation of mulberry leaf parathas with several ranges of commercial like: frozen paratha especially in Western markets where consumers seek authenticity, but lack the time or the skills required to make a paratha from scratch. Ready-to-cook paratha may also be studied. These

parameters offer one-step preparation and save time and avail safe functional food for human being.

5. References

1. Huber L. Styles of adaptative mechanisms to situations of stress among people of different age and the 21st century civilization diseases, Problemy Higieny i Epidemiologii 2010;91(2):268-275.
2. Mohamed S. Functional foods against metabolic syndrome (obesity, diabetes, hypertension and dyslipidemia) and cardiovascular disease, Trends in Food Sci Technol, 2014;35(2):114-128.
3. Piana N, Battistini D, Urbani L, Romani G, Fatone C, Pazagli C *et al*, Multidisciplinary lifestyle intervention in the obese: Its impact on patients' perception of the disease, food and physical exercise, Nutr Met Cardio Dis, 2010;23(4):337-343.
4. Annunziata A, Vecchio R. Functional foods development in the European market: a consumer perspective, J Fun Foods, 2013;3:223-228.
5. Chang HH, Functional food consumption and depression among the elderly- what can we learn from a longitudinal survey?, Econ Model, 2013;33:187-193.
6. Bornkessel S, Bröring S, Omta SWFO, van Trijp H. What determines ingredients awareness of consumers? A study on ten functional food ingredients, Food Qua Pref 2014;32C:330-339.
7. Pang G, Xie J, Chen Q, Hu Z. How functional foods play critical roles in human health, Food Sci Hum Well, 2012;1(1):26-60.
8. Baboota RK, Bishnoi M, Ambalam P, Kondepudi KK, Sarma SM, Boparai RK *et al*. Functional food ingredients for the management of obesity and associated co-morbidities, J Fun Foods 2013;5:997-1012.
9. Świderski F, Kolanowski W. Functional and dietetic foods, (Scientific and Technical Publishing) Warsaw, Poland) 2003.
10. Bugała W, Morwa Biała, Przewodnik, Drzewa i Krzewy. (National Publishing House of Agriculture and Forestry, Warsaw, Poland) 2009.
11. Jeszka M, Kobus-Cisowska J, Flaczyk E. Mulberry leaves as a source of biologically active compounds, Postępy Fitoterapii 2009;3:175-179.
12. Jiang DQ, Guo Y, Xu DH, Huang YS, Yuan K, Lv ZQ, Antioxidant and anti-fatigue effects of anthocyanins of mulberry juice purification (MJP) and mulberry marc purification (MMP) from different varieties mulberry fruit in China, Food Chem Toxicol 2013;59:1-7.
13. Kobus-Cisowska J, Gramza-Michałowska A, Kmiecik D, Flaczyk E, Korczak J. Mulberry fruit as an antioxidant component in muesli, Agric Sci 2013;4(5B):130-135.
14. Yadav P, Garg N, Kumar S. Improved shelf stability of mulberry juice by combination of preservatives, Indian J Nat Prod Resour 2014;5(1):62-66
15. Popović Z, Smiljanić M, Kostić M, Nikić P, Janković S. Wild flora and its usage in traditional phytotherapy (Deliblato Sands, Serbia, South East Europe), Indian J Tradit Knowle 2014;13(1):9-35.
16. Shaikh IM, Ghodke SK, Ananthanarayan L. Staling of chapatti (Indian unleavened flat bread), Food Chem, 2007;101:113-119.
17. Association of Official Analytical Chemists, Official methods of analysis (Washington DC) 2000.
18. Siger A. The use of instrumental methods to analyze phenolic compounds, In: Food Analysis: selected methods of qualitative and quantitative determinations of food ingredients, edited by M Nogala-Kałucka, (Poznan University of Life Sciences Press, Poznan), 2010.
19. Amarowicz R, Pegg RB, Bautista DA. Antibacterial activity of green tea polyphenols against Escherichia coli K12, Food/Nahrung 2002;44(1):60-62.
20. Oktay M, Gulcin I, Kufrevioglu OI. Determination of in vitro antioxidant activity of fennel (*Foeniculum vulgarae*) seeds extracts, Lebensmittel-Wissenschaft Technologie 2003;36:263-271.
21. Tang SZ, Kerry JR, Sheehan D, Buckley DJ. Antioxidative mechanisms of tea catechins in chicken meat system, Food Chem 2002;76:45-51.
22. Baryłko-Pikielna N, Matuszewska I. Sensory food testing, (PFTS Publishing, Krakow) 2009.
23. Flaczyk E, Kobus-Cisowska J, Przeor M, Korczak J, Remiszewski M, Korbas E *et al*. Chemical characterization and antioxidative properties of Polish variety of Morus alba L. leaf aqueous extracts from the laboratory and pilot-scale processes, Agric Sci 2013;4(5B):141-147.
24. Jeszka-Skowron M, Flaczyk E, Jeszka J, Krejpcio Z, Król E, Buchowski MS. Mulberry leaf extract intake reduces hyperglycemia in streptozotocin (STZ)-induced diabetic rats fed high-fat diet, J Fun Foods 2014;8:9-17.
25. Lee CY, Sim SM, Cheng HM. Systemic absorption of antioxidants from mulberry (Morus alba L) leaf extracts using an in situ rat intestinal preparation, Nutr Res, 2007;27:492-497.
26. Tsuduki T, Kikuchi I, Kimura T, Nakagawa K, Miyazawa T. Intake of mulberry 1-deoxynojirimycin prevents diet-induced obesity through increases in adiponectin in mice, Food Chem, 2013;139:16-23.
27. Wang WX, Yang HJ, Bo YK, Ding S, Cao BH. Nutrient composition, polyphenolic contents, and in situ protein degradation kinetics of leaves from three mulberry species, Livestock Sci 2012;146(2, 3):203-206.
28. Grajek W, Role of antioxidants in reducing the occurrence risk of cancer and cardiac vascular diseases, Food Sci Technol Qual 2004;1(38):3-11.
29. Lim Ho S, Park So H, Ghafoor K, Hwang Sung Y, Park J. Quality and antioxidant properties of bread containing turmeric (*Curcuma longa* L.) cultivated in South Korea, Food Chem 2011;124:1577-1582.
30. Przeor M, Flaczyk E. Effect of air-drying temperature on antioxidant activity in mulberry (*Morus alba* L.) shoots and leaves, Adv Agric Sci Prob Iss, 2011;569:277-283.
31. Cheynier V. Polyphenols in foods are more complex than often thought, Am J Clin Nutr 2005;81(1):223S-229S.
32. Katsube T, Tsurunaga Y, Sugiyama M, Furunod T, Yamasaki Y. Effect of air-drying temperature on antioxidant capacity and stability of polyphenolic compounds in mulberry (*Morus alba* L.) leaves, Food Chem 2009;113:964-969.
33. Holtekjolen AK, Baevre AB, Rodbotten M, Berg H, Knusten SH. Antioxidant properties and sensory

profiles of breads containing barley flour, Food Chem, 2008;110:414-421.
34. Jing H, Kitts DD, Chemical and biochemical properties of casein-sugar Maillard reaction products, Food Chem Toxicol, 2012;40(7):1007-1015.
35. Yu XY, Zhao MY, Hu J, Zeng ST, Bai XL. Correspondence analysis of antioxidant activity and UV-Vis absorbance of Maillard reaction products as related to reactants, Food Sci Technol 2012;46(1):1-9.
36. Chang LW, Juang LJ, Wang BS, Wang MY, Tai HM, Hung WJ, Chen YJ *et al*, Antioxidant and antityrosinase activity of mulberry (*Morus alba* L.) twigs and root bark, Food Chem Toxicol, 2011;49:785-790.
37. Huang D, Ou B, Prior RL. The chemistry behind antioxidant capacity assay, J Agric Food Chem 2005;53:1841-1856.
38. Naczk M, Shahidi F. Extraction and analysis of phenolics in food, J Chromatogr A, 2004; 1054(1-2):95-111.
39. Jomova K, Valko M. Advances in metal-induced oxidative stress and human disease, Toxicology 2011;283:65-87.
40. Silván JM, van de Lagemaat J, Olano A, del Castillo MD. Analysis and biological properties of amino acid derivates formed by Maillard reaction in foods, J Pharmaceut Biomed Anal 2006;41:1543-1551.
41. Rzedzicki Z, Kasprzak M. Study of chemical composition selected assortments of bread, Bromatologia i Chemia Toksykologiczna, 2009;XLII(3) 277-281.
42. Gunathilake KDPP, Ranaweera KKDS. Antioxidative properties of 34 green leafy vegetables. J. Funct. Foods 2016;26:176-186.
43. Prior RL. Oxygen radical absorbance capacity (ORAC): New horizons in relating dietary antioxidants/bioactives and health benefits. J. Funct. Foods 2015;18:797-810.
44. Gunathilake KDPP, Ranaweera KKDS, Rupasinghe HPV. Change of phenolics, carotenoids, and antioxidant capacity following simulated gastrointestinal digestion and dialysis of selected edible green leaves. Food Chem. 2018;245:371-379. [PubMed].
45. Rutuja Ashok Kadam, Nivedita Dattatray Dhumal, Vitthalrao Bhimasha Khyade. The Mulberry, *Morus alba* (L.): The Medicinal Herbal Source for Human Health. International Journal of Current Microbiology and Applied Sciences ISSN: 2319-7706 Int. J. Curr. Microbiol. App. Sci 2019;8(4):2941-2964
46. Moore, Stanford "Lyman Creighton Craig 1906-1974". National Academy of Sciences Biographical Memoirs 1978, 49-77. Retrieved 2016-02-26.
47. Lowery OH, Rosenbrough NJ, Far AL, Randall RJ. Protein measurement with folin phenol reagent. J. Biol. Chem 1951;193:265-275.
48. Vaidyaratnam, Varier, PS, Indian Medicinal Plants- A Compendium of 500 species, I, Orient longman publishing house, Kottakkal-India 2002, 146.
49. Ahmed M, Saeed F, Mehjabeen, Noor Jahan. “Evaluation of Insecticidal and Antioxidant activity of selected Medicinal plants” Journal of Pharmacognosy & Phytochemistry 2013;2(3):153-158.
50. Monika Przeor, Ewa Flaczyk. Antioxidant properties of paratha type flat bread enriched with white mulberry leaf extract Indian Journal of Traditional Knowledge 2016;15(2):237-244.