Development & Analysis of Hypoglycemic Effects of Wheat Flour, Chickpea & Coriander Bread

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Abstract

Spices have long been considered medicinal foods. Seed spices are an important area of agricultural commodities that contribute significantly to our country's economy. Most of the spices have nutritional value and potential to cure different diseases. Coriander is also the spice which is helpful in reduction of blood cholesterol level, blood sugar level, hypertension and hepatoprotective role. The coriander is added in chickpea flour-based biscuits to increase their nutritional value. These biscuits are good for consumption of diabetic and hypercholesterolemia patients. The analysis of bread was performed after making different treatments. The values of moisture content of chickpea flour-based bread were 1.4% to 3.88% respectively. Mean value of crude fat content of coriander powder based breads ranges from 15.24 % and 27.18 %. Mean values of protein content in different treatments have been documented andranging from 17.78% to 20.26%.The mean values for ash content in different treatments ranges from 4.92g/100g of the developed product. TFC content varied from 20.17 to 57.72 QE/g. The mean values of total phenolics varied from 24.01 to 69.49 in different treatments. The mean values of DPPH content were in range of 27.62 to 71.28 in different treatments. Iron content of bread ranges from 1.17mg/100g to 3.35mg/100g. The mean zinc content in cookies created with various treatments, ranges from to 1.74mg/100g to 4.26mg/100g. The results have demonstrated that the T_3 and T_6 are best treatments and also these have best consumer acceptability. The more acceptability of these two treatments is due to balanced amount of chickpea flour and coriander powder.

Key words: **Chickpea, Coriander, Bread, Spices**

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Introduction

Spices have long been considered medicinal foods. Seed spices are an important area of agricultural commodities that contribute significantly to our country's economy. Most of the spices have nutritional value and potential

to cure different diseases. Coriander is also a type of spice which is helpful in Lowering of blood cholesterol level, blood sugar level, and hypertension. The coriander is added in chickpea flour-based bread to increase their nutritional value. This type of breads is good for consumption of diabetic and hypercholesterolemia patients. Moreover, the plants are natural sources of different products, including phytochemicals, polyphenols, flavonoids, and phenolic compounds. These phytochemicals act as free radical scavengers and anti-oxidants. An annual Apiaceae plant often known as Chinese parsley or cilantro in the United States, it's a member of that family.According to its geographical origins, coriander is indigenous to a wide range of regions, including Central Asia, the Near East, and Abyssinia. Coriander is also known as Cilantro, Dhaniya, Persil Arabe, and Persil Chinois, as well as Dhania Chinese Parsley and Coriander Essential Oil (Lopes *et al.,* 2014). It is cultivated for its pleasant herbal scent and used in Asian cuisines of the region. It has strong therapeutic benefits, whether it is utilized as leaves or whole seeds in ground form. It can be used with a variety of publications. Coriander has been studied extensively as a medicinal crop (Saxena and Agarwal, 2019).

Linalool, the major molecule contained in seeds, is known for its ability to affect numerous important disease pathogenesis pathways. Aside from its moderating effects, C. sativum's powerful anti-oxidant capacity is a fundamental mechanism for its protection against neurodegenerative disorders, cancer, and metabolic syndrome (Prachayasittikul*et al.,* 2018). Coriander plant acts as carminative, Diuretic, treatment of nausea, vomiting, seasonal flu, cold, fever, and other digestive issues or Gut issues. Dry coriander is used to cure diarrhea and chronic dysentery and prevent acidity (Kaium, 2013). Coriander aerial portions contain large levels of polyphenolic chemicals, caffeic acid, protocatechuic acid, and glycitin. Neuroprotective and anti-oxidant effects of Coriander Sativum have also been shown to lower Alzheimer's disease risk (Kacániová*et al.,* 2020). In a study, coriander extracts were found to reduce hyperglycemia while boosting glucose absorption, metabolism, and insulin production (Jelodar *et al.,* 2007). To reduce LDL and VLDL levels while increasing HDL considerably by adding coriander to the diet (Dhanapakiam *et al.,* 2007).

Incorporating beans into controlling and preventing metabolic illnesses, including diabetes, heart disease, and colon cancer, a person's regular diet offers several physiological advantages. One of the most important crops globally is legumes like beans and chickpeas because of their high nutritional content. Since ancient times, pulses have been commonly grown crops all across the globe(Arefian *et al.,* 2014). The future of the food market places a greater premium on food safety and the demand for environmentally responsible protein sources. Because the majority of people are adopting a vegan diet, researchers are concentrating on the many plant foods that contain protein. Chickpeas are a food that is strong in protein but are very inexpensive (20–22 percent) (Sandhu and Lim, 2008).

Chickpeas are served as one of the most abundantly consuming legumes worldwide. The high protein content shows a high nutritional level and the supply of active peptides; moreover, it contains a variety of metabolites with pharmacological actions. Several chickpea chemicals have discovered anti-oxidant, antihypertensive, hypocholesterolemic, and anti-cancer properties. Phytates, saponins, and phenolic substances have been found in protein hydrolysates and alcoholic extracts, making their consumption a feasible choice for lowering the risk of chronic degenerative diseases (Faridy*et al.,* 2020). Cysteine and methionine concentrations in chickpea seeds are lower than in grains, whereas lysine and arginine concentrations are higher. Lysine, on the other hand, is a limiting amino acid because of the abundance of sulfur-based amino acids in grains

(Rachwa-Rosiak *et al.,* 2015). The regular use of grains and pulses, such as dhal with rice or chapatti, is common in Indian cuisine. Protein quality may be improved by supplementing certain amino acid shortages with grains and legumes, which helps maintain the body's normal amino acid balance (Sánchez-Chino *et al.,* 2019).

In comparison to other phenolic acids and flavonoids, chlorogenic acid and quercetin have a greater level of concentration (Thavarajah, 2012). Xanthophylls, cryptoxanthin, and beta-carotene are among the carotenoids found in chickpea seeds. It is important to include carotenoids in diet since they promote iron absorption in the human body. Cancer and tumor-fighting capabilities have been discovered in the canthaxanthin compound (Welch, 2002).

The main objective for the present project is to

- To prepare coriander and chickpea composite flour Bread & evaluating the physico chemical properties of the developed Bread
- To evaluate the nutritional benefits of developed bread

Material and Methods

3.1 Sample preparation

Coriander seeds are soaked in water to remove the impurities. After cleaning purpose, the seeds were air dried and then followed by grinding with help of electrical grinder. Finally, the chickpea flour was also sieved and mix with coriander powder for the development of bread.

3.2 Preparation of composite flours

The chickpea flour, coriander powder and wheat flour were blended in different proportions. Then, packaged them into polypropylene bags for storage purpose and analysis.

3.3 Treatment plan

Treatments	Wheat flour	Chickpea flour	Coriander powder
T_1	30%	70%	0
T_2	40%	0	60%
T_3	40%	30%	30%
T_4	60%	40%	0
T_5	60%	0	40%
T_6	60%	20%	20%

3.4 Analysis

3.4.1 Moisture content

The AOAC standard technique was used to measure the Bread's moisture content. After chopping up the 5g of bread into China plates, the hot air oven was set to 1050C for around 24 hours. The sample was taken out after 24 hours and placed it in desiccator for about 6-10 minutes. Then checked the weight of the sample 3-4 and noted it. After this place the China dishes again in the hot air oven till the constant weight was achieved. Then used the given formulae to calculate the total moisture contents in the dried sample.

$$\text{Moisture (\%)} = \frac{\text{weight of fresh sample (g) - weight of dried sample (g)}}{\text{weight of fresh sample (g)}} \times 100$$

3.4.2 Ash Content

The ash content of bread was measured by the standard methods given in AOAC, (2016). In this procedure the 2g of sample was taken in previously weighed china dishes and then charred them on the burner. After this place the china dishes in muffle furnace at temperature of 5500C for 4 to 5 hours. Then removed the

china dishes for furnace and placed it in desiccator before weighing them. Then amount of ash in these samples was measured by the given formula.

$$\text{Ash (\%)} = \frac{\text{weight of ash (g)}}{\text{weight of sample (g)}} \times 100$$

3.4.3 Crude Fat content

The fat content of the different samples of developed breads were determined by using standard procedures of AOAC, (2016). For measurement of crude fat, the moisture free sample was taken and then the Soxhlet apparatus was used for further procedure. 5g of moisture free sample was taken in different thimbles and wrapped it with filter paper. After wrapping placed them in the extraction tubes of the Soxhlet apparatus. In additional weighed the conical flasks and also attached them with extraction unit. After this added 40ml of n-hexane in each conical flask and set the temperature conditions to boiling for 2 hours, 15 minutes washing and 15 minutes drying. Moreover, the chiller was also attached with the extraction system for condensation process of the evaporated solvent. During this process the hexane was boiled, condensed and evaporated while passing through the sample present in thimbles for extraction of fat. The process was continued for two hours until all the fat was extracted from samples and collected in conical flasks. After this pour the sample into pre weighed petri dish and leave it in oven for about 1-2 hours to evaporate all the solvents from the samples. Then, cool the samples in desiccator and weighed them again. After this calculate the fat content from the following formula.

$$\text{Crude fat (\%)} = \frac{\text{weight of sample (g) - weight of fat freesample (g)}}{\text{weight of sample (g)}} \times 100$$

3.4.4 Crude Protein content

The kjeldahl method outlined in AOAC was used to determine the crude protein content of several bread samples. 2g of dried samples were taken and put them in digestion flask for digestion process. After this added 30ml of concentrated H2S04, 5g of digestion mixture and digestion tablets in the flask and weight till the transparent material was obtained in the flask after digestion process completed. Then diluted the digested material at the concertation of up to 250ml.Then, using a distillation device, they extracted 10 ml of the digested material and distilled it with 40 percent NaOH. To remove the ammonia, 4 percent boric solution with the methyl red indicator was used in this technique, which condensed the ammonia. The distillate that was obtained at the end then titrated it with 0.1N H2SO4 solution which was present in burette. The process was done until the golden yellow color appeared at the end. Then calculate the protein content by using following formulas.

$$(\%)\ \text{Nitrogen} = \frac{\text{volume of 0.1N } H_2SO_4 \text{ used (mL)} \times \text{volume of sample} \times 0.0014}{\text{weight of sample (g)} \times \text{volume of sample before dilution (ml)}} \times 100$$

$$\text{Crude protein}(\%) = \text{Nitrogen}(\%) \times 6.25 \text{ (Correction factor)}$$

3.4.5 Total Flavonoid content

The total flavonoids of the developed breads were measured by the method described by Saxena and Agarwal, (2019). The flavonoid solution of methanol was prepared by mixing 0.5ml volume of standard oil and 10ml of liquid in the flask. The different reagents were used to measure the level of flavonoids in the samples. The 5%of NaNo2 solution was mixed in 0.3ml volume. Then this solution was also added in the solution that was present in the flask. After that left this for 5 to 6 minutes for their proper mixing. When this mixture was settled down then add 10% solution of ALCL3 in the preexisting mixture. Then the whole solution was mixed for about 5 minutes with the help of

shaking. After this the 2ml of distilled water was added in the above solution and placed the mixture in shadow for several time. Then the absorbance of the prepared was detected at 510nm with the help of machine known as spectrophotometer. The reading was noted and it give the value of flavonoid content as quercetin equivalent mg/10g of the fresh sample.

3.4.6 Total phenolic content

Breads were tested for total phenolics using the method outlined by Saxena and Agarwal (2019). Folin-Ciocalteu assay was used to determine the total phenolic content of the raw material using Quercetin and Gallic acid. Reagent and Na2CO3 solution are added to 2g of raw material, which is subsequently dissolved in 0.5 mL of reagent. Using a spectrophotometer set at 725 nm, the solution was combined with 10 mL of distilled water after 20 minutes. Quercetin and gallic acid standard curves were produced using a standard gallic acid and quercetin solution at various concentrations such as 0, 1, 2, 3, 4, 5, and 10 mg/ml. The same chemicals and conditions were used to make a blank solution as were used to make the standard and sample solutions. The absorbance values were recalculated after the sample preparation. Analysis was performed in triplicate, with the standards, samples, and blanks protected from direct sunlight.

3.4.7 Antioxidant analysis

The total antioxidants of the different treatment of breads were measured by methods described by Mohite and Waghmare, (2020).The data was also evaluated using one-way ANOVA (one-way analysis of variance) (one-way analysis of variance). The SPSS 13.0 application was then used to undertake statistical analysis of the data. The shaking of the mixture was done for about 2 hours by using shaker machine. Then 2mg solution of DPPH was made by mixing it with 50ml of methanol solution. Then mixed the prepared solution with 25 µl methanol extract. Stored the mixture in the darker area for completion of reaction. Then measured its absorbance at 515nm with the help of spectrophotometer.

3.4.8 Mineral analysis

The iron and zinc contents of the developed bread was measured by using flame photometer and atomic absorption spectrophotometer and through method described by AOAC, (2016). 0.5g of moisture free sample was used for mineral analysis in a separate conical flask. The concentrated solution of HNO3 was added in the flask containing 10ml volume. Then heated the sample at low flame that is temperature about 85ºC till the fumes of yellow colored appeared out. Then added the 6ml of HCLO4 in the flask and again heated the flask at temperate of 180ºC. Stirred the solution continuously with the help of stirrer till yellow-colored fumes appeared in the sample. When the content in the flask remained 1-2ml then stopped the heating procedure. Then content in the flask were filtered and taken out. Mixed the content with distilled water to made the solution 100ml. After that passed the solution through the flame photometer and atomic absorption spectrophotometer to measure the iron and zinc content. For conversion of mineral content from ppm to milligram, multiplication of ppm was carried out with dilution factor then divided them by 100.

3.5 Sensory Evaluation

Hedonic scale was used to assess all of the samples on a nine-point scale. A 1 indicates an extreme dislike; 2 indicates a moderate dislike; 3 indicates a moderate dislike; 4 indicates a slightly negative preference; 5 indicates a neutral preference; 6 indicates a slightly positive preference; 7 indicates a moderately positive preference; 8 indicates a strongly positive preference; and 9 indicates an extremely positive preference (Pasqualone*et al.,* 2013).

3.6 Statistical Evaluation

The data was statistically evaluated for each measurement by presenting the average and standard deviation values (SD). The data was also evaluated using one-way ANOVA (one-way analysis of variance) (one-way analysis of variance). In order to determine the importance of the disparity, the Post Hoc method was utilized (p 0.05). (p 0.05). The SPSS 13.0 application was then used to undertake statistical analysis of the data (Montgomery, 2017).

Results

Table 4.1 Mean values for Moisture content of chickpea-based coriander fortified bread

Treatments	Mean Comparison
T1	3.24±0.85
T2	1.62±1.322
T3	1.4±0.492
T4	2.22±0.643
T5	1.52±0.743
T6	3.88±0.742

Table 4.2 Mean values for Ash content of chickpea-based coriander fortified bread

Treatments	Mean Comparison
T1	4.92±1.032
T2	4.88±1.302
T3	4.29±1.492
T4	4.72±1.021
T5	4.5167±0.643
T6	3.79±1.032

Table 4.3 Mean values for Fat content of chickpea-based coriander fortified bread

Treatments	Mean Comparison
T1	27.18±1.954
T2	24.14±1.045
T3	22.66±1.053
T4	26.12±0.742

T5	19.86±0.492
T6	15.24±0.743

Table 4.4 Mean values for Protein content of chickpea-based coriander fortified bread

Treatments	Mean Comparison
T1	19.62±0.733
T2	20.26±0.843
T3	18.97±1.322
T4	17.78±1.422
T5	18.66±0.854
T6	17.83±0.593

Table 4.5 Mean values for TFC content of chickpea-based coriander fortified bread

Treatments	Mean Comparison
T1	57.72±0.733
T2	55.38±0.432
T3	33.33±0.482
T4	20.68±0.583
T5	22.14±0.522
T6	20.17±1.422

Table 4.6 Mean values for TPC content of chickpea-based coriander fortified bread

Treatments	Mean Comparison
T1	69.49±0.00
T2	57.50±0.01
T3	37.57±0.01
T4	28.54±0.01
T5	25.63±0.22
T6	24.017±0.57

Table 4.7 Mean values for DPPH content of chickpea-based coriander fortified bread

Treatments	Mean Comparison
T1	71.287±1.302
T2	69.54±0.722
T3	41.22±0.854
T4	28.93±0.893
T5	28.44±0.833
T6	27.62±0.853

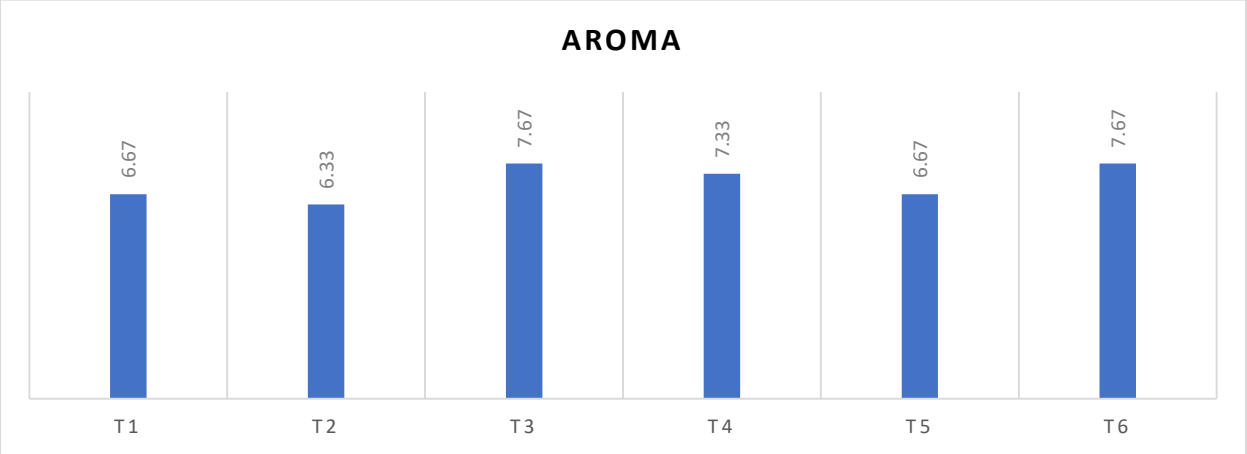
Table 4.8 Mean values for Iron content of chickpea-based coriander fortified bread

Treatments	Mean Comparison
T1	3.3567±0.583
T2	1.77±0.783
T3	2.13±0.873
T4	2.9367±0.633
T5	0.98±0.482
T6	1.13±0.393

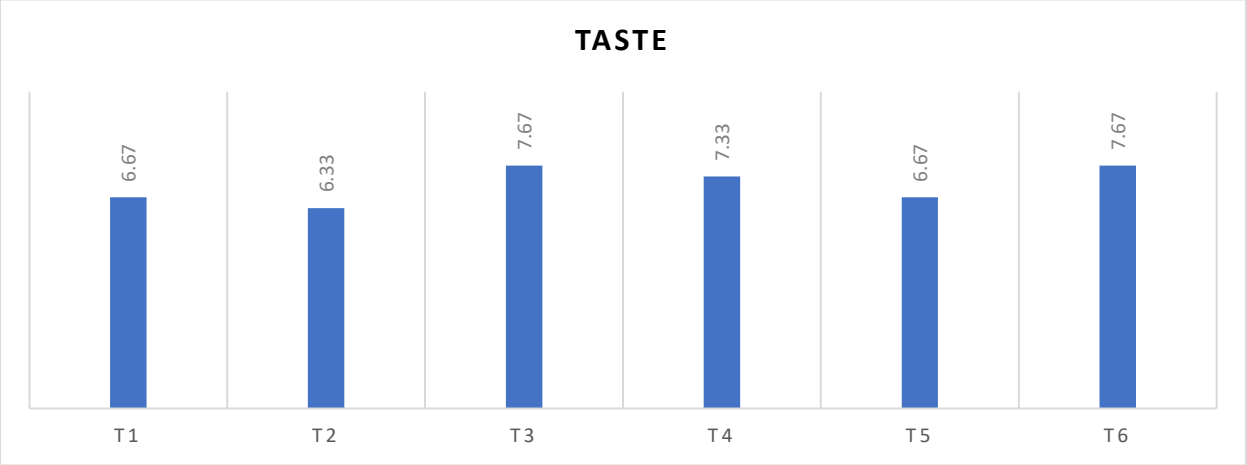
Table 4.9 Mean values for Zinc content of chickpea-based coriander fortified bread

Treatments	Mean Comparison
T1	1.74±0.854
T2	4.26±0.643
T3	3.1367±1.492
T4	1.78±0.722
T5	2.24±1.032
T6	1.98±1.302

Graph 4.1 Mean values for aroma of chickpea-based coriander fortified bread

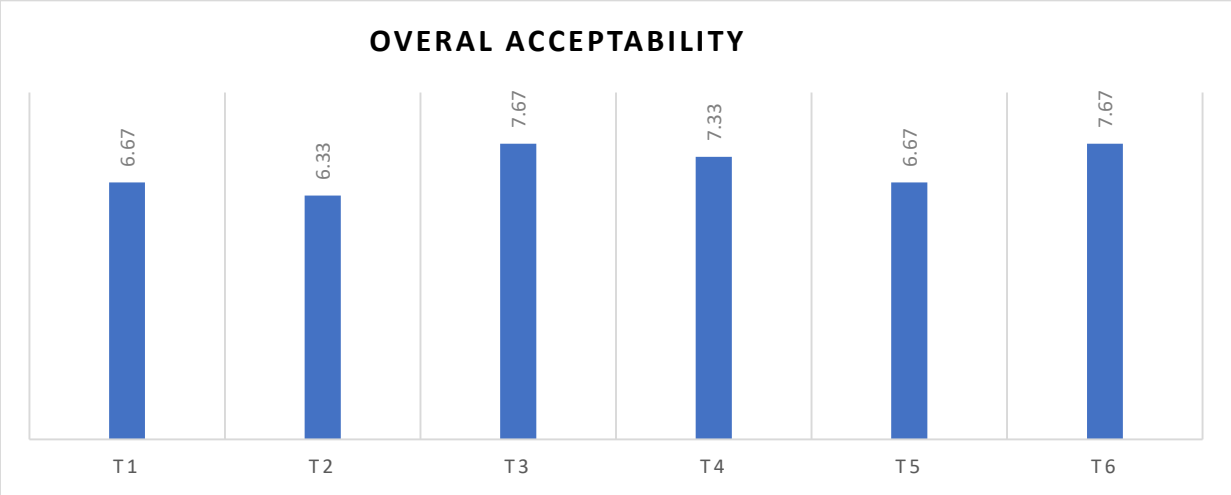


Graph 4.2 Mean values for taste of chickpea-based coriander fortified bread



Graph 4.3 Mean values for Appearanceof chickpea-based coriander fortified bread

Graph 4.3 Mean values for Appearanceof chickpea-based coriander fortified bread



Discussion

Moisture analysis is the important analysis that is performed on any food product. It is significant in terms of quality of a product as well as storage, processing and shipping of the product. Table 4.1 shows that the maximum value for moisture was 3.24±0.85 of T1 (60%WF, 60%CF, CP0%) and minimum value was 1.4±0.492 in T_3 (40%WF, 30%CF, 30%CP). Ash content is simply the mineral content after burning away of all the organic components. Ash is the inorganic residue that remains after a meal has been completely oxidized or ignited. The mean values for ash content in different treatments have been shown in table 4.2 varying from 4.92g/100g of the developed product. The highest value was exhibited by T_6 (3.79±1.032) while the T_1 (4.92±1.032) showed the lowest ash content.Table 4.3 contains the mean values for fat content. Mean value of crude fat content of chickpea flour biscuits and its composition with coriander powder ranges from 15.24 % and 27.18 %. The minimum value of fat in developed biscuits was 15.24% in T_6 while the maximum fat percentage is 27.18% in T1.

Table 4.4 shows the protein content averages for the various treatments, ranging from 17.78% to 20.26%. T4 had the lowest protein content (17.78 whereas T2 had the highest (20.26). According to the findings, adding more chickpea flour to bread increases their protein content.The results have explained that total flavonoids contents in different treatments have highly significant effect with respect to coriander powder and chickpea flour.The mean values for total flavonoids contents in different treatments have been described in table 4.5. The table has shown that mean values varied from 20.17 to 57.72 QE/g in which highest value was shown by T1 (57.72±0.73) while T6 showed the lowest one (20.17±1.42). The data regarding total phenolic contents of different treatments of developed breadhas been described in table 4.6. The data from the table have depicted that, total phenolic contents in relation to different treatments affects highly significantly.As seen in table 4.24, the average phenolic content of several treatments is shown. A range of 24.01 to 69.49 was found among treatments. T1 had the highest mean total phenolic content (69.49)

and T1 had the lowest mean total phenolic content (24.02).

The data related to DPPH values have showed that with respect to chickpea flour and coriander powder in different treatments have significant effect. The mean values for antioxidant activity in term of DPPH in different treatments have been explained in table 4.7. The mean values were in range of 27.62 to 71.28 in different treatments. The highest antioxidant activity was shown by T1 (71.28±1.30) while the lowest one was exhibited by T5 (27.62±0.85).Table 4.8 shows the iron content in various concentrations of coriander-fortified chickpea cookies, with very significant findings (P0.01). Bread iron content ranged from 1.17mg/100g to 3.35mg/100g in this study. Mean values for T4 (3.35670.583) and T5 (0.980.482) were the highest and lowest, respectively. The table 4.9 illustrates the Zinc content in bread created with various treatments, ranging from 1.74mg/100g to 4.26mg/100g. T_1 had the lowest value (1.74±0.854), while T_2 had the highest value (4.26±0.643). The iron content increases with increasing concentration of coriander seeds.

References

AOAC (Association of Official Analytical Chemist). 2016. The Official Methods of Analysis of Association of Official Analytical Chemist International, 20th Ed. Arlington, USA.

Dhanapakiam, P., J.M. Joseph, V. Ramaswamy, M. Moorthi and A.S. Kumar. 2007. The cholesterol lowering property of coriander seeds (Coriandrum sativum): mechanism of action. Journal of Environmental Biology. 29:53.

Jelodar, G., M. Mohsen and S. Shahram. 2007. Effect of walnut leaf, coriander and pomegranate on blood glucose and histopathology of pancreas of alloxan induced diabetic rats. African Journal of Traditional, Complementary and Alternative Medicines. 4:299-305.

Kačániová, M., L. Galovičová, E. Ivanišová, N.L. Vukovic, J. Štefániková, V. Valková, P. Borotová, J. Žiarovská, M. Terentjeva and S. Felšöciová. 2020. Antioxidant, antimicrobial and antibiofilm activity of coriander (Coriandrum sativum L.) essential oil for its application in foods. Foods. 9:282.

Kaium, A., M. Islam, S. Sultana, E. Hossain, S. Shovon and A. Mahjuba. 2015. Yield and yield contributes of coriander (Coriandrum Sativum L.) as influenced by spacing and variety. International Journal of Scientific and Research Publications. 5:1-5.

Mohite, D. and R. Waghmare. 2020. The fortification of biscuits with coriander leaf powder and its effect on physico-chemical, antioxidant, nutritional and organoleptic characteristics. Int. J. Food Stud. 9.

Montgomery, D.C. 2017. Design and analysis of experiments, John wiley & sons.Inc. Hoboken, NJ, USA.

Pasqualone, A., A.M. Bianco and V.M. Paradiso. 2013. Production trials to improve the nutritional quality of biscuits and to enrich them with natural anthocyanins. CyTA-Journal Food. 11:301–308.

Prachayasittikul, V., S. Prachayasittikul, S. Ruchirawat and V. Prachayasittikul. 2018. Coriander (Coriandrum sativum): A promising functional food toward the well-being. Food Research International. 105:305-323.

Rachwa-Rosiak, D., E. Nebesny and G. Budryn. 2015. Chickpeas—Composition, nutritional value, health benefits, application to bread and snacks: A review. Critical Reviews in Food Science and Nutrition. 55:1137-1145.

Sánchez-Chino, X.M., C. Jiménez Martínez, E.B. León-Espinosa, L. Garduño-Siciliano, I. Álvarez-González, E. Madrigal-Bujaidar, V.R. Vásquez-Garzón, R. Baltiérrez-Hoyos and G. Dávila-Ortiz. 2019. Protective effect of chickpea protein hydrolysates on colon carcinogenesis associated with a hypercaloric diet. Journal of the American College of Nutrition. 38:162-170.

Sandhu, K.S. and S.-T. Lim. 2008. Digestibility of legume starches as influenced by their physical and structural properties. Carbohydrate polymers. 71:245-252.

Saxena, S.N. and D. Agarwal. 2019. Pharmacognosy and phytochemistry of coriander (*Coriandrum sativum L.*). Int. J. Seed Spices. 9:1–13.

Thavarajah, P. 2012. Evaluation of chickpea (Cicer arietinum L.) micronutrient composition: Biofortification opportunities to combat global micronutrient malnutrition. Food Research International. 49:99-104.

Welch, R.M. 2002. Breeding strategies for biofortified staple plant foods to reduce micronutrient malnutrition globally. The Journal of nutrition. 132:495S-499S