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`Development and quality evaluation of dried vegetable soup added with some legumes

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***Abstract*---**Fruits and vegetables play an important role in the diet due to their high amounts of fiber minerals and vitamin content. Different vegetables i.e., potatoes, carrot, onion, garlic, tomato with different legumes such as lentils and green peas with addition of some seasonings like salt black pepper coriander and cumin was used to prepare dried vegetable soup. Rehydration ratio, physiochemical analysis, sensory evaluation and net number of calories obtain per

serving of soup was accomplished. pH of vegetable soup decreased slightly during storage i.e. (6.40±0.32, 6.31±0.08 6.27±0.26) and for acidity they increased slightly i.e. (2.28-2.28) that is good for soup shelf life. Color analysis gave précised data about soup sensory evaluation where mean values of L*a*b* are increasing gradually i.e. (81.72, 81.87±0.21, 81.94±0.03±0.20), (5.61±0.09, 5.57±0.18, 5.59±0.22) and (29.54±0.12, 29.43±0.10, 29.53±0.05). The purpose of adding legumes is to increase the nutritional content up to a mark able extent, where the soup mixes will provide noticeable amounts of the desired nutrients particularly, from vegetables and protein (12.72±0.22, 12.54±0.16, 12.63±0.15) from legumes, with better protein digestibility and mineral accessibility. Water activity and amount of moisture (9.14±0.09, 9.23±0.03, 9.45±0.18) of final product increased stability of the dried soup mixes. Addition of legumes affected the flavor, taste as well as color and acceptability of the obtained soup mixes up to a mark able extent. The ash content of the soup mixes increased significantly by adding legumes i.e. (6.55±0.17, 6.59±0.21, 6.67±0.23). The findings of this study clearly showed the value of adding lentil, green pea, and chickpea to dried vegetarian soup combination as a valuable food additive to improve nutritional qualities and technological quality of the resulting soup. The soup samples' overall sensory quality was satisfactory, and their sensory qualities were examined as well. The lentil inclusion was the most beneficial and widely accepted.

***Keywords*---**Quality of soup, development of soup, vegetable mix soup and legume mixed soup.

Introduction

People are living a stressful lifestyle as a result of urbanization. They could not manage to get time to cook food so being accustomed of eating junk food and such items which are unhealthy because of their high sugar, fat, and salt levels, as well as their low nutritional profile i.e., regarding fat, protein, fiber, minerals and vitamins. Most of these foods are empty calories food. Malnutrition and illnesses are linked to the use of these nutrient-deficient foods. Furthermore, a cereal-based diet may exacerbate this illness. This issue can be solved by preparing high nutrient foods that can be cooked in less time. Dried soup powder is one of the easy-to-cook foods accessible in our country, and it plays a significant role in meeting present and future demand of consumer (1). Soup mixes in dry form enjoy a benefit i.e., Security from deterioration from oxidation and enzymatic activity and steadiness of flavor at ambient temperature throughout extensive stretches of time i.e., 6 months. Moreover, dry soup mixes are prepared for rehydration in a brief time frame for busy schedule of people now a day, lodgings, emergency clinics, eateries, and for use in institutes just as to military rations (2). Various investigations have shown that addition of more vegetables is related to decrease of cardiac sicknesses i.e., CVDs and conceivably can decrease weight, constant respiratory infections, diabetes and some diseases. Vegetables also help in avoidance of NCDs i.e., non transmittable diseases that

are due to the presence of more amount of macronutrient, cell reinforcement constituents, phenolic compounds that balance the biochemical cycles which cause cardiovascular and no transmittable diseases. Vegetable consumption went from 35g to 394g per day, with a mean addition of 209g per day (1). Numerous nations add to this proposal says that 3 servings from these 5 totals should be from vegetables i.e., more than 240g per day. World health organization, Food and agriculture organization does exclude some species, for example, cassava and potato in their meaning of vegetables. Notwithstanding, obliquity with respect to every single source of vegetables i.e., Soups, sauce and dinners can be viewed as a vegetable. Simultaneously, dried vegetable powders don't fit the bill to consider a vegetable piece as indicated by rules on computing and imparting products of the soil segments in composite food varieties from an institution of grocery distribution in United Kingdom. Drying of vegetables is used to protect vegetable's supplements and flavor. Before the real drying stage, there is a pre-handling step to eliminate unfamiliar impurities, choose, washing, periodically strip, seed removal, and diminishing vegetable size. Anti-nutrients like phytate and oxalate, to name a couple, are common in plant-based supplemental foods, and they prevent newborns from absorbing critical nutrients needed for growth and development (3). Soaking, fermenting, roasting, and germination have all been used to improve the bioavailability of micronutrients in plant-based diets by lowering anti-nutrient content and increasing digestibility, quality of nutrient, and absorption of critical elements. Bioavailability refers to the ability of nutrients to be absorbed and utilized by the body. There are numerous techniques determine the availability of nutrients, (WHO). World health organization said that balanced studies often analyze the difference between intake and disappearance in feces as bioavailability, which is the procedure used in this study. High cholesterol level of meat products, and financial issues for the developing nations also make it compulsory for the development of an alternative to vegetable products having good nutrients which promote health such as legumes, cereals, and vegetables, etc to from products with no cholesterol level although rich in minerals, protein, fiber, starches, disease-preventing antioxidant contents and vitamins (4). Kishk is typically eaten as a thick soup by adding boiling water to the dried mixture. It can preserved in jars for 1–2 years without degradation due to its non-hygroscopic property (5). The awareness of people about the vegetable products containing the legumes and healthier foods increase the demand of functional foods in the market. The assimilation of beneficial nutrient in+-to the food products is the modern and new concept for the functional foods in the market (Sarkar, 2010). But besides their benefits, limited use of some of these underutilised legumes has been linked to a higher prevalence of difficulty in cooking, longer cooking times, a negative correlation with hunger, and low delectability (6). Mists are prepared foods made from mixed meat or vegetables in stock or hot/boiling water and thickened with thickeners (7). Mist expression is generally based on a multifunctional concept that includes, among other things, food choices, price, health, and delicate appeal (8). Many legumes with significant food potential, such the African yam bean, chump pea, Jackbean, and Bambara groundnut, are underutilised in Nigeria and other West African nations (9). An inventive solution to lessen the donkeywork, longer cooking time, and energy demand involved with the metamorphosis and enhancement of these underutilised legumes is to process them (10) into instant soupbase maquillages that might be reconstituted and prepared for immediate consumption (11). Instant food is veritably popular in

ultramodern society. Soup is one of the top moment foods which people like so important with other fast food item. It's actually a part of ultramodern diurnal life. Soup is veritably important accessible to eat. It's now fulfilling the consumer's social conditions. Soup is a liquid which is prepared from vegetables, fish or meat with water, juice or stock and some thickening agents and fall under heterogenous order of food. Generally there are two kinds of mists like thick haze and clear haze. Thick mists are prepared by mixing greasepaint of cereal or palpitation flour, cream and eggs. Thin mists are made from clear excerpts of factory corridor and creatures which are comestible. Soup blend is the mix of colorful dried and pulverized constituents in the optimum rate so as to gain the needed flavor when made into haze with hot water. They're nearly ready to eat and take lower time to cook as they can be directly added in boiling water and stirred to get the haze within twinkles. It has an important part for maintaining nutritive status of people by covering a wide range of dried foods. Soup blend is nearly free from pathogenic attack and it can save its quality until one month under normal condition (12). Furthermore, (12) gave the study on medication of dried submissive haze supplemented with many legumes. Soup can be prepared with the combination of vegetables like potatoes, carrot, tomatoes, onion, garlic and coriander with many legumes similar ashull-less barley flour, lentil, green pea and funk pea. The result from chemical, physical, rheological and sensitive evaluation indicated that supplemented vegetable haze with legumes bettered the nutritive value of haze and especially enhanced good protein insipidity with other nutrient like carbohydrates, fats, iron and zinc, extended shelf- life and stability of dried haze by reduced content of humidity and water exertion. Supplementation affected taste, color, flavor and overall adequacy but didn't affect the consistence and appearance of the haze. At various storeroom intervals, the products' chemical and sensitive characteristics were assessed (0, 3 and 6 months). The cost of product of all the products also worked out to see their profitable feasibility (13). The main objectives of my study are following

- To develop vegetable soup supplemented with legumes
- To assess the quality and nutritional benefits of soup

Assessing the antioxidant potential and sensory quality of resultant soup mixes

Materials and Methods

The research work was performed in Postgraduates Research Laboratories, University of Agriculture, Faisalabad.

3.1. Preparation of dried vegetables

3.1.1. Procurement of materials

Materials included fresh vegetables and legumes were purchased from local market of Faisalabad.

Chemicals and reagents

Required chemicals were purchased from Merck.

3.1.2. Sterilization of glass wares

Hot air oven was used for the sterilization of glass wares. The glassware must not remove immediately from hot air oven and slow cooling period is necessary to avoid the cracking. Time and temperature for the sterilization of glassware was done 171℃ for 30 min following the method of (14).

3.1.3. Pretreatments of raw materials

Carrots and potatoes were sorted. Washing peeling and slicing in cubic form was done. After this they are blanched in hot water for 5 min at a temperature of 95℃ and are washed in cold water.

3.1.4. Drying

Then their drying was performed in hot airflow dryer at 65℃ in first 4 hours and after this period of 4 hours, temperature is reduced to 50℃ until they are dried completely.

3.1.5. Milling and sieving

To convert these vegetables into powder form it was milled and then powder was sieved through a mesh size of 315 micron. Although tomatoes have high water content, first of all their slicing was done and then dried and milled and sieved as above mention method.

3.1.6. Pretreatment of legumes

As the legumes are main constitutes of dried vegetable soup so their pretreatments and right use at right time is also as much important as their presence in soup as a cheap source of protein at the replacement of meat. Legumes have less amount of water content as compared to the other ingredients I am using in soup i.e. tomatoes, green peas, potatoes, onion, garlic etc. Therefore, they require different kind of pretreatments as for vegetables. Pretreatments of legumes are given below:

Flow Chart:

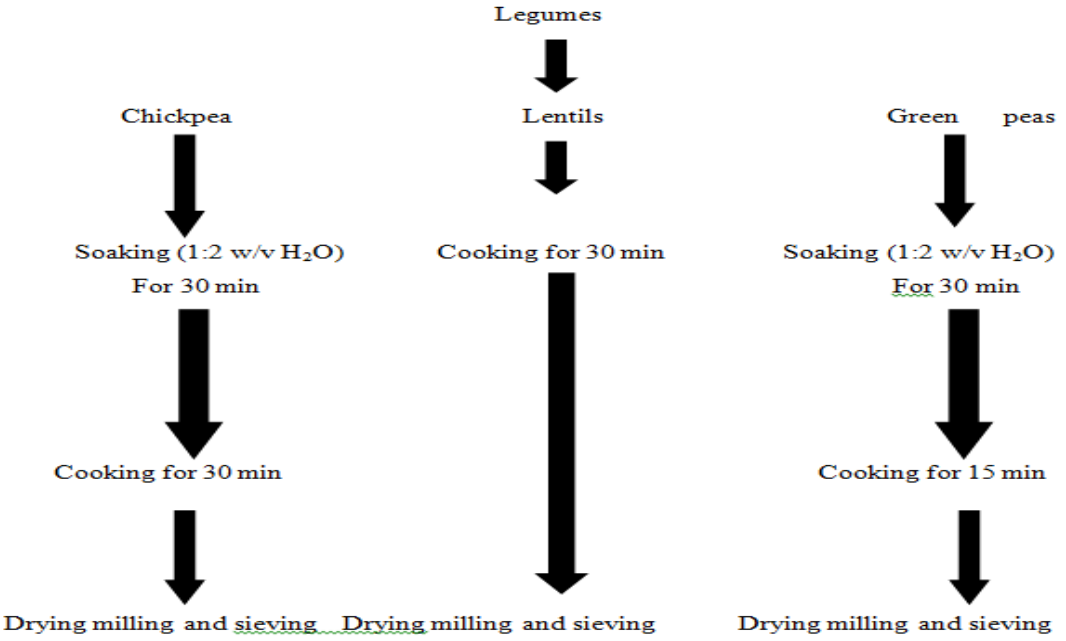


Fig:1

Figure 3.1: Preparation of dried vegetarian soup mixture

After drying and milling, seasoning of the prepared samples was done with dried garlic, black pepper, onion, coriander, cumin and salt after these four samples of dried soup mixture were prepared.

1. Development of vegetable soup mix

Vegetable soup was combined with green peas and lentils in ratios (0:100), (35:65), (35:65) to make resultant products. Dried vegetable soup was packed in polyethylene bags (15).

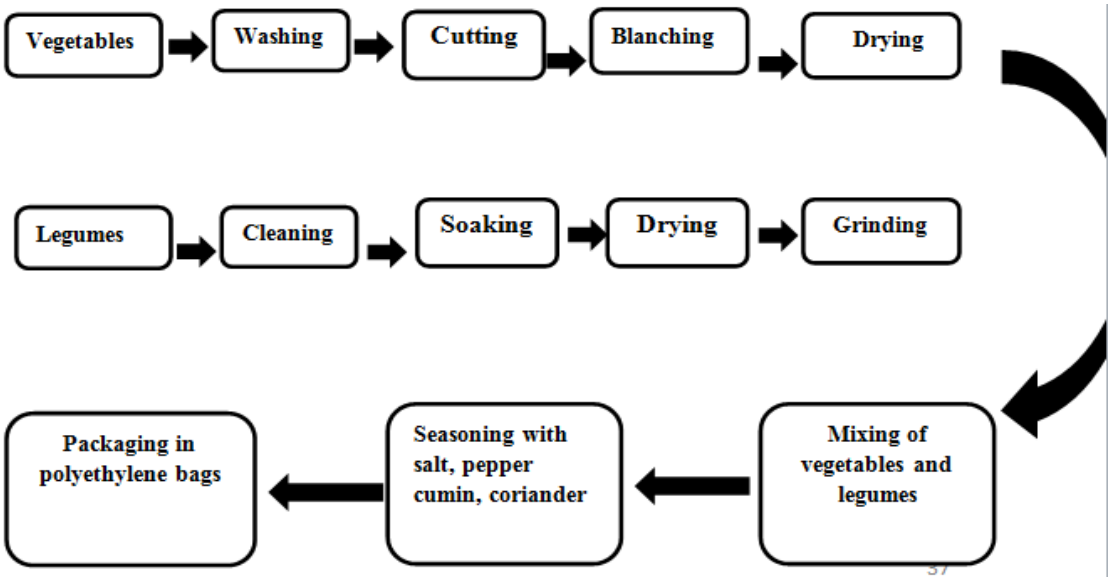


Fig:2

Figure 3.2: Development of vegetable mix soup

Pre-treatment is an exceptionally expansive term and could mean number of various unit tasks relying upon a definitive evenhanded with regards to what the pre-treatment is intended to achieve forestall enzymatic sauteing, or enzymatic rancidity whitening/heat treatment is utilized for inactivating the catalysts answerable for searing/rancidity. Likewise, de hulling of grains is additionally considered as pre-treatment to eliminate the husk from grains in specific food handling applications. So, pre-treatment is an inborn piece of any food handling activity and is explicit for explicit applications. Pre-treatment is significant relying upon the handling strategy to be utilized. For instance, at least one pre-medicine, for example, whitening, dissipation and synthetic treatment (e.g., sodium metal bisulphite) might be expected before drying to limit energy utilization and to forestall enzymatic caramelizing during drying process. Treatment with "Green" technique is a must limiting any immediate compound moieties the less oxidation that happens, the better the sustenance and the probability that your item was sell. Mass protection is an unquestionable requirement for any profit from your endeavors (16).

Table 3.1: Treatment plan for the preparation of vegetable mix soup

Ingredients (g)	Vegetable soup T_0	Green pea soup T_1	Lentil soup T_2
All concerned vegetables except green pea and lentils	100	0	0
Tomato	5.0	5.0	5.0
Garlic	0.75	0.75	0.75
Onion	1.20	1.20	1.2
Green peas	35.0	35.0	35.0
Carrot	14	14	14
Lentils	35.0	35.0	35.0

3.4. Proximate analysis of Vegetarian soup mixture

Vegetarian soup mixture was analyzed for proximate composition such as moisture content, ash content, crude protein, crude fat and crude fiber according to (17) method numbers 44-12A, respectively.

3.4.1. Moisture determination

The moisture content of soup was found out by applying the procedure narrated (17) method no 44-12A, in an oven through drying method. 5g sample was taken in the China dish and weighing had been done by using a digital weighing balance. After weighing, sample was put into the hot air oven for the drying purpose at temperature 105℃ for 24 hours and after that sample was placed into desiccator to avoid reabsorption of moisture from the environment and again weight was done and noted the value by applying the following formula:

$$\text{Moisture (\%).} = \frac{\text{Wt. of sample before drying} - \text{Wt. of sample after drying}}{\text{Wt. of sample before drying}} \times 100$$

3.4.2. Ash determination

The amount of ash percentage in soup was found out by applying the method number 08-01 as described in (17). 5g sample was taken in a crucible and charred on burner until all volatile fractions disappear and no more smoke arises from the sample, put the crucible in desiccator to attain the normal temperature, now put the crucible in a furnace for 3-4 hours at 62℃. After that the ash weight

was measured. The amount of ash was measured by using the formula written below,

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

3.4.3. Crude protein content

The nitrogen content of soup was figured out by following the technique of (17) strategy no. 46-30 utilizing Kjeldahl contraption. Taken 3g of test, one assimilation tablet and 30mL of sulphuric acid was added into the absorption flagon with the end goal of processing. After finish of the assimilation, 10mL of processed example was taken and weakened with refined water up to 100mL. Then 10mL of weakened example was taken in a container and 40% NaOH was added and set in refining get together. Then, at that point, 20mL boric corrosive (4%) arrangement was taken in a different receptacle and barely any drops of marker were included it. Additionally, put the measuring glass in refining get together. After refining light brilliant shade of tests were gotten and the examples were titrated against 0.1N H2SO4 until light pink tone showed up. The variable of 6.25 duplicated to decide the protein content in soup by utilizing the accompanying recipe:

$$\text{Nitrogen (\%).} = \frac{\text{Volume of 0.1N } H_2SO_4 \text{ used} \times \text{Volume of dilution} \times 0.0014}{\text{Weight of sample} \times \text{volume of diluted sample}} \times 100$$

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

3.4.4. Crude fat determination

The crude fat content of soup was estimated by adopting the method number 30-25 as mentioned in (17) by using Soxhlet apparatus. 2g of dried sample was taken after removal of moisture by using hot air oven for 24 hours. Converted the dried sample into the powder form and put into the filter paper by closing the filter paper through steeper pins. N-hexane or di-ethyl ether was used as an organic solvent. The completed 6 to 8 siphon cycles of Soxhlet apparatus to remove soluble fat from sample and noted the value by using the formula in the term of percentage.

$$\text{Crude fat (\%).} = \frac{\text{Weight before extraction of fat - Weight after extraction of fat}}{\text{Wt. of sample before extraction of fat}} \times 100$$

3.4.5. Crude fiber determination

Samples after the extraction of fat were subjected to crude fiber analysis by using Fiber tech following the guidelines of AACC Method No. 32-10 (17) Crude fiber content expected by digesting defatted sample. In a beaker take 2g of fat free sample and 200mL 1.25% sulphuric acid was added to it up to the mark and then boiled for 30 minutes. After that of filtering the beaker, contents to make the sample acid free 2-3 washings were done with hot water. The sample residues were transferred into beaker and now the addition of 200mL of 1.25% NaOH solution was done and the whole procedure was repeated again. Now the residues were carefully transferred to china dish and placed in oven for drying for 3-4

hours at 100°C until the constant sample weight. After that sample charring was done. Then placed the sample at 550°C in a muffle furnace until greyish residue left. The percentage of crude fiber was calculated as,

$$\text{Crude fiber (\%).} = \frac{\text{Weight loss on ignition (g).}}{\text{Weight of sample (g).}} \times 100$$

3.5. Quality analysis of vegetable soup mix

3.5.1. Titratable acidity

A precise and simple titration procedure was adopted for the authenticity of this parameter. A 10g sample was incorporated into 250mL beaker. Sodium hydroxide (NaOH, 0.1N) was prepared and transferred into burette with the help of pipette. The sample in beaker was diluted with water following the addition of phenolphthalein indicator. Titration was performed against NaOH and final level of base in burette was notified (18). and titratable acidity was calculated by using formula:

$$\text{Titratable acidity} = \frac{\text{Volume of NaOH used} \times 0.1\text{N} \times 0.067}{\text{volume of sample}} \times 100$$

3.5.2. pH determination

pH meter was taken for demonstration of pH and first, buffer liquids with pH 4, 7 were utilized for calibration of device. A 30g of sample was diluted with distilled water into 100mL sterilized beaker and cathode plate of device was inserted into it. The pH was put down and similarly three readings were taken and the average value was calculated by following the method of (19).

3.5.3. Color determination

The color values (L*, a*, b*) of soup were evaluated by using colorimeter following the method of (20) All the soup was placed at room temperature to check the color difference among all balls. Triplicate readings were used to find out yellowness, lightness and redness of soup.

3.6 Phytochemical analysis of vegetable soup mix

3.6.1 Antioxidant activity

Antioxidant activity of fermented soup was analyzed through DPPH (2.2-dipheny l-1-picryl-hydrazyl-hydrate) radical scavenging assay following the method explained by (21). For DPPH solution preparation, in 100mL methanol, 3.0mg of DPPH was mixed. After that, 2.0mL of DPPH solution was taken from it and was mixed with 50µg of fermented soup sample. It was shacked and for 30–60 minutes, it was placed in shady area at room temperature. At 517nm, radical scavenging capacity was calculated by controlling the decline in absorbance using spectrophotometer. Blank reading was also taken. Lower absorbance shows higher DPPH free radical scavenging activity. Following formula was used for it

$$\text{DPPH radical scavenging capacity (\%).} = \frac{A_0 - A_1}{A_1} \times 100$$

A_0 = Control absorbance (all reagents without sample or blank reading).

A_1 = Absorbance of extract sample

3.6.2 Total phenolic contents

Total phenolic contents were assessed by the method described by (21). For this purpose, 1g of sample was taken and added in methanol solution present in test tube and was well shaken. At 15000 rpm test tube was centrifuged for 4 minutes. After centrifugation supernatant and sediment was separated and supernatant was stored for analysis. In a test tube containing 0.5mL of Folin-Ciocalteau reagent and 10mL distilled water, 100µg of fermented soup sample was incorporated. It was shaken well in an orbital shaker for 5 minutes. After that 6.9mL distilled water and 1.5mL of sodium carbonate (20%). was also incorporated. The mixes were homogenized and incubated for 30 minutes at 40℃. Spectrophotometer was set at 725nm and run blank which do not contain folin reagent. Then the sample was run at 725nm and total phenolic contents was detected as a standard gallic acid was used and the results were expressed as milligram gallic acid equivalents per gram sample.

$$\text{Total Phenolic contents (mg GAE/g).} = C \times \frac{V}{M}$$

M = Methanolic extract sample weight

V = Extracted sample weight

C = Gallic acid concentration (mg/mL).

3.7. Microbial analysis of vegetable soup mix

3.7.1. Total plate count

MRS agar was used for TPC and it was prepared, sterilize in the autoclave at 121°℃ for 20 minutes. MRS was poured into petri-dish and allowed to solidify. Homogenized sample (1mL) was taken and added to 9mL distilled water in test tube. Similarly, again another 1mL sample from previous tube was brought to mix with 9mL water in another tube and so on. Similarly, bacterial culture was diluted 10 times through serial dilution and poured on to MRS agar media for growth at incubation temperature. After 48 hours total number, bacterial colonies were calculated through colony counter and CFU/g was used for the presentation of results according to (22).

3.8. Sensory evaluation

The sensory evaluation of final product was also performed by the panellist at National Institute of Food Science and Technology. Product evaluation was

performed through the proper scoring system known as 9-point hedonic scale. The product was assessed for its flavour, taste, aroma, colour and overall acceptance during different period (up to 21 days) of storage (23).

3.9. Statistical analysis

The acquired data was inspected by using two factor factorial design (two-way analysis of variance) for relative comparison of treatments. Statistics 8.1 was utilized for application of statistical parameters. Trials were done in triplicate sequence for calculating the standard error and mean values (24).

Results and Discussion

The current work was intended with the preparation of dried vegetable soup, and its protein source as legumes instead of meat that is a cheaper and replacement of meat in a soup. The study was comprised of three basic stages. In first stage of study vegetables were dried and ground. In second phase of study preparation of soup was accomplished. At the end the vegetarian soup was assessed with physiochemical and microbial tests along with sensory evaluation. The preparation of vegetable soup mix is carried by the process described by (25). Different vegetables were used to make soup in dry form with addition of some legumes. The vegetables were sorted were taken out for drying in Cabinet dryer (65±5) till moisture content was less than 10%. Acidity and proximate components of each sample were determined and best soup sample was selected based on sensory evaluation. The best vegetable soup sample was powdered and used to make soup mix along with the powder of other ingredients. Sensory analysis was performed for selection of best soup mix formulation. Proximate and microbial analysis of the best soup mix was performed. This research was conducted at the National Institute of Food Science and Technology, University of Agriculture Faisalabad. All experimentations related to research work were performed at Fruits and vegetable Laboratory, National Institute of Food Science and Technology, University of Agriculture Faisalabad. The results obtained after compositional and quality analysis were further subjected to statistical analysis and data is as follow;

3.1. Physicochemical and biochemical characterization

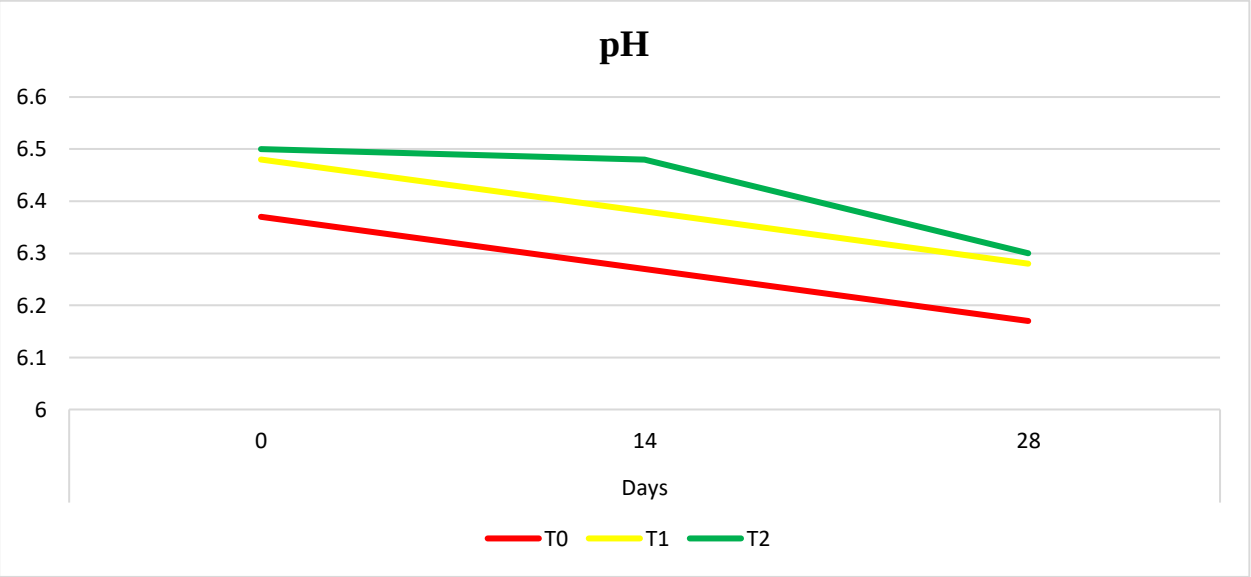
4.1.1 pH measurement:

Determination of pH is very important for the adaptation of food products. It affects the quality of food and changes during processing.

The pH of vegetarian soup is given in (fig:3). Days showed no significant effect on pH and treatment also showed no significant effect on pH. The maximum value was observed in T_0 (6.42) followed by T_1 (6.35), T_2 (6.29). With the addition of legumes, the pH increased slightly and also increased during storage of 28 days. The maximum mean value was at 0 day (6.40) and minimum at 28 day (6.27). (26) measured the pH of soup samples. The pH value varied from 6.5-5.5.67 having orange peel as an additive and it caused decrease in pH value reported that legumes addition decreased the pH value due to organic acids effect such as

ascorbic acid, citric acid and tartaric acid. The quality analysis of application of lemon and orange peels in soup products and found similar results for the pH. The pH was slightly varied from this study due to the difference in the treatments and conditions declared that there was no significant difference in pH in zero time among treatments which means that different concentrations of vegetable mix does not affect pH value.

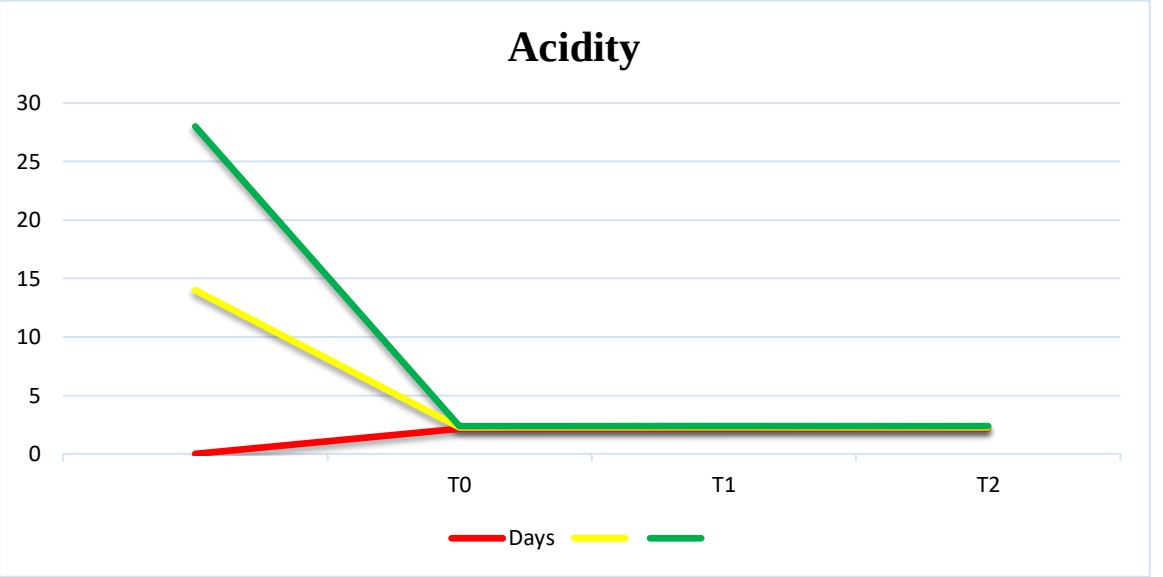
Fig:3



4.1.2. Acidity measurement

Total titratable acidity is a measure of the amount of acid or acids present in a food sample. It is not to be confused with pH, a measure of the concentration of hydrogen ions

The acidity of vegetarian soup was given in (fig:4). Days and treatments, both showed non-significant effect on acidity. The maximum mean value was at 0 day (2.34) and minimum at 28 day (2.22). The maximum value was observed in T_1 (2.28). With the addition of legumes, the acidity increased slightly and during storage of 28 days it decreased. (27) measured the acidity of dried soup mix comprises of chickpea flour and dried vegetables and stated that acidity does not affect soup quality significantly and usually soups are basic in nature and not acidic.

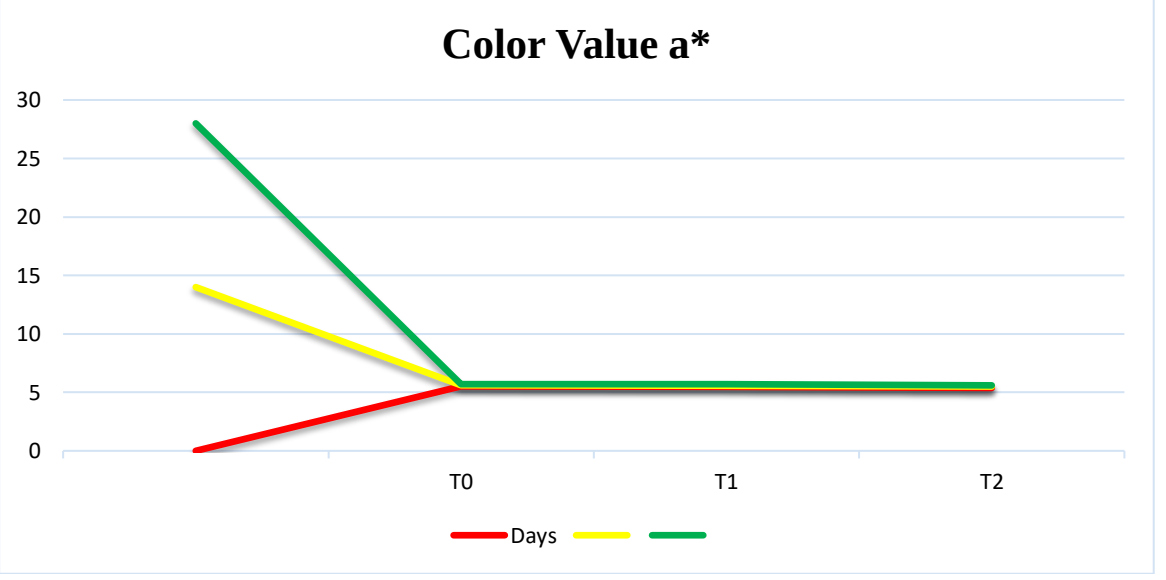


4.1.3. Color Measurement

Color is an important factor for quality and sensory attributes of food. The factors that affect soup colors are types of ingredients, pH and oxygen. Changes in the composition of soup also affect the color of soup.

The L* value of vegetarian soup is given in (fig:5). Days showed highly significant effect on value and treatments showed highly significant effect on L* value. The maximum value was observed in T_1 (81.96) followed by T_0 (81.84), T_2 (81.76) with the addition of legumes the color of L* value increased and during storage of 28 days it also increased. The maximum mean value was at 14 day (83.87) and minimum at 0 day (79.30) (28) showed that the L* parameter decreased with the increase in legume flour addition in vegetable soup. This change was due to the dark color of green peas. Many authors have described that L* lightness highly linked with fat and moisture content because free fat and water on surface affects light reflection. Powder products retained and water and caused in decreasing of lightness. It might be due to the white content present in legumes.

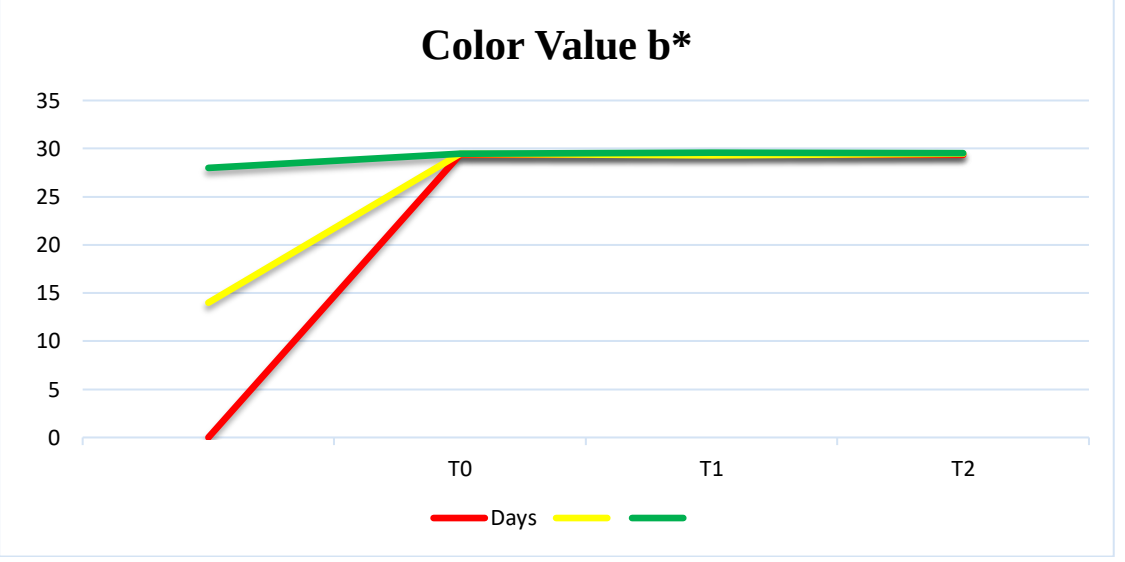
The value of vegetarian soup was given in (fig:6). Days showed highly significant effect on a value and their interaction with treatment showed significant effect on a value. The maximum value was observed in T_0 (5.62) followed by T_1 (5.58), T_2 (5.60) with the addition of legumes the color increased and during storage of 0. 7, 14 days it also increased. The maximum mean value was at 14 day (8.18) and minimum at 0 day (6.32). (29)]studied the use of legume flour in green vegetable soup. In this control had highest a* value followed by other treatments. The decrease in redness was due to the darker color of green peas. With the addition of legume a* value decreased with concentration of legume increased.



The b* value of vegetarian soup was given in (fig:7). Days showed highly significant effect on color and their interaction with treatment showed significant

effect on color. The maximum value was observed in T_1 (29.48) followed by T_2 (29.46), T_0 (29.45) with the addition of legumes the color increased and during storage of 0. 14, 28 days it also increased. The maximum mean value was at 14 day (32.26) and minimum at 0 day (25.27).

(30) stated that as you move along the L axis toward the center of the color space, colors become more neutral and greyer. So, the b value of soups also decreases. Consider how the saturation and intensity of the opposing colors would be reduced if their corresponding values cancelled each other out. The a and b axis' extremities, in both the large positive and negative numbers, are where the colors are the most saturated.

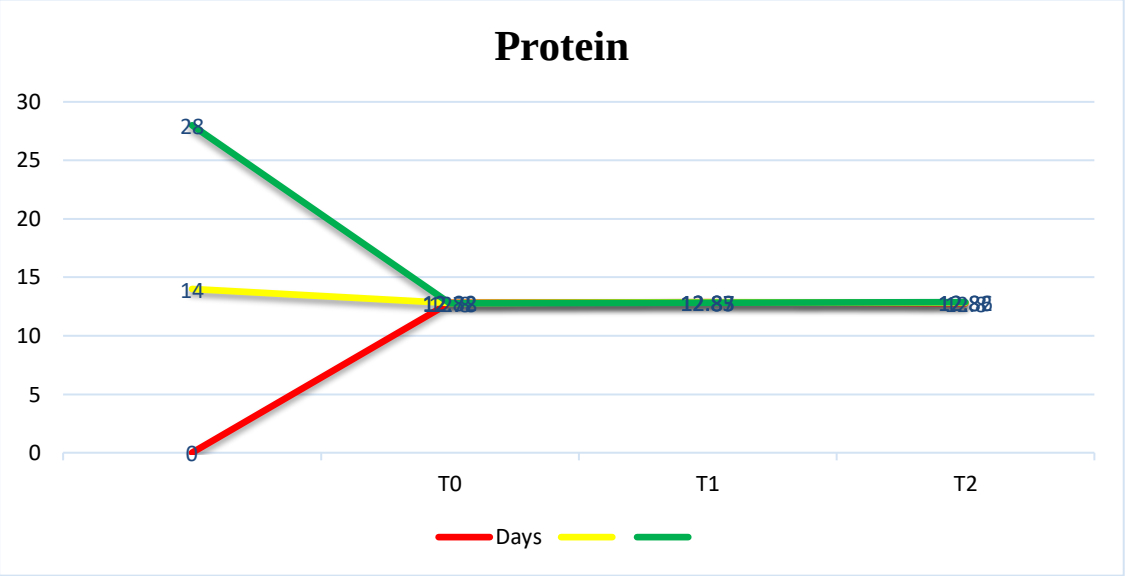


4.1.4 Protein Determination:

The content of crude protein in vegetables and legumes powder was determined with the aid of Kjeldahl apparatus. Crude protein of legumes was found and results that obtained were subjected to statistical analysis.

The protein values of vegetarian soup was given in (fig:8). Days showed significant effect on protein and treatment showed highly significant effect on protein. The maximum value was observed in T_1 (12.85) followed by T_2 (12.82), T (12.80) with the addition of legumes the protein increased and during storage of 0. 14, 28 days it also increased. The maximum mean value was at 0 day (15.54) and minimum at 28 day (15.51). With 16-33 % protein content, vegetable soup possesses a massive potential to correct and prevent protein energy malnutrition. Protein content of the legumes greatly depends upon environmental and agronomic factors. The protein content of legumes is greater than protein content of all the cereals. Foods rich in protein had a great deal of effect on weight loss due to the loss of fats in the body. (31) investigated positive effect and composition of legumes, peptides and proteins and effect of these on human body. The results of the study revealed that intake of 25 % protein of the total energy consequence in

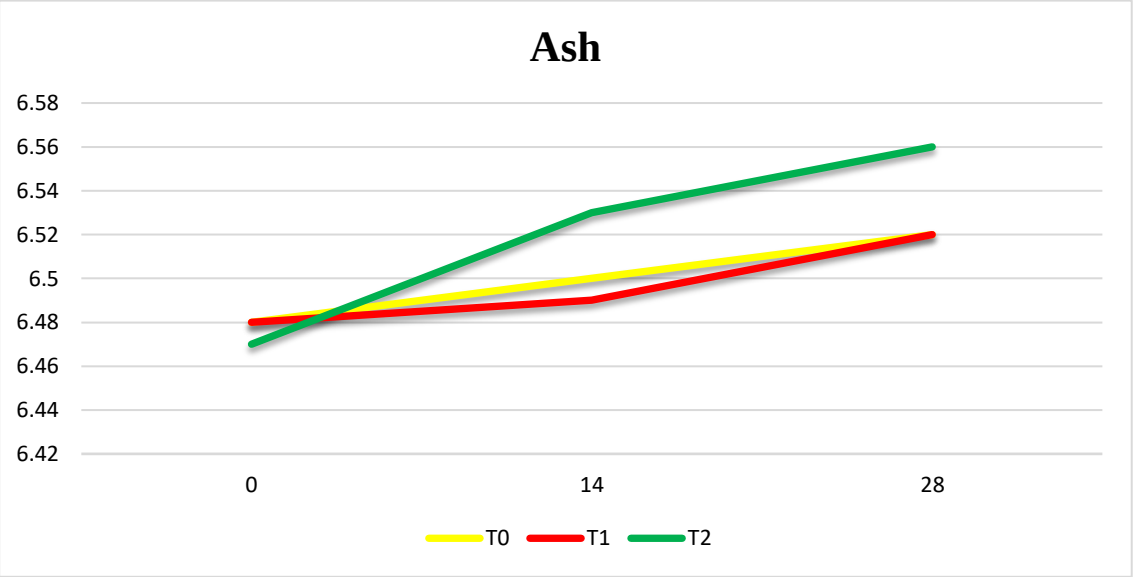
a significant fat loss. Consumption of high protein diet may also help to maintain body weight. A factor of 6.25 was multiplied to determine the protein content. Protein is a major component of legumes after water. It provides strength to muscles and helps in sport and movement of the body. In the absence of carbohydrates and fats, crude protein provides energy to the body. Crude protein of legumes was found and results that obtained were subjected to statistical analysis.



4.1.5 Ash Determination:

Ash refers to any inorganic material, such as minerals, present in food. It's called ash because it's residue that remains after heating removes water and organic material such as fat and protein. The ash content of most vegetables is around 1% and is generally higher than that of fruits. Beans contain up to 4% ash (29).

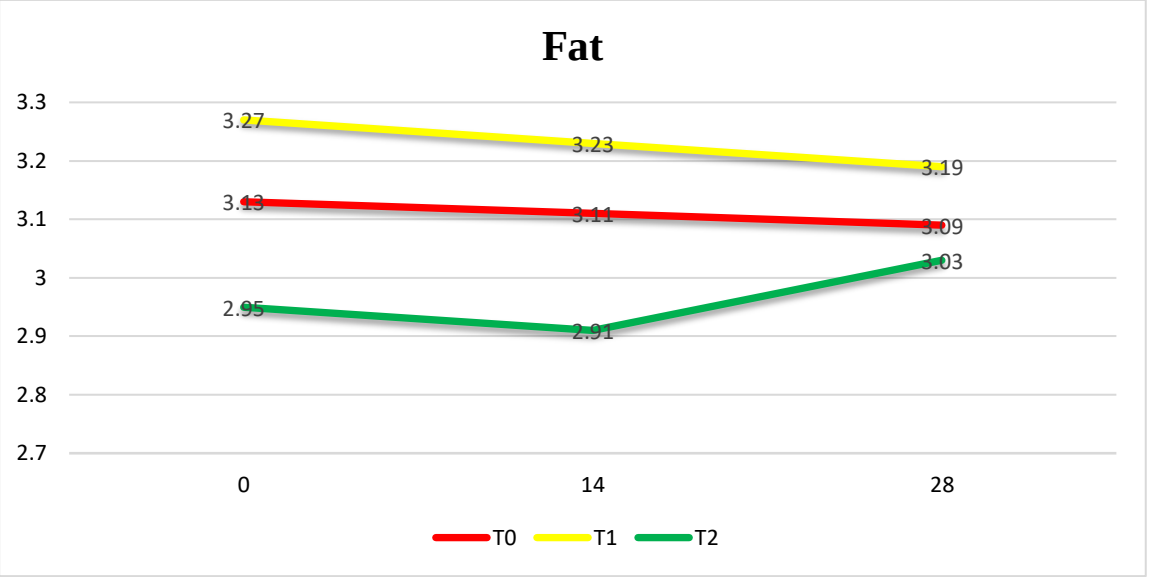
The values of ash of vegetarian soup was given in table (fig:9). Days showed significant effect on ash and treatments showed highly significant effect on ash. The maximum value was observed in T_2 (6.53) followed by T_0 (6.50), T_1 (6.50) with the addition of legumes the ash increased and during storage of 0. 14, 28 days it also increased. The maximum mean value was at 28 day (6.70) and minimum at 0 day (6.22). (32) determine the ash of legumes, including lentils, chickpeas and peas, are rich sources of highly nutritious protein and dietary fiber, are readily available and are relatively inexpensive. The use of legumes in food products is limited, especially in Western countries, probably due to traditional eating practices, lack of consumer understanding, processing techniques and diversified food products. Public recognition of the health benefits of consuming legumes such as antioxidant activity (AA) could be effective for the expansion of food uses of legumes.



4.1.6 Fat determination

Crude fat in legumes is of vital importance in terms of providing energy along with carbohydrates and acting as a lubricant. It provides flavor and aroma. Good fat is also important in the growth and development of new muscle fibers and retains fat soluble vitamins which are important for normal body functioning and metabolic activities.

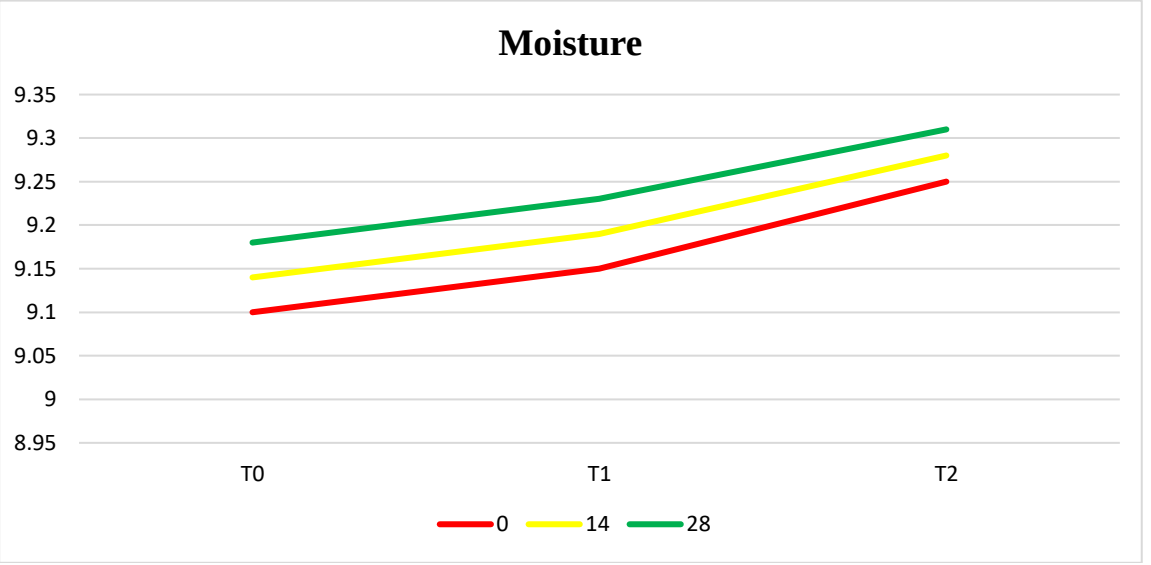
The values of fat of vegetarian soup were given in table (fig:10). Days showed no significant effect on fat and treatment also showed no significant effect on fat. The maximum value was observed in T_1 (3.23) followed by T_0 (3.11), T_2 (2.99) with the addition of legumes the fat increased and during storage of 0. 14, 28 days it also increased. The maximum mean value was at 0 day (9.41) and minimum at 28 day (8.47) **(33)** study was to compare and investigate the effects of wheat bread fortification with various levels of legume powder 2,4 and 6 % (full fat) and cakes (defatted, residue after oil extraction). Legume fortification resulted in darker breads with no discernible effect on overall acceptability. In terms of sensory profile, however, the fortified bread outperformed the control. These findings suggest that adding legume powder and defatted cake to whole wheat bread can improve its overall quality.



4.1.7 Moisture Determination:

Moisture is most important feature because it tells consumers when food is safe to eat, shelf life is significant.

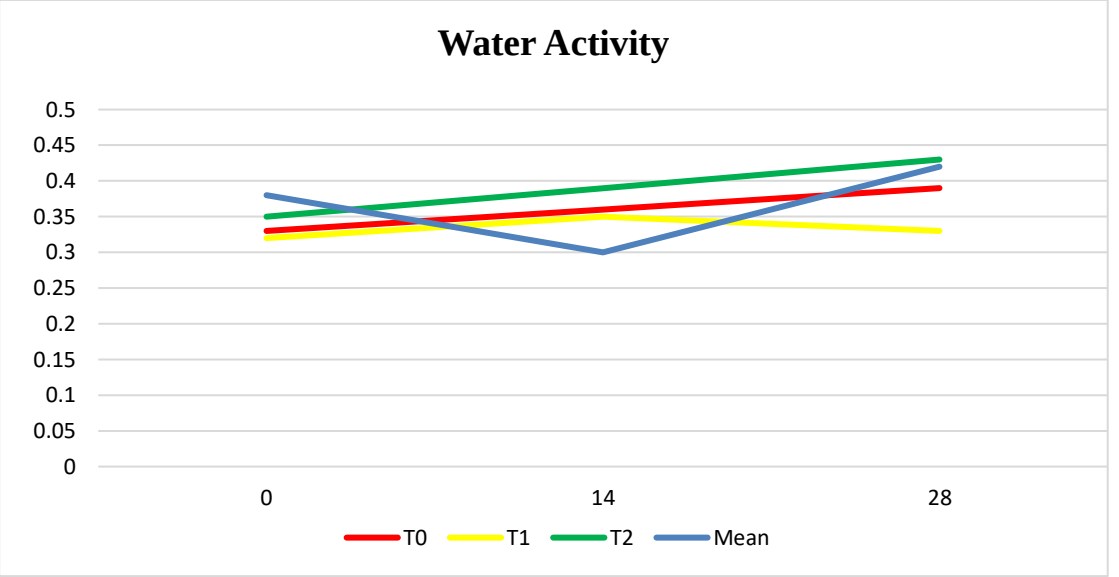
The values of moisture of vegetarian soup were given in table (fig:11). Days showed highly significant effect on moisture and their interaction with treatment showed significant effect on moisture. The maximum value was observed in T_2 (9.28) followed by T_1 (9.19), T_2 (9.04). With the addition of legumes, the moisture increased and during storage of 0. 14, 28 days it also increased. The maximum mean value was at 28 day (9.72) and minimum at 14 day (8.52). (34) investigated that the amount of moisture in soup mixes affects its shelf life because more water makes a product more susceptible to bacteria, which can rot and harm food because they contain less acid than fruits and can be dried to brittleness, veggies are excellent for drying. Vegetables contain only 10% moisture when they are thoroughly dried, and no known microbes can grow at that percentage.



4.1.8 Water activity

The difference between the vapor pressure of the meal when it is in perfect equilibrium with the air media around it and the vapor pressure of distilled water in the same circumstances is the food's water activity (aw).

The values of aw of vegetarian soup are given in table (fig:12). Days showed highly significant effect on aw and their interaction with treatment showed significant effect on aw. The maximum value was observed in T_2 (0.39) followed by T_0 (0.35), T_2 (0.36). With the addition of legumes aw increased and during storage of 0. 7, 14 days it also increased. The maximum mean value was at 28 day (0.42) and minimum at 14 day (0.30). The product needs to be properly dried to prevent bacterial development and stop enzymatic reactions from happening. The water activity (aw) in the vegetables that was dried is therefore increased to 0.15 to 0.20 aw. (35) studied that addition of legumes improve both aw and cooking yield because legumes contains high amount of protein which allow binding free water with legume samples so it help in enhancing aw.



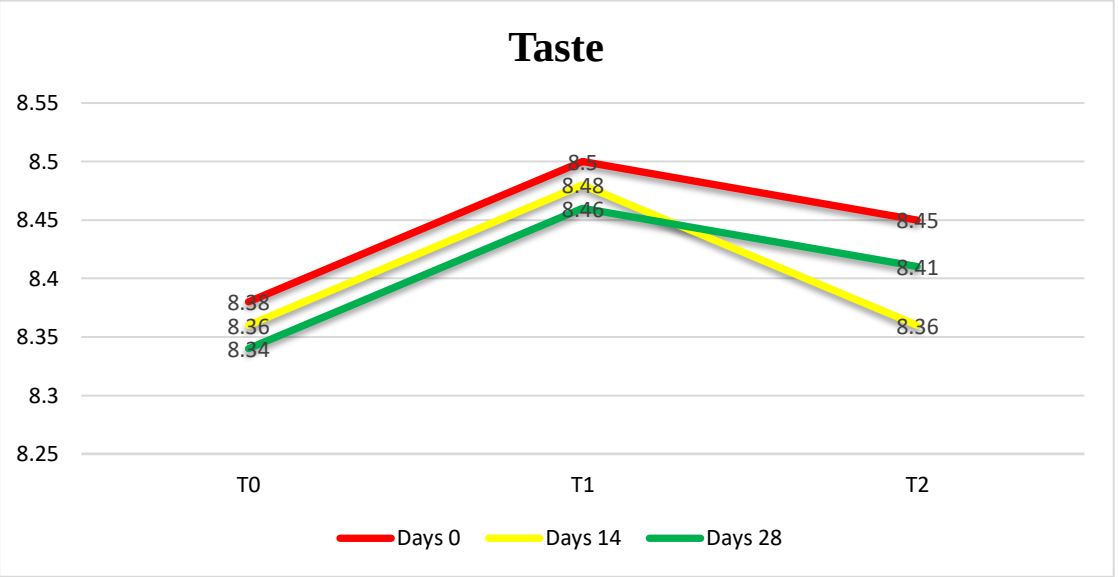
4.2 Sensory Analysis

The most important factor for any product is consumer acceptance according to the product organoleptic and sensorial characteristics. Sensory evaluation of soup was carried out to evaluate the taste, pH, flavor, chew ability and overall acceptability of the candy as describe by nine-point hedonic scale (36).

4.2.1 Taste

The taste molecules in the veggies are created and released by heat. The human sense of taste allows us to experience the flavors of the foods and beverages we consume. To taste something is to consume or drink a small amount of it.

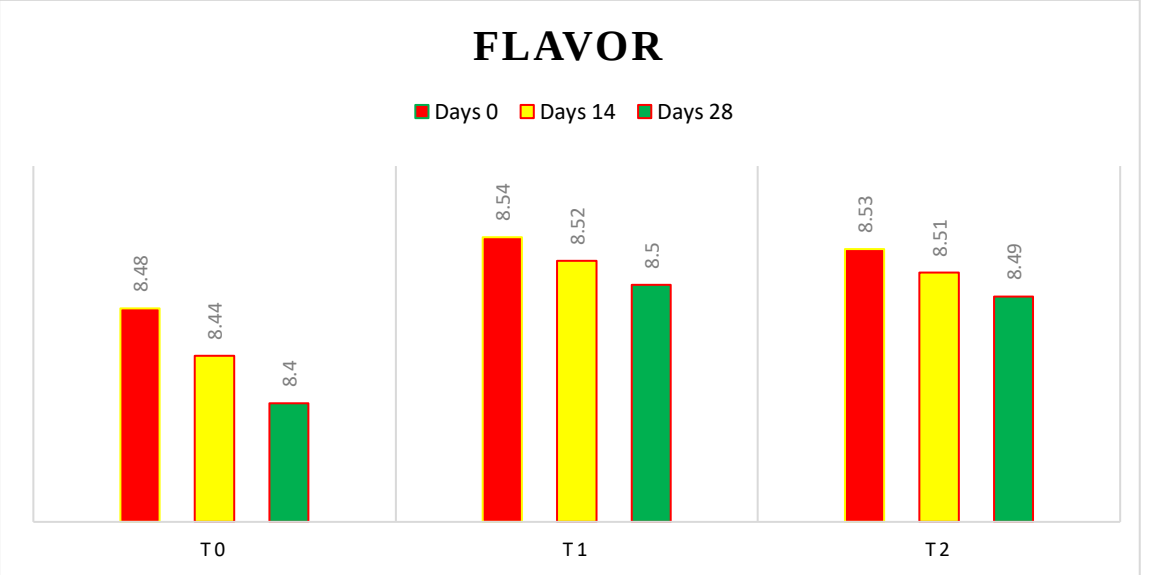
The values of taste of vegetarian soup were given in (fig:13). Days showed highly significant effect on taste and with treatment showed highly significant effect on taste. The maximum value was observed in T_1 (8.48) followed by T_2 (8.43), T_2 (8.36). With the addition of legumes, the taste increased and during storage of 0, 14, 28 days it also increased. The maximum mean value was at 14 day (9.31) and minimum at 28 day (7.64). (37) studied soup samples with legumes additives and the control. There were decreased in sensory attributes parameters like color, taste, odor, flavor and texture by increasing legumes powder concentration. Soup containing legumes at 5.0% additive was well accepted and exhibited the maximum score of sensory properties compared to control. While, in the case of 10% additive, the mean scores were lower which indicated that samples were unacceptable compared to the 2.5 and 7.5%.



4.2.2 Flavor:

Flavor or flavor is either the sensory perception of taste or smell, or a flavoring in food that produces such perception.

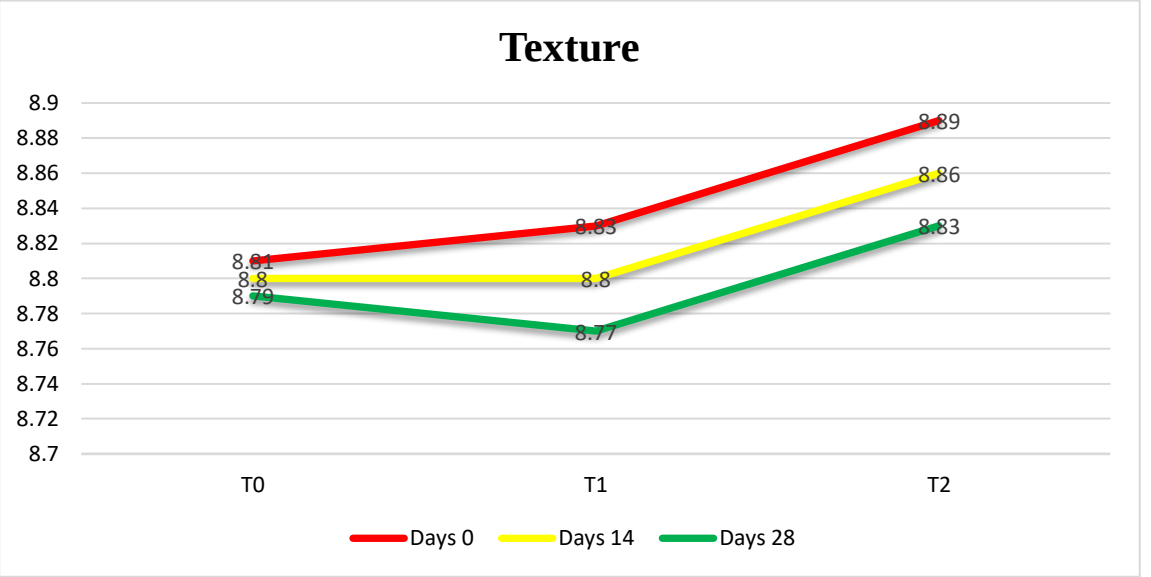
The values of flavor of vegetarian soup was given in (fig:14). Days showed highly significant effect on flavor and their interaction with treatment showed significant effect on flavor. The maximum value was observed in T_1 (8.52) followed by T_2 (8.51), T_0 (8.44). With the addition of legumes, the flavor increased and during storage of 0. 14, 28 days it also increased. The maximum mean value was at 14 day (9.24) and minimum at 28 day (7.62) (38) reported that the characteristic flavor of dried vegetarian soups mainly originates from the breakdown of carbohydrates, lipids and proteins through the action of microbial and endogenous meat enzymes. The development of flavor is also influenced by several variables such as product formulation (especially spices) and processing condition. Different levels of protein concentrate did not significantly affect the flavor of vegetarian soup. But the interaction between protein concentrate, legume powder and storage period significantly affected the flavor score values.



4.2.3 Texture:

The texture of the soup must be really accurate. It should be extremely smooth and lump-free if it is meant to be smooth. If specific ingredients' soft and crisp textures are meant to contrast, the soup shouldn't be overcooked because this turns all the ingredients mushy and soft (39).

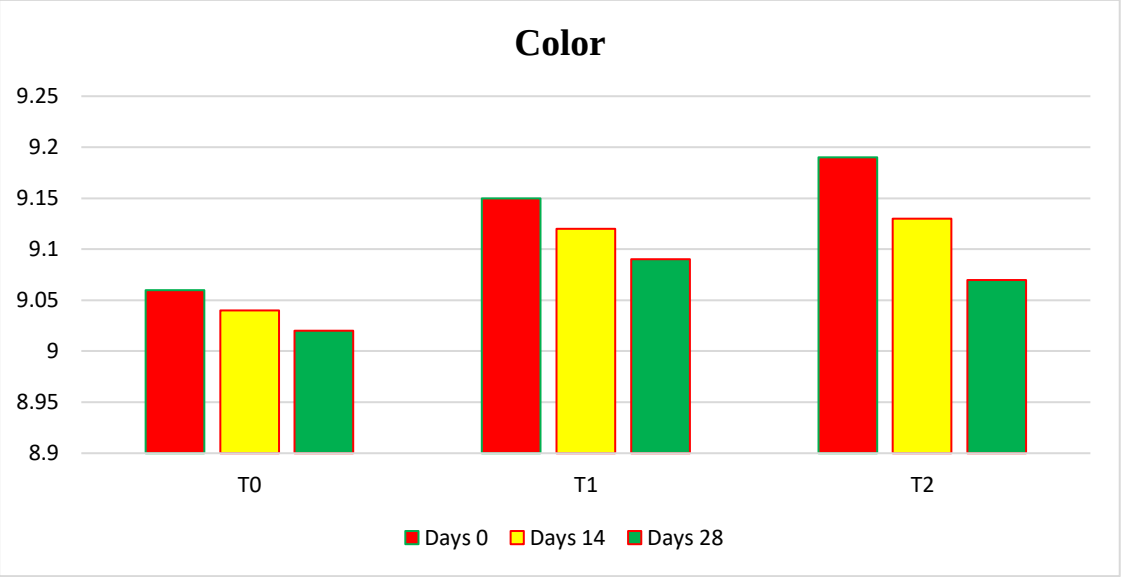
The values of texture of vegetarian soup were given in (fig:15). Days showed significant effect on texture and treatment showed highly significant effect on texture. The maximum value was observed in T_2 (8.86) followed by T_1 (8.80), T_2 (8.80) with the addition of legumes the texture increased and during storage of 0. 14, 28 days it also increased. The low moisture content and high fiber content found in soup mixes with high legumes powder content contributed to the texture decrease observed for the 15 and 20 percent legumes treatments compared to the control treatment. The addition of legumes reduced the texture of the mixture. The control had the highest texture values, and the difference between the control and T1 percent was not significant. In terms of all textural properties, however, there were significant differences between treatments. It showed that with the addition of legume powder in chicken soup caused a significant decrease in texture (31).



4.2.4 Color:

Water released from the vegetables as they cook to "dry" brown them, which involves cooking them over low heat without any oil or additional water. This improves your ability to manage the Millard reaction and caramelization two crucial reactions (34).

The values of color of vegetarian soup were given in (fig:16). Days showed significant effect on color and treatments also showed significant effect on color. The maximum value was observed in T_2 (9.13) followed by T_1 (9.12), T_2 (9.04) with the addition of legumes the color increased and during storage of 0, 7, 14 days it also increased. The maximum mean value was at 0 day (9.41) and minimum at 28 day (8.47). (29) studied soup samples with legumes additives and the control. There were decreased in sensory attributes parameters like color, taste, odor, flavor and texture by increasing legumes powder concentration. Soup containing legumes at green pea additive was well accepted and exhibited the maximum score of sensory properties compared to control. While, in the case of lentil additive, the mean scores were lower which indicated that samples were unacceptable compared to the red kidney beans.



Conclusion:

Vegetable soup mix is a dried food product prepared by spontaneous drying of vegetables such as carrots, potatoes, green peas, garlic, etc. It is one of the most significant dried foods of World which is consumed by almost all households. It is a good source of minerals and vitamins during off-seasons when some vegetables are scarce. It is valued for its uniquely appetizing flavor and served in several ways. Soup mix is a blend of various dried and powdered ingredients in the optimum ratio so as to obtain the required flavor when made into soup with hot water. Due to the demand of special foods by consumers and also because of time factor people now a days are attracted towards easy foods. As a consequence, the demand of ready to eat or ready to cook minimally processed products has noticeably increased during recent years. Soup mix is becoming popular and better option for the population in this busy world. This research was focused on preparing vegetable soup mix added with legumes. All samples were analyzed for moisture content, acidity, ash, and protein content and fiber determination. Sensory analysis was performed for the selection of best vegetable soup mix. Vegetable soup mix made from the lentils was found to be best. The findings of this study clearly showed the value of adding lentil, green pea, and chickpea to dried vegetarian soup combination as a valuable food additive to improve nutritional qualities and technological quality of the resulting soup. They provide a respectable amount of protein, minerals, and fiber and have good stability, and have a longer shelf life. The soup samples' overall sensory quality was satisfactory, and their sensory qualities were examined as well. The lentil inclusion was the most beneficial and widely accepted.

References

1. Farzana T, Mohajan S, Saha T, Hossain MN, Haque MZ. Formulation and nutritional evaluation of a healthy vegetable soup powder supplemented with soy flour, mushroom, and moringa leaf. Food science & nutrition. 2017;5(4):911-20.
2. Rekha M, Yadav AR, Dharmesh S, Chauhan A, Ramteke R. Evaluation of antioxidant properties of dry soup mix extracts containing dill (Anethum sowa L.) leaf. Food and Bioprocess Technology. 2010;3(3):441-9.
3. Al Hasan SM, Hassan M, Saha S, Islam M, Billah M, Islam S. Dietary phytate intake inhibits the bioavailability of iron and calcium in the diets of pregnant women in rural Bangladesh: a cross-sectional study. BMC Nutrition. 2016;2(1):1-10.
4. Panghal A, Janghu S, Virkar K, Gat Y, Kumar V, Chhikara N. Potential non-dairy probiotic products–A healthy approach. Food bioscience. 2018;21:80-9.
5. Salameh C, Scher J, Petit J, Gaiani C, Hosri C, Banon S. Physico-chemical and rheological properties of Lebanese kishk powder, a dried fermented milk-cereal mixture. Powder Technology. 2016;292:307-13.
6. George TT, Obilana AO, Oyeyinka SA. The prospects of African yam bean: past and future importance. Heliyon. 2020;6(11):e05458.
7. Islam M, Sarker MNI, Islam MS, Prabakusuma AS, Mahmud N, Fang Y, et al. Development and quality analysis of protein enriched instant soup mix. Food and Nutrition Sciences. 2018;9(6):663-75.
8. Sudarsan SM, Santhanam SG, Visalachi V. Development and formulation of instant soup mix from sprouted horse gram and radish leaves. International Journal of Home Science. 2017;3(1):346-9.
9. Ibeabuchi J, Okafor D, Peter–Ikechukwu A, Agunwa I, Eluchie C, Ofoedu C, et al. Comparative Study on the Proximate Composition, Functional and Sensory Properties of Three Varieties of Beans Phaseolus lunatus, Phaseolus vulgaris and Vigna um–bellata. International Journal of Advancement in Engineering Technology, Management and Applied Science (IJAETMAS). 2017;5(1):1-23.
10. Odedeji J, Akande E, Fapojuwo O, Ojo A. Effects of Thermal and Non-Thermal Pre-Processing Methods on Physical Attributes of Jackbean (Canavalia ensiformis) Seed. Challenging Issues on Environment and Earth Science Vol 6. 2021:89-101.
11. Salvi J, Katewa S. A review: underutilized wild edible plants as a potential source of alternative nutrition. Int J Bot Stud. 2016;1(4):32-6.
12. Harrison S, Couture P, Lamarche B. Diet quality, saturated fat and metabolic syndrome. Nutrients. 2020;12(11):3232.
13. Duan X, Zhang M, Mujumdar A, Wang R. Trends in microwave-assisted freeze drying of foods. Drying Technology. 2010;28(4):444-53.
14. Wang W, Yan Z, Yao H, Li P, Peng W, Su W, et al. Extraction and purification of pedunculoside from the dried barks of Ilex rotunda using crystallization combined with polyamide column chromatography. Separation Science and Technology. 2021;56(10):1710-20.
15. Abdel-Haleem AM, Omran AA. Preparation of dried vegetarian soup supplemented with some legumes. Food and Nutrition sciences. 2014;5(22):2274.

16. van Buren L, Grün CH, Basendowski S, Spraul M, Newson R, Eilander A. Nutritional quality of dry vegetable soups. Nutrients. 2019;11(6):1270.
17. Chemists A. Approved methods of the AACC. The Association. 2000.
18. Öztürk F, Kalkan S, Elmas E, Elmas S, Bariş P, Demir Ö. Some quality parameters of powdered soups prepared from different fish species. Brazilian Archives of Biology and Technology. 2019;62.
19. Ying D, Schwander S, Weerakkody R, Sanguansri L, Gantenbein-Demarchi C, Augustin MA. Microencapsulated Lactobacillus rhamnosus GG in whey protein and resistant starch matrices: Probiotic survival in fruit juice. Journal of Functional Foods. 2013;5(1):98-105.
20. Pathare PB, Opara UL, Al-Said FA-J. Colour measurement and analysis in fresh and processed foods: a review. Food and bioprocess technology. 2013;6(1):36-60.
21. Shori AB. Proteolytic activity, antioxidant, and α-Amylase inhibitory activity of yogurt enriched with coriander and cumin seeds. LWT. 2020;133:109912.
22. Praepanitchai O-A, Noomhorm A, Anal AK. Survival and behavior of encapsulated probiotics (Lactobacillus plantarum) in calcium-alginate-soy protein isolate-based hydrogel beads in different processing conditions (pH and temperature) and in pasteurized mango juice. BioMed research international. 2019;2019.
23. Martini LA, Catania AS, Ferreira SR. Role of vitamins and minerals in prevention and management of type 2 diabetes mellitus. Nutrition reviews. 2010;68(6):341-54.
24. Montgomery DC. Design and analysis of experiments: John wiley & sons; 2017.
25. Ainebyona P, Kigozi J, Mukisa IM. Determination of the Effect of Changing Ingredient Type and Concentration on Functional Properties of Banana-Vegetable Soup Powder. 2021.
26. Mitchell M, Brunton NP, Wilkinson MG. Impact of salt reduction on the instrumental and sensory flavor profile of vegetable soup. Food research international. 2011;44(4):1036-43.
27. Jagadesan S, Harish R, Miranda P, Unnikrishnan R, Anjana RM, Mohan V. Prevalence of overweight and obesity among school children and adolescents in Chennai. Indian pediatrics. 2014;51(7):544-9.
28. Candore G, Balistreri CR, Colonna-Romano G, Grimaldi MP, Lio D, Listi' F, et al. Immunosenescence and anti-immunosenescence therapies: the case of probiotics. Rejuvenation Research. 2008;11(2):425-32.
29. Binou P, Yanni AE, Karathanos VT. Physical properties, sensory acceptance, postprandial glycemic response, and satiety of cereal based foods enriched with legume flours: A review. Critical Reviews in Food Science and Nutrition. 2022;62(10):2722-40.
30. Armstrong LE, Johnson EC. Water intake, water balance, and the elusive daily water requirement. Nutrients. 2018;10(12):1928.
31. Grosso G, Micek A, Godos J, Pajak A, Sciacca S, Galvano F, et al. Dietary flavonoid and lignan intake and mortality in prospective cohort studies: Systematic review and dose-response meta-analysis. American journal of epidemiology. 2017;185(12):1304-16.
32. Pesta DH, Samuel VT. A high-protein diet for reducing body fat: mechanisms and possible caveats. Nutrition & metabolism. 2014;11(1):1-8.

33. Sharma KD, Karki S, Thakur NS, Attri S. Chemical composition, functional properties and processing of carrot—a review. Journal of food science and technology. 2012;49(1):22-32.
34. Li Y, Li J, Fan L. Effects of combined drying methods on physicochemical and rheological properties of instant Tremella fuciformis soup. Food Chemistry. 2022;396:133644.
35. Foschia M, Horstmann SW, Arendt EK, Zannini E. Legumes as functional ingredients in gluten-free bakery and pasta products. Annual review of food science and technology. 2017;8:75-96.
36. Sonawane A, Chauhan O, Semwal SD, Semwal A. Drying characteristics and lycopene degradation kinetics of tomato soup. Chemical Data Collections. 2021;35:100757.
37. Martínez-Tomé M, Murcia MA, Mariscal M, Lorenzo M, Gómez-Murcia V, Bibiloni M, et al. Evaluation of antioxidant activity and nutritional composition of flavoured dehydrated soups packaged in different formats. Reducing the sodium content. Journal of food science and technology. 2015;52(12):7850-60.
38. Kamble KS, Mote G, Sahoo A. Process development of instant Moringa pod soup powder supplemented with herbs. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):3281-6.
39. Wu G. Dietary protein intake and human health. Food & function. 2016;7(3):1251-65.