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# Technological and Chemical Studies on Bread Supplemented with some Vegetables Powder.

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## Abstract

This study aims to investigate the effect of partial substitution of wheat flour (WF) (82% ext.) with some vegetables as carrot (CF), eggplant (EPF), and radish (RF) at a concentration of 5%, 10% and a mixture between them on the chemical, rheological, and sensory evaluation of bread. The results of the chemical composition on raw materials showed the highest ratio of moisture, fiber, ash, fat and protein in vegetable powders while, wheat flour recorded the highest ratio of carbohydrates. The obtained results showed a significant difference in mineral content between wheat flour, carrot, eggplant, and radish flour powders. The addition of carrot, eggplant, and radish powders to wheat flour increased the fiber, fat and protein of bread supplemented with vegetable powders compared to the control bread. There was a significant difference in energy between different types of bread under investigation. Also, the results indicated that there were significant differences in mineral content in the prepared bread. The results of farinograph and extensograph showed an increase in water absorption, elasticity, proportional number and dough energy while, the extensibility decreased in all blends as compared to the control sample. Thus, the results of the present study showed that vegetable powders may be regarded as an excellent source of protein, fiber, and mineral content. Hence, it is recommended to use these vegetables powders to raise the nutritional values of bread products.

*Key words: Bread, carrot, eggplant, radish, technological studies*

## Introduction

Bread is a major staple food that is eaten all over the world [1]. Bread is a high-energy meal that is high in nutrients such as carbohydrates and fat [2,3] but, low in other elements including protein, minerals, and vitamins[4]. Bread is a fermented confectionery food made mostly from wheat flour, water, yeast, and salt through a series of processes that include mixing, kneading, and prodding, proofing, shaping and baking [5,6].

Fruit and vegetable flours are abundant in fiber, protein, and minerals, as well as having large water and oil holding capacity. As a result, it may be utilized new low-calorie and cost products [7]. Incorporating vegetables into bread may also be a viable option for getting this essential food category into the diet of the general public. Vegetables that contain natural antioxidants may also be a good natural option for extending the shelf life of bread [8]. So, adding vegetables to bread might have both economic and health benefits [9]. Furthermore, they are affordable, widely accessible, have reduced calorie content, and frequently include other essential components such as antioxidants, which may give extra health benefits [10].

Carrots (Daucus carota L) are healthy root vegetables that are commonly orange in color, but come in a variety of colors including purple, black, red, white, and yellow. It's a good source of phytonutrients like phenols, polyacetylene, carotenoids, and high source of vitamin C in food, with moisture, protein, fat, carbohydrates, sugar, and fiber levels ranging from 84 to 95 %, 0.6 to 2.0 %, 0.2 to 0.7 %, 9.58 to 10.6 %, 5.4 to 7.5 %, and 0.6 to 2.9 %, respectively [11,12]. Carrots contents high amount of minerals and vitamins including calcium, iron, sodium, potassium, magnesium, copper, zinc, carotenes, thiamine, riboflavin, niacin, and vitamin C [13, 14].

Eggplant (Solanum melongena L) is a major tropical and subtropical vegetable crop that's commonly utilized in a variety of dishes. They also contain therapeutic properties, which are critical to human health [15]. After potatoes and tomatoes, eggplant (Solanum melongena L.) is the world's third most significant horticultural crop [16]. It contains a lot of minerals and vitamins. It includes a range of phytochemicals, including polyphenols that give essential health advantages in addition to being high in fiber and low in fat [17].

Radish is a root vegetable that is grown and consumed all over the world and is considered a staple of the human diet, despite its rarity in some areas. Radishes are commonly consumed raw as a crisp vegetable, mostly in salads. Radish is a necessary part of one's diet. Alkaloids and nitrogen compounds, coumarins, enzymes, glucosinolates, oil seed compounds, organic acids, phenolic compounds, flavonoids, proteins, amino acids, tannins, brassinosteroids, and polyphenols are among the major chemical constituents of radish [18-20].

The objective of the present study was to determine the chemical composition, minerals content, rheological properties, and sensory evaluation of bread replaced with some vegetables at different ratios.

## Materials and Methods

### Materials:

Carrots, Eggplant and Radish were obtained from the local markets in Zagazig, Egypt.

**Wheat flour:**

Wheat flour (82% extraction) was obtained from Mills Company, Zagazig, Egypt.

**Additives materials:**

Sugar, salt and fresh compressed yeast were obtained from the local markets, Zagazig, Egypt.

**Methods**

**Preparation of vegetables flour (carrot, eggplant, radish):**

Vegetables cleaned well and impurities were removed from them, then washed well with water, cut into small slices and dried at (0- 60 °C) by oven drying fan model Super Serving, Science Center Laboratory for Soil, Food, Feed Stuff Faculty of Technology and development, Zagazig University for 2 days and ground to powder.

**Technological process**

**Preparation of different blends of bread:**

Blends of bread were prepared using wheat flour 82% extraction rate as control and that substituted with 5% and 10% of carrot, eggplant and radish powders. These blends formulations were presented in table (1).

**Table (1): Blends components of WF and its mixtures containing CF, EPF and RF for bread dough**

| Samples No. | Blends % | | | |
|---|---|---|---|---|
| | WF | CF | EPF | RF |
| Control | 100 | - | - | - |
| T1 | 95 | 5 | - | - |
| T2 | 90 | 10 | - | - |
| T3 | 95 | - | 5 | - |
| T4 | 90 | - | 10 | - |
| T5 | 95 | - | - | 5 |
| T6 | 90 | - | - | 10 |
| T7 | 90 | 5 | 5 | - |
| T8 | 90 | 5 | - | 5 |
| T9 | 90 | - | 5 | 5 |
| T10 | 85 | 5 | 5 | 5 |

*WF: Wheat flour (82% ext.) CF: carrot flour EPF: eggplant flour RF: radish flour,*

**Preparation of bread:**

To make the dough, 100 g of wheat flour (82% extraction) was mixed by hand for about 10 minutes with 0.5 g of fresh compacted yeast, 1.5 g of salt, 1.0 g sugar, and water. After 1 hour of fermentation, the dough was cut into pieces. The pieces were left to ferment at the same temperature for around 45 minutes. The fermented dough pieces were flattened to a diameter of about 20.0 cm and cooked for 2:2.5 minutes in a baking bakery. Before being packaged in polyethylene, the loaves were allowed to cool for one hour at room temperature [21].

**Sensory Evaluation:**

Bread samples were evaluated for their sensory characteristics by 20 panelists from the staff and non-staff members of the Department of Home Economics, Faculty of Specific Education, Zagazig University. All samples were provided in plates having white color at ambient temperature. The panelists were asked to evaluate each sample of the bread for general appearance, separation of layers, crumb color, crust color, outside layer thickness, taste, odor, texture, and overall acceptability average. The samples were rated on (very good = 10, good = 8, fair = 4 and poor = 2). Scores were collected and analyzed statistically.

**Statistical analysis**

Statistical analyses were calculated using one-way classification. Analysis of variance was calculated with costate and least significant difference (LSD) at $p \leq 0.05$.

**Chemical analysis:**

Moisture, protein, fat, fiber and ash content were determined in carrot, eggplant and radish according to ISO IEC 17025 – 2017.

**Total carbohydrate:** T.C contents of samples were determined by the difference, according to the equation of Chatfield, and Adams [22].

**Determination of Minerals content:**

Phosphorus (P) was determined by spectrophotometer (Manufacturer labomed, Inc., USA, Model spetro22, S.N 221101) using **ISO 5491/2005** according to **(ISO IEC 17025-2017).** The environmental conditions of the test were 29ºC, moisture 36%.

Sodium (Na) and Potassium (K) elements contents were determined by flame photometer spectroscopy apparatus (CIBA corning model 410, USA, Serial No., 4887) [23].

Calcium, magnesium, iron, manganese, zinc and copper were determined and calculated on a dry weight basis. Elemental analyses were made on known weight (0.5 gm) for each dried sample [24].

**Energy value:**

One of each dried sample was weighed and determined by calorimeter apparatus.

**Rheological parameters:**

The rheological measurements were carried out for each above mentioned flour portion under investigation using farinograph and extensographe in the rheological laboratory department of bread and dough, food technology research institute, Giza, Egypt [25].

**Results and discussion**

The data of chemical composition of raw materials wheat flour 82% ext. carrot flour, eggplant flour, and radish flour are shown in table (2). The results showed that CF, EPF, and RF had the highest value of moisture, fiber, fat, ash, and protein compared to wheat flour while, wheat flour recorded the highest value in carbohydrates. The mean values of WF were 13.86%, 0.49%, 0.55%, 3.32%, 11.94%, and 69.84% for moisture, fiber, fat, ash, protein, and carbohydrates. The energy values of wheat flour, carrot flour, eggplant flour, and radish flour were 3826.3, 3583.7, 3826.3 and 3583.7 cal/g, respectively. These results were confirmed by the work of Hussein and Maray [10, 26]. They found that moisture, protein, ether extract, ash, crude fiber, and total carbohydrate content were 13.20%, 11.80%, 1.66%, 1.15%, 1,70%, and 83.69% respectively.

Regarding carrot flour, the results showed 21.42% moisture, 6.66% fiber, 2.5% fat, 6.24% ash, 10.01% protein and 53.16% carbohydrates. These results were nearly in agreement with Hussein [27] who reported that carrot powder had 9.20% crude protein, 2.90% fat, 6.83% ash, 7.16% fiber and 65.26% carbohydrates.

Regarding eggplant flour, the obtained results showed 22.88% moisture, 15.57% fiber, 2.72% fat, 4.48% ash, 12.15% protein and 42.5% carbohydrates. These results were higher than those obtained by Rodriguez-Jimenez [28] who reported that eggplant was 12.32% fiber, 1.75% fat, 7.31% ash, 12.5 protein and 57.54% carbohydrates.

Regarding radish flour, the results showed that it contains 22.39% moisture, 14.90% fiber, 2.01% fat, 12.48% ash, 16.63% protein and 31.59 carbohydrates. The results revealed that CF, EPF, and RF have higher ash and fiber levels than wheat flour. Furthermore, the data shows that EPF and RF are high in protein. These findings make them extremely beneficial in the preparation of high-nutritional-content bread goods.

**Table (2): Chemical Composition (% on dry weight basis) of WF, CF, EPF and RF**

| Parameters | WF | CF | EPF | RF |
|---|---|---|---|---|
| **Moisture (%)** | 13.86± 0.25 | 21.42±0.39 | 22.88 ± 0.41 | 22.39 ±0.40 |
| **Fiber (%)** | 0.49± 0.04 | 6.66 ± 0.50 | 15.57 ± 1.16 | 14.90 ±1.11 |
| **Fat (%)** | 0.55± 0.02 | 2.51± 0.07 | 2.72 ± 0.08 | 2.01± 0.06 |
| **Ash (%)** | 3.32± 0.03 | 6.24 ± 0.06 | 4.48 ± 0.04 | 12.48 ±0.12 |
| **Protein (%)** | 11.94±0.64 | 10.01±0.38 | 12.15 ± 0.46 | 16.63 ±0.64 |
| **Carbohydrates (%)** | 69.84 | 53.16 | 42.5 | 31.59 |
| **Energy (Cal/g)** | 3826.3 | 3583.7 | 3826.3 | 3583.7 |

*WF: Wheat flour (82% ext.)    CF: carrot flour    EPF: eggplant flour, RF: radish flour,*

Data indicated in the table (3) show the minerals content of wheat flour (82% extraction), carrot flour, eggplant flour, and radish flour. The results showed a significant difference between wheat flour, carrot flour, eggplant flour, and radish flour. The highest value of P, K, Na, and Ca had recorded with radish. Whole wheat flour contained the highest value of Mg and Mn. Also, carrots recorded the highest values of Zn and Cu. The highest Fe content was recorded for eggplant, carrot, wheat flour and radish. The results were 7.225, 6.966, 4.946, and 0.927 mg/100g, respectively.

The mineral contents of wheat flour were 200, 1460, 1760, 326.90, 440.50, 0.0865, 1.347, 4.946, and 0.622 mg/100g of P, K, Na, Ca, Mg, Mn, Zn, Fe, and Cu, respectively. These results are higher than those recorded by El Hadidy and Hussein [10, 29].
The results of carrot flour were 150, 330, 220, 220.77, 276.75, 0.831, 2.638, 6.966 and 1.425 mg/100g, for minerals respectively. These results disagree with Ali work [30]. Also, the results of eggplant flour were 240, 2520, 1650, 187.22, 393.25, 0.503, 1.657, 7.225 and 0.908 mg/100g. Radish flour contains 380, 4720, 3310, 402, 15, 285.75, 0.540, 2.187, 0.927, and 0.716 respectively.

**Table (3): Minerals content of WF, CF, EPF and RF (on dry weight basis)**

| Parameters (mg/100g) | WF | CF | EPF | RF |
|---|---|---|---|---|
| **P** | 200 | 150 | 240 | 380 |
| **K** | 1460 | 330 | 2520 | 4720 |
| **Na** | 1760 | 220 | 1650 | 3310 |
| **Ca** | 326.90 | 220.77 | 187.22 | 402.15 |
| **Mg** | 440.50 | 276.75 | 393.25 | 285.75 |
| **Mn** | 0.87 | 0.83 | 0.50 | 0.54 |
| **Zn** | 1.35 | 2.64 | 1.66 | 2.19 |
| **Fe** | 4.95 | 6.97 | 7.23 | 0.93 |
| **Cu** | 0.62 | 1.43 | 0.91 | 0.71 |

*WF: Wheat flour (82% ext.) CF: carrot flour EPF: eggplant flour RF: radish flour*

The Sensory evaluation of bread samples made from 82% wheat flour only (control bread) and supplemented with carrot, eggplant, and radish at different replacement levels were evaluated for shape, separate layers, crumb color, crust color, layer thickness, taste, odor, softness and overall acceptability. The data had collected from the sensory evaluation were statistically analyzed then the results are shown in Table 4. The results showed that the control bread sample scored the highest values compared with other bread samples. The sensory characteristics of bread were scored differently in each sample. These differences had caused by the ratio of replacement of the used vegetable powder. In the same table, bread supplemented with 5% CF, 10% CF, 5% RF, 5%CF+5% RF, and 5%CF+5%EPF+5%RF recorded higher acceptability than other samples with scores of 8.91, 8.77, and 8.23.
The outlined data in Table 5 show the chemical compositions of bread prepared from carrot powder, eggplant powder, and radish powder with wheat flour and bread prepared from 100% wheat flour (82% extraction). The results showed that there were differences in moisture, fiber, fat, ash, protein, total carbohydrates and energy values.
The highest moisture content was 24.07% in T1 while, the lowest value was 15.17% in T3 comparing with control bread. The fiber content in T6 which contains 5%CF+5%EPF+ 5% RF was 3.08 higher than control bread. The presented results in table 5 showed the highest fat content was 1.77% in T6. While the lowest fat content was 0.15%

in control bread. In the same table, the highest value of ash was 7.11% in T5 whereas; the lowest ash content was 3.73% in T6. Also, the protein content in T6 was 15.29% higher than all other supplemented bread while, control bread recorded the lowest content of protein at 12.07%.

**Table (4): sensory evaluation of supplemented bread**

| Samples | Shape | Separate layer | Crumb color | Layar color | The lauer thickness | taste | Odor | softness | Overall quality score |
|---|---|---|---|---|---|---|---|---|---|
| **Control** | $10^{a}$ ± 0.00 | $10^{a}$ ± 0.00 | $10^{a}$ ± 0.00 | $10^{a}$ ± 0.00 | $10^{a}$ ± 0.00 | $10^{a}$ ± 0.00 | $10^{a}$ ± 0.00 | $10^{a}$ ± 0.00 | $10^{a}$ ± 0.00 |
| **5%CF** | $8.86^{ab}$ ± 1.21 | $8.86^{b}$ ± 1.32 | $8.68^{b}$ ± 1.52 | $8.68^{a}$ ± 1.49 | $8.64^{b}$ ± 1.68 | $8.5^{bc}$ ± 1.60 | $8.77^{b}$ ± 1.23 | $8.73^{b}$ ± 1.45 | $8.91^{b}$ ± 1.11 |
| **10%CF** | $8.91^{ab}$ ± 1.23 | $8.86^{b}$ ± 1.17 | $8.77^{ab}$ ± 1.48 | $8.68^{b}$ ± 1.62 | $8.59^{b}$ ± 1.65 | $8.77^{b}$ ± 1.63 | $8.64^{b}$ ± 1.53 | $8.59^{b}$ ± 1.44 | $8.77^{bc}$ ± 1.29 |
| **5%EPF** | $7.5^{cd}$ ± 1.79 | $8.95^{b}$ ± 1.05 | $7.23^{cd}$ ± 1.54 | $7.09^{cd}$ ± 1.69 | $8.32^{b}$ ± 1. 70 | $7.45^{bc}$ ± 1.77 | $8.14^{b}$ ± 1.52 | $8.09^{b}$ ± 1.63 | $8.09^{bc}$ ± 1.66 |
| **10%EPF** | $6.64^{d}$ ± 1.99 | $9^{b}$ ± 1.02 | $6.36^{d}$ ± 1.97 | $6.14^{d}$ ± 2.10 | $8.05^{b}$ ± 1.73 | $7.05^{c}$ ± 1.89 | $7.86^{b}$ ± 1.55 | $7.59^{b}$ ± 1.56 | $7.41^{c}$ ± 1.79 |
| **5%RF** | $8.91^{ab}$ ± 1.19 | $9.09^{b}$ ± 0.87 | $9.09^{ab}$ ± 0.97 | $9.05^{ab}$ ± 0.95 | $9.18^{ab}$ ± 0.85 | $8.36^{bc}$ ± 1.43 | $8.45^{b}$ ± 1.60 | $8.68^{b}$ ± 1.73 | $8.77^{bc}$ ± 1.34 |
| **10%RF** | $8.86^{ab}$ ± 1.17 | $9.14^{b}$ ± 0.94 | $9.05^{ab}$ ± 1.09 | $8.95^{ab}$ ± 1.29 | $9.05^{ab}$ ± 1.05 | $7.41^{bc}$ ± 2.34 | $7.81^{b}$ ± 2.06 | $8.41^{b}$ ± 2.17 | $8.27^{bc}$ ± 1.83 |
| **5%CF+ 5%EPF** | $7.05^{cd}$ ± 2.06 | $9.14^{b}$ ± 0.94 | $7.09^{cd}$ ± 2.00 | $6.91^{cd}$ ± 2.07 | $8.45^{b}$ ± 1.63 | $8.09^{bc}$ ± 1.27 | $7.82^{b}$ ± 1.84 | $7.86^{b}$ ± 1.32 | $8.18^{bc}$ ± 1.30 |
| **5%CF+ 5%RF** | $8.95^{ab}$ ± 1.17 | $9.14^{b}$ ± 0.83 | $9.05^{ab}$ ± 1.13 | $9.05^{ab}$ ± 1.0 | $9.05^{ab}$ ± 1.00 | $8.64^{b}$ ± 1.26 | $8.36^{b}$ ± 1.71 | $8.68^{b}$ ± 1.84 | $8.77^{bc}$ ± 1.63 |
| **5%RF+ 5%EPF** | $8.18^{bc}$ ± 1.65 | $9^{b}$ ± 1.11 | $7.91^{bc}$ ± 1.69 | $8.23^{b}$ ± 1.41 | $8.68^{b}$ ± 1.29 | $7.86^{bc}$ ± 1.70 | $8.18^{b}$ ± 1.59 | $8.41^{b}$ ± 1.44 | $8.18^{bc}$ ± 2.20 |
| **5%CF+ 5%RF+ 5%EGF** | $8^{bc}$ ± 1.98 | $8.68^{b}$ ± 1.39 | $7.55^{c}$ ± 1.90 | $7.95^{bc}$ ± 1.70 | $8.41^{b}$ ± 1.53 | $7.68^{bc}$ ± 1.52 | $8.18^{b}$ ± 1.47 | $8.36^{b}$ ± 1.50 | $8.23^{bc}$ ± 1.51 |
| **LSD** | 0.898 | 0.611 | 0.888 | 0.893 | 0.819 | 0.945 | 0.920 | 0.921 | 0.903 |

*Control: Wheat flour (82% ext.  CF: carrot flour EPF: eggplant flour  RF: radish flour, Each value represents mean of three replicates± standard deviation  very good = 10,    good = 8,    fair = 4 and poor = 2*

Carbohydrate content decreased in all bread samples supplemented with vegetables as compared to the control bread. The carbohydrates content were 66.74%, 63.86%, 59.66%, 58.03%, 57.15%,55.44%, and 55.31% for control bread followed by T3, T5, T2, T4, T1, and T6. In the same table, the total energy values of bread were significantly decreased by composite bread. The highest energy value was 5767.1 cal/g in bread supplemented with 5%RF. While the lowest energy value was 1068.9 cal/g in bread supplemented with 5% EPF.

**Table (5): chemical composition of supplemented bread**

| Samples | Moisture | Fiber | Fat | Ash | Protein | T.C | Energy |
|---|---|---|---|---|---|---|---|
| | | | % | | | | Cal / g |
| **Control** | 15.22±0.27 | 0.41±0.03 | 0.15±0.01 | 5.41±0.05 | 12.07±0.46 | 66.74 | 4068.9 |
| **T1** | 24.07±0.43 | 1.04±0.08 | 0.36±0.01 | 6.62±0.07 | 12.47±0.48 | 55.44 | 4554.1 |
| **T2** | 20.75±0.37 | 1.30±0.10 | 0.87±0.03 | 6.89±0.07 | 12.16±0.47 | 58.03 | 1554.1 |
| **T3** | 15.17±0.27 | 1.68±0.13 | 1.11±0.03 | 5.91±0.06 | 12.27±0.47 | 63.86 | 4311.5 |
| **T4** | 20.75±0.37 | 1.22±0.09 | 1.46±0.04 | 4.98±0.05 | 14.44±0.55 | 57.15 | 1068.9 |
| **T5** | 17.12±0.31 | 1.34±0.10 | 0.76±0.02 | 7.11±0.07 | 14.01±0.54 | 59.66 | 5767.1 |
| **T6** | 20.82±0.37 | 3.08±0.23 | 1.77±0.02 | 3.73±0.04 | 15.29±0.58 | 55.31 | 4068.9 |

*Each value represents mean of three replicates± standard deviation C: control 100% WF T1:5%CF + 95 %WF T2: 10%CF +90 %WF T3:5%CF +5%RF +90%WF T4: 5% EPF + 95%%WF T5: 5%RF + 95%WF T6: 5%CF +5%RF+ 5% EPF+85% WFT.C: total carbohydrates*

Data presented in table 6 show the mineral content of wheat bread and supplemented bread with vegetable powder. The results indicated that there were differences in mineral content between different bread. Bread prepared from 5%EPF had the highest contain P, K, and Na, were 370,780 then 1790 mg/100g, respectively compared with control bread and other treatments while, bread of 10% CF had the highest content of Ca and Mg at levels of 288.13 and 457.75 mg/100g. Also, Bread supplemented with 5%CF+5%EPF+5%RF had recorded the highest values of Mn, Fe, and Cu which were 1.03, 7.96, and 0.52 mg/100g, respectively while, bread supplemented with 5% of CF had the highest contain Zn 2.00 mg/100g compared with control bread and other treatments. The increased P, K, Na, Ca, Mg, Mn, Zn, Fe, and Cu contents in the mixed bread may be due to the different levels of vegetable powder.

**Table (6): Mineral contents of supplemented bread**

| Samples | P | K | Na | Ca | Mg | Mn | Zn | Fe | Cu |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | (mg/100g) | | | |
| **C** | 150 | 200 | 330 | 77.35 | 161.00 | 0.956 | 1.452 | 7.112 | 0.374 |
| **T1** | 150 | 660 | 650 | 89.00 | 183.00 | 0. 930 | 2.005 | 2.574 | 0.357 |
| **T2** | 130 | 270 | 370 | 288.12 | 457.75 | 0. 932 | 1.275 | 6.204 | 0.290 |
| **T3** | 180 | 620 | 760 | 185.05 | 147.25 | 0. 971 | 1.471 | 7.054 | 0.408 |
| **T4** | 370 | 780 | 1790 | 81.02 | 329.00 | 0. 872 | 1.304 | 6.504 | 0.299 |
| **T5** | 200 | 500 | 690 | 81.55 | 205.50 | 0. 990 | 1.521 | 6.724 | 0.267 |
| **T6** | 180 | 670 | 680 | 155.67 | 268.75 | 1.030 | 1,959 | 7.956 | 0.522 |

*C: control 100% WF T1:5%CF + 95 %WF T2: 10%CF +90 %WF, T3:5%CF +5%RF +90%WF T4: 5% EPF + 95%%WF T5: 5%RF + 95%WF, T6: 5%CF +5%RF+ 5% EPF+85% WF*

The presented data in table 7 and fig. (1) show the farinogragh parameters included water absorption (%), arrival time (min), dough development (min), dough stability (min), and degree of softening (B.U). The water absorption of the composite flour dough ranged from 60.0% to 66.0% and was significantly higher than the control at 55.5%. The absorption of more water during mixing is a typical characteristic of composite starches [(31)]. Several studies also reported that the dough made from composite flour absorbed more water than that made from wheat flour alone [32, 33]. Also, there was no significant difference in the arrival time between dough samples.

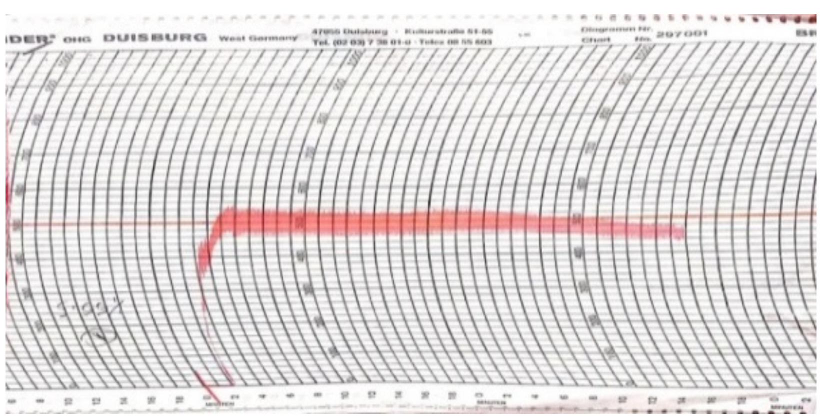
Development time is the time from the first addition of water to the time the dough reaches the point of the greatest torque. During this phase of mixing, the water hydrates the flour components and the dough was developed. The development time of the dough made from the substituted flour 5%CF and 5%CF+5%RF was the same with control 2.0 min, shortened for 10%CF and 5%EPF 1.5 min, and lengthened for T6 2.5 during mixing.

The Stability time for treatment samples ranged from 11.5 min to 16.0 min and the control recorded 13.5 min. The stability time of 5% EPF was longer 16.5 min than that of control 13.5 min except for the dough of 5% CF had shortened than control 11.5 min. The dough softening degree of the control dough was 20 B.U. and the dough made from 5%CF, 5% CF+ 5% RF, and 5% RF recorded 30 B.U was higher than the control but decreased in T2, T4, and T6 10 B.U.

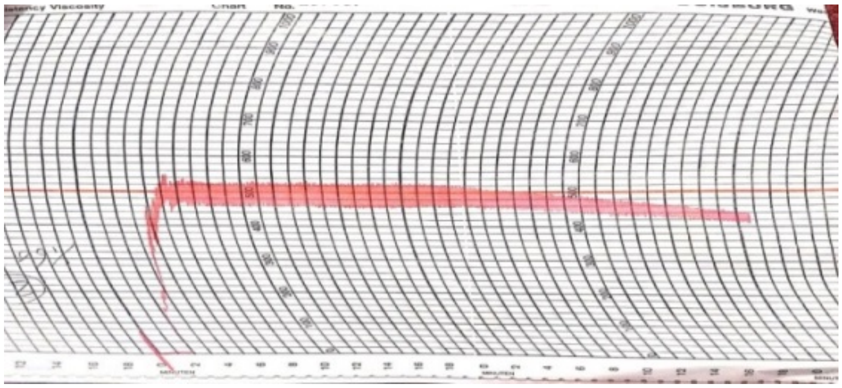
**Table (7): Effect of CF, EPF and RF on farinographe parameters of bread dough**

| Samples | W.A (%) | A.T (min) | D.D.T (min) | S.T (min) | D.S (B.U) |
|---|---|---|---|---|---|
| C | 55.5 | 1.5 | 2.0 | 13.5 | 20 |
| T1 | 60.0 | 1.5 | 2.0 | 11.5 | 30 |
| T2 | 60.0 | 1.0 | 1.5 | 14.5 | 10 |
| T3 | 65.0 | 1.5 | 2.0 | 12.0 | 30 |
| T4 | 66.0 | 1.0 | 1.5 | 16.0 | 10 |
| T5 | 60.5 | 1.5 | 2.0 | 12.0 | 30 |
| T6 | 66.0 | 1.5 | 2.5 | 13.0 | 10 |

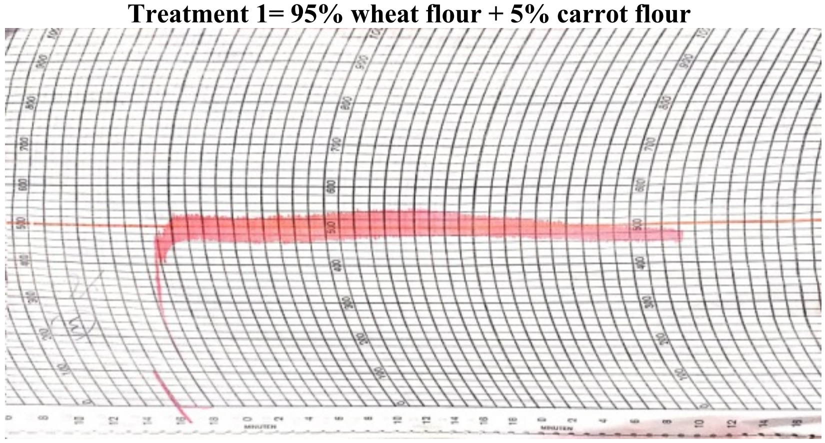
C: control 100% WF T1:5%CF + 95 %WF, T2: 10%CF +90 %WF T3:5%CF +5%RF +90%WF T4: 5% EPF + 95%%WF, T5: 5%RF + 95%WF, T6: 5%CF +5%RF+ 5% EPF+85% WF W.A: water absorption. A.T: arrival time D.D.T: dough development time S.T: stability time D.S: degree of softening



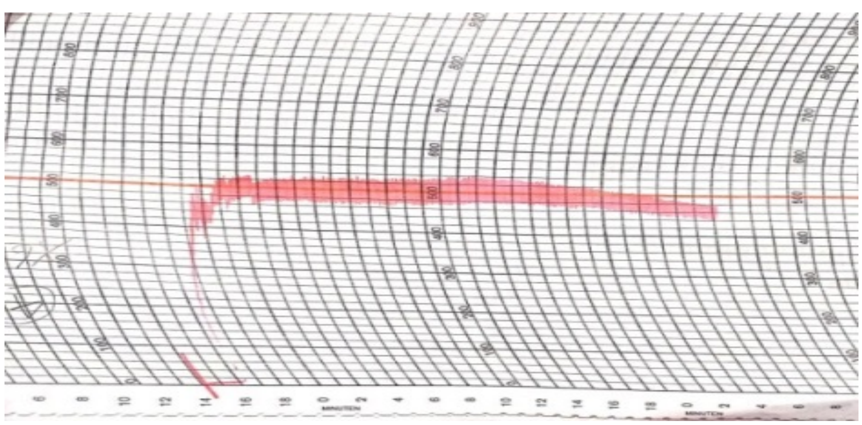

**Control = 100% wheat flour**



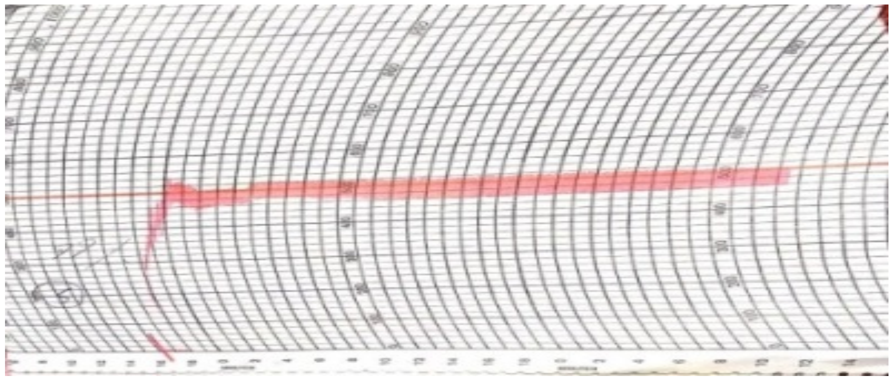
**Treatment 1= 95% wheat flour + 5% carrot flour**



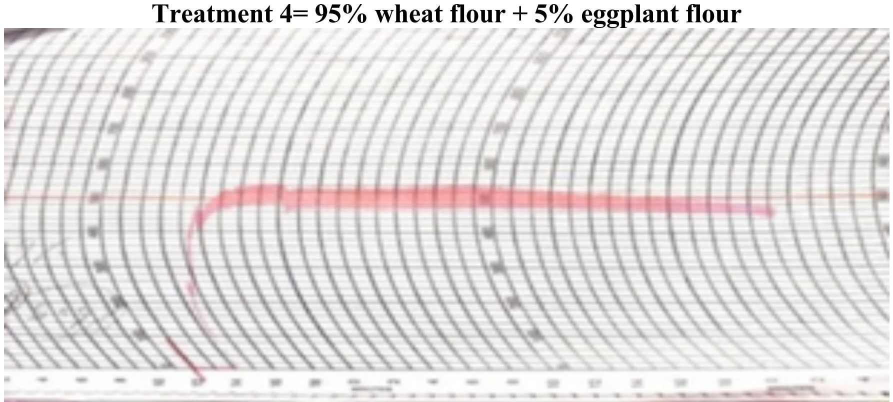
Treatment 2 = 90% wheat flour + 10% carrot flour



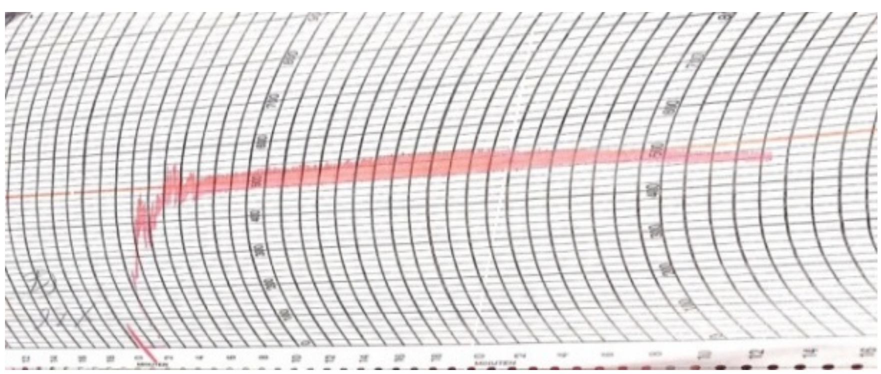
**Treatment 3 = 90% wheat flour + 5% carrot flour + 5%radish flour**



**Treatment 4= 95% wheat flour + 5% eggplant flour**



Treatment5= 95% wheat flour + 5% radish flour



**Treatment6= 85% wheat flour + 5% carrot + 5% radish + 5% eggplant**

**Fig. (1): farinograme of dough prepared from wheat and wheat flour with 5% carrot, eggplant, radish and mixture of them.**

Data are given in Table 8 and fig. (2) show the extinsograph parameters and including the resistance to extension (elasticity), extensibility (mm), proportional number (P.N), and energy. The results showed that elasticity increased in all blends compared with 100%

wheat flour. The elasticity of the composite flour dough ranged from 270 B.U to 480 B.U and was significantly higher than the control of 220 B.U. These results were similar to the report [34] (wheat flour, quinoa, and barley flour). Also, the results revealed that the values of extensibility for the control dough had decreased due to the addition of vegetable flour to wheat flour. The dough made from 5%CF+5%RF+5%EPF recorded the lowest value in extensibility of 70 mm whereas, the control dough recorded the highest value of 120 mm. in the same table, the proportional number of blends increased from 1.83 for the control sample to 2.45, 3.10, 3.60, 4.47, 5.29, and 6.86 for T1, T5, T3, T4, T2, and T6, respectively.

Concerning the dough energy value, the results showed that dough containing 5% CF was the highest at 68 cm² when compared to the control sample 48 cm². These results are similar to the data of El-Mehiry [35].

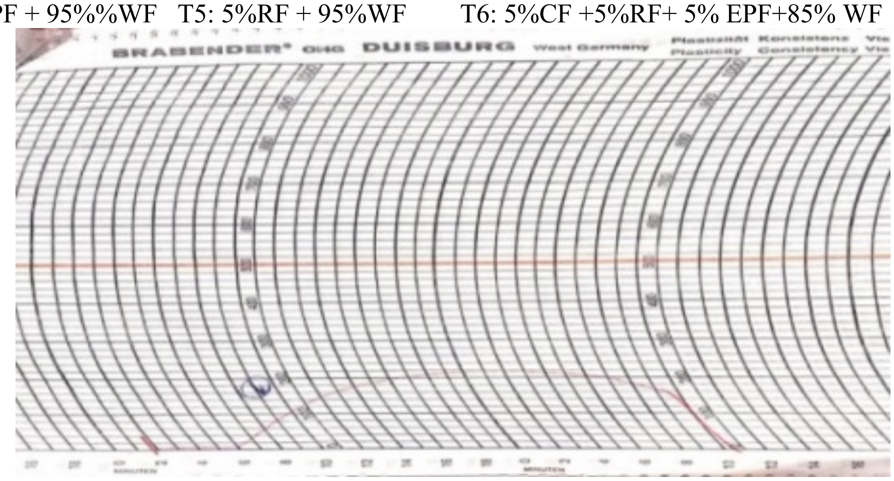
**Table (8): Effect of wheat flour supplemented with vegetable powders on Extensograph parameters**

| Samples | Elasticity (BU) | Extensibility (mm) | Proportional Number (P.N) | Energy (cm2) |
|---|---|---|---|---|
| C | 220 | 120 | 1.83 | 48 |
| T1 | 270 | 110 | 2.45 | 55 |
| T2 | 450 | 85 | 5.29 | 68 |
| T3 | 360 | 100 | 3.60 | 65 |
| T4 | 380 | 85 | 4.47 | 53 |
| T5 | 310 | 100 | 3.10 | 57 |
| T6 | 480 | 70 | 6.86 | 51 |

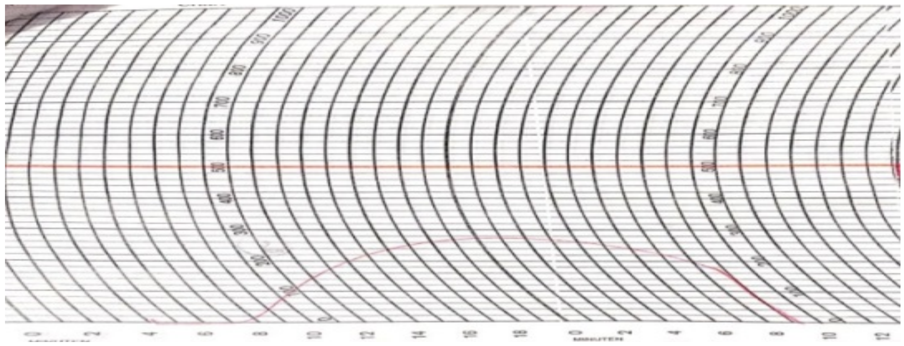
Each value represents mean of three replicates± standard deviation

C: control 100% WF T1:5%CF + 95 %WF T2: 10%CF +90 %WF T3:5%CF +5%RF +90%WF

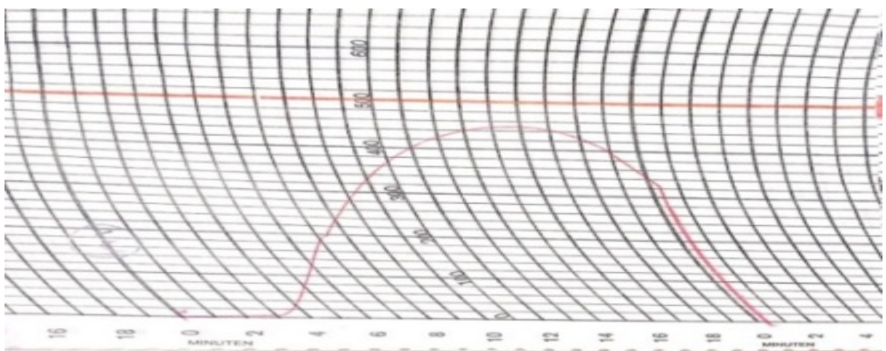
T4: 5% EPF + 95%%WF T5: 5%RF + 95%WF T6: 5%CF +5%RF+ 5% EPF+85% WF



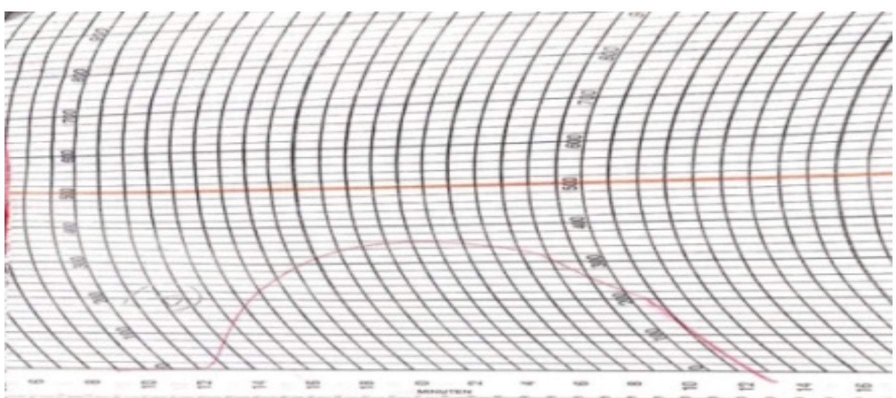

**Control = 100% wheat flour**



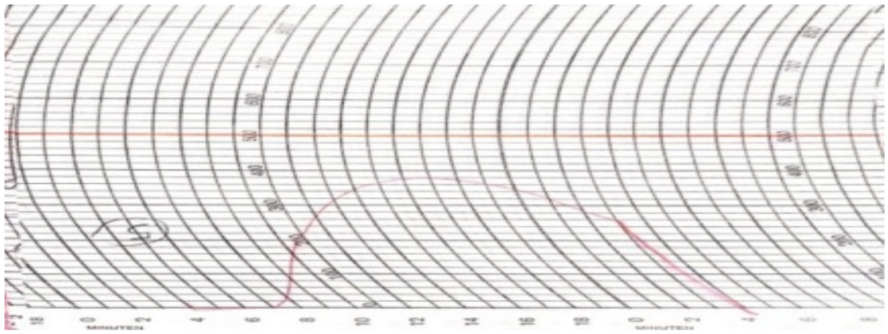
**Treatment1= 95% wheat flour + 5% carrot flour**



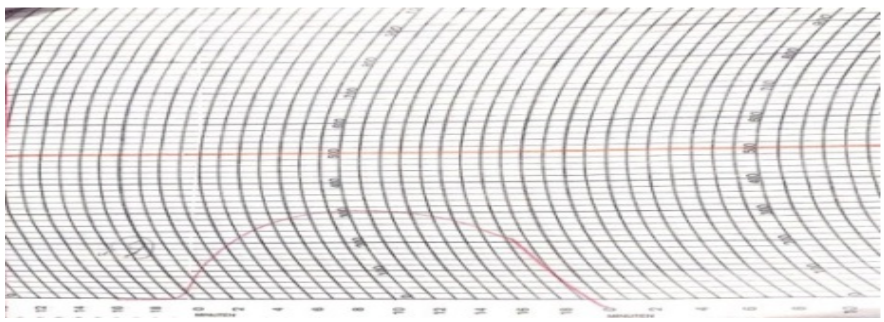
**Treatment2 = 90% wheat flour + 10% carrot flour**



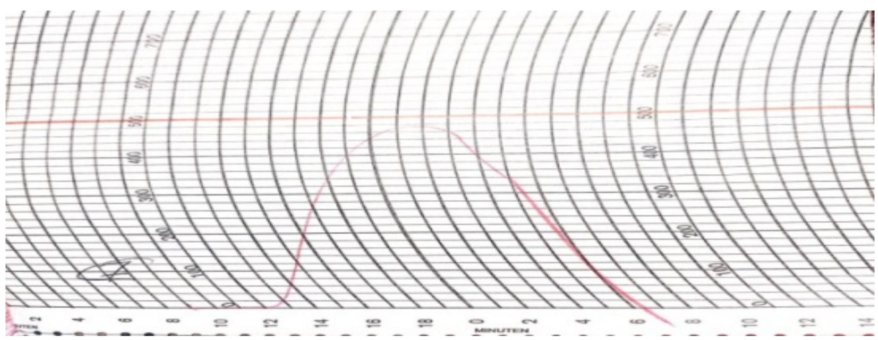
**Treatment3 = 90% wheat flour + 5% carrot flour + 5%radish flour**



**Treatment4 = 95% wheat flour + 5% eggplant flour**



**Treatment5= 95% wheat flour + 5% radish flour**



**Treatment 6: 85% wheat flour + 5% carrot + 5% radish + 5% eggplant**

**Fig. (2): Extensograme of dough prepared from wheat and wheat flour with 5% carrot, eggplant, radish and mixture of them**

## Conclusion

Some vegetable powder had an effect after adding them to wheat flour as powder and making bread to increase the content of minerals and nutrients. The results of the chemical composition of the bread samples supplementation recorded the highest values in fiber, protein, and fat. Also, the bread sample fortified with 5% radish recorded the highest value in the energy content. Therefore, we recommended like of that vegetable powders by a concentration up to 5% amount to include it in our daily diet and food supplementation.

## References

[1]Motrena, SG; Carvalho, MJ; Canada, J; Alvarenga, NB; Lidon, FC; Elisa, BP: Characterization of Gluten-Free Bread Prepared from Maize, Rice and Tapioca Flours Using the Hydrocolloid Seaweed Agar-Agar. *Recent Research in Science and Technology*, (2011) 3: 64-68.

[2] Oluwajoba, SO; Malomo, O; Ogunmoyela OAB, Dudu, OEO; and Odeyemi, A: Microbiological and Nutritional Quality of Warankashi Enriched Bread. *Journal of Microbiology, Biotechnology and Food Sciences,* (2012) 2(1): 42–68.

[3]Ameh, MO; Gernah, DI; Igbabul, BD: Physico-chemical and Sensory Evaluation of Wheat Bread Supplemented with Stabilized Undefatted Rice Bran. *Journal of Food and Nutrition Science*, (2013) 4: 43–48.

[4]Young, J: Functional Bakery Products Current Directions and Future Opportunities. *Food Industry Journal*, (2001) 4: 136–144.

[5]Dewettinck K; Van, BF; Kuhne, B; Courtens, T; and Gellynck: Nutbritional Value of Bread: Influence of Processing Food Interaction and Consumer Perception. Review. *Journal of Cereal Science*, (2008) 48: 243-257.

[6]Sivam, AS; Sun-Waterhouse D; Siew, YQ; and Perera, CO: Properties of Bread Dough with Added Fiber Polysaccharides and Phenolic Antioxidants: A Review, *Journal of Food Science*, (2010) 75(8): 163-174.

[7]Ferreira, Mariana SL; Santos, Moˆ nica CP; Moro, Thaı´sa MA; Basto, Gabriela J; Andrade, Roberta MS; Goncalves, Edira, CBA: Formulation and Characterization of Functional Foods Based on Fruit and Vegetable Residue Flour. *Journal of Food Science Technology*. (2013) 13197- 013- 1061-4.

[8] Joffe, M; Robertson, A: The Potential Contribution of Increased Vegetable and Fruit Consumption to Health Gain in The European Union. *Public Health Nutrition*, (2001) 4: 893–901.

[9]Mastromatteo, M; Danza, A; Guida, M; Del Nobile, MA: Formulation Optimisation of Vegetable Flour-Loaded Functional Bread Part I: Screening of Vegetable Flours and Structuring Agents. *International Journal of Food Science. Technology*, (2012) 47: 1313–1320.

[10] Hussein, AMS; Kamil, MM; Hegazy, NA; Abo El-Nor SAH: Effect of Wheat Flour Supplemented with Barely and/or Corn Flour on Balady Bread Quality, *Journal of Food Science & Nutrition*, (2013) 63(1): 11-18

[11] Hansen, S; Purup S; Christensen Lp: Bioactivity off Alcarinol and The Influence of Processing and Storage on Its Content in Carrots (Daucuscarota L). *Journal of the Science of Food and Agriculture,* (2003) 83: 1010–1017.
[12] Hashimoto, T and Nagayama, T: Chemical Composition of Ready to Eat Fresh Carrot, *Journal of Food Hygien, Soc. Japan,* (2004) 39: 324 – 328.
[13] Arscot, SA; and Tanumihardio, SA: Carrots of Many Colors Provide Basic Nutrition and Bioavailable Phytochemicals Acting as a Functional Food. *Comprehensive Review in Food Science and Food Safety*, (2010) 9 (2): 223–239.
[14] Sharma, KD; Karki, S; Thakur, NS; and Attri, S: Chemical composition, functional properties and processing of carrot – a review, *Journal of Food Science Technological*, (2012) 49 (1): 22 – 32.
[15] FAO: Retrieved From The Faostat on The World Wide Web for South Asian Countries for The Year 2007, (2011).
[16] Se˛kara A, Cebula S, Kunicki E: Cultivated Eggplants–Origin, Breeding Objectives and Genetic Resources: A Review. *Folia Horticulturae*, (2007) 19: 97–114.
[17] Akanitapichat P, Phraibung K, Nuchklang K, Prompitakkul S: Antioxidant and Hepatoprotective Activities of Five Eggplant Varieties, *Food Chemtoxicol*, (2010) 48 (10): 3017-21.
[18] Gutierrez, RMP, Perez, RL: *Raphanus Sativus* (Radish): Their Chemistry and Biology. *The Scientific World Journal*, (2004) 4: 811-837.
[19] Aruna G, Yerragunt VG, Raju AB: Photochemistry and Pharmacology of *Raphanus Sativus*. *International Journal of Drug Formulation and Research*, (2012) 3 (1): 43-52.
[20] Sham, TT; Yuen; ACY; Ng YF; Chan C O, Wahmok, DK; Chan, SW: A Review of The Phytochemistry and Pharmacological Activities of Raphani Semen. *Hindawi Publishing Corporation*, (2013) 1-16.
[21] El-Batawy, OI; Samar, M; Mahdy & Abo El-Naga, MY: Utilization of Cheese Whey and UF Milk Permeate in Manufacture of Egyptian Baladi Bread. A*lexandria Journal of Food Science. & Technological.* (2018) 15 (1): 9-22.
[22] Chatfield, C. and Adams, G: Food Composition. USA Department of Agriculture. *Citc* (1940) 549.
[23] Westerman, ED: Soil Testing and Plant Analysis, (3rd Ed.), Monograph No.3, Soc, of Am. Book Series, SSA, Ins., *Madison, Wisconsin, USA* (1990).
[24] Nation, JI; and Robenson, FA: Concentration of some Major and Trace Elements in Honey Bee, Royal Jelly and Pollen Determined By Atomic Absorption Spec-Trophostometer. *Journal of Apiculture Research*, (1971) 10 (1): 35- 43.

[25] A.A.C.C: American Association of Cereal Chemists. Approved Methods of The A.A.C.C. Published by the *American Association of Cereal Chemists*, 10th Ed., St. Paul, Mn. (2000) USA.
[26] Maray, ARM; Mohamed Saleh Abed-El Bary, Khalil Ebraheim Khalil, Magda Ragab Abed El-Baki: Effect of The Partial Replacement of Wheat Flour with Barley Flour on Quality Attributes of Bread and Biscuits. *Journal of Food Science*, (2018) 1(1): 42-50
[27] Hussein, M A; Yonis, A M; and Abd El–Mageed, H A: Effect of Adding Carrot Powder on The Rheological and Sensory Propertiesof Pan Bread. *Journal Of Food and Dairy Science, Mansoura University*, (2018) 4 (6): 281 – 28.
[28] Rodriguez-Jimenez, JR; Carlos, A; Amaya-Guerra , Juan G; Baez-Gonzale , Carlos Aguilera-Gonzalez, Vania Urias-Orona and Guillermo Nino-Medina: Physicochemical, Func-tional, and Nutraceutical Properties of Eggplant Flours Obtained by Different Drying Methods, *Journal Molecules*, (2018) 23: 3210.
[29] El Hadidy, GS; and Rizk, EA: Influence of Coriander Seeds on Baking Balady Bread., *Journal of Food and Dairy Sciences, Mansoura University*, (2018) 9 (2): 69–72.
[30] Ali, HM and Ahmed, ZS: Chemical Composition, Physical and Sensory Evaluation of Biscuits Mixed with some Vegetable Powders. *Journal of Home Economics*, (2018) 28: 3.
[31] Doxastakis G, Zafiriadis I, Irakil M, Marlani H, Tananaki C: Lupin, Soya and Triticale Addition to Wheat Flour Dough and Their Effect on Rheological Properties. *Food Chemistry Journal*, (2002) 77: 219-227.
[32] El-Bedewy, LA; El-Kholie, EM; El-Sayed Teer El-Bar, A: Quality of Bread Fortified with Some Cereals Mixture, *Journal of Home Economics*, (2020) 30: (1).
[33] Lee, Mr; Swanson Bg; Baik, Bk: Influence of Amylase Content on Properties of Wheat Starch and Bread Making Qualities of Starch and Gluten Blends. *Cereal Chemistry*, (2001) 78: 701-706.
[34] Morita N, Maeda T, Miyazaki M, Yamamori M, Miura H, Ohtsuka I: Dough and Baking Properties of High Amylase and Waxy Wheat Flours. *Cereal Chemistry*, (2002) 79: 491-495.
[35] El-Mehiry, HF; Ramadan, AM, and Abd El-Hay, MM: Rheological, Nutritional and Quality Characteristics of Pan Bread Produced From Wheat Flour and Papaya Fruits Powder. *Journal of Studies and Searches of Specific Education*, (2016) 2 (2): 315-335.

# دراسات تكنولوجية وكيميائية على الخبز المدعم بمسحوق بعض الخضروات

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## الملخص العربي

تهدف هذه الدراسة إلى دراسة تأثير الإستبدال الجزئى لدقيق القمح 82% بمسحوق بعض الخضروات كالجزر والباذنجان والفجل بتركيز 5%، 10% على الخواص الريولوجية والحسية والتركيب الكيميائى للمواد الخام والخبز المنتج . أظهرت نتائج التركيب الكيميائى للمواد الخام زيادة فى الرطوبة والألياف والدهون والرماد والبروتين فى مسحوق الخضروات. بينما سجل دقيق القمح زيادة محتوى الكربوهيدرات .أظهرت النتائج وجود فروق معنوية فى محتوى المعادن بين دقيق القمح والجزر والباذنجان والفجل . تم انتاج الخبز المدعم بمسحوق الخضروات وبتركيزات مختلفة واعداد استمارات تحكيم لتقدير الخواص الحسية للخبز المنتج. أظهرت النتائج قبول لدى المستهلكين للخبز بالمقارنة بخبز الكنترول. تم اختيار افضل العينات لتكون محل الدراسة وأجريت التحاليل الكيميائية والريولوجية عليها . أدت إضافة مسحوق الخضروات إلى زيادة فى الالياف والدهون والبروتين فى الخبز المدعم بمسحوق الخضروات. توجد فروق معنوية فى السعرات الحرارية بين عينات الخبز المختلفة. أيضا هناك فروق معنوية فى محتوى المعادن بين عينات الخبز المختلفة. أظهرت نتائج الفارينوجراف والإكستنسوجراف زيادة نسبة امتصاص الماء والمرونة وطاقة العجين والرقم النسبى فى العجين المخلوط بينما انخفضت مطاطية العجين بالمقارنة بالكنترول. ولذلك اظهرت نتائج هذه الدراسة أن مساحيق بعض الخضروات مصدر جيد للبروتين والألياف والدهون. ومن ثم يوصى بإستخدامها فى إنتاج خبز ذو قيمة غذائية عالية.

الكلمات المفتاحية: الخبز، الجزر، الباذنجان، الفجل، دراسات تكنولوجية