Vol 3 No 3 September 2022 Pages 54-61e-ISSN 2708-5694

Journal of Agriculture, Food and Environment (JAFE)

Journal Homepage: http://journal.safebd.org/index.php/jafe

https://doi.org/10.47440/JAFE.2022.3310

Original Article

Processing Low Calorie Flat Bread with added value of Carrot and pumpkin Powder

Nada*, Shatat A, Khalil MM and El-Gammal RE

Food Industries Department, Faculty of Agriculture, Mansoura University Mansoura City, Egypt

Article History

Received: 05 July 2022

Revised: 21 August 2022

Accepted: 30 August 2022

Published online: 30 September 2022

***Corresponding Author**

Nada, E-mail: nadashatat7@gmail.com; rawana@mans.edu.eg

Keywords

Flat bread, Carrot, pumpkin, Chemical composition, Caloric value and Dietary fiber.

How to cite: Nada, Shatat A, Khalil MM and El-Gammal RE (2022). Processing Low Calorie Flat Bread with added value of Carrot and pumpkin Powder. J. Agric. Food Environ. 3(3): 54-61.

ABSTRACT

This research aimed to study the effect of addition carrot powder and pumpkin powder on some properties of flat bread. Carrot powder and pumpkin powder were added with the ratio of 10 % and 20% with bread flour in order to prepare flat bread. Chemical composition, caloric value, mineral content, dietary fiber, texture profile and staling rate of flat bread samples were studied. Obtained results indicated that addition of carrot powder and pumpkin powder increased the amount of protein, ash, crude fibers, minerals and dietary fiber in prepared flat bread samples. While, the carbohydrates and caloric value content decreased in compared with those of control samples. Texture properties also resulted that addition of carrot and pumpkin powder positively influence on some texture parameters. Staling rate results showed that there was gradual decrease in all fortified flat bread samples for freshness up to 72 hours of storage in compared with those of control sample, also, an observed decrease in staling rate after 72 hours of storage of all flat bread samples. Results of sensory evaluation showed that flat bread samples with 10% carrot and pumpkin powder were more acceptable than those of other sample with 20% carrot and pumpkin powder.

Introduction

Vegetable inexpensive and available in a lot quantities (Chantaro *et al*., 2008 and Shyamala and Jamuna, 2010), it has a lower caloric content, and often has other important compounds such as antioxidants (Chantaro *et al*., 2008) which might provide additional health benefits (Gonzalez-Centeno *et al*., 2010). Vegetables contain a higher content of dietary fiber. Also, it has better functional properties than those obtained from cereal processing (Gonzalez-Centeno *et al*., 2010). Vegetable fibers have better quality as it's higher soluble dietary fiber content, better water holding capacities and lower phytic acid contents. Beside these, vegetables have also contained various bioactive substances such as antioxidants, polyphenols and carotenoids (Cao *et al*., 1996 and Eim *et al*., 2008).

Bread may be a described as a fermented confectionary product produced mainly from wheat flour, water, yeast and salt by a series of process involving mixing, kneading, proofing, shaping and baking (Dewettinck *et al*., 2008). Bread can be enriched with dietary fiber from various sources, namely carrot powder (Kohajdová *et al*., 2012). Adding of dietary fiber to bakery products increases dietary fiber intake, decreases the caloric value of wheat rolls and prolongs freshness due to its capacity to retain water and thus reduces economic losses (Elleuch *et al*., 2011 and JURASOVÁ and KUKUROVÁ 2011).

Dietary fiber is a complex carbohydrate that is indigestible and found in the structural components of plants. They cannot be absorbed by the body and thus have no calorific value; however, the health benefits of eating a fiber-rich diet are numerous, including constipation prevention, blood sugar regulation, heart disease prevention, the reduction of high cholesterol and the prevention of certain cancers. Dietary fibers are attractive not just for their nutritional benefits, but also for their functional and technological properties, and they may be used as food ingredients as a result of these (Thebaudin *et al*. 1997 and Schieber *et al*. 2001).

The partial substitution of wheat flour with non-wheat flour increases the nutritional quality of bakery products and satisfies customers' requests for nutritious food and a diverse range of food items (Alvarez-Jubete *et al*. 2010). Wheat may be used to make a variety of items (El- Gammal and El kewawy, 2014).

Bakery items are consumed all over the world, and rich fibers and b-carotene sources can be incorporated into these products to enrich them with fibers and b-carotene. Carrot is one which has a great potential. Carrot (*Daucus Carota*) in recent times, consumption of carrot and its products has gained wide acceptance as a result of its natural antioxidants properties coupled with the anticancer activities of β-carotene in it which is a precursor of vitamin A (Dreosti 1993 and Speizer *et al.* 1999).

As a result, eating carrots and carrot products can help prevent vitamin A deficiency, especially in children under the age of six and adults. Vitamin A deficiency (VAD) has been identified as a major public health issue in developing countries, including Nigeria, necessitating the development of enriched baked products such as biscuits that are widely accepted and consumed as snacks to meet nutritional needs and improve the health of vulnerable groups. Baked goods like bread, morning cereals, and especially biscuits might be a convenient vehicle for adding vitamins and protein to address these consumer health demands. Because carrots are a good source of micronutrients, dried carrots could be ground into flour to boost vitamin A and mineral content in dishes (Akubor and Eze 2012).

Pumpkin (*Cucurbita moschata)* is one of the important cucurbitaceous vegetable grown all over India. Pumpkin is abundant in carotene, a yellow or orange pigment that gives it its color. It also contains a lot of carbohydrates and minerals. Beta-carotene is a primary source of vitamin A in plants with a nice yellow-orange color (Lee, 1983). Pumpkin powder, which has a longer shelf life, can be made from it. The flavor, sweetness and vivid yellow-orange color of pumpkin powder make it a popular ingredient. It has been reported to be used as a natural coloring ingredient in pasta and flour mixes, as well as a supplement to cereal flours in bakery products such as cakes, cookies, bread, soups, sauces and instant noodles (Ptitchkina *et al*., 1998).

So, this study was conducted to evaluate substitution bread wheat flour with carrot powder and pumpkin powder. To achieve this aim, approximate chemical composition, caloric value, minerals content, dietary fiber, texture profile analysis (TPA) and staling rate were evaluated.

Materials and Methods

Materials

Carrot (*Daucus Carota*) and pumpkin (*Cucurbita moschata*) were obtained from local market in El- Mansoura city, El-Dakahlia Governorate, Egypt.

Other ingredients

Wheat flour (72% extraction rate) for all purpose, instant active dry yeast, butter, sugar and salt. All baking materials were obtained from local market, El-Mansoura city, El-Dakahlia Governorate, Egypt.

Methods

Preparation of Carrot and Pumpkin powder

A) Preparation of Carrot powder:

Fresh carrot was washed to remove dirt and other field damaged portion with running tap water and cut into slices of 5mm size using a domestic vegetable peeler. Peeled carrot for was blanched at 100 ℃, for 2 min as mention by Anitha *et al*., (2020). Blanched carrot was kept in a tray dryer for drying. Carrot was dried at 65 ℃ for 3-4hrs in air circulation dryer (GARBUIO - Treviso) at Food Industries Dept., Fac. of Agric., Mans. University. After drying, it was grounded into powder with a mixer (MOULINEX) and sieved (2 mm) to get a fine powder and stored at ambient temperature conditions in sealed in polythene cover for further use.

B) Preparation of Pumpkin powder:

Fresh pumpkin was washed to remove dirt and other field damaged portion with running tap water, then peeled and the fibrous matter and seeds were removed and made into slices of 5mm size cubes thickness using a knife for pretreatments blanching at temperature 100 °C, for 5 min in hot water. The blanched sliced form of pumpkin was kept in a tray dryer for drying. Pumpkin was dried at 65°C for 7-8hrs as mention by Anitha *et al*., (2020) in air circulation dryer (GARBUIO - Treviso) at Food Industries Dept., Fac. of Agric., Mans. University. After drying process, it was grounded into powder with a mixer (MOULINEX) and sieved (2 mm) to get a fine powder and stored at ambient temperature conditions in sealed in polythene cover for further use.

Preparation of flat bread samples

According to Asghar *et al*., (2005) four flat bread formula were prepared**,** wheat flour was mixed with salt, water and various other ingredients to form dough as mention in Table (1). Bakers' yeast or sourdough is also used as leavened products. Dough mixing involves the combining and blending of the formula ingredients. It was agreed that it should have a fermentation time of 30 to 60 min. Then it was baked it in (stainless steel gas) oven at 350-425 °C for 1-2 min for a quality flat bread production Pahwa *et al*., (2016). Some flat bread is baked on an overheated hot plate with different shapes of dough. After baking, flat bread was cooled at room temperature (25±2˚C) and packed in air tight polyethylene bags until analysis were carried out.

Table (1) Flat bread formula

Ingredient	Flat bread formulas (g)				
	Fc	F_1	F_2	F_3	F_4
Wheat Flour 72%	100	90	80	90	80
Carrot Powder	-	10	20	-	-
Pumpkin Powder	-	-	-	10	20
Sugar	4	4	4	4	4
Salt	1	1	1	1	1
Yeast	3	3	3	3	3

*Fc: control Flat bread with 100% wheat flour, F_1: flat bread with 10% carrot powder, F_2: flat bread with 20% carrot powder, F_3: flat bread with 10% pumpkin powder, F_4: flat bread with 20% pumpkin powder.

Analytical Methods

Chemical analysis

Moisture, crude protein (as nitrogen), fat, ash and crude fibers in raw materials and flat bread samples were determined according to the method described in A.O.A.C. (2010). Protein content was calculated by multiplying total nitrogen percentage with the factor 6.25. The total carbohydrate was calculated by differences at Laboratory of soil fertility tests and monitoring of fertilizer quality, Central laboratory, Faculty of Agriculture, Mansoura University. The caloric value of raw materials and products was calculated according to the following equation: E (caloric value) = 4 (carbohydrate %+ protein %) + 9 (fat %).

Determination of some minerals content

Minerals contents in raw materials and flat bread samples were determined according to Chapman and Pratt (1978). The total quantities of iron, zinc, magnesium, sodium, calcium, potassium and copper were determined by atomic absorption spectrophotometry as indicated to the methods of A.O.A.C. (2005). Whereas, phosphorus was determined by spectrophotometer according to the method of Astm (1975) using Sens AA ″GBC scientific equipment″ model ″Sens AA Dual″ made in Dandenong, Victoria, Australia, Micro-Analysis unit, Faculty of Science, Mansoura University, El-Dakahlia Governorate, Egypt.

Determination of Dietary fibers

-Determination of total dietary fibers

Total dietary fibers in raw materials and flat bread samples were measured according to A.O.A.C. (2010) at Food Tech. Res. Institute, Agric. Res. Center, El-Giza, Egypt.

-Determination of soluble and insoluble dietary fibers

Soluble and insoluble dietary fibers in raw materials and flat bread samples were determined according to method described by Prosky *et al.* (1988) at Food Tech. Res. Institute, Agric. Res. Center, El-Giza, Egypt.

Texture profile analysis of flat bread (TPA)

Texture measurements of flat bread samples were investigated with universal testing machine (Cometech, B type, Taiwan) provided with software. Back extrusion cell with 35 mm diameter compression disc was used. Two cycles were applied, at a constant crosshead velocity of 1 mm/s, to 30% of sample depth, and then returned. From the resulting force–time curve, the values for texture attributes, i.e. Hardness (N), adhesiveness (mj), gumminess (N), chewiness (mj), cohesiveness, springiness (mm) and resilience were calculated from the TPA graphic according to Gomez *et al.*, (2007). at Food Tech. Res. Institute, Agric. Res. Center, EL-Giza, Egypt.

Determination of flat bread (staling rate)

Flat bread samples staling rate were determined by alkaline water retention capacity technique described by Kitterman and Rubanthaler (1971).

Sensory evaluation of flat bread samples

Samples of fresh bread samples that were baked and placed at room temperature (25±2˚C) were applied to sensory tests and evaluated and recorded according to Gelinas and Lachance (1995), using ten panelists among students in food industry department faculty of Agriculture, El-Mansoura University.

Statistical analysis

Obtained data were statistically analyzed using the producer of the SAS software system program (SAS, 2010). Analysis of variance was conducted using General Liner Model (GLM) procedure (Snedecor and Cochran, 1980). Means were separated using Duncan's test at a degree of significance (P≤ 0.05).

Results and Discussion

1. Chemical composition and caloric value of raw materials used in flat bread preparing

Proximate chemical composition of wheat flour (72% ext.), carrot powder and Pumpkin powder are presented in Table (2). The obtained results detected that Pumpkin powder recorded the highest moisture content being 14.02%, while carrot Powder had lower moisture content being 9.22%. Meanwhile, the highest value of crude protein was recorded for carrot Powder (13.56) however, Pumpkin Powder and wheat flour had the lowest crude protein value being 11.37 and 11.25%, respectively. While, wheat flour (72% ext.) had the highest fat content being 1.48 % as compared to pumpkin powder and carrot powder. On the other side, carrot powder and pumpkin powder contained the highest ash content (7.33 and 6.36%) respectively. While, wheat flour (72% ext.) had the lowest ash and crude fibers content being (0.63 and 0.64%) respectively.

However, Carrot Powder had the highest crude fibers followed by Pumpkin Powder being 13.94%, and 9.37%, respectively. The obtained results are in the line with those reported by Mala, *et al.*, (2018) declared that Pumpkin Powder contained 8.9 % crude fibers. While, Assenova *et al.*, (2021) found that Carrot Powder contains 8.55% fibers. Wheat flour (72% ext.) recorded the highest value of total carbohydrates being 85.78%. While, pumpkin Powder had the lowest total carbohydrates content being 72.00%. Wheat flour recorded the highest caloric value content being 405.44 (cal/100g), while pumpkin powder had lower caloric value content being 345.72 (cal/100g). The obtained results are in the line with those reported by Anitha *et al.*, (2020) who found that Pumpkin Powder contained 14.37 % crude protein, 1.32%fat, 5.6%ash and 72.70 % total carbohydrates.

Table 2. Chemical composition and caloric value of raw materials used in flat bread preparation (% on dry weight basis).

Chemical constitutes (%)	Raw materials		
	Wheat flour (72% ex.)	Carrot powder	Pumpkin powder
Moisture	12.60 [b]	9.22 [c]	14.02 [a]
Crude protein	11.25 [b]	13.56 [a]	11.37 [b]
Fat	1.48 [a]	0.91 [c]	1.36 [b]
Ash	0.63 [c]	7.33 [a]	6.36 [b]
Crude Fibers	0.64 [c]	13.94 [a]	9.37 [b]
Total carbohydrates**	85.78 [a]	80.47 [b]	72.00 [c]
Caloric Value (cal/100g)	401.44 [a]	384.31 [b]	345.72 [c]

**Carbohydrates were determined by the difference.
*a, b, c = Means followed by different letters in the same column are significantly different by Duncan's multiple test (p<0.05).

2. Minerals Content of raw materials used in flat bread preparing

Minerals content are important for certain physicochemical processes which are essential to human life. Per day, greater than 100 mg of the macro-minerals (Na, Mg, K, Ca and P) and less than 100 mg of micro-minerals (Fe, Cu and Zn) are required Soetan *et al.*, (2010). The minerals content of raw materials are presented in Table (3).

These results indicated that pumpkin Powder proved to be of the highest content of K, Ca, Mg, Na and Fe compared with Carrot Powder and wheat flour (72% ext.). It was recorded (3286.41, 291.80, 426.33, 98.43 and 64.63 mg/100g), respectively. While, Carrot Powder had the highest content of P, Zn and Cu. It was recorded (731.21, 4.11 and 0.96 mg/100g), respectively. Assenova *et al.*, (2021) who found that Carrot Powder contains (78.0, 94.5, 610, 0.65, 1.06 and 0.98 mg/100g) for Ca, Mg, P, Fe, Zn and Cu, respectively.

Anitha *et al.*, (2020) who found that Pumpkin Powder contained 12.0 mg for Fe and 100 mg for Ca. However, wheat flour (72% ext.) had the lowest minerals content being (153.90, 11.51, 34.92, 42.63, 90.72, 0.95, 0.48 and 0.19 mg/100g), for K, Ca, Mg, Na, P, Fe, Zn and Cn respectively.

Table 3. Minerals of raw materials used in flat bread preparation (mg/100g on dry weight basis).

Minerals (mg/100g)	Raw materials		
	Wheat flour (72% ex.)	Carrot powder	Pumpkin powder
K	153.90^{c}	3224.30^{b}	3286.41^{a}
Ca	11. 51^{c}	198.61^{b}	291.80^{a}
Mg	34.92^{c}	163.81^{b}	426.33^{a}
Na	42.63^{c}	71.18^{b}	98.43^{a}
P	90.72^{c}	731.21^{a}	391.90^{b}
Fe	0.95^{c}	3.82^{b}	64.63^{a}
Zn	0.48^{c}	4.11^{a}	2.22^{b}
Cu	0.19^{c}	0.96^{a}	0.81^{b}

*a, b, c = Means followed by different letters in the same column are significantly different by Duncan's multiple test ($p<0.05$).

3. Total, soluble and insoluble dietary fibers of raw materials used in flat bread preparing

Dietary fiber, a group of plant carbohydrate polymers, includes both oligosaccharides and polysaccharides which may be associated with lignin and other non- carbohydrate components such as polyphenols, saponins and waxes (Elleuch *et al.*, 2011). Dietary fibers have been categorized into two major groups called insoluble dietary fiber (IDF) and soluble dietary fiber (SDF) based on their water solubility (Elleuch *et al.*, 2011). Total dietary fibers (TDF), soluble dietary fibers (SDF) and insoluble dietary fibers (IDF) of wheat flour (72% ext.), Carrot Powder and Pumpkin Powder were analyzed and the results are presented in Table (4).

Concerning the dietary fibers content, the results showed that, Carrot Powder contained the highest percentage of TDF, SDF and IDF, which amounted in 64.19, 21.03 and 43.16 %, respectively followed by the dietary fibers content in pumpkin powder which recorded 28.39, 7.16 and 21.23%, respectively for TDF, SDF and IDF, respectively. These results are in accordance with those obtained by Kohajdová *et al.*, (2012) who found that the total dietary fibers of Carrot Powder were 55.70. Lokuge *et al.*, (2018) who found that total dietary fibers of pumpkin powder ranged from 26.5 to 29.7%. Meanwhile, wheat flour (72% ext.) had the lowest percentage of TDF, SDF and IDF, which being 4.52, 1.57 and 2.95% for wheat flour, respectively.

Table 4. Total, soluble and insoluble dietary fibers of raw materials used in flat bread preparation (% on dry weight basis).

Raw materials	Dietary fibers (%)		
	TDF	SDF	IDF
Wheat flour (72% ex.)	4.52 ^{c}	1.57 ^{c}	2.95 ^{c}
Carrot powder	64.19 ^{a}	21.03 ^{a}	43.16 ^{a}
Pumpkin powder	28.39 ^{b}	7.16 ^{b}	21.23 ^{b}

*a, b, c = Means followed by different letters in the same column are significantly different by Duncan's multiple test ($p<0.05$).
TDF: total dietary fibers
SDF: soluble dietary fibers
IDF: insoluble dietary fibers

4. Chemical composition and caloric value of flat bread samples

Effect of addition different raw material carrot powder and pumpkin powder on proximate analysis composition of processed flat bread samples was tested and the results are introduced in Table (5). From the obtained data, protein, ash and crude fibers content increased in all produced flat bread samples by adding the substitution levels of carrot powder and pumpkin powder, while total carbohydrates and caloric value decreased with adding amount of supplementation compared to control sample. Moisture content was highest in pumpkin powder samples which reached to (36.74) for blend (F4).

In addition, crude protein content was highest in carrot powder samples which amounted (12.99 %) for blend (F2), followed by pumpkin powder samples which reached (11.96 %) for blend (F4), then 11.08% for control sample. However, fat was highest content in control sample which being (3.52 %) compared to other samples. On the other side, carrot powder samples contained the highest content of ash and crude fibers (2.94 and 2.92%) for blend (F2) and (2.76 and 2.68%) for blend (F1), followed by pumpkin powder samples (2.36 and 2.36%) for blend (F4) and (2.28 and 2.18%) for blend (F3), respectively compared to (1.88 and 1.68%) for control sample (FC), respectively. In contrast, total carbohydrates were highest content in control sample which being (52.99 %) compared to other samples. Using of carrot powder and pumpkin powder decreased caloric value content of flat bread samples compared to control sample which being 287.96 (cal/100g).

These results are approximately similar to those obtained by Assenova *et al.*, (2021) who reported that substitution of sausage flour by carrot powder resulted in improvement of its nutritional value as chemical composition which reduces the amount of fat and moisture, compensating them by increasing the amount of protein, crude fibers and minerals. While, Mala, *et al.*, (2018) declared that improvement of chemical and nutritional characteristics of wheat flour muffins when combined it with pumpkin powder which reduces the amount of fat, compensating them by increasing the amount of protein, crude fibers and minerals.

Table 5. Chemical composition and caloric value of flat bread samples (% on dry weight basis).

Chemical constitutes (%)	Raw materials				
	FC	F1	F2	F3	F4
Moisture	36.11^{b}	34.13^{c}	33.86^{c}	36.31^{ab}	36.74^{a}
Crude protein	11.08^{c}	12.53^{a}	12.99^{a}	11.26^{b}	11.96^{b}
Fat	3.52^{a}	2.01^{c}	1.26^{c}	2.36^{b}	2.18^{b}
Ash	1.88^{d}	2.76^{b}	2.94^{a}	2.28^{c}	2.36^{c}
Crude Fibers	1.68^{d}	2.68^{b}	2.92^{a}	2.18^{c}	2.36^{c}
Total** carbohydrates	52.99^{a}	47.99^{b}	47.68^{b}	47.52^{bc}	47.36^{c}
Caloric Value (cal/100g)	287.96^{a}	260.17^{b}	254.02^{c}	256.36^{b}	256.9^{b}

*a, b, c = Means followed by different letters in the same column are significantly different by Duncan's multiple test ($p<0.05$).
**Carbohydrates were determined by the difference.
* Fc: control Flat bread with 100% wheat flour, F_1: flat bread with 10% carrot powder, F_2: flat bread with 20% carrot powder, F_3: flat bread with 10% pumpkin powder, F_4: flat bread with 20% pumpkin powder.

5. Minerals content of flat bread samples

Mineral content in samples of flat bread illustrated in Table (6), from the obtained results, the partial switch of all raw materials increased the content of minerals in all samples of flat bread gradually in parallel with addition of all raw materials. Additionally, it may be observed that all samples of processed bread were superior in K, Ca, Mg, Na, P, Fe, Zn and Cn comparing with control sample.

From nutritional view, samples of processed flat bread contained higher content of studied minerals. Such as, flat bread with carrot powder for blend (F2) reached to (377.18, 42.63, 151.64, 175.16, 181.64, 1.94, 0.23 and 0.69 mg/100g), respectively in compared with control sample (164.33, 19.67, 148.65, 173.18, 177.63, 1.74, 0.09 and 0.51 mg/100g), for the same minerals, respectively. These results are approximately similar to those obtained by Assenova *et al.*, (2021) they mentioned that the partial switch of flour with carrot powder resulted in higher levels of important nutrients such as Ca, P, Mg, Cu and Fe. Also, flat bread with pumpkin powder for blend (F4) reached to (468.12, 77.54, 254.17, 181.27, 288.03, 12.38, 0.16 and 0.61 mg/100g), respectively as compared to control sample.

Table 6. Minerals of flat bread samples (mg/100g on dry Weight basis).

Minerals (mg/100g)	Flat bread samples				
	FC	F1	F2	F3	F4
K	164.33^{d}	372.76^{d}	377.18^{c}	465.28^{b}	468.12^{a}
Ca	19.67 ^{e}	34.92^{d}	42.63^{c}	60.72^{b}	77.54^{a}
Mg	148.65^{e}	150.26^{d}	151.64^{c}	252.76^{b}	254.17^{a}
Na	173.18^{d}	173.78^{d}	175.16^{c}	177.31^{b}	181.27^{a}
P	177.63^{d}	179.18^{d}	181.64^{c}	283.29^{b}	288.03^{a}
Fe	1.74^{d}	1.86^{c}	1.94c	12.11^{b}	12.38^{a}
Zn	0.09^{e}	0.19^{b}	0.23^{a}	0.13^{d}	0.16^{c}
Cu	0.51^{c}	0.63^{b}	0.69^{a}	0.53^{c}	0.61^{b}

*a, b, c = Means followed by different letters in the same column are significantly different by Duncan's multiple test ($p < 0.05$).

* Fc: control Flat bread with 100% wheat flour, F_1: flat bread with 10% carrot powder, F_2: flat bread with 20% carrot powder, F_3: flat bread with 10% pumpkin powder, F_4: flat bread with 20% pumpkin powder.

6. Total, soluble and insoluble dietary fibers of flat bread samples

The dietary fibers content including total, soluble and insoluble dietary fibers of selected flat bread samples under study are shown in Table (7). From the obtained results, it could be indicated that the dietary fibers content of all flat bread samples were increasing by increasing the substitution amounts of carrot powder and pumpkin powder which reached to (6.15, 2.34 and 3.81 %) for blend (F2) and (5.78, 2.16 and 3.62 %) for blend (F4), respectively in compared with control sample (4.40, 1.56 and 2.84 % on dry weight basis), for total, soluble and insoluble fibers respectively. These results are in agreement with Kohajdová *et al.*, (2012) and Castro *et al.*, (2019) they reported that carrot powder is a good source of dietary fibers. Also, Mala, *et al.*, (2018) who noticed that substitution of muffins flour by pumpkin powder resulted in increasing of its dietary fibers.

Table 7. Total, soluble and insoluble dietary fibers of flat bread samples (% on dry weight basis).

Flat bread samples	Dietary fibers (%)		
	TDF	SDF	IDF
Fc	4.40 ^{d}	1.56 ^{e}	2.84 ^{d}
F1	5.34 ^{c}	1.96 ^{c}	3.38 ^{c}
F2	6.15 ^{a}	2.34 ^{a}	3.81 ^{a}
F3	5.10 ^{c}	1.84 ^{d}	3.26 ^{c}
F4	5.78 ^{b}	2.16 ^{b}	3.62 ^{b}

*a, b, c = Means followed by different letters in the same column are significantly different by Duncan's multiple test ($p<0.05$).

TDF: total dietary fibers

SDF: soluble dietary fibers

IDF: insoluble dietary fibers

* Fc: control flat bread with 100% wheat flour, F_1: flat bread with 10% carrot powder, F_2: flat bread with 20% carrot powder, F_3: flat bread with 10% pumpkin powder, F_4: flat bread with 20% pumpkin powder.

7. Texture profile of flat bread samples

Some physical characteristics namely, flat bread texture profile analysis (TPA) are tabulated in Table (8). Springiness is ability of dough to recover its original form after the deforming force removal. While, cohesiveness is the extent which the dough can be deformed before rupture. Gumminess represents the required force to disintegrate a semisolid sample to a steady state of swallowing. Chewiness is the needed work to chew a sample to be a steady state of swallowing. Finally, resilience shows how well a sample resists to regain its original position. Cohesiveness, springiness and resilience were calculated from texture profile graphic. Springiness and resilience, give information about the after-stress recovery capacity (Borune, 2002).

The highest value of hardness cycle1 detected in flat bread sample prepared with carrot powder for blend F1 which reached to (41.04), while increased in flat bread sample prepared with pumpkin powder which reached to (21.25 and 24.30) for blends (F3 and F4), respectively comparing with the control sample (20.25).

Adhesiveness was highest value in flat bread sample prepared with carrot powder for blend F1 which reached to (23.90) followed by sample with pumpkin powder for blend F4 (13.70) compared to the others. Resilience was highest value in flat bread sample prepared with pumpkin powder for blend F3 (0.02) comparing to the other samples which had no significant effect with the control resilience. The highest value of hardness cycle2 detected in flat bread sample prepared with pumpkin powder which reached to (30.49) for blend F4, followed by sample with carrot powder which reached to (30.47) for blend F1 comparing with the control sample (23.51).

The highest value of cohesiveness detected in flat bread sample prepared with carrot powder which reached to (1.45 and 1.47) for blends (F1and F2), respectively, followed by sample with pumpkin powder which reached to (1.17 and 1.12) for blends (F3 and F4), respectively comparing with the control sample (0.83). Springiness of prepared flat bread gradually increased with increasing the level of substitution of carrot and pumpkin powder which reached to (19.33, 20.56, 20.55 and 20.67) for blends (F1, F2, F3 and F4), respectively comparing with the lowest one recorded with control sample (18.05).

As for, gumminess, it was found an increase with addition of carrot powder and pumpkin powder, while the lowest value with control sample (16.80). Chewiness was defined as the energy required masticating a solid food to a state ready for swallowing (Karaoğlu and Kotancilar, 2009). Also, chewiness of flat bread increased with the addition of carrot powder and pumpkin powder comparing with the lowest value (303.20) for the control sample. These results are nearly in accordance with those found by Salehi *et al.*, (2016) with using carrot powder and Hosseini *et al.*, (2018) with using pumpkin powder.

Table 8. Texture profile analysis for flat bread samples

Texture Profile properties	Flat bread samples				
	FC	F1	F2	F3	F4
Hardness Cycle1	20.25[d]	41.04[a]	17.38[e]	21.25[c]	24.30[b]
Adhesiveness	12.50[c]	23.90[a]	13.30[b]	12.10[c]	13.70[b]
Resilience	0.01[b]	0.01[b]	0.01[b]	0.02[a]	0.01[b]
Hardness Cycle2	23.51[b]	30.47[a]	20.17[c]	21.77[c]	30.49[a]
Cohesiveness	0.83[c]	1.45[a]	1.47[a]	1.17[b]	1.12[b]
Springiness	18.05[b]	19.33[b]	20.56[a]	20.55[a]	20.67[a]
Gumminess	16.80[d]	59.64[a]	25.49[b]	24.90[b]	19.85[c]
Chewiness	303.20[e]	1152.80[a]	524.00[c]	511.70[d]	564.30[b]

*a, b, c = Means followed by different letters in the same column are significantly different by Duncan's multiple test ($p<0.05$).

* Fc: control flat bread with 100% wheat flour, F_1: flat bread with 10% carrot powder, F_2: flat bread with 20% carrot powder, F_3: flat bread with 10% pumpkin powder, F_4: flat bread with 20% pumpkin powder

8. Staling rate of flat bread samples

Staling rate is a physical phenomenon, concerns with the progressions that happen in bread subsequent to baking. Alkaline water retention capacity (AWRC) is simplest test follow the stalling in bakery products, increases in AWRC are resulted from the freshness of baked products (Gray and Bemiller, 2003).

The staling results of flat bread prepared by using 100% wheat flour (72% ext.) as control and the other flat bread samples that replaced with carrot powder and pumpkin powder stored for 72 hrs. at room temperature (25±2˚C) are presented in Table (9).

There was an increase in the degree of freshness (decrease in the staling) in the sample of flat bread that was prepared through the partial substitution of wheat flour up to blend F2 and blend F4, since the alkaline water retention capacity values were (312.52 and 316.72) after 72 hrs. storage, respectively, comparing with (285.31) for control sample.

The results showed a decrease in the ability to retain alkaline water gradually during the storage period for all flat bread prepared samples. These results are in agreement with that obtained by Besbes *et al*., (2014) and Nivelle *et al*., (2017) reported a decrease in crumb moisture during storage (as moisture migrates from crumb towards crust), which accelerated starch-gluten interactions and bread firming.

Table 9. Staling rate of flat bread samples.

Flat bread sample	Storage period (hours)			
	Zero time	24 Hours	48 hours	72 hours
FC	399.60 [b]	330.90 [c]	288.20[d]	285.31 [b]
F1	372.33 [c]	323.00 [c]	322.60[b]	271.58 [c]
F2	366.85 [c]	332.40 [c]	314.60 [c]	312.52 [a]
F3	420.34 [a]	393.40 [a]	285.10 [a]	278.80[bc]
F4	372.52 [c]	357.05[b]	326.36[b]	316.72 [a]

*a, b, c = Means followed by different letters in the same column are significantly different by Duncan's multiple test ($p<0.05$).

Table 9. Sensory evaluation of processed fresh flat bread samples

Flat bread samples	Sensory properties						
	Appearance (20)	Crust Color (10)	Crumb Color (10)	Texture (20)	Flavor (20)	Taste (20)	Overall acceptability (100)
				Carrot powder			
FC	18.20 ±5.59	9.15 ±2.83	9.15 ±2.81	18.60 ±5.75	18.60 ±5.80	18.60 ±5.74	92.30 ±28.39
F1	16.90 ±5.20	8.30 ±2.58	8.30 ±2.58	16.40 ±5.07	16.60 ±5.11	16.30 ±5.04	82.80 ±25.40
F2	15.40 ±1.90	7.55 ±0.72	7.40 ±0.84	15.10 ±1.45	14.80 ±1.69	15.20 ±1.69	75.45 ±7.39
LSD (at 5%)	1.12	0.54	0.52	1.03	0.93	0.94	4.11
				Pumpkin powder			
FC	18.80 ±5.75	9.45 ±2.91	9.35 ±2.89	19.40 ±5.92	19.60 ±5.95	19.10 ±5.84	95.70 ±29.11
F3	17.10 ±5.26	8.60 ±2.65	8.60 ±2.65	14.90 ±4.80	15.40 ±4.82	15.10 ±4.73	79.70 ±24.54
F4	15.40 ±1.35	7.65 ±0.88	7.50 ±0.97	12.10 ±0.99	13.60 ±1.58	12.00 ±1.33	68.25 ±5.40
LSD (at 5%)	1.37	0.65	0.67	1.17	1.19	1.16	4.43

** Means of triplicate ± SD.

* Fc: control flat bread with 100% wheat flour, F_1: flat bread with 10% carrot powder, F_2: flat bread with 20% carrot powder, F_3: flat bread with 10% pumpkin powder, F_4: flat bread with 20% pumpkin powder.

9. Sensory evaluation of fresh flat bread samples

For measuring product liking and preference, the hedonic scale is a unique scale, providing both reliable and valid results Stone *et al.* (2012). Sensory evaluation continues to play an important role in assess the quality of food because it measures what consumers actually perceive and among the main characteristics associated with quality are surface color, flavor, taste and texture (Bryhni *et al*., 2002). The organoleptic properties of prepared flat bread produced by using 100% wheat flour (72% ext.) as control and the other flat bread samples which prepared by partial substitution of wheat flour by (10 and 20 %) of carrot powder and (10 and 20 %) of pumpkin powder were evaluated to select the best substitution level for produce high quality flat bread.

Sensory evaluation of fresh flat bread samples prepared by substitution of wheat flour by carrot powder and pumpkin powder, the results in Table (10) showed that, there were significant differences in all sensory attributes between the control sample and flat bread blends (10 and 20 %). The acceptability of all flat bread samples decreased with the increasing amount of carrot powder and pumpkin powder supplementation. The results of overall acceptability showed that the highest value was found for control sample and flat bread blend with (10%) carrot powder and pumpkin powder against the lowest value for flat bread blend with (20%) carrot powder and pumpkin powder. The sensory characteristics liking results pointed out that a partial substitution of bread flour with up to 10% of carrot powder and pumpkin powder in flat bread is satisfactory. Acceptable quality could be observed by incorporating carrot powder up to 10 % in flat bread samples. Salehi *et al*., (2016) found that the sensory characteristics as crumb color, flavor, texture and overall acceptability were acceptable when using carrot powder up to ratio 10 %. Hosseini *et al*., (2018) reported that addition of pumpkin powder caused a higher texture, flavor and overall acceptance when using pumpkin powder up to ratio 10 %.

Conclusion

Carrot powder and pumpkin powder investigated in this study can be considered as suitable ingredient for flat bread supplementation due to high content of dietary fiber and low caloric value. Also, the inclusion of carrot powder and pumpkin powder in flat bread improved the protein, minerals, ash and fiber content which could serve as relief of malnutrition since the bakery products prepared from refined flour are low in minerals, ash and dietary fiber.

Reference

AOAC (2005). Official Methods of Analysis of the Association of Official Analytical Chemists.18th edition, Washington DC.

AOAC (2010). Official Methods of Analysis, 17th Ed., Association of Official Analytical Chemists International. Gaithersburg, Maryland, USA.

Akubor PI and Eze JI (2012). Quality evaluation and cake making potential of sun and oven dried carrot fruit. International Journal of Biosciences, 2(10), 19-27.

Alvarez-Jubete L, Auty M, Arendt EK, and Gallagher E (2010). Baking properties and microstructure of pseudocereal flours in gluten-free bread formulations. European Food Research and Technology, 230(3), 437-445.

Anitha S, Ramya H and Ashwini A (2020). Effect of mixing pumpkin powder with wheat flour on physical, nutritional and sensory characteristics of cookies. Int J Commun Syst, 8(4), 1030-5.

Asghar A, TRAIG MW, ANJUM FM and Hussain S (2005). Effect of carboxy methyl cellulose and gum arabic on the stability of frozen dough for bakery products. Turkish Journal of Biology, 29(4), 237-241.

Assenova B, Okuskhanova E, Smolnikova F, Nikolaeva N, Vlasova K, Gayvas A and Rotanov E (2021). Study of the chemical composition of carrot powder and its effect on the nutritional value of sausage products. International Journal of Modern Agriculture, 10(2), 3659-3669.

Astm S (1975). Annual book of American society of testing materials standard water.

Besbes E, Jury V, Monteau JY and Le Bail A (2014). Effect of baking conditions and storage with crust on the moisture profile, local textural properties and staling kinetics of pan bread. LWT-Food Science and Technology, 58(2), 658-666.

Bourne M (2002). Food texture and viscosity: concept and measurement. Elsevier.

Bryhni EA, Kjos NP, Ofstad R and Hunt M (2002). Polyunsaturated fat and fish oil in diets for growing-finishing pigs: effects on fatty acid composition and meat, fat and sausage quality. Meat Science, 62: 1–8.

Cao G, Sofic E and Prior RL (1996). Antioxidant capacity of tea and common vegetables. Journal of agricultural and food chemistry, 44(11), 3426-3431.

Castro M, Tatuszka P, Cox DN, Bowen J, Sanguansri L, Augustin MA and Stonehouse W (2019). Effects on plasma carotenoids and consumer acceptance of a functional carrot-based product to supplement vegetable intake: A randomized clinical trial. Journal of Functional Foods, 60, 103421.

Chantaro, P., Devahastin, S., and Chiewchan, N. (2008). Production of antioxidant high dietary fiber powder from carrot peels. LWT-Food Science and Technology, 41(10), 1987-1994.

Chapman HD and Pratt PF (1978). Methods of analysis for soils, plants and waters. 50, California Univ. Div. Agriculture Science Priced Publication, 4034.

Dewettinck K, Van Bockstaele F, Kühne B, Van de Walle D, Courtens TM and Gellynck X (2008). Nutritional value of bread: Influence of processing, food interaction and consumer perception. Journal of Cereal Science, 48(2), 243-257.

Dreosti IE (1993). Vitamins A, C, E and β-carotene as protective factors for some cancers. Asia Pacific journal of clinical nutrition, 2, 21-25.

Eim VS, Simal S, Roselló C and Femenia A (2008). Effects of addition of carrot dietary fiber on ripening process of a dry fermented sausage (sobrassada). Meat Science, 80, 173-182.

El-Gammal RE and El Kewawy HE (2014). Effect of addition of stabilized rice bran on physical, rheological and chemical charatarestics of pan bread. Journal of Food and Dairy Sciences, 5(11), 813-825.

Elleuch M, Bedigian D, Roiseux O, Besbes S, Blecker C and Attia H (2011). Dietary fibre and fibre-rich by-products of food processing: Characterisation, technological functionality and commercial applications: A review. Food chemistry, 124(2), 411-421.

Gelinas P and Lachance O (1995). Development of fermented dairy ingredients as flavor enhancers for bread. Cereal chemistry (USA).

Gómez M, Ronda F, Caballero PA, Blanco CA and Rosell CM (2007). Functionality of different hydrocolloids on the quality and shelf-life of yellow layer cakes. Food hydrocolloids, 21(2), 167-173.

González-Centeno MR, Rosselló C, Simal S, Garau MC, López F & Femenia A (2010). Physico-chemical properties of cell wall materials obtained from ten grape varieties and their byproducts: grape pomaces and stems. LWT-Food Science and Technology, 43(10), 1580-1586.

Gray JA and Bemiller JN (2003). Bread staling: molecular basis and control. Comprehensive reviews in food science and food safety, 2(1), 1-21.

Hosseini Ghaboos SH, Seyedain Ardabili SM and Kashaninejad M (2018). Physico-chemical, textural and sensory evaluation of sponge cake supplemented with pumpkin flour. International Food Research Journal, 25(2).

JURASOVÁ ZKJKM and KUKUROVÁ K (2011). Application of citrus dietary fibre preparations in biscuit production. Journal of Food and Nutrition Research, 50(3), 182-190.

Karaoğlu MM and Kotancilar HG (2009). Quality and textural behaviour of par-baked and rebaked cake during prolonged storage. International journal of food science and technology, 44(1), 93-99.

Kitterman JS and Rubenthaler GL (1971). Assessing quality of early generation wheat selections with micro AWRC test. Cereal Science Today, 16(9), 313-+.

Kohajdová Z, Karovičová J and Jurasová M (2012). Influence of carrot pomace powder on the rheological characteristics of wheat flour dough and on wheat rolls quality. Acta Scientiarum Polonorum Technologia Alimentaria, 11(4), 381-387.

Lee FA (1983). Milk and milk products. In Basic Food Chemistry (pp. 363-395). Springer, Dordrecht.

Lokuge GM, Vidanarachchi JK, Thavarajah P, Siva N, Thavarajah D, Liyanage R, and Alwis J (2018). Prebiotic carbohydrate profile and in vivo prebiotic effect of pumpkin (Cucurbita maxima) grown in Sri Lanka. Journal of the National Science Foundation of Sri Lanka, 46(4).

Mala SK, Aathira P, Anjali EK, Srinivasulu K and Sulochanamma G (2018). Effect of pumpkin powder incorporation on the physico-chemical, sensory and nutritional characteristics of wheat flour muffins. International Food Research Journal, 25(3), 1081-1087.

Nivelle MA, Bosmans GM and Delcour JA (2017). The impact of parbaking on the crumb firming mechanism of fully baked tin wheat bread. Journal of agricultural and food chemistry, 65(46), 10074-10083.

Pahwa A, Kaur A and Puri R (2016). Influence of hydrocolloids on the quality of major flat breads: A review. Journal of Food Processing, 2016.

Prosky L, Asp NG, Schweizer TF, Devries JW and Furda I (1988). Determination of insoluble, soluble, and total dietary fiber in foods and food products: interlaboratory study. Journal of the Association of Official Analytical Chemists, 71(5), 1017-1023.

Ptitchkina NM, Novokreschonova LV, Piskunova GV and Morris ER (1998). Large enhancements in loaf volume and organoleptic acceptability of wheat bread by small additions of pumpkin powder: possible role of acetylated pectin in stabilising gas-cell structure. Food Hydrocolloids, 12(3), 333-337.

Salehi F, Kashaninejad M, Akbari E, Sobhani SM and Asadi F (2016). Potential of sponge cake making using infrared–hot air dried carrot. Journal of texture studies, 47(1), 34-39.

SAS (2010). Statistical Analysis System. User's Guide: Statistics, SAS Institute Inc, Gary, Nc., USA.

Schieber A, Stintzing FC and Carle R (2001). By-products of plant food processing as a source of functional compounds—recent developments. Trends in Food Science and Technology, 12(11), 401-413.Sendecor, G.W. and Cochran, W.G. (1997). Statistical Methods; 7th Ed. Oxford and J; B.H. Publishing Co. 6(2): 240:285.

Shyamala BN and Jamuna P (2010). Nutritional Content and Antioxidant Properties of Pulp Waste from Daucus carota and Beta vulgaris. Malaysian journal of nutrition, 16(3).

Snedecor GW and Cochran WG (1980). Statistical methods. 7th. Iowa State University USA, 80-86.

Soetan KO, Olaiya CO and Oyewole OE (2010). The importance of mineral elements for humans, domestic animals and plants: A review. African journal of food science, 4(5): 200-222.

Speizer FE, Colditz GA, Hunter DJ, Rosner B and Hennekens C (1999). Prospective study of smoking, antioxidant intake, and lung cancer in middle-aged women (USA). Cancer Causes and Control, 10(5), 475-482.

Stone H, Bleibaum RN and Thomas HA (2012). Sensory evaluation practices.

Thebaudin JY, Lefebvre AC, Harrington M and Bourgeois CM (1997). Dietary fibres: nutritional and technological interest. Trends in Food Science and Technology, 8(2), 41-48.