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Effect of Adding of Moringa and Turmeric as Nutritive Food Colorants on Chemical, Physical and Rheological Properties of Pan Bread

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ABSTRACT

This research aimed to study the effect of addition moringa and turmeric powders on some properties of pan bread. Moringa and turmeric powders were added with the ratio of 5%, wheat flour and oat flour in order to prepare coloured pan bread. Chemical composition, mineral content, antioxidant activity, rheological properties and staling rate of pan bread samples were studied. Obtained results indicated that addition of moringa powder increased the amount of protein, ash, crude fibers, minerals and antioxidant activity in prepared pan bread samples. While, the carbohydrates content decreased in compared with those of control samples. Rheological properties also resulted that addition of Moringa and turmeric powder negatively influnced on some farinograph parameters (water absorption, arrival time, and dough development time and dough stability) and extensograph parameters (elasticity, extensiblity, proportional number and energy of dough). Staling rate results showed that there was gradual decrease in all fortified pan bread samples for freshness up to 48 hours of storage in compared with those of control sample, also, an observed decrease in staling rate after 48 hours of storage of all pan bread. Sensory evaluation results indicated that there was an enhancment in all nutritional value, the acceptability properties of all pan bread samples.

Keywords: Pan bread, Moringa, turmeric, rheological properties and staling rate.

INTRODUCTION

Bread is a significant staple food and the most consumed bakery products all over of the world in both rustic and metropolitan populaces. An assortment of bread of various shape, flavors, sizes and textures that contain various ingredients and are prepared under different conditions exists across numerous continents. The bakery products can be utilized as a vehicle for consolidation of different nutritionally rich fixings (El-Mehiry *et al*. 2016). Incomplete supplanting of wheat flour with non-wheat flours improves the nutritional quality of bakery products and fulfills purchasers' mentioned for healthy food and motley collection in food items (Alvarez-Jubete *et al*. 2010). Wheat can be used for readiness of numerous products (El-Gammal and El kewawy, 2014). Dietary fiber intake has health-defensive effects and disease-inversion benefits. People devour generous amounts of dietary fiber, comparing to the people who have small fiber intake, are at lower risk for developing; diabetes, hypertension, cardiovascular health disease, certain gastrointestinal diseases and obesity. Expanding the admission of high fiber foods or fibers supplements improves serum lipoprotein values, blood glucose control for diabetic individuals, lowers blood pressure, aids weight loss, and improves regularity (Otles and Ozgoz, 2014).

Bread substituted with other crude materials have been created as oat. Oat (*Avena sativa* L.) is a cereal that has discovering ample applications in food fortification because of their nutritional value and high energy in particular high dietary vitamins, minerals content and fiber (Rasane *et al.*, 2015). Its bioactive compounds are associated in decreasing the degree of cholesterol (β-glucans, tocotrienols), the postprandial glucose level (β-glucans), the blood pressure (specific protein fractions), the oxidative stress (phenolic acids, avenantramides, tocols) or in prevention of breast and colon cancer (dietary fibers, O-methylated flavonoids by tricine-glucosides type or lunazina peptide) Nakurte *et al.* (2013) and Gangopadhyay *et al.* (2015).

Moringa powder (*Moringa oleifera*) is one of the most popular species among the Moringaceae family. Moringa oleifera leaves contained considerable amount of essential micro nutrients. Moringa leaves powder were standardized and incorporated in popularly consumed food products like cake and bakery products (Malemnganbi and Singh, 2021). Dry Moringa leaves could be sprinkled on any food items to improve nutritional value. (Clement *et al.* 2017). Moringa oleifera contains phytosterol compounds and the leaves have certain quality as lactagogum i.e. increasing breast milk production (Kiranawati and Nurjanah, 2014). Moringa leaves possess fiber, fat, protein and mineral like magnesium, calcium, phosphorus, iron, copper and sulfur. A few studies have shown that moringa leaves are protein-rich, ranging from 179 to 268 $g.kg^{-1}$ of dry matter and have fatty acids and amino, minerals and vitamin that are adequate for human (Zhang *et al.* 2019). Aside from going about as an ideal source of natural antioxidants, Moringa leaves were bountiful sources of protein, potassium and calcium. Improve the time storage of fat-containing foods varieties concerning the presence of a alternate class of antioxidant compounds, including phenolic and carotenoids or flavonoids (Daulay *et al.* 2019).

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Turmeric (*Curcuma longa*) has been utilized traditionally as an anti-diabetic and has been proven important to posse high anticancer and antioxidant activity properties. The active components in turmeric, i.e. curcumin, which is a yellow coloring agent, present in the rhizomes of turmeric, and tetrahydro-curcumin (THC), which is the major colorless metabolites of curcumin, also possess anti-diabetic, anti-inflammatory, and antioxidant activity. In the scientific literature, a lot of information data is accessible with respect to the nutritional properties of turmeric and its utilization to develop sweet bakery products (Lim *et al*., 2011; El-Gohery, 2020 and Shashanka *et al.* 2020).

So, this study was conducted to evaluate the applicability of coloring pan bread with natural colorants namely (moringa and turmeric) from wheat and oat flours mixture. To achieve this goal, approximate chemical composition, bioactive compounds and rheological characteristics and staling rate were evaluated.

MATERIALS AND METHODS

Materials:

Wheat flour (*Triticum aestivum*, 72% extraction), oat flour (*Avena sativa*), baking powder, sugar, instant active dry yeast, skim milk powder, salt and commercial corn oil were obtained from local market, El-Mansoura city, El-Dakahlia Governorate, Egypt.

Moringa powder (*Moringa oleifera*), turmeric powder (*Curcuma longa*), were purchased from local market, El-Mansoura city, El-Dakahlia Governorate, Egypt.

Methods:

Pan bread formulas:

Three flour mixtures were utilized to prepare samples of pan bread according to the ratios as follows:

- Control: 100% wheat flour
- Blend (1): 60% wheat flour + 40% oat flour
- Blend (2): 55% wheat flour + 40% oat flour+5% Moringa powder
- Blend (3):55% wheat flour + 40% oat flour+ 5% Turmeric powder

Baking process of pan bread:

Samples of pan bread were prepared as indicated by the technique described in A.A.C.C. (2010) at Food Technology Research Institute, Agricultural Research Center, El-Giza, Egypt. The resulted dough were let to rest for 20 min at 30±2 ◦C (first proofing), and then the dough were partitioned into 400 g for pieces, hand stacked, and put into metal pans at 30±2 ◦C and 80-85% relative humidity in fermentation cabinet for 60 min. then, dough was baked in electrically heated oven (with steam added during baking) at 210-220 ◦C for 15-20 min (National MFG Co.). Acquired portions were separated from the metal dish, cooled to ordinary room temperature, enclosed by polyethylene packs, and then the sacks were stored at room temperature (25±2 ◦C).

Analytical Methods:

Chemical analysis:

Moisture, protein, crude fibers, ash, carbohydrates of raw materials and pan bread samples were determined as indicated to the method described in A.O.A.C. (2010).

- **Determination of some minerals content:**

Mineral contents of raw material and samples of pan bread were determined as indicated to Chapman and Pratt (1979). The total quantities of Fe, Zn, Mg, Na, K and Ca were determined by atomic absorption spectrophotometry as indicated to the methods of A.O.A.C. (2005). Whereas, P content was determined by spectrophotometer as indicated to the method of Astm (1975).

- **Determination of bio-active compounds:**

Bio-active compounds were determined for raw materials and pan bread, Total phenols content were expressed as Gallic acid equivalent (mg.g^{-1}) (Slinkard and Singleton, 1977). Total flavonoids content were determined by a colorimetric technique as indicated to Zhishen *et al*., 1999. DPPH scavenging activity assay based on slight modifications (Re *et al*. 1999).

Rheological measurements of dough:

Measurements of Rheological were achieved for flour mixtures utilizing farinograph and extensograph tests as described by A.A.C.C (2012) procedure at Food Technology Research Institute, Agricultural Research Center, El-Giza, Egypt.

- **Determination of pan bread (staling rate):**

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

- **Sensory evaluation of pan bread samples:-**

Samples of fresh pan and colored bread that were baked and placed at room temperature (25±2◦C) were applied to sensory test and evaluated and recorded as indicated to A.A.C.C. (2005), utilizing seven panelists from the Food Industries Dep. Fac. Agric., El-Mansoura University.

Statistical analysis:

ANOVA were analyzed using the producer of the Statistical Analysis System (CoSTATE) software program. Significant differences among treatments means were determined by Duncan's Multiple Comparisons at $P \leq 0.05$, according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

1.Chemical composition, minerals content and bio active compounds of raw materials used in pan bread preparing:

Proximate chemical composition of raw materials namely wheat flour, oat flour and natural colorant namely (Moringa and turmeric) are presented in Table (1).

Obtained data detected that oat flour recorded the highest amount of moisture content being 14.23%, while the lowest one realized with turmeric powder 1.02%. Meanwhile, the highest values of crude protein were realized for moringa powder (21.94%). However, turmeric powder had the lowest crude protein scored (10.84%). On the other side, turmeric powder contained the highest ash (8.21%), followed by moringa powder (7.01%), while the wheat flour had the lowest ash (0.72%). As for the crude fiber found that moringa powder (26.63%), while the lowest crude fiber recorded with wheat flour as (0.61%). The highest values of total carbohydrates recorded by wheat flour being 86.28%. While, moringa powder had the lowest value of total carbohydrates (39.64).

The obtained results are in the line with those reported by Khalaf *et al*. (2018) resulted that wheat flour 72% had moisture (9.50%), crude fat (0.99%), crude protein (10.64%), ash (0.50%), crude fiber (0.47%)and carbohydrates (87.69%). Also, Abd El-Ghany (2020) resulted that strong wheat flour 72 extraction contain 12.60, 12.25, 0.70, 0.63, 0.64 and 85.78% for moisture, protein, lipids, ash, crude fibers and carbohydrates, respectively. While, Hamad *et al.* (2020) showed that oat contained 6.94% Moisture, 18.47% protein, 6.93 % fat, 1.95% Ash, 9.86% fiber and 55.85% carbohydrates. Also, Ibrahim *et al*. (2020) showed oat had 12.69% protein content indicating potential to be utilized as source of protein for human food and animal, whilst in high fat contents 6.67%, crude fiber contents 17.83%, moisture contents showed 9.29 % and ash contents 6.02%. In the same line, Abouel-Yazeed, (2019) resulted that when doing a proximate analysis of moringa leaves found that moringa is rich in carbohydrate 53.63%, protein 23.14% and fiber 10.61%. El-Gohery, (2020) reported that turmeric powder (as antioxidant and colorants agent) contained 10.63%, 4.89%, 9.62%, 6.13% and 68.73% for protein, fat, ash, crude fiber and total carbohydrates respectively.

Data concerning with minerals content of raw materials used in the experiment as; wheat flour, oat flour (Moringa and turmeric) are given in Table (1). Turmeric powder had the highest value of potassium content, while wheat flour recorded the lowest one (2486.43 and 176.33 mg.100g^{-1}), respectively. On the other hand, moringa powder had the highest value of calcium content (2138.98 mg.100g^{-1}), when wheat flour has the lowest content of calcium (30.68 mg.100g^{-1}). As for the content of magnesium found that moringa powder recorded the highest value (416.56 mg.100g^{-1}), while wheat flour recorded the lowest value (27.01 mg.100g^{-1}). Moringa recorded the highest sodium value, while oat flour had the lowest one as (68.31 and 5.18 mg.100g^{-1}), respectively. Oat flour scored the highest content of phosphors (463.11 mg.100g^{-1}), while turmeric powder scored the lowest one (21.14 mg.100g^{-1}). Turmeric powder had the highest value of iron content while, wheat flour obtained the lowest value one (38.21 and 2.64mg.100g^{-1}). Moringa powder represented the highest content of zinc 4.91 mg.100g^{-1}), while wheat flour recorded the lowest value of zinc (0.81 mg.100g^{-1}).

Table 1. Gross chemical composition, minerals and bio active compounds of raw materials used in colored pan bread preparation:

Components Raw materials	Moisture	Crude protein	Ash	Crude fiber	Total carbohydrates*	Minerals (mg.100g^{-1}) K	Ca	Mg	Na	P	Fe	Zn	Bioactive compounds TP	TF	DPPH%
Wheat flour (72%)	13.82 ±0.08b	11.21 ±0.06c	0.72 ±0.02d	0.61 ±0.02d	86.28 ±0.08a	176.33 ±0.57d	30.68 ±0.75d	27.01 ±0.26d	25.11 ±0.64c	148.41 ±1.35c	2.64 ±0.32d	0.81 ±0.07c	93.6 ±1.17c	1360.00 ±4.00a	7.14 ±0.08d
Oat flour	14.23 ±0.11a	13.86 ±0.04b	1.74 ±0.02c	3.81 ±0.03c	72.47 ±0.09b	334.81 ±1.58c	51.23 ±1.31c	116.11 ±1.46c	5.18 ±0.25d	463.11 ±2.21a	12.23 ±0.33c	3.74 ±0.09b	84.80 ±1.35d	586.70 ±3.16b	14.80 ±0.13c
Moringa powder	4.78 ±0.06c	21.94 ±0.05a	7.01 ±0.04b	26.63 ±0.04a	39.64 ±0.11d	1601.75 ±1.46b	2138.98 ±3.22a	416.56 ±1.35a	68.31 ±0.34a	312.82 ±1.18b	25.18 ±0.47b	4.91 ±0.08a	914.43 ±1.84a	67.42 ±1.19c	94.68 ±0.15a
Turmeric powder	1.02 ±0.09d	10.84 ±0.08d	8.21 ±0.03a	11.16 ±0.04b	68.77 ±0.09c	2486.43 ±2.19a	201.25 ±3.11b	194.32 ±1.30b	35.61 ±0.24b	21.14 ±0.82d	38.21 ±0.44a	3.68 ±0.14b	518.87 ±2.52b	48.18 ±1.21d	33.76 ±0.11b
LSD at 1%	0.24	0.16	0.08	0.09	0.26	4.27	6.47	3.27	1.10	4.06	1.08	0.27	4.92	7.35	0.33
LSD at 5%	0.16	0.11	0.05	0.06	0.18	2.93	4.44	2.24	0.76	2.78	0.74	0.17	3.38	5.05	0.23

Means of triplicates ± SD
***Carbohydrates were determined by the difference**
TP: total phenol mg.100 g^{-1}
TF: total flavonoid mg.100g^{-1}
DPPH: α, α-diphenyl-β-picrylhydrazyl

These results were agreed with those recorded by El-Gammal *et al.* (2016) indicated that Moringa leaves powder contained some essential minerals namely Calcium, Magnesium, Phosphorous and Iron. In the same way, Abd El-Ghany, (2020) indicated that both of moringa leaves and powder had high essential macro-elements as K, Ca, Mg, Na, P and micro- elements as Fe and Zn.

Moringa powder are an important source of total phenol. The result of the total phenol contents significantly recorded the highest value in moringa powder (914.43 mg.100g^{-1}), while the lowest value indicated with oat flour (84.80 mg.100g^{-1}). Wheat flour recorded the highest value of total flavonoid (1360.00 mg.100g^{-1}) followed by oat flour which scored (586.70 mg.100g^{-1}). While the lowest value with turmeric powder (48.18 mg.100g^{-1}). Phenolic and flavonoids compounds possess different biological activities, but the most important are antioxidant activity, which is associated with a reduced risk of cancers and cardiovascular diseases.

Antioxidant activity is an important parameter to establish the food product healthy functionality. Antioxidant capacity of vegetables and fruits has been examined utilizing wide assortment of methods. In this study, free radical (DPPH) scavenging assay were utilized to assess the antioxidant activity of raw materials under investigation. This assay has frequently been utilized to asses antioxidant capacity. Data are reported in Table (1). Free radical scaving activity (DPPH) was exerted by moringa powder with value of 94.68%, while the lowest one recorded with oat flour as 14.80%.

2. Chemical composition, minerals content and bio active compounds of colored pan bread samples:

Effect of addition different raw material (Moringa and turmeric) on proximate analysis composition of processed pan bread samples was tested and the results are introduced in Table (2). It could be easily observed that ash and crude protein contents were gradually increment with raw material addition and the highest values recorded with moringa powder, whereas moisture and total carbohydrates decreased with addition of colorants, while crude fiber decreased with all addition except with blend 1.

The moisture content of any foods is normally considered as a pointer of food quality and shelf life. It is significant to measure the moisture content of bakery products because of its potential impact on the physical, sensory, and microbial properties of such items (El-Gamma *et al*. 2016).

The obtained data illustrated that moisture content was gradually decreased from 16.94% with control to 10.32% with blend 3. Decrease in moisture content in utilizing powder of raw materials in the pan bread blends may be effective implications in microbiological quality and texture of bread processed as indicated by (El-Gammal *et al*. 2016). While, there was an increment in content of protein with addition of moringa and turmeric powder in all samples of pan bread from 15.58% with control to 17.13% in blend 2 (moringa powder), 15.76% (turmeric powder). Utilizing of moringa leaves powder increased content of crude protein nearly about 9.94% over control sample of bread. This may be attributed to addition caused by the high protein content of Moringa leaves powder. These results are exactly similar to the one obtained by El-Gammal *et al*. (2016) and Abd El-Ghany (2020) they reported that with addition of moringa leaves powder to pan bread increased protein% ammount.

For the ash content in the same Table results found that ash values increased from 1.78% in control samples to 1.93, 2.63 and 2.94% prepared bread samples with oat, moringa and turmeric, respectively. Additionally, in the same Table there was a decrease in carbohydrate content, ranged from 74.81 with control to 58.83% in blend 2 (moringa powder). El-Gammal *et al.* (2016) and Abd El-Ghany (2020) reported that substitution of pan bread by moringa powder resulted a decrease in carbohydrate contents.

Table 2. Chemical composition, minerals and bio active content of pan bread samples:

Components Pan bread	Moisture	Crude protein	Ash	Crude fiber	Total carbohydrates	Minerals mg.100g^{-1}							Bioactive compounds		
						K	Ca	Mg	Na	P	Fe	Zn	TP	TF	DPPH%
Control*	16.94 ±0.09^{b}	15.58 ±0.16^{d}	1.78 ±0.04^{c}	0.56 ±0.02^{a}	74.81 ±0.18^{b}	114.76 ±1.47^{e}	64.44 ±0.60^{d}	74.81 ±0.14^{d}	218.11 ±1.26^{d}	183.16 ±0.27^{d}	3.83 ±0.05^{e}	1.18 ±0.04^{c}	7.40 ±0.17^{e}	93.30 ±0.22^{e}	8.07 ±0.04^{c}
Blend (1)	15.66 ±0.12^{c}	14.41 ±0.08^{e}	1.93 ±0.03^{c}	0.61 ±0.03^{a}	73.89 ±0.15^{c}	121.18 ±0.70^{d}	58.13 ±0.09^{e}	63.11 ±0.18^{e}	196.83 ±0.91^{e}	165.18 ±1.65^{e}	4.16 ±0.05^{d}	0.96 ±0.03^{d}	52.10 ±0.12^{c}	253.30 ±0.68^{c}	8.09 ±0.09^{c}
Blend (2)	11.74 ±0.05^{d}	17.13 ±0.02^{a}	2.63 ±0.06^{b}	0.46 ±0.02^{b}	58.83 ±0.11^{e}	136.47 ±1.01^{c}	668.11 ±0.63^{a}	213.46 ±0.48^{a}	279.22 ±0.74^{a}	214.13 ±0.16^{a}	4.36 ±0.13^{c}	1.26 ±0.04^{c}	768.53 ±1.24^{a}	296.38 ±0.63^{a}	78.14 ±0.09^{a}
Blend (3)	10.32 ±0.09^{e}	15.76 ±0.04^{c}	2.94 ±0.07^{a}	0.38 ±0.05^{c}	66.31 ±0.08^{d}	168.43 ±0.89^{a}	416.21 ±0.72^{b}	146.03 ±0.45^{b}	238.54 ±1.05^{b}	191.05 ±0.57^{c}	4.77 ±0.14^{b}	1.43 ±0.03^{b}	744.67 ±1.47^{b}	271.24 ±0.42^{b}	51.84 ±0.15^{b}
LSD $_{at\ 1\%}$	0.22	0.22	0.12	0.08	0.34	2.53	1.41	0.88	2.52	2.19	0.24	0.12	2.24	1.66	0.99
LSD $_{at\ 5\%}$	0.15	0.17	0.08	0.06	0.24	1.78	0.98	0.61	1.77	1.53	0.17	0.08	1.58	1.17	0.70

***Control: 100% wheat flour**
Blend (1): 60% wheat flour + 40% oat flour
Blend (2): 55% wheat flour + 40% oat flour+5% Moringa powder
Blend (3):55% wheat flour + 40% oat flour+ 5% Turmeric powder
Means of triplicates ± SD
TP: total phenol mg.100 g^{-1}
TF: total flavonoid mg.100g^{-1}
DPPH: α, α-diphenyl-β-picrylhydrazyl

Mineral content in samples of pan bread also illustrated in Table (2), from the obtained results, the partial switch of all raw materials increment the content of minerals in all samples of pan 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 and Zn comparing with control sample. From nutritional view, samples of processed pan bread contained higher content of studied minerals. Such as, pan bead blend 2 (moringa powder) contained Ca, Mg and Na contents 668.11, 213.46 and 279.22 comparing with that obtained in control bread sample as reported by El-Gammal *et al*. (2016) and Abd El-Ghany (2020) they mentioned that the partial switch of flour in pan bread with moringa leaves and seeds powder resulted in produced pan bread with significant higher levels of important nutrients such as Ca, Zn, Mg and Fe.

The antioxidant activity including total phenol, total flavonoid and DPPH in samples of pan bread under study are shown in Table (2). From the obtained results, it could be indicated that total phenol, total flavonoid and DPPH were increased with all addition of substitution raw materials (Moringa and turmeric), which recorded that highest values with blend 2 (moringa powder) and scored 768.53, 296.38 and 78.14 for total phenol, total flavonoid and DPPH, respectively followed by blend 3 (turmeric powder) which recorded 744.67, 271.24 and 51.84 for total phenol, total flavonoid and DPPH, respectively comparing with the control 7.40, 93.30 and 8.07 for total phenol, total flavonoid and DPPH, respectively.

3. Sensory evaluation of fresh pan bread samples:

Sensory evaluation continues to play a significant part in evaluate the quality of food because it measures what consumers really perceive and among the fundamental characteristics related with quality are surfaces flavor, color, taste, and texture (Bryhni *et al*. 2002). The organoleptic properties of prepared pan bread by utilizing different colorant namely (moringa and turmeric powder) were assessed to choose the best substitution for produced high quality accepted pan bread. Samples of pan bread were evaluated by seven panelists for their internal and external properties as shown in Table (3).

Additionally, the results showed that the ability to retain alkaline water was gradually decreased during the storage period for all samples of pan bread. These results are in alignment with that reported by Besbes *et al*. (2014) and Nivelle *et al.* (2017) illustrated that crumb moisture was decreased during storage, which accelerated bread firming and starch-gluten interactions. All these qualities may be due to the increment in moisture content.

Presented data indicated that all sensory properties in samples of bread were decreased by addition of colorant. There was a significant difference in all sensory attributed between the control sample and pan bread blends (1, 2 and 3). Significant decrease for crust and crumb color for all samples could be attributed to the different color which affect negatively to consumers. There was low significant differences was recorded between blend 1, 2 and 3 for crust color.

Concerning to substitution of all colorant in pan bread samples, there was a significant decrease comparing with the control sample which recorded the highest value followed by control. There was a significant difference in the texture, taste, flavor, general appearance and overall acceptability.

Table 3. Sensory evaluation of processed fresh pan bread samples.

Pan bread samples	Sensory properties						
	Crust color (10)	Crumb color (10)	Texture (20)	Taste (20)	Flavor (20)	General appearance (2)	Overall acceptability (100)
Control*	9.64±0.11[a]	9.64±0.09[a]	19.23±0.12[a]	19.29±0.03[a]	19.11±0.09[a]	19.58±0.13[a]	96.52±0.04[a]
Blend (2)	8.00±0.05[b]	8.17±0.06[c]	16.17±0.06[d]	17.00±0.06[bc]	17.11±0.07[c]	17.23±0.04[c]	83.76±0.08[d]
Blend (3)	8.62±0.03[ab]	8.75±0.10[b]	17.25±0.07[b]	17.06±0.08[b]	17.50±0.09[b]	18.87±0.08[ab]	88.06±0.08[b]
Blend (4)	8.56±0.13[b]	8.25±.09[c]	16.75±0.06[c]	16.87±0.09[c]	17.50±0.03[b]	18.12±0.03[bc]	86.06±0.07[c]
F.test	**	**	**	**	**	**	**
LSD at 1%	1.53	0.23	0.17	0.23	0.19	1.47	1.95
LSD at 5%	1.05	0.16	0.12	0.16	0.13	1.01	1.34

***Control: 100% wheat flour**
Blend (1): 60% wheat flour + 40% oat flour
Blend (2): 55% wheat flour + 40% oat flour+5% Moringa powder
Blend (3):55% wheat flour + 40% oat flour+ 5% Turmeric powder

From the results in Table (3), it can be indicated that all pan bread samples with different addition from colorant recorded significant decrease comparing with control (100% wheat). The pan bread sample in blend 2 considered be the good samples and recorded highest values from blend 1 and 3 comparing with control. Blend 2 (moringa powder) recorded the highest values after control blends in texture, taste, flavor, general appearance and overall acceptability. In general, all panelists liked with moringa powder ($p<0.05$) on taste, texture, flavor and acceptance. In spite of this the decadent panelists didn't discover any important difference in preference with regard to color. The decreased sensory attributes in samples of bread with moringa leaves powder might be because of the odor and color of the dried green leaves. These previous results were in good agreement with those obtained by Sengev *et al.* (2013). These results are in agreement with those indicated by El-Gammal *et al.* (2016) and Abd El-Ghany (2020) reported that addition of Moringa powder caused a higher texture, flavor and overall acceptance pan.

4.Rheological properties:

- **Effect of different raw materials addition on farinograph parameters of pan bread dough behavior:**

Dough rheological properties are significant for their impact in quality of bread because of their important impact on final volume of loaf (El-Gammal *et al*. 2016). The effect of 60% wheat flour 72% with 40% oat flour addition of 5% from moringa and turmeric powder on farinograph parameters (water absorption, arrival time, and dough development time and dough stability) and the results are presented in Table (4) and illustrated in Figure (1).

From the data obtained in Table (4), the water absorption was gradually decreased with addition oat flour 40% in blend which recorded 54.0% comparing with control (100% wheat flour) which recorded 56.0%. Additionally, with the addition of different colorant (moringa and turmeric powders) caused an increase in water absorption comparing with the control. Pan bread with 60% wheat flour + 40% oat flour with addition of each; 5% moringa powder in blend (2) or 5% turmeric powder in blend (3) scored the highest value of water absorption (79.0%) for both bends, compared with (56.0%) for the control wheat flour dough.

Table 4. Farinograph parameters of pan bread dough with different raw materials added.

Flours blends	Farinograph parameters				
	Water absorption (%)	Arrival time (min)	Dough development (min)	Stability time (min)	Degree of softening (B.U)
Control*	56.0	0.5	10.5	>12	---
Blend (1)	54.0	1.0	7.5	19	10
Blend (2)	79.0	2.5	5.5	7.5	90
Blend (3)	79.0	3.5	75	8.5	80

Control: 100% wheat flour
Blend (1): 60% wheat flour + 40% oat flour
Blend (2): 55% wheat flour + 40% oat flour+5% Moringa powder
Blend (3):55% wheat flour + 40% oat flour+ 5% Turmeric powder

This increase in absorption of dough water might be attributed to the higher contents of fibers and protein of added colorant. While addition of either moringa or turmeric powder recorded the highest value of water absorption. These results in agree with those of Khalefa *et al.* (2018) resulted that a raised at the absorption water was happened with increasing the substitution levels of moringa seeds and leaves powder to wheat flour as compared to 100% strong wheat flour as control sample. Also, Almeida *et al.* (2010) observed that, an increase in water absorption of the produced dough was happened with the addition of fibers sources to wheat flour. This could be attributed to higher water hydration capacity of fibers (Turksoy and Ozkaya, 2011). In addition, Park *et al.* (2012) observed 69.4% highest water absorption in cake flour with addition of turmeric powder 8% followed by 64.5% in cake flour with addition of turmeric powder 6% while the control had 49.6% the lowest water absorption. The increment in absorption water indicated an action of turmeric powder as oxidizing agent in dough environment. Water absorption is deemed to be a significant characteristic of wheat flour, as Simon (1987) illustrated that increased in water absorption is required for good chapatti properties which remain soft for a longer time.

Concerning to the data in Table (4), it could be concluded a gradually increased in the time of arrival and dough development with the addition of oat flour. The addition of turmeric powder in blend (3) recorded the highest values of arrival time and dough development time as (3.5 and 75 min), respectively comparing with the control (100% wheat flour). Dough development time is defined as the time (min.) to be need to mix flour and water to form dough with suitable consistency, Park *et al.* (2012) resulted that increasing in dough development time from 1.2 to 3.5 min with increasing addition of turmeric powder from 0 to 8%. An increase in dough development time could be attributed to slow rate of development of gluten and hydration by the addition of turmeric powder. Similar results were found by Zaidul *et al.* (2004) resulted that could be increase was happened in dough development time due to the increase in water absorption.

Dough resistance and its strength for mechanical action is measured utilizing dough stability (min.). Dough stability time is known as the time (min) between the first point water addition and the point at which first signal of weakening of dough is noticed. Thus, in the experiment could observed that the dough stability (min.) of the composite wheat dough in blend (1) increased to 19 min comparing with the control >12, while with addition of colorant beginning from blend (2 and 3) were decreased from >12 with control sample to (7.5 and 8.5 min), respectively for blends (2 and 3). The decrease in the stability time indicates the weakness of dough strength may be attributed to the dilution effect caused by the utilizing different colorant which reduces the wheat gluten content in the blends (Abd El-Ghany, 2020).

Regarding to the degree of softening the samples, an increase in the softening value was recorded in the samples recorded decrease in dough stability. Results introduced in Table (2) revealed a gradually increased in degree of softening values with the addition of oat flour and colorants comparing with the control. On the other hand, the data proves that there is a relative correlation between degree of softening and dough stability time with the replacement ratio of colorants (moringa and turmeric), as an example stability time of blend (2) contains moringa powder recorded the lowest value (7.5 min), in the same time recorded the highest degree of softening (90 B.U). The same results were reported by Abd El-Ghany, (2020).

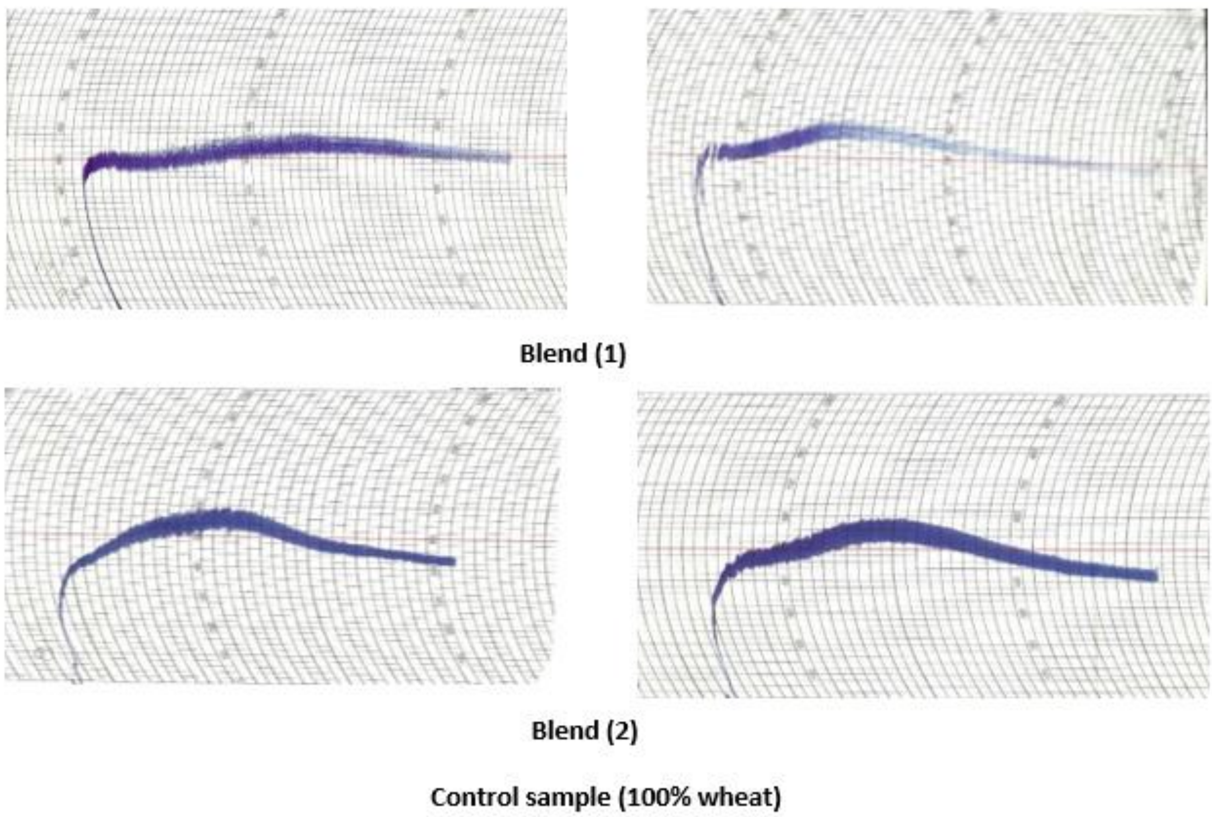

Fig. 1.Farinograph parameters of pan bread dough behavior with different raw materials

5. **Effect of different raw materials addition on extensograph parameters of pan bread dough behavior:**

Extensograph analysis gives data about the viscoelastic conducts of a dough and resistance to extension and measures dough extensibility. A combination of both good extensibility and resistance results in desirable dough properties (Zalatica *et al.*, 2012).

Data illustrated in Table (5) and Fig. (2) indicated the impact of wheat flour substitution with oat flour and different colorant (moringa and turmeric powder) on extensograph parameters (elasticity, extensiblity, proportional number and energy of dough).

However, it could be stated that blends (1 and 2) were gradually decreased in the values of elasticity from (310 B.U) for control sample to (210 and 300 B.U) for blend (1 and 2), respectively. On the contrary, blend (3) record 400 B.U, comparing to the control (310 B.U). The highest value of elasticity was recorded in blend (3) included turmeric powder, this could be clarified by the fact that antioxidant activity of turmeric powder with prevents oxidative polymerization of bakery flour slurry and this absence of polymer cross linkages lead to higher viscosity of bakery flour slurry (Loewe, 1993).

Table 5. Extensograph parameters pan bread dough behavior with different raw materials added.

Flours blends	Extinsograph parameters			
	Elasticity (B.U)	Extensiblity "E" (mm)	Proportional number (R/E)	Energy (Cm^2)
Control*	310	150	2.06	75
Blend (1)	210	100	2.1	25
Blend (2)	300	75	4.0	25
Blend (3)	400	80	5.0	30

Control: 100% wheat flour
Blend (1): 60% wheat flour + 40% oat flour
Blend (2): 55% wheat flour + 40% oat flour+5% Moringa powder
Blend (3):55% wheat flour + 40% oat flour+ 5% Turmeric powder

Outcomes data demonstrated that control dough sample had the highest value of extensibility (mm), it significantly diminished with expanding of addition ratios of replacement materials, where it recorded 150 mm with the control and diminished to 75 mm with blend (2) moringa powder.

Furthermore, proportional number which calculated from extensibility and elasticity values, recorded various values. Blend (3) in with trimetric powder realized the highest value (5.0), while the least value was (2.06) with control (100% wheat flour).

Finally, the bread crumb value needed the input of dough energy (cm^2). In the interim, the control sample scored the highest value being (75 cm^2), whereas other blends samples were lower in the energy values. Results were realized (25 & 25 cm^2) for blends (1 and 2), while it scored (30 cm^2) for blend (3), respectively. These results are in around comparative with Khalefa *et al.* (2018) and Abd El-Ghany (2020) reported that with increasing the substitution levels moringa powder to wheat flour, found that the proportional number and energy decreased. Additionally, with the addition of moringa leaves powder recorded the maximum resistance to extension extensibility and energy decreased. In the same line Park *et al.* (2011) studied the impact of turmeric powder on the pasting properties of wheat dough and found a significant in all the parameters which recorded an increased with increasing turmeric powder content and had no significant effect in energy.

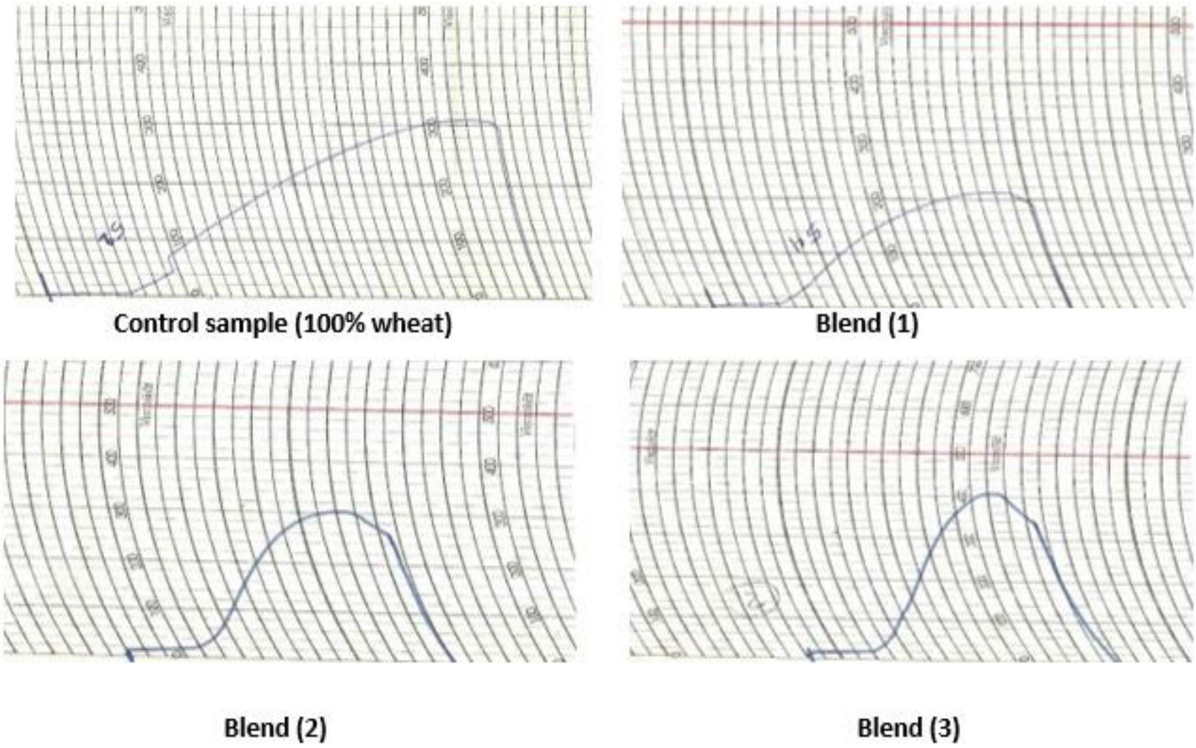

Fig 2. Extensograph parameters pan bread dough behavior with different raw materials

6.Staling rate:

Staling rate is a physical phenomenon, concerned with the progressions that happened in bread subsequent to baking. Alkaline water retention capacity is simplest test follow the stalling in bakery products, increments in Alkaline water retention capacity are come about because of the freshness of baked products (Gray and Bemiller, 2003).

The staling results of pan bread samples that prepared with (Moringa and turmeric) stored for 48 hours at room temperature (25±2 ◦C) are presented in Table (6).

Generally, there were a gradual increase in freshness (decrease in staling rate) up to 24 hours of storage in compared with control pan bread samples. The best values of freshness recorded for processed pan bread in moringa powder pan bread, followed by turmeric pan bread with alkaline water retention capacity values being (244.55 and 146.23, respectively) after 24 hours. Then there was an observed decrease in staling rate after 48 hours of storage of all pan bread samples. These results are in agreement with that obtained by El-Gammal *et al.* (2016) and Abd El Ghany (2020) they recorded that all samples of produced pan bread were more freshness with different values of MLP than control samples prolonged storage.

Table 6. Staling rate of different processed pan bread samples.

Pan bread samples	Staling rate		
	Zero time	24 hours	48 hours
Control*	299.19±0.29[a]	287.27±0.65[a]	147.19±0.70[a]
Blend (2)	279.71±0.53[b]	244.55±0.59[b]	130.58±0.60[c]
Blend (3)	194.71±0.42[c]	146.23±0.34[c]	144.17±0.61[b]
LSD at 1%	1.29	1.64	1.93
LSD at 5%	0.85	1.06	1.03

***Control: 100% wheat flour**
Blend (2): 55% wheat flour + 40% oat flour+5% Moringa powder
Blend (3):55% wheat flour + 40% oat flour+ 5% Turmeric powder
Means of triplicates ± SD

CONCLUSION

Finally, it could be clearly conducted that this study was a preliminary to upgrade nutritional value of bakery products with addition ratio of 5% from *Moringa oleifera* and turmeric powders which resulted in brought about striking increased significant nutrients for human health such as bio-active compound, protein, minerals (Fe, Ca, K and Zn), and antioxidants. Also, addition of *Moringa oleifera* and turmeric powders have a great nutritional benefits for developing countries and might help in decrease malnutrition diseases.

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تأثير إضافه مسحوق المورينجا و الكركم كمكونات غذائيه على الصفات الفيزيائيه و الكيميائيه و الريولوجيه لخبز القوالب.

أحمد عبدالعزيز الرفاعى، رانيا إبراهيم الجمال، الزهراء محمود مطاوع و عبدالسلام على
قسم الصناعات الغذائيه – كلية الزراعه – جامعة المنصوره – جمهوربة مصر العربيه

أجريت هذه الدراسه بغرض دراسة تأثير إضافة مسحوق المورينجا و الكركم كمكونات طبيعيه و غذائيه لتحسين الصفات الفيزيائيه و الكيميائيه لخبز القوالب، تم إضافة مسحوق المورينجا و الكركم بنسبة 5% من دقيق القمح إلى خبز القوالب المصنع من (55% دقيق قمح : 40% دقيق شوفان) لتحسين لونه و تم دراسة الخواص الكيميائيه و الفيزيائيه و الريولوجيه و معدل البيات على عينات الخبز المصنعه. و أظهرت نتائج التحاليل الكيميائيه للمواد الخام احتواء مسحوق المورينجا على نسبه مرتفعه من البروتين و الالياف بالاضافه لبعض العناصر المعدنيه مثل الكالسيوم، الفوسفور، البوتاسيوم، الماغنسيوم، الحديد و الزنك. كما أظهرت نتائج الخواص الريولوجيه أن إضافه مسحوق المورينجا و الكركم قد أثر سلبيا على بعض قيم الفارينوجراف و الاكستنسوجراف فقد انخفضت و لكن فى الحدود المعنويه نسبيا بإضافة المواد المختلفه. و قد أوضحت أيضا أن لعينات خبز القوالب تحت الدراسه و نتائج معدل البيات أن هناك انخفاض تدريجى في طزاجة جميع عينات الخبز حتى 48 ساعه مقارنه بالعينه الكنترول، أما بالنسبه للتقيم الحسى فوجد أنه على الرغم من وجود تحسن فى القيمه الغذائيه لعينات الخبز إلا أن جميع عينات الخبز تحت الدراسه قد انخفضت بإضافه الملونات.

الكلمات الداله: خبز القوالب، مسحوق المورينجا، الكركم، الخصائص الريولوجيه، الخواص الكيميائيه، معدل البيات.