

## Pan Bread Quality as Affected by the Addition of Ajwain and Thyme Powders

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### Abstract

Consumer acceptability and pan bread quality as influenced by the addition of ajwain (*Trachyspermum ammi* L.) and thyme (*Thymus vulgaris*) leaves powders were investigated. Ajwain and thyme powders were used to replace 2, 4 and 6% of pan bread wheat flour. Levels at 2 and 4% were acceptable by panelists. Meanwhile, substitutes at level 6% showed the lowest acceptability score comparing to control samples. Specific volume of pan bread samples were significantly ( $p < .05$ ) decreased, except  $A_2$  sample which containing 2% ajwain powder. Sample containing 4% thyme ( $T_4$ ) recorded the lowest specific volume  $3.51 \text{ cm}^3/\text{g}$ , while control sample recorded the highest value  $4.11 \text{ cm}^3/\text{g}$ . Crumb color was significantly affected ( $p < .05$ ), increasing replacement level decreasing  $L^*$  values and increasing  $b^*$  values. That means the darkness gradually increased, and yellowness decreased. The  $a^*$  values for ajwain increased while,  $a^*$  values of thyme decreased, indicated that pan bread contained ajwain become more redness, while thyme pan bread become more greenness. Textural profile analysis showed an increase in hardness and reduced in resilience with no significant differences observed, except  $T_4$  pan bread sample which recorded 8.19N and 0.18 for hardness and resilience, respectively comparing to control sample which recorded 7.50N and 0.20 for hardness and resilience, respectively. Concerning to cohesiveness,  $T_4$  sample recorded the lowest score 0.54 with no significant differences comparing to control sample which recorded 0.62.

**Key words:** Ajwain; Thyme; Pan bread quality; Consumer acceptance.

### Introduction

Bread in its various forms is one of the most consumed food products and becoming an essential product of the international food market (Saranraj and Geetha, 2012; Menon *et al.*, 2015 and Bolarinwa *et al.*, 2019). According to the Codex Alimentarius, bread is the product resulting from baking dough obtained by mixing flour and water, with or without addition of edible salt, fermented bakery's yeast (Heras-Mozos *et al.*, 2019).

Medical and aromatic plants have been used for a long time to improve the sensory characteristics of food, as well as a preservatives substance and for their nutritional and healthy properties (Nieto, 2017). Medical and aromatic plants are generally recognized as safe (GRAS) and are widely used for their antioxidant activities and as alternative synthetic preservatives Ajwain (*Trachyspermum ammi*) belong to family Apiaceae, the most utilized part is ajwain seeds (Singh *et al.*, 2004), thymol is the major compound. These seeds are used in Asian cooking and for baking biscuits, bread and in bean dishes (Mood *et al.*, 2014). Lamiaceae is one of the most important families in the production of essential oils with antioxidants and antimicrobial properties (Nieto, 2017), thyme (*Thymus vulgaris*) belong to this family.

There are several baking studies for bakery products that incorporate with medical and aromatic plants, such as (*Boehmerianivea* L.) ramie powder

(Lee and Joo, 2012), cinnamon and orange extracts (Ahmed and Hussein, 2012), Oregano (Dhillon *et al.*, 2013), Chokeberry Polyphenols Extract (Bialek *et al.*, 2016) and green tea powder (Ning *et al.*, 2019).

The objective of this study was to evaluate the quality characteristic of pan bread incorporated with ajwain seed powder and thyme leaves powder at different levels, as well as to determine the organoleptic acceptability of the product.

### Materials and Methods

#### 1. Materials:

Ajwain (*Trachyspermum ammi* (L.) seeds, thyme (*Thymus vulgaris*) leaves were purchase from Harraz for Food Industry and Natural Products, Cairo, Egypt. wheat flour 72% extract, instant yeast, salt and sugar were purchased from the local market. Sunflower oil was obtained from Arma for Food Industry, 10<sup>th</sup> of Ramadan City, Egypt.

#### 2. Methods:

##### a. Preparation and formulation of pan bread samples

The straight dough method for pan bread production was carried out according to the method described by (AACC, 2002) with some modification at Special Unit for Bakery Products Food Technology Research Institute (FTRI), Giza, Egypt. Basic dough formula of 1000g flour basis was

consisted of instant yeast (15g), sugar (20 g), salt (12g), sunflower oil (4g) and the required amount of water. The blends of wheat flour with ajwain and thyme as shown in Table (1) and all other ingredients were mixed together. The resulted dough was let to rest for 30 min (first proofing), then divided to (350 gm) pieces, rolled and molded in molding. Each piece was placed in baking pans (28x12x7 cm) tightly greased to prevent the loaves from sticking pans and was let to ferment for 60 min in a cabinet at

30°C and 80 - 85% relative humidity, then baking process was carried out in electrically heated oven at 230°C for 25-30 min. After baking, loaves were separated from the baking pans and allowed to cool for 2 hr. at room temperature (28°C± 5°C) for physical and organoleptic evaluation. The produced loaves were weighted, and the volume was measured by the rapeseed displacement method according to (AACC, 2002).

**Table 1.** Pan bread ingredients

Sample	Flour (g)	Ajwain/or thyme powder (g)	Yeast (g)	Sunflower oil (g)	Salt (g)	Sugar (g)
Control	1000	-	15	4	12	20
A <sub>2</sub>	980	20	15	4	12	20
A <sub>4</sub>	960	40	15	4	12	20
A <sub>6</sub>	940	60	15	4	12	20
T <sub>2</sub>	980	20	15	4	12	20
T <sub>4</sub>	960	40	15	4	12	20
T <sub>6</sub>	940	60	15	4	12	20

\*Control: bread without any addition; A<sub>2</sub>, A<sub>4</sub> and A<sub>6</sub>: pan bread contains ajwain seed powder 2%, 4% and 6%, respectively. T<sub>2</sub>, T<sub>4</sub> and T<sub>6</sub> pan bread: contain 2%, 4% and 6% thyme leave powder, respectively.

### b. Overall acceptability

A seven-point hedonic scale was used to evaluate the overall acceptability of the bread formulations; where 1 = dislike very much, 2 = dislike moderately, 3 = dislike slightly, 4 = neither like nor dislike, 5 = like slightly, 6 = like moderately and 7 = like very much as suggested by Wójcik *et al.*, (2017), to determine the acceptable levels of replacement. Breads were considered acceptable if their mean scores for overall acceptability were above 4 (neither like nor dislike).

### c. Sensory evaluation

The Organoleptic characteristics of the pan bread attributes were evaluated by fifteen panelists of Food Technology Research Institute (FTRI) for color (20), taste (20), odor (20), appearance (20) and texture (20) as described by Seleem *et al.*, (2014).

### d. Physical analysis

#### 1. Specific volume of pan bread loaves

After baking and cooling for 2 hr. The bread volume was measured according to the method of AACC (2002); weights were recorded by using decimal digital weighing scale. The specific volume was calculated as the ratio between the volume and the weight of the bread (cm<sup>3</sup>/g). Three replicates of each sample were analyzed.

#### 2. Texture profile analysis

Texture parameters (hardness, cohesiveness and resilience) of pan bread samples were measured objectively by using a texture analyzer CT3 Texture Analyzer (Version 2.1, 10000 Gram unit, Brookfield,

Engineering Laboratories, Inc. USA), according to method 74-09 (A.A.C.C., 2000) and as described by Peng *et al.*, (2010), whereas one slice of pan bread approximately 25mm thick or two slices, each approximately 12.5mm thick could be used. Set up a 36 mm diameter cylindrical probe at a test speed of 2 mm/s. The location of testing was the center of the bread slices avoiding non-representative areas of crumb. Sample was subjected to 40% deformation and trigger load 5g. Parameters (graph and data) were automatically recorded by computer software (TA-CT-PRO Software). Hardness (N or g), cohesiveness and resilience were also recorded. Test was a total of three samples per treatment undergo. Results were calculated as the average of the three determinations per treatment.

### 3. Color measurement

The color (CIE\* system) of pan bread crumb were determined using a Chroma-meter (Minolta CR-400, Minolta, Osaka, Japan) according to the method of Zhu *et al.*, (2016). Where, L\* indicates the brightness-darkness. While positive and negative a\* indicates the redness-greenness and b\* indicates yellowness-blueness.

### e. Statistical analysis

The results were statistically analyzed using CoState statistical software (CoHort Software, Monterey, CA, USA). The statistical calculations included the analysis of variance (ANOVA) one way completely randomized. p<0.05 was considered to be significant using Duncan's test. All data were

expressed as means values  $\pm$  Standard Deviation (SD), as described by Snedecor and Cochran (1982).

## Results and Discussion

### 1. Consumer acceptability

The consumer acceptability was conducted to evaluate the acceptable level of ajwain and thyme powders. Data in Table (2) cleared that the treatment A<sub>2</sub> and T<sub>2</sub> revealed no significant difference compared to control sample, while there was a significant difference ( $p < 0.05$ ) between control and other treatments.

**Table 2.** Consumer acceptability of pan bread samples

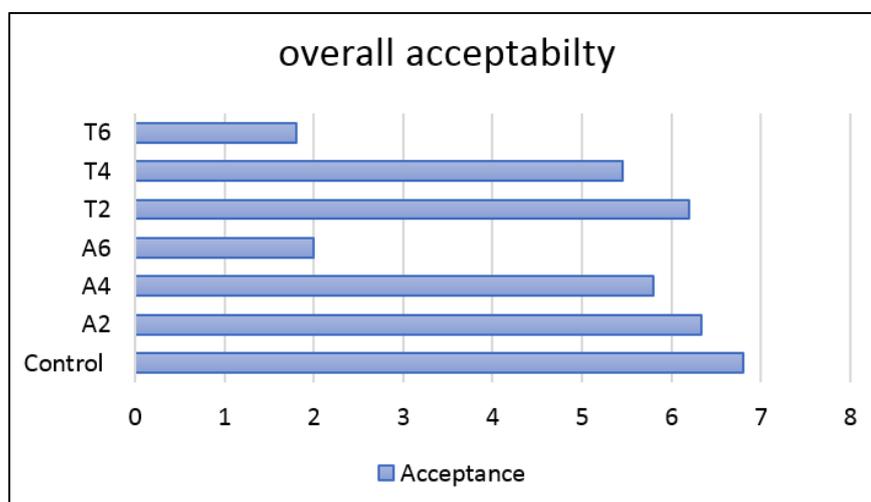
Treatment	Consumer acceptability
Control	6.80 $\pm$ 0.41 <sup>a</sup>
A <sub>2</sub>	6.33 $\pm$ 0.90 <sup>ab</sup>
A <sub>4</sub>	5.80 $\pm$ 1.01 <sup>bc</sup>
A <sub>6</sub>	2.00 $\pm$ 0.92 <sup>d</sup>
T <sub>2</sub>	6.20 $\pm$ 0.94 <sup>abc</sup>
T <sub>4</sub>	5.45 $\pm$ 1.76 <sup>c</sup>
T <sub>6</sub>	1.80 $\pm$ 0.99 <sup>d</sup>
LSD	0.76

\*Control: bread without any addition; A<sub>2</sub>, A<sub>4</sub> and A<sub>6</sub>: pan bread contain sajwain seed powder 2%, 4% and 6% respectively. T<sub>2</sub>, T<sub>4</sub> and T<sub>6</sub> pan bread: contain 2%, 4% and 6% thyme leave powder.

Means $\pm$ SD. Mean values in the same column with different superscript letters are significantly different ( $P < 0.05$ ).

Pan bread samples which recorded above 4 (neither like nor dislike) were considered acceptable as shown in Fig. (1). Samples A<sub>6</sub> and T<sub>6</sub> were not acceptable by the most of panelists probably due to its strong aroma and their bitter after taste. These

finding in the same line with those obtained by Vasileva *et al.*, (2018) who stated that pan bread with 5% melissa waste affected negatively on consumer acceptability and was considered not appropriate at these level as variant for bread preparation.



**Fig. 1** The overall acceptability of pan bread samples

### 2. Sensory evaluation

The overall bread quality was evaluated for the sensory attributed of their taste, color, odor, and texture. The mean sensory evaluated values are presented in Table (3). The results showed that the control sample scored the best results for all attributes compared to other samples, except in odor, whereas, A<sub>2</sub> sample recorded the best score. In general, no significant difference in all sensory attributes was observed between bread with 2% replacement and control sample. The samples at 6% replacement had the lowest score in taste with

significant differences ( $p < 0.05$ ) compared to other samples. The acceptable blends were selected to evaluate the quality characteristics of pan bread. These results closed to that obtained by Seleem and Mohamed (2014) who found that incorporated thyme at level 2% showed significant differences only in general appearance. Also, Abd El-Megeid *et al.*, (2009) found that the best level of fortification green tea which had the highest scores was recorded for 2% fortified bread followed by 4% fortified bread, while 6% fortified bread had the lowest scores.

**Table 3.** Sensory evaluation of pan bread samples

Sample	Taste	Color	Odor	Appearance	Texture
Control	18.80±0.56 <sup>a</sup>	18.87±0.74 <sup>a</sup>	18.27±0.88 <sup>ab</sup>	18.33±0.90 <sup>a</sup>	18.53±0.74 <sup>a</sup>
A <sub>2</sub>	18.00±0.75 <sup>ab</sup>	18.27±0.88 <sup>a</sup>	18.73±0.79 <sup>a</sup>	18.60±0.63 <sup>a</sup>	18.46±0.51 <sup>a</sup>
A <sub>4</sub>	17.60±0.91 <sup>b</sup>	18.53±0.74 <sup>a</sup>	17.73±0.45 <sup>bc</sup>	18.00±0.53 <sup>ab</sup>	17.40±0.63 <sup>b</sup>
A <sub>6</sub>	9.33±2.16 <sup>c</sup>	18.33±0.90 <sup>a</sup>	16.53±0.83 <sup>d</sup>	17.53±0.63 <sup>bc</sup>	17.13±0.64 <sup>bc</sup>
T <sub>2</sub>	18.3±0.72 <sup>ab</sup>	16.93±0.70 <sup>b</sup>	18.13±0.83 <sup>ab</sup>	17.13±0.74 <sup>c</sup>	18.06±0.59 <sup>a</sup>
T <sub>4</sub>	17.47±0.83 <sup>b</sup>	13.47±1.06 <sup>c</sup>	17.33±0.82 <sup>c</sup>	15.53±0.91 <sup>d</sup>	16.80±0.67 <sup>c</sup>
T <sub>6</sub>	9.13±1.60 <sup>c</sup>	9.13±1.80 <sup>d</sup>	16.27±0.88 <sup>d</sup>	13.46±1.55 <sup>e</sup>	15.60±0.83 <sup>d</sup>
LSD	0.87	0.75	0.57	0.65	0.48

\*Control: bread without any addition; A<sub>2</sub>, A<sub>4</sub> and A<sub>6</sub>: pan bread contain sajjwain seed powder 2%, 4% and 6% respectively. T<sub>2</sub>, T<sub>4</sub> and T<sub>6</sub> pan bread: contain 2%, 4% and 6% thyme leave powder.

Means±SD. Mean values in the same column with different superscript letters are significantly different (P< 0.05).

### 3. Specific volume

Pan bread specific volume was ranged between 4.11cm<sup>3</sup>/g (control) to 3.51cm<sup>3</sup>/g for (T<sub>4</sub>) treatment as shown in Table 4. From the obtained result it could be noticed that the specific volume tends to decrease with increasing substitution level. This finding is in agreement with those obtained by Feili *et al.*, (2013) and Ning *et al.*, (2017). Significant differences (p<0.05) was observed between control and pan bread samples except (A<sub>2</sub>) sample. This

decrease probably due to the effect of ajwain and thyme on gluten network (Schmiele *et al.*, 2012 and Odunlade *et al.*, 2017). Increasing quantity of yeast used or longer proofing time could probably improve the volume (Odunlade *et al.*, 2017). Also, Maktouf *et al.*, (2016) reported that lipids had positively affects the specific volume due to their ability to form lipid monolayers at the gas/liquid interphase of the gas cells.

**Table 4.** Specific volume of pan bread

Treatment	Specific volume (cm <sup>3</sup> /g)
Control	4.11±0.10 <sup>a</sup>
A <sub>2</sub>	3.99±0.11 <sup>ab</sup>
A <sub>4</sub>	3.89±0.02 <sup>b</sup>
T <sub>2</sub>	3.85±0.10 <sup>b</sup>
T <sub>4</sub>	3.51±0.03 <sup>c</sup>
LSD	0.15

\*Control bread without any addition; A<sub>2</sub> and A<sub>4</sub>: pan bread contain sajjwain seed powder 2% and 4%, respectively. T<sub>2</sub> and T<sub>4</sub> pan bread: contain 2 and 4% thyme leave powder.

Means±SD. Mean values in the same column with different superscript letters are significantly different (P< 0.05).

### 4. Effect of ajwain and thyme powders on pan bread crumb color

The color values of pan bread crumb are presented in Table 5. All color data were expressed as L\* (lightness - darkness), a\* (redness - greenness) and b\* (yellowness - blueness) values. The obtained results in Table (5) showed that crumb color of pan

bread was significantly (p<0.05) affected by replacement level of ajwain and thyme powders. From the results it could be noticed that the increase level of ajwain and thyme significantly decreased L\* values. Mean while, b\* values increased. This finding is in agreement with those obtained by Lee and Joo, (2012) and Zhu *et al.*, (2016).

**Table 5.** Effect of ajwain and thyme powders on pan bread crumb color

Sample**	Crumb		
	L*	a*	b*
Control	78.35±0.70 <sup>a</sup>	0.84±0.07 <sup>c</sup>	16.55±1.11 <sup>d</sup>
A <sub>2</sub>	68.90±0.40 <sup>b</sup>	2.33±0.11 <sup>b</sup>	21.28±0.66 <sup>c</sup>
A <sub>4</sub>	65.15±1.29 <sup>c</sup>	3.16±0.16 <sup>a</sup>	23.36±0.78 <sup>b</sup>
T <sub>2</sub>	65.61±0.50 <sup>c</sup>	0.34±0.02 <sup>d</sup>	24.29±0.78 <sup>ab</sup>
T <sub>4</sub>	61.13±0.43 <sup>d</sup>	-0.37±0.09 <sup>e</sup>	25.26±0.81 <sup>a</sup>
LSD	1.26	0.18	1.53

\*\*Control: bread without any addition; A<sub>2</sub> and A<sub>4</sub>: pan bread contains sajjwain seed powder 2% and 4%, respectively. T<sub>2</sub> and T<sub>4</sub> pan bread: contain 2 and 4% thyme leave powder.

Means±SD. Mean values in the same column with different superscript letters are significantly different (P< 0.05).

That means the darkness gradually increased, and yellowness decreased. The  $a^*$  values of pan bread crumb contained ajwain increased. Meanwhile,  $a^*$  values of thyme bread decreased compared to control sample. This observation indicated that pan bread contained ajwain become more redness, while thyme pan bread become more greenness. The observed crumb color corresponds mainly to the natural color of ajwain and thyme powders used (Lee, 2015; Pasrija, *et al.*, 2015 and Zhu *et al.*, 2016).

### 5. Effect of ajwain and thyme powders on pan bread crumb texture profile

Hardness is one of the most important parameters to determine bread quality and used as an indicator of bread freshness. The obtained results in Table (6) revealed that hardness was negatively correlated with

bread quality. There were gradually increased in hardness values, but no significant differences in hardness were observed between control sample and other samples, except T<sub>4</sub> sample which significantly difference ( $p < 0.05$ ) was noticed. This increasing probably due to interactions between fibers and gluten (Feillet *et al.*, 2013). Similar increasing trend was observed by other previous studies evaluated the effect of ramie powder (Lee and Joo, 2012) and green tea (Ning *et al.*, 2017).

On the other hand, as shown in Table (6) cohesiveness reduced with no significant differences in all pan bread samples were observed compared with the control sample. Similar to bread hardness, there was a significant difference ( $p < 0.05$ ) on resilience only between control and T<sub>4</sub> sample.

**Table 6.** Effect of ajwain and thyme powders on pan bread textural characteristics

Sample*	Textural characteristics		
	Hardness (N)	Cohesiveness	Resilience
Control	7.50±0.25 <sup>b</sup>	0.62±0.08 <sup>a</sup>	0.20±0.01 <sup>a</sup>
A <sub>2</sub>	7.62±0.24 <sup>b</sup>	0.59±0.06 <sup>a</sup>	0.19±0.01 <sup>ab</sup>
A <sub>4</sub>	7.73±0.10 <sup>b</sup>	0.59±0.09 <sup>a</sup>	0.19±0.003 <sup>ab</sup>
T <sub>2</sub>	7.66±0.25 <sup>b</sup>	0.60±0.09 <sup>a</sup>	0.19±0.002 <sup>ab</sup>
T <sub>4</sub>	8.19±0.21 <sup>a</sup>	0.54±0.06 <sup>a</sup>	0.18±0.003 <sup>b</sup>
LSD	0.40	0.14	0.01

\*Control bread without any addition; A<sub>2</sub> and A<sub>4</sub>: pan bread contains ajwain seed powder 2% and 4%, respectively. T<sub>2</sub> and T<sub>4</sub> pan bread: contain 2 and 4% thyme leave powder.

Means±SD. Mean values in the same column with different superscript letters are significantly different ( $P < 0.05$ ).

### Conclusion

At level of 2% replacement insignificant differences observed compared to control, except in color characteristics. These changes due to the natural color of raw materials ajwain seeds and thyme leaves. Substituted at levels up to 6% were unacceptable by the most of panelists probably due to their after teats and strong aroma.

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### تأثير نبات الأجوين على جودة خبز القوالب

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2- قسم علوم الأغذية - كلية الزراعة - جامعة القاهرة - الجيزة - مصر

3- قسم بساتين الزينة - كلية الزراعة - جامعة القاهرة - الجيزة - مصر

تم دراسة تأثير إضافة نبات الأجوين وأوراق الزعتر على مدى القبول العام وجودة خبز القوالب. تم إستبدال دقيق القمح بمسحوق الأجوين أو الزعتر بنسب 2 و 4 و 6%. ووجد أن الإستبدال بنسبه 2 و 4% كانت مقبول بدرجة كبيرة، بينما لم يكن الإستبدال بنسبة 6% مقبول من جانب معظم المحكمين. أدى الإستبدال الجزئي لدقيق القمح إلى حدوث إنخفاض معنوى فى الحجم النوعى للخبر، فيما عدا العينة A المحتوية على 2% من مسحوق الأجوينوالتي لم تتأثر معنويا، فيما سجلت العينة T<sub>4</sub> المحتوية على 4% مسحوق الزعتر أقل قيم للحجم النوعى 3.51 سم<sup>3</sup>/جم مقارنة بالعينة الكونترول والتي سجلت أعلى القيم 4.11 سم<sup>3</sup>/جم. كما تأثر لون لب الخبز معنويا بدرجة الإستبدال حيث إنخفضت قيم \*a\* وازادت قيم \*b\*، وبالتالي زيادة الداكنة وانخفاض الإصفرار. وفيما يتعلق بقيم \*a\* فقد زادت عند الاستبدال بالأجوين، فى حين أنها انخفضت فى حالة الاستبدال بالزعتر، وتشير النتائج المتحصل عليها أن لب الخبز المحتوى على الأجوين أصبح أكثر احمرار، فى حين أن الخبز المحتوى على الزعتر يميل إلى الاخضرار. كما تم دراسته الخصائص الميكانيكية للقوام مثل الصلابة، التماسك والمرونة وأظهرت الدراسة حدوث انخفاض غير معنوى فى الصلابة والمرونة فيما عدا المعاملة T<sub>4</sub> والتي حدث لها إنخفاض معنوى وقد سجلت 8.19 نيوتن و 0.18 كقيم للصلابة والمرونة على الترتيب، مقارنة بالكونترول والذى سجل 7.50 نيوتن للصلابة و 0.20 للمرونة. وفيما يتعلق بالتماسك، سجلت العينة T<sub>4</sub> أقل القيم 0.54 مع عدم ملاحظة أى فروق معنوية مقارنة بالكونترول والذى سجل 0.62. ولهذا توصى الدراسة بإستخدام هذه الأعشاب فى صناعة خبز القوالب تجاريا من أجل الحصول على منتج عالى الجودة.

**الكلمات المفتاحية:** خبز القوالب، الأجوين، أوراق الزعتر، الخواص الحسية، الصفات الفيزيائية.

