

SOME TECHNOLOGICAL STUDIES ON PRETZEL.

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ABSTRACT

The effect of using different replacements of corn starch (15, 20, 25 and 30%), spices (salt, chili, ketchup and cumin) and dipping solutions (water, 2% citric acid, 2% sodium hydroxide, 2% sodium carbonate and 2% Egg white) on the quality characteristics during the processing of one of the bakery products named pretzel was studied. Results showed that adding of 75%wheat flour + 25% corn starch in pretzel formula improved sensory characteristics of the produced pretzel where it decreased dough stability and increased dough weakening. Regarding adding of spices to pretzel produced from 75%wheat flour + 25% corn starch, chili gave the highest acceptability. Pretzel made from 75% wheat flour + 25% corn starch dipped in 2% sodium hydroxide solution gave product with superior sensory characteristics as compared with other dipping solutions at the same concentration.

INTRODUCTION

Pretzel is a new bakery product manufactured in Egypt, but represents a major, growing portion of snack sales worldwide. The sales in the United States alone were exceeding 1.2billion in 2001(*Seetharaman et al., 2002*). Despite the popularity of pretzels as a snack, very little research has been conducted on this product compared with research done on other baked products including cookies, crackers or other snack foods. Research on pretzels is particularly lacking with respect to the properties of raw materials or processing parameters that influence final product qualities from the perspective of consumers. Practically, no research has been done in these areas since hard pretzels were introduced into the American market in 1861. Several patents have been granted for new methods in hard pretzel manufacturing including processing methods (*Juranovic and Tuzzio 2001; Rooney and Rooney, 2001*). Pretzel could be produced by simple process and the ingredients include flour, oil, sugar or salt and yeast. During pretzel processing, the dough is shaped by an extruder at relatively low pressure, treated with hot-alkali solution then salted and baked. Baking process is carried out in two stages as i.e. a quick- rapid initial bake at high temperature, followed by a slow drying process at a lower temperature (*Groff, 2001*).

Seetharaman et al. (2004) studied the role of water in pretzel dough development and the consequent impact on pretzel integrity. They made different samples with different water levels. They found that dough with low water content produced brittle pretzel due to the lack of gluten development in the dough and inadequate starch gelatinization during baking, while at high water content, it was unacceptable due to extensive gelatinization and retrogradation of starch. Pretzel quality therefore appeared to be a function of appropriate gluten development and starch gelatinization in the product.

Sleem (2000) mentioned that adding of corn meal (starch) to wheat flour dough of pretzel caused an increase in water absorption and dough stability and a decrease in dough weakling because of the reduction in protein and gluten in the blends. Also, *Yao et al. (2005)* stated that flour protein content, the amount of water added to make dough and dough mixing time were important variables influencing dough behavior. Caustic concentration affected brightness of half-baked pretzels but did not influence the color of the final product. Baking time was the most important factor for both half-baked product and final product qualities. The hardness of fully baked pretzels was influenced by baking time, temperature in baking oven zone one, drying time and drying temperature. The color of final products was significantly influenced by baking time, while both baking time and drying temperature affected the moisture content of the final product.

Therefore the present work was carried out to study the effect of adding different ingredients i.e. levels of corn starch , spices e.g., chili , ketchup and cumin and dipping solutions e.g., water , citric acid , sodium bicarbonate and egg white during pretzel processing. In addition the effect of the additives on the rheological properties and quality characteristics of the final product.

MATERIALS AND METHODS

Materials:

Wheat flour (72% extraction rate) obtained from Egyptian Milling Company, El-Malik Fisals ,Giza, Egypt, corn starch and spices (chili, ketchup and cumin) and egg white obtained from local market were used.

Methods:

1) Pretzel production:

Pretzel was produced according to *Seetharaman et al. (2004)* as follows: wheat flour (100g), fat (20g), sugar (one g) yeast (one g) and salt (one g) were mixed for one min. The water (42.5% flour basis) was added and remixed for 4 min to form dough. The dough was rested for 20 min then shaped. The shaped pretzel was baked at 180°C for 10 min then passed through a dipping solution 1% sodium hydroxide at 95°C for 10-15sec. The produced pretzel was then baked at low temperature i.e. 93°C for 30 min.

2) Wheat flour in the blend was partially replaced with corn starch at different levels i.e. 15, 20, 25 and 30%. Chili, cumin and ketchup separately were added in stead of 1% salt to pretzel formula containing 25% corn starch which was considered as the best level. Also, various dipping solutions i.e. water; citric acid (2%), sodium bicarbonate (2%) and white egg instead of 1% sodium hydroxide solution were tested.

3) Farinograph parameter:

Pretzel flour dough as well as blends containing 10, 15, 20, 25 and 30% corn starch was tested for water absorption, arrival time, dough stability and dough weakening according to *AACC (2000)*.

4)Sensory evaluation:

Different treatments of produced pretzel were organoleptically evaluated for general appearance, color, texture, crust formation and flavor by using 12 panelists according to the method of *Matz (1984)*.

5)Statistical analysis:

Sensory evaluation results for different pretzels were statistically analyzed according to the method described by *Sendecore and Cohran (1980)*.

RESULTS AND DISCUSSIONS

Data in Table (1) show the effect of adding of corn starch at different levels i.e. 15, 20, 25 and 30% on sensory characteristics of pretzel. In all characters of the pretzel, the highest increase was observed by adding corn starch at 25% followed by 20% while, the lowest increase was observed by adding 30 and 15% corn starch respectively. This increase was significant in each of appearance, texture and flavor. And insignificant order in color and crust formation of the produced pretzel. All treatments of corn starch is superior as compared with the produced pretzel without the addition of corn starch (control), except crust formation which was not affected by starch treatments. Also, there was a gradual increase in all pretzel characteristics by increasing corn starch treatments until 25%, and then it decreased equally which obtained in pretzel containing 30% corn starch.

Table (1): Sensory Characteristics of pretzel as affected by adding of corn starch.

Characteristic	Appearance (20)	Color (20)	Texture (20)	Crust formation (20)	Flavor (20)	Overall acceptability (100)
Blends						
100% wheat flour (control)	14	15.32	12.68	20.00	14.68	76.68
85%wheat flour + 15% corn starch	16.68	16.00	16.00	20.00	17.32	86
80% wheat flour+20% corn starch	19.32	.18	19.32	20.00	20.00	96.64
75%wheat flour + 25% corn starch	20.00	20.00	20.00	20.00	20.00	100.00
70% wheat flour +30% corn starch	16.68	17.32	18.68	20.00	15.32	88
L.S.D at 5%	0.58	NS	0.46	NS	0.78	

From Table (1) it could be stated that adding corn starch with 25% in pretzel formula improved the produced pretzel as compared with which made from wheat flour only. There were significant differences in general appearance, texture, flavor and textured total scores, but in insignificant differences in both of the crust formation and color of the obtained pretzel. From the previous data adding starch to pretzel formula gave product with high quality.

Seetharaman et al. (2004) reported that both high and low- protein flours were unacceptable for pretzel production, while straight and patent-

grade flours containing 8-10% protein were most satisfactory for pretzel making.

Concerning the rheological characteristics of the studied blends, results in Table (2) showed that, farinograph parameters of pretzel dough produced from wheat flour were affected by adding different percentage of corn starch (10, 15, 20, 25 and 30%). These characteristics were slightly lower than control dough produced from 100% wheat flour. Also, adding corn starch to pretzel dough decreased dough stability and increased dough weakening from 4.5 to 1 min and from 80 to 180 B.U at 30% corn starch percentage.

Table (2): Farinograph parameters of pretzel dough as affected by different blends.

Blends No.	Water absorption	Arrival time (min)	dough stability(min)	dough weakening(B.U)
100% wheat flour	61.0	1	4.5	80
90% wheat flour + 10% corn starch	60.0	1	3.0	100
85%wheat flour + 15% corn starch	59.4	1	2.5	110
80%wheat flour +20%corn starch	58.6	1	2.0	140
75%wheat flour + 25% corn starch	58.0	1	1.5	150
70%wheat flour +30% corn starch	57.2	1	1.0	180

The effect of adding corn starch and spices on sensory appearance, color, texture, crust formation and flavor of pretzel are shown in Table (3). All characteristics of pretzel made from wheat flour with 25% corn starch were in high score as compared with pretzel produced from wheat flour only. These differences were insignificant order. Addition of spices to pretzel formula represents different effects. In general, adding chili gave highest acceptability to the pretzel which had the highest score in appearance, color and crust formation and the same score in texture, but its flavor was the lower one as compared with the spices addition.

Table (3): Sensory Characteristics of pretzel as affected by adding of spices.

Blends	characteristic	General Appearance (20)	Color (20)	Texture (20)	Crust formation (20)	Flavor (20)	Total (100)
	Species						
100% Wheat flour	Salt (control)	15.60	14.00	14.80	16.80	16.00	77.20
	Chilli	16.40	17.80	15.60	17.60	14.40	81.60
	Ketchup	15.60	16.80	15.60	16.80	15.60	80.40
	Cumin	15.60	14.80	15.60	17.60	15.20	78.80
75%wheat flour + 25% corn starch	Salt (control)	20.00	16.80	20.00	20.00	19.20	96.00
	Chilli	20.00	19.60	20.00	20.00	18.80	98.40
	Ketchup	16.00	19.20	20.00	19.20	20.00	94.40
	Cumin	20.00	14.20	20.00	20.00	19.20	93.40
L.S.D at 5%	NS	NS	NS	NS	NS	NS	NS

Table (4) shows the effect of water, citric acid, sodium hydroxide, sodium carbonate and egg white on sensory characteristics of pretzel i.e. general appearance, color, texture, crust formation, flavor and total scores. All characteristics significantly affected by adding 2% NaOH to the pretzel formula gave produce in the highest scores in all characteristics followed by adding egg white and sodium carbonate, respectively. The lowest scores found in pretzel dipped in water and citric acid respectively. Total scores followed the same trend. In general appearance there was a significant differences between adding water or, and citric acid and the other additives .There was no significant differences between adding sodium carbonate and adding egg white in all pretzel characteristics and also in total scores .In pretzel characteristics i.e. texture, crust formula, color and flavor, there were significant differences between used water and the other used treatments.

Table (4): Sensory Characteristics of pretzel as affected by adding of different dipping solutions.

Dipping Solutions	General Appearance (20)	Texture (20)	Crust formation (20)	Color (20)	Flavor (20)	Total scores (100)
Water	11.20	13.60	10.40	10.00	13.20	58.40
2% citric acid	13.60	15.20	10.80	11.60	11.6	62.80
2% NaOH	18.80	18.80	19.60	19.60	18.80	95.60
2%Na ₂ CO ₃	16.00	17.20	17.60	16.00	17.20	84.00
Egg white	16.40	18.00	17.60	17.20	18.80	88.00
L.S.D at 5%	0.56	0.50	0.50	0.43	0.48	1.14

* NaOH: Sodium Hydroxide.

* Na₂CO₃: Sodium Carbonate.

The effect of the interaction between corn starch in pretzel formula and one of water, citric acid, sodium hydroxide, sodium carbonate and egg are shown in Table(5). Sensory characteristics of pretzel made from 75% wheat flour + 25% corn starch were in the higher levels with every dipping solution as compared with those of pretzel made of wheat flour only. Total scores followed the same trend. These differences were insignificant order except total scores which had significant differences. From the over mentioned results, 25% corn starch in formula improved the produced pretzel, also addition of sodium hydroxide followed by egg and sodium carbonate gave product with superior characteristics as compared with other materials.

Table (5): Sensory Characteristics of pretzel as affected by interactions between corn starch (75%Wheat flour +25% corn starch) and different dipping solutions.

Blends	dipping solutions	Appearance (20)	Texture (20)	Crust formation (20)	Color (20)	Flavor (20)	Total scores (100)
75% Wheat flour +25% corn starch	Water	12.00	14.40	10.40	10.40	14.40	61.60
	2% citric acid	14.40	16.00	11.20	12.00	12.80	66.40
	2% Na OH	16.0	20.00	20.00	19.20	20.00	95.20
	2% Na CO	18.40	18.40	18.40	16.80	18.40	90.40
	Egg white	17.60	19.20	17.60	17.60	20.00	92.00
100% wheat flour	Water	10.40	12.80	10.40	9.60	12.00	55.20
	2% citric acid	12.80	14.40	10.40	11.20	10.40	60.00
	2% Na OH	17.60	17.60	19.20	20.00	17.60	92.00
	2% Na CO	14.40	16.00	16.80	15.20	16.00	78.40
	Egg white	15.20	16.80	17.60	16.80	17.60	84.00
L.S.D at 5%		NS	NS	NS	NS	NS	1.60

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بعض الدراسات التكنولوجية على البريتزل

وفاء كمال جلال ، أمل محمود حسن عبد الحليم ، هنار عبد الفتاح سليم
قسم بحوث تكنولوجيا المحاصيل ، معهد بحوث تكنولوجيا الأغذية، الجيزة

تم في هذا البحث دراسة تأثير إستبدال دقيق القمح بنسب مختلفة من نشا الذرة (١٥ ، ٢٠ ، ٢٥ ، ٣٠%) وكذا دراسة تأثير إختلاف محاليل الغمر (ماء، حمض الستريك، هيدروكسيد الصوديوم ، كربونات الصوديوم، بيضاء البيض) وكذا أنواع مختلفة من مكسبات الطعم (ملح الطعام، الشطة، كاتشاب، كمون) على صفات الجودة وذلك عند صناعة البريتزل (لحد منتجات المخابز).

أثبتت النتائج أنه عند نسبة إستبدال ٢٥% دقيق قمح بنشا الذرة في خلطة البريتزل pretzel تحسنت الخصائص الحسية والريولوجية لخلطات العجينة محل الدراسة حيث أدت إلى تقليل ثبات العجينة وزيادة إضمار العجينة. أما بالنسبة لمكسبات الطعم المختلفة فكانت أفضلها طعم الشطة من حيث الخصائص الحسية. أما بالنسبة لمحاليل الغمر فكان أفضلها الغمر في محلول هيدروكسيد الصوديوم (تركيزه ٢%) مقارنة بباقي محاليل الغمر الأخرى عند نفس التركيز.