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Effect of using tomato pomace powder as a By-product from food factories on sensorial, rheological, chemical and microbiological properties of pizza adough.

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Abstract

The objective of this study feasibility of using tomato pomace powder (TPP) as a by-product from food industry to produce pizza dough were utilized in substituting part of wheat flour (72% extra.) at two levels (7 and 12 %) .At the first, organoleptic properties of different pizza samples were evaluated, then chemical, rheological, physicochemical and total bacterial and fungi count were studied. The results indicated that tomato pomace powder was extremely in protein, ash, dietary fiber as compared with wheat flour (72% extra).Also; tomato pomace powder has the highest percentage of lycopene (9.17 mg/100g) and Vitamin C (44.6mg/100g). Sensorial evaluation showed that there were significant differences between pizza samples containing tomato pomace powder substitution with 7 and 12% compared with control pizza (100%wheat flour 72% extra.).However pizza sample which prepared substation with 12% tomato pomace powder was significantly higher than control sample which prepared with 100%wheat flour (72% extra) at all sensory characteristics except taste property. The rheological characteristics for pizza dough formulae were studied. Water absorption increased significantly with increasing tomato pomace powder (TPP) from 7 to 12%. Dough stability and Elasticity were increased whereas extensibility values decreased. Also, firmness were increased significantly with increasing (TPP).pizza prepared from 12% tomato pomace powder had a higher ratio of dietary fiber, protein and ash. The results indicated that addition of tomato pomace powder as a by-product from food factories up to 12 % was feasible to produce sensorial acceptable pizza. In generally, it can be stated that enrichment of pizza with tomato pomace powder is advantageous due to the increased nutritional value, as tomato pomace powder is rich source of dietary fiber, vitamin c, lycopene and B-carotene.

Keywords: pizza, food processing by-product, tomato pomace, sensorial, chemical and rheological characteristics, microbiological.

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Introduction

Nowadays, there is a considerable interest in studying the feasibility of using by-products from food processing plants as raw materials for production of dietary fiber powder since these wastes are inexpensive and highly abundant. Fruits and vegetables wastes or residues are among the most promising by-products with high dietary fiber content, and possess a good balance between soluble dietary fiber (SDF) and insoluble dietary fiber (IDF).By-products for further exploitation on the production of food additives or supplements with high nutritional value have gained increasing interest because these are high-value products and their recovery may be economically attractive. It is well known that by-products represent an important source of sugars, minerals, organic acid, dietary fiber and phenolics which have a wide range of action which includes antitumoral, antiviral, antibacterial, cardio protective and ant mutagenic activities Sonja Djilas Jasna et al., (2009).Tomato (Lycopersicun esculentum) *is one of the most widely cultivated vegetable crops in Iran Rezaeipour et al., (2008). Tomato pomace is a by-product obtains from the processing of tomatoes for concentrated paste, juice, sauce and ketchup and contains skin and seeds. Tomato pomace is a fibrous material and small proportion is dried and use as an animal feed Haddadin et al., (2001). Carlson et al., (1981) showed that the addition of tomato seed to wheat flour bread had a positive effect on loaf volume and improved the overall protein quality of the bread. The supplementation at10 and 20%replacement levels increased lysine by 40.2 and 69.0% respectively. The high fiber content of dried tomato pomace indicates that it can be used in poultry diets at low inclusion rates as an alternative to cereal byproducts Dotas et al., (1999). Researchers are constantly searching for ways to improve the worldwide use of tomato residues by including them in poultry feed Assi and King, (2007); Squires et al., (1992). One approach to increase the rate of these ingredients in poultry diets is possible by hydrolyzing the crude fiber into digestible saccharides Haddadin et al., (2001).It is well documented that foods can be made healthier by using ingredients or amounts of ingredients with less calories, sodium, and saturated fat without the consumer knowing. This is known as*

the „stealth health " approach Tribole, (1999); Wagner et al., (2007); Lone et al., (2009). For example, in the study by Montesano et al., (2006), the trained panelists could not detect a difference between the 100% high-gluten flour and the 100% high-gluten plus flax crust when the pizza samples were eaten with the toppings. However, little is known about the effects of the stealth health approach on consumer acceptance. Considering the high consumption of pizza, the current nutrient content in pizza and the issues of chronic disease in this country, understanding the consumer acceptance of "healthier" pizza may have great significance.

Materials and methods

Materials

Wheat flour: (*Triticum aestivum)* **(**72% extra), sugar, yeast and salt were purchased from local market, El- Mansoura city, Egypt.

Tomato pomace *(Lycopersicum esculentum*): Was obtained from Egyptian Canning Company (BEST), Meniat Samannud, Aga, Dakhleia Governorate, Egypt.While margarine was purchased from Misr Oil and Soap Company, El-Mansoura city, Egypt.

The Growth media**:** Dextrose, Peptone, potassium dihydrogen phosphate, Magnesium sulfate, Rose Bengal, Nutrient agar, Streptomycin solution and Beef extract were purchased from El-Gomhoria company for Trading in Medicines, Chemicals and Medical Supplies, Mansoura city, Egypt.

Methods

Preparation of tomato pomace powder: Tomato pomace by-product was dried in electric drier oven at 50 Cº for 5:6 hrs. until the moisture content ranged from (7to10%). Then ground separately using a Maxy hermetic Mill Grinder, patent N:53985B, Italy to pass through 60 mesh sieve. The powder samples were packaged in polyethylene bags and stored in cool at 4-7 Cº until using and analysis **a**ccording to **Hegazy and Ibrahium, (2009)**.

Pizzas dough manufacture:

Pizza dough formulae were prepared according to **Clarke and Farrell**

(2000) and Ingredients were in Table (1).

Table (1): Ingredients used in pizza dough formulae% .

Samples / Ingredients	PC	PS 1	PS 2
Flour	100g	93g	88g
Tomato pomace	-	7g	12g
Margarine	14g	14g	14g
Sugar	1g	1g	1g
Yeast	2g	2g	2g
Salt	1g	1g	1g
Water	14 ml	19ml	23ml

PC: 100% wheat flour.
PS1: 93% wheat flour +7%Tomato pomace.
PS2: 88% wheat flour +12%Tomato pomace.

Sensorial properties

Were carried out by a properly well trained panel of 15 panelists. They were selected if their individual scores in 10 different tests showed a reproducibility of 90%. The 15 member internal panel evaluated on a three point hedonic scale, scoring was based on a 100 point scale (10-100) where (90-100) = excellent, (70-80) = very good, (50-60) = good, (30-40) = fair and (10-20) = poor. Mineral water was used by the panelists to rinse the mouth between samples according to the method described by AACC, (2002).

Analysis:

Chemical composition:

Were determined namely, moisture, crude fat, crude protein and ash according to methods of **A.O.A.C. (2000)**.While total carbohydrate was

estimated by difference as follows:-**Carbohydrate =100 - [(moisture %) + (ash %) + (protein %) + (fat %)].**

Lycopene and Beta carotene: ***Was extracted from tomato fruits using acetone and petroleum ether and measured calorimetrically using spectrophotometer at wave length of 503 n.m according to the method described by*** *Ranganna (1976).*

Ascorbic acid (vitamin C): was determined by titration with 2.6 diclorophenol indophenol blue dye according to the method reported in **A.O.A.C. (2000).**

Rheological characteristics

The effect of fruits and vegetables fiber on the mixing profile of the dough was studied using:

Farinograph: (Brabender, Duisburg, Germany) according to the standard AACC (2000). Farinograph test was carried out to determine the water absorption, arrival time, dough development time, dough stability and degree of weakening.

Extensograph*:* (Brabender, Duisburg, Germany) according to the standard AACC (2000). Extensograph test was carried out to determine the elastic properties, resistance to extension (B.U.), extensibility (mm), proportional number and energy (cm2).

Amylography*:* The gelatinization and retro gradation behavior of wheat flour were studied using Micro Viscoamylograph (Bra bender, Germany) according to the standard AACC (2000). Wheat flour 15.0 g was mixed with 0.8 g of selected hydrocolloid in 100 ml of distilled water. The mixture was heated from 30oC to 95oC with a constant heating rate of 1.5oC/min. and held at 95oC for 30 min. The paste was cooled to 50oC with the same rate and finally kept at 50o C for 10 min. The resulting behavior was studied for the following parameters: gelatinization temperature, peak viscosity, breakdown during heating, heating stability, set back during cooling and cooling stability. All measurements were carried out in triplicate.

Physical Characteristics for pizza sample

PH of dough: was determined by direct immersion of a pH electrode the batter at room temperature (25 ^{o}C) using a Digital pH meter (Jenway, Model 3020, Dunmow, Essex, UK) Khalil, (1998).

Texture profile analysis of pizza: was determined for product by a universal testing machine (cometech, B type, Taiwan).Provided with software. An aluminum 25 mm diameter cylindrical probe was used in a "Texture Profile Analysis" (TPA) double compression test to penetrate to 50% depth, at 1 mm/s speed test Bourne, (2003).

Bacteriological examination

Total bacterial counts (T.B.C) were performed for pizza in Microbiology Dep. Faculty of Agriculture, Mansoura University according to Difico- Manual (1985).

Total bacterial count medium: the nutrient agar medium was used for enumeration of the total bacterial count in pizza.

Constituent of medium was as the follows according to Difico Manual, (1985):-

Nutrient agar medium	***(9 l-1)***
Beef extract	***3 gm.***
Peptone	***5.0 gm.***
Agar	***20 gm.***
Distilled water	***1000 ml***
PH	***7.2***

Total fungi counts by Martin medium

Fungal counts were determined by the dilution method on **Martins, (1950)** medium after 5 days incubation at 30c.

Method of analysis

Enumeration of pizza microorganism's Serial decimal dilution were prepared prior to making these dilutions, the suspension was shaken mechanically for 15min for plate counts, and three plates were prepared from each dilution.

Martins medium Martin, (1950) for fungi:-

Dextrose 10.0 gm., Peptone 5.0 g, Potassium dehydrogenate phosphate 1.0 g, Magnesium sulfate (Mg so4. 7 H2o) 0.5 g, Rose Bengal 1 part in 30.000 parts of medium, Nutrient agar 20 g, Distilled water 1000 ml. the antibiotic was sterilized separately and added aseptically to the sterilized medium(Streptomycin solution 30 ml per 100 cooled medium) for bacteria.

Enumeration of raw material

Serial decimal dilution were prepared prior to making these dilutions ,the suspension was snake mechanically for 15 min .for plate counts, three plates were prepared from each dilution.

Plate count determinations

Plate count technique was used to determine total microbial density. For total bacterial colony count determination was employed, triplicate plates were prepared for each dilution and incubated 3 days at 30 ºC.

Statistical analysis

Values represented are the means and standard error, significance was used at P. <0.05. (ANOVA) was done using **SPSS (2007)** program for windows.

Results and Discussion

Sensory evaluation

Table (2) represent sensory properties mean scores of pizza containing tomato pomace powder at two levels of replacement. From this table it could be noticed that pizza made by 93 %Wheat flour +7% Tomato pomace powder replacement was high in some parameters tested (taste, color and overall acceptability) with total score of 44.70 compared with control, being less when compared with pizza 88%Wheat flour +12% Tomato pomace powder 48.00 but was still acceptable, (sample rated very good to explanted for different parameters). From the results in the same table it could be noticed that pizza which made with 7 and 12% tomato pomace replacement gave more or similar less scores when compared with control with total score 43.60, 44.70% and 48.00%, respectively).

Montesano et al., (2002) reported that, when samples covered with the toppings of pizza (sauce and cheese), the consumers could not detect a difference in the crust made with high gluten flour.

Table (2): Sensory evaluation of control compared to experimental samples of pizza.

Parameter / Samples	Texture (10)	Aroma (10)	Taste (10)	Color (10)	Overall acceptability (10)	Total score
PC	8.90 ±0.08	9.30 ±0.07	9.10 ±0.07	7.20 ±0.09	9.10 ±0.04	43.60 ±0.76
PS1	8.80 ±0.13	9.20 ±0.40	9.40 ±0.13	8.10 ±0.30	9.20 ±0.13	44.70 ±0.43
PS2	9.50 ±0.30	9.90 ±0.03	9.00 ±0.15	9.80 ±0.08	9.80* ±0.13	48.00 ±0.93

Means in the same raw with different letters are significantly different ($P < 0.05$).

PC: pizza control 100% wheat flour. PS1: pizza sample1: 93% wheat flour + 7%Tomato pomace.

PS2: pizza sample2: 88% wheat flour + 12%Tomato pomace.

Chemical composition of TPP and wheat flour

Data in Table (3) represent the proximate chemical composition of wheat flour (72 % extra) of protein, fat, ash, crude fiber, total carbohydrates contents (on dry weight basis) and moisture contents. From these results the wheat flour was suitable for used to make pizza. Also, this data show the chemical composition of tomato pomace powder on dry weight basis. It could be noticed that the tomato pomace powder was rich in protein, lycopene, dietary fiber and vitamin c. The moisture content of tomato pomace powder was 7.53±0.04%. Meanwhile, the protein content was 18.70±0.48%, the fat content 0.43±0.02%, dietary fiber content 26.87±0.64%, ash content 5.62±0.11%, lycopene 9.16±0.11mg/100g, Vitamin C 44.6±0.11 mg/100g and total Carbohydrate content 67.72%, respectively. In this respect, Harb (1986) determined the chemical

composition of tomato pomace and found that moisture, crude protein and crude fiber content were 9.25, 21.5 and 39.8%, respectively. This finding may focus the interest of utilizing tomato pomace as a high protein source, dietary fiber and Vitamin C in some food formulation. Generally, the value of protein content was lower than that reported by King and Zeidler (2004) found that protein content was 26.8%, dietary fiber content was 26.3%, and moisture was 5.1% and fat was11.9% in tomato pomace powder. Maheri-Sis et al., (2012) found that chemical composition of tomato pomace on dry matter basis (%) for dry matter was 94.46%, crude protein was ٢٤.٠٨%, ether extract was13.98%, crude ash was ٥.٧٣%, acid detergent fiber was 33.6%, neutral detergent fiber was 47.8%and non-fiber carbohydrate was ٨.٤١ and content of lycopene was disagree with Rezaeipour et al., (2012) they reported that lycopene in dried tomato pomace was 0.527%. This result agrees with Abdollahzadeh et al., (2010) they found that dried tomato pomace contains 20.8 – 23.5% fiber.

Table (3): Chemical composition of raw material used in making pizza formulae (on dry weight basis).

Raw Materials / Constitutes	WF	TPP
Moisture %	11.93±0.02	7.53±0.04
Protein %	10.49±0.12	18.70±0.48
Fat %	1.58±0.15	0.43±0.02
*Carbohydrate %	74.72	67.72
Ash %	0.74±0.08	5.62±0.11
DF %	0.54±0.02	26.87±0.64
Lycopene (mg/100g)	ND	9.16±0.11
Vitamin c (mg/100g)	ND	44.6±0.11

Significantly different *P< 0.05). *Carbohydrate was calculated by difference.

WF =Wheat flour 72%extra. DF =Dietary fiber. TPP: Tomato pomace powder. ND= non detectable

Rheological properties

Rheological properties of wheat flour are significantly influenced by cultivation environment Mikhaylenko et al., (2000).The gelatinization and retro gradation behavior of wheat flour upon adding different percentage of tomato pomace using Visco amylograph are shown in Table(4). Data show that addition tomato pomace was increase Max. Viscosity from 440 to 560 for dough with 7% tomato pomace Because of forma reduction in starch content and an increase in protein and fiber content of dough when replaced with tomato pomsac powder. The apparent amylose content of flour correlates significantly with peak viscosity, final viscosity, breakdown and setback in RVA Zeng et al., (1997); Yamamori and Quynh, (2000). Symon and Brennan (2004) reported that substitution of 5% wheat starch with β-glucan-rich fiber fractions from barley decreased the peak viscosity, breakdown and final viscosity in comparison to the control starch ($p<0.05$). This reduction is likely to be because of water being withheld from the starch granules by the β-glucan and a decrease in the starch content of wheat flour pastes. Sogi et al., (2002) reported on pasting properties of wheat flour blended with dried tomato seed meal at 0-30% using Bra bender Visco Amylograph indicated that peak viscosity, viscosity at 95°C, viscosity at 50°C and setback on cooling decreased with the increase in levels of dried tomato seed meal. Sogi et al., (2002) reported that substitution of wheat flour with dried tomato seed meal decreasing in peak viscosity and setback on cooling using Visco amylograph. Conclusion: Addition of any kind of fiber material with high antioxidant like tomato pomace powder activity showed a decrease in viscosity with little modification in baking process, the tomato pomace enriched dough can be used as a functional ingredient.

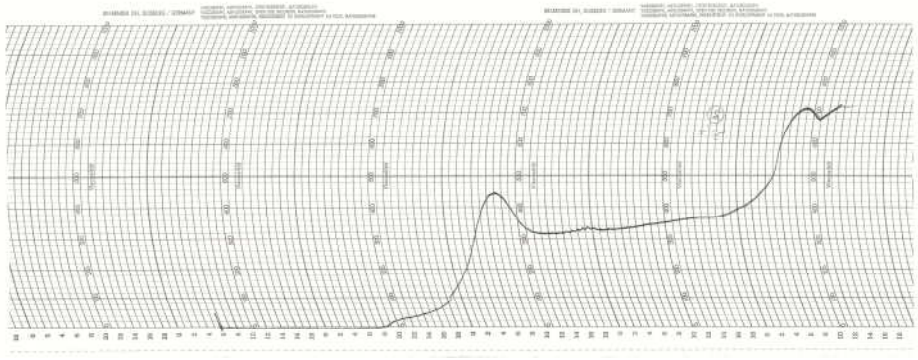
Table (4): Rheological characteristics of Visco Amylograph for dough samples compared to control.

Test results / Samples	Transient Point ºC	Max. Viscosity B.U	Tamp.at Max. Viscosity ºC	Viscosity at 95 ºC B.U	Viscosity at 50 ºC B.U	Setback B.U
DC	63.0	440	91.5	330	700	260
DS1	57.0	560	94.0	480	890	330
DS2	57.0	410	96.0	360	580	170

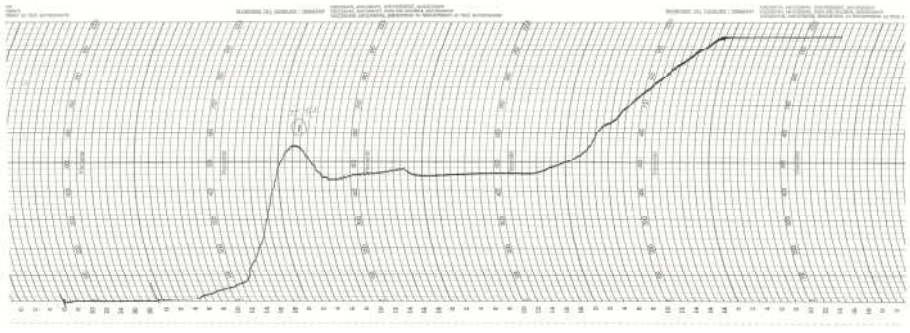
B.U: Bra bender unit. **DC**: Dough control: **100%**Wheat flour.

DS1: Dough sample 1: **93 %**Wheat flour +7% Tomato pomace powder.

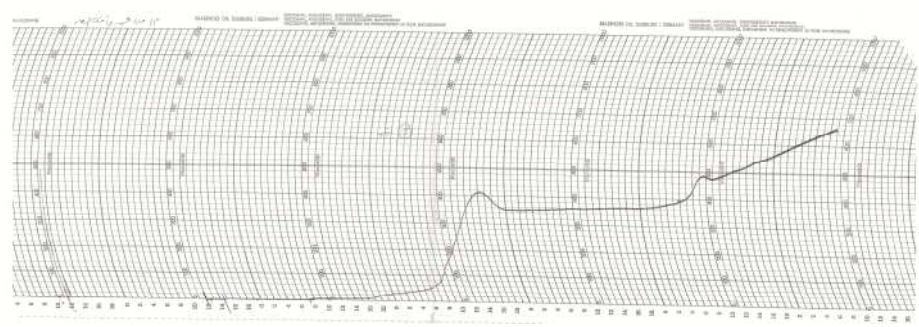
DS2: Dough sample 2: **88%**Wheat flour +12% Tomato pomace powder.



Control (1) WF dough



Dough 7% TPP



Dough 12% TPP

Rheological properties (Farinograph parameters) of three different dough formulas (100%Wheat flour, 93 %Wheat flour +7% Tomato pomace powder and 88%Wheat flour +12% Tomato pomace powder) were studied. The effects of these additions were studied and the obtained data are shown in table (5).Data show that all additions percentage of tomato pomace powder increased the water absorption. Dough stability time is an important index for the strength of the dough. The results show that the addition of 7% tomato pomace powder and wheat flour& 12% tomato pomace powder to wheat flour increased dough stability time(6.0 and 5.0 min)than the control wheat flour (2.0min). Tomato pomace powder increased the dough water absorption, reduction in the dough arrival when added to flat breads Majzoobi et al., (2010). Sogi et al., (2002) reported that substitution of wheat flour with dried tomato seed meal (DTSM) effected on rheological properties by increasing in water absorption, dough stability using Farinograph.

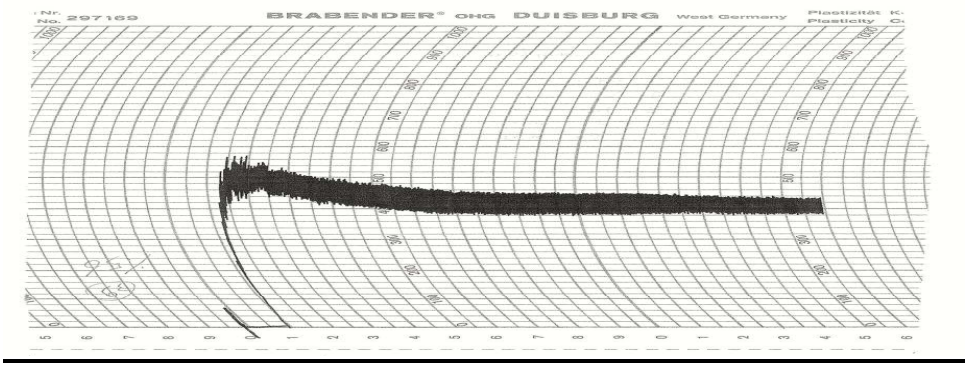
Table (5): Rheological characteristics of Farinograph for different dough formula samples compered to control.

Test results / Samples	Farinograph				
	Water absorption (%)	Arrival time (min)	Dough Development (min)	Dough stability (min)	Degree of softening (B.U)
DC	56.0	0.5	1.0	2.0	90
DS1	59.5	0.5	1.0	6.0	90
DS2	64.8	0.5	1.0	5.0	90

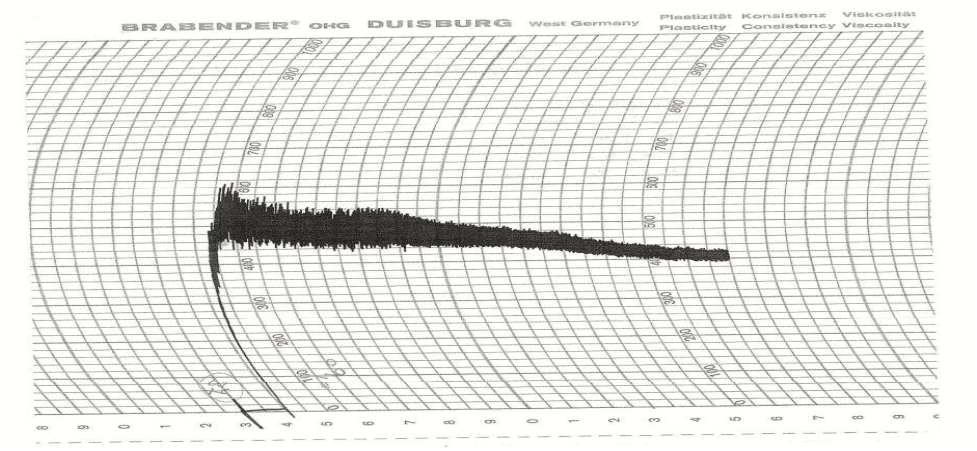
B.U: Bra bender unit. **DC**: Dough control: **100%**Wheat flour.

DS1: Dough sample 1:**93 %**Wheat flour +7% Tomato pomace powder.

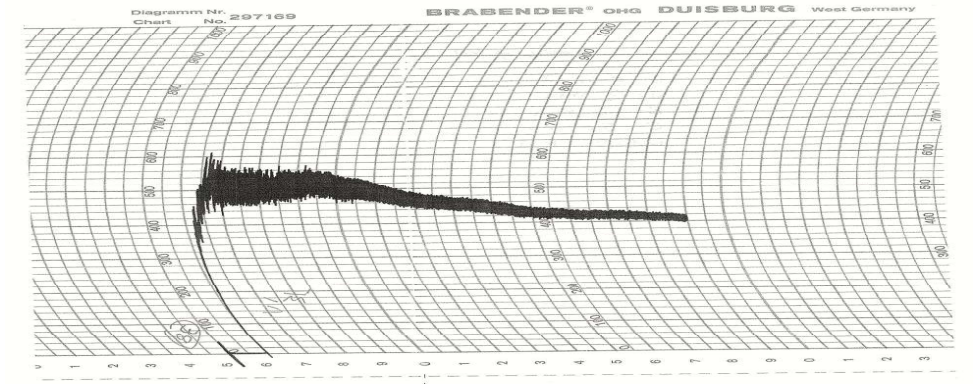
DS2: Dough sample 2:**88%**Wheat flour +12% Tomato pomace powder.



Dough Control100WF



Dough 7% TPP



Dough 12% TPP

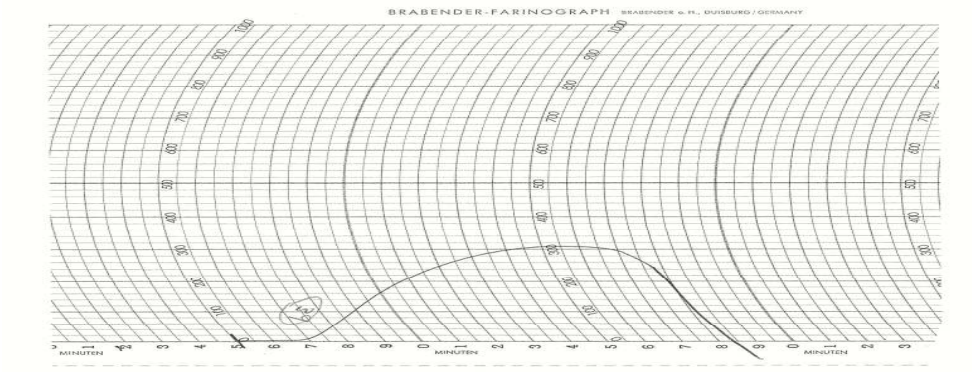
Data in Table (6) shows the effect of addition fiber sources (in ratios of 7 and 12%) with wheat flours (72% extraction) dough on the Extensograph parameters, elasticity, extensibility, proportional number between them and also the energy. The results show that the elasticity was 310 B.U for the control sample (wheat flour 72% extract), while it increased with the level 7% of tomato pomace. Also, the extensibility showed a value of 115 mm for the control sample (wheat flour 72% extract) .and decreased with increasing the levels of tomato pomace. Sharoba et al., (2013) they found that blending with fiber sources showed a slight decrease due to the dried fiber sources. The lowest extensibility

value was recorded due to the blend containing 12% tomato pomace powder. It could be noted that addition of fiber percentages had a good Extensograph parameters like the control sample increased elasticity and this result agree with those obtained by Doweidar (2001) who found that the addition of dietary fiber source led to increase elasticity.

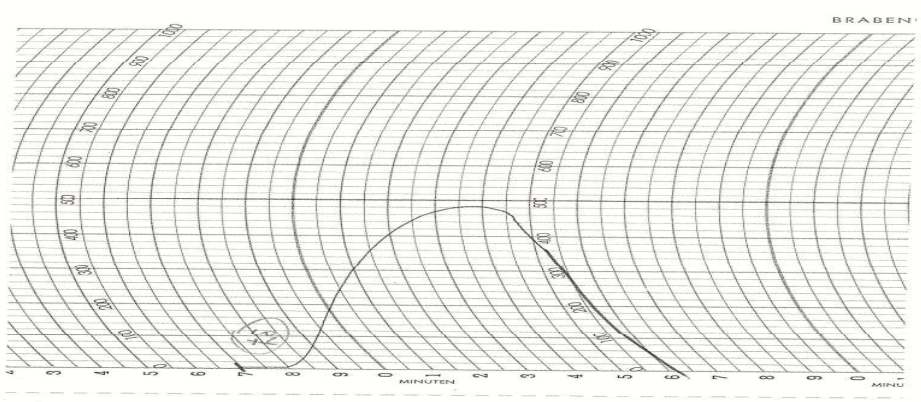
Table (6): Rheological characteristics of Extensograph for dough samples compered to control.

Test results / Samples	Extensograph			
	Elasticity (B.U)	Extensibility (mm)	P.N	Energy (cm2)
DC	310	115	2.70	61
DS1	480	80	6.00	60
DS2	400	75	5.33	53

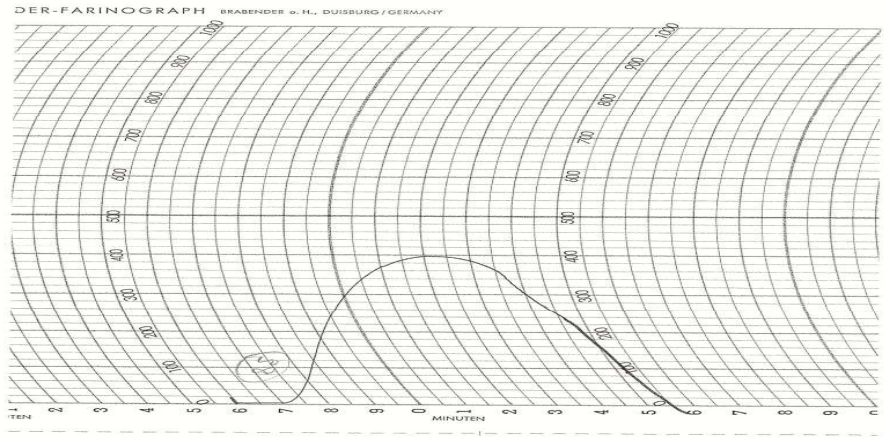
DC: Dough control: **100%**Wheat flour. **DS1**: Dough sample 1:**93 %**Wheat flour +7% Tomato pomace powder. **DS2**: Dough sample 2:**88%**Wheat flour +12% Tomato pomace powder. **PN:** proportional number. **B.U: Bra bender unit.**



Dough Control100WF



Dough 7% TPP



Dough 12% TPP

Proximate chemical composition of pizza samples

Data in Table (7) showed the gross chemical composition of pizza formulae processed made from wheat flour (72%extraction) with substitution with by-products of the food factories namely tomato pomace. Results indicated that moisture content ranged from (9.89±0.11%to 14.76±0.07%) in pizza formulae. The highest content of moisture (14.76±0.07%) recorded for pizza formulae contained 12% tomato pomace .while pizza control has the lowest content of moisture was (9.89±0.11%). Results also indicated that fat content in prepared pizza samples was 14.12±0.19% and 14.99±0.18% for pizza formulae cont ained 7% tomato

*pomace powder and pizza formulae contained 12% d tomato pomace powder, respectively, protein content was 13.28±0.06- 15.17±0.05 in prepared pizza samples 7% and 12%, respectively and dietary fiber content was 23.97±0.24-25.16±0.37 in prepared pizza samples 7% and 12%, respectively. This result agree with Abdollahzadeh et al., (2010); Aghajanzadeh-Golshani et al., (2010); Mirzaei-Aghsaghali et al., (2011) they found that tomato pomace produced in Iran contains 21.7-26.4% crude protein, 13.4-15.9% fat, 3.4-12.2% crude ash and 49.2-57.4% neutral detergent fiber on dry matter basis and 26% dry matter on as-fed basis, Keiko Goto and Stephanie Bianco-Simeral, (2011) they found that fat content in pizza control was 18.0%. Sogi et al., (2002) reported that the bread supplemented with 10% dried tomato seed meal exhibited good sensory characteristics and improved protein quality. Lycopene, B-carotene and Vitamin C were determined in pizza control, pizza formulae contained 7% tomato pomace and pizza formulae contained 12% tomato pomace and recorded in table (7), noted that pizza formulae contained 88% wheat flour +**12% tomato pomace** is the highest content in Lycopene, Beta carotene and Vitamin C content and it due to tomato pomace powder content in pizza. This result agree with Aghajanzadeh et al., (2010) they reported that this by-product is a good source of vitamin B1, B2 and A. dried tomato pomace (DTP) is an excellent source of α-Tocopherol (Vitamin E) and lycopene Sahin et al., (2008). So, it may be a new source of antioxidant to prevent lipid oxidation in broiler meat. on the other hand, other investigators have shown that Vitamin C and Vitamin E improved feed conversion and layer performance Whitehead et al., (1998), Bollenger Lee et al., (1999), Sahin and Kucuk (2001); Sahin et al., (2002).*

Table (7): Chemical composition for pizza formulae sample compered to control (g. /100g. on dry weight basis).

Samples / Parameter	PC	PS1	PS2
Moisture %	9.89c±0.11	12.84b±0.12	14.76a±0.07
Protein %	10.35c±0.03	13.28b±0.06	15.17a±0.05
Fat %	14.01b±0.06	14.12b±0.19	14.99a±0.18
*Carbohydrate%	63.35	55.91	50.84
Ash %	2.40c±0.03	3.85b±0.06	4.24a±0.03
Dietary fiber %	0.25c±0.02	23.97b±0.24	25.16a±0.37
Lycopene (mg/100g)	ND	1.18b±0.02	3.95a±0.13
Beta carotene(mg/100g)	ND	2.01b±0.08	3.97a±0.06
V.C (mg/100g)	0.25 ±0.23	12.31b±0.14	18.62a±0.46

Significantly different (P < 0.05). *Carbohydrate was calculated by difference. PC: Pizza control: 100% wheat flour. PS1: Pizza sample1: 93% wheat flour +7%Tomato pomace.

PS 2: Pizza sample2: 88% wheat flour + 12%Tomato pomace**.** ND= non detectable.

Physical Characteristics for pizza sample

Data of pH value, firmness are represented in Table (8). The results showed that replacing wheat flour with tomato pomace powder (7 and 12%) did not have any significant (P≤ 0.05) effect on batter PH. All PH value were weakly Acidity, ranging from PH 5.57: 5.64.From this result it noted that addition of tomato pomace powder decreased pH value compared with pizza control but high percentage of tomato pomace powder increasing pH value and this result agree with Yuangklang et al., (2010) they found that increasing intakes of tomato pomace powder caused increasing PH values.

Chumpawadee and Pimpa (2009) concluded that these results are due to high carbohydrate fraction in tomato pomace. The results presented in Table (8) show the texture characteristics of pizzas contained different percentage of fiber source. Firmness must be explained by the different chemical interactions. Dietary fiber sources led to the hardest with firmness higher than that of the control Gomez et al., (2007).

Table (8): pH of dough and texture profile analysis of pizza samples compared to control.

Attributes / Samples	pH	Firmness
PC	5.64*±0.18	65.46^{c}±0.09
PS1	5.57±0.24	88.07^{b}±0.32
PS 2	5.60±0.09	91.06^{a}±0.93

* The mean difference is significant at the 0.05 level. PC: Pizza control: 100% wheat flour.

PS1: Pizza sample1: 93% wheat flour + 7%Tomato pomace.

PS 2: Pizza sample2: 88% wheat flour + 12%Tomato pomace.

Bacteriological Examination

Data presented in table (9) showed the average of total bacterial count and total fungi count **of** pizza formulae at zero time and three days. It is clear from these results that total **bacterial count of samples with 7% and 12% tomato pomace was less than** total **bacterial count of pizza control and this result due to Tomato Pomace is a by-product in the Tomato processing industry is capable of synthesizing Silver Nanoparticle. It showed good antibacterial activity towards resistant pathogens. Moreover, the process for the production of Silver Nanoparticle is environmental friendly and free from organic solvents and toxic chemicals. So, it is one of the effective recycling processes to utilize the tomato pomace. Josephine Nirmala Many et al., (2014).** Also, the international

Microbiological standard recommended that the limit of bacterial contaminate for food of less than 10^6 cfu/g. Anon (1974) ,whereas Rombouts and Nouts (1995) revealed that bacterial counts obtained in plants food were in the order of 12 x 10^7 to 108 cfu/g.

Table (9): Total bacterial count and total fungi count of pizza samples compered to control.

Samples	***At zero time***		
	cfu/ml	***log/cfu/ml***	***Fungi***
PC	***220 X10^2***	***4.34***	***183.50 X 10^2***
PS1	***185.55 X10^2***	***4.27***	***171.52 X 10^2***
Ps2	***170.30 X10^2***	***4.23***	***161.30 X 10^2***
After three days			
Samples	***cfu/ml***	***log/cfu/ml***	***Fungi***
PC	***39.50 X 10^2***	***3.59***	***4.00X 10^2***
PS1	***36.00 X 10^2***	***3.56***	***2.33X 10^2***
PS2	***33.00 X 10^2***	***3.52***	***1.24 X 10^2***

PC: Pizza control: 100% wheat flour.

PS1: Pizza sample1: 93% wheat flour + 7%Tomato pomace.

PS 2: Pizza sample2: 88% wheat flour + 12%Tomato pomace.

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تأثيراستخدام مسحوق تفل الطماطم كمنتج ثانوي لمصانع الأغذية علي الصفات الحسية والريولوجية و الكيميائية والميكربيولوجية لعجينة البيتزا

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الملخص العربي

الهدف من هذه الدراسة استخدام مسحوق تفل الطماطم كمنتج ثانوي لمصانع الاغذية في انتاج عجينة البيتزا باستبدال جزء من دقيق القمح(استخلاص ٧٢٪) بنسبة (٧و ١٢ ٪).وتم تقييم الخصائص الحسية لعينات البيتزا والتركيب الكيميائي و الصفات الريولوجية و الفيزيائية و العد الكلي للبكتريا و الفطريات.أكد التركيب الكيميائي علي أن مسحوق تفل الطماطم غني بالبروتين والرماد والالياف الغذائية مقارنة بدقيق القمح (استخلاص ٧٢٪) و أيضا مسحوق تتفل الطماطم يحتوي علي نسبة عالية من الليكوبين ٩,١٧ ملجم /١٠٠ جم و فيتامين ج٤٤,٦ ملجم /١٠٠ جم. وأظهر التقييم الحسي أن هناك اختلافات واضحة في عينات البيتزا التي تحتوي علي مسحوق تفل الطماطم باستبدال ٧ و ١٢٪ مقارنة بعينة الكنترول (دقيق القمح استخلاص ٧٢٪). ومع ذلك عينة البيتزا التي تحتوي علي ١٢٪ مسحوق تفل طماطم كانت أعلى بكثير من العينة الكنترول (دقيق القمح استخلاص ٧٢٪) في جميع الخصائص الحسية ماعدا خاصية الطعم. أوضحت دراسة الخصائص الريولوجية لعجية البيتزا زيادة في نسبة امتصاص الماء بشكل كبير مع زيادة نسبة استبدال مسحوق الطماطم ب٧و ١٢ ٪. و زادت خاصية استقرار العجين والمرونة في حين أن خاصية القابلية للتمدد انخفضت .أيضا، زادت خاصية الصلابة بشكل ملحوظ بزيادة استبدال مسحوق تفل الطماطم.

أثبتت نتائج الدراسة أن عينات البينزا المحضرة من مسحوق تفل الطماطم ١٢٪ تحتوي علي نسبة أعلى من الألياف الغذائية والبروتين والرماد.

من نتائج الدراسة وجد أن إضافة مسحوق تفل الطماطم كمنتج ثانوي لمصانع الأغذية بنسبة تصل إلى ١٢٪ كانت ممكنة لإنتاج بيتزا مقبولة حسيا.

عموما تدعيم البيتزا بمسحوق تفل الطماطم مفيد نظرا لزيادة القيمة الغذائية نتيجة لمحتواه العالي من الألياف الغذائية وفيتامين ج و الليكوبين وبيتا كاروتين.

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