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UTILIZATION OF TOMATO PROCESSING WASTES IN PREPARATION OF LOW FAT HIGH DIETARY FIBER BEEF PATTIES

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ABSTRACT: Dietary fiber plays an important role in human health, so high fiber, low fat foods tend to reduce risk diseases. Tomato industries yield a high amount of by products mainly tomato skin and seeds, which can utilize as a new good source of dietary fiber. The tomato wastes were added at 0, 3, 5, 7 and 9 % levels to beef patties instead of meat fat mixture. Prepared patties were evaluated for some important chemical, physicochemical and sensory traits. Results revealed that addition of tomato wastes led to higher contents ($P<0.05$) of moisture, protein (when tomato seed was substituted with fat). However, ash, crude fiber and lower fat and protein (when substituted with skin) contents. WHC, plasticity and cooking yield of beef patties were significantly ($P< 0.05$) improved by the substitution of beef meat fat mixture with tomato wastes accompanied with reduction in cooking loss. Shrinkage and thiobarbituric acid value (TBA) was also observed. No significant differences were detected in organoleptic properties between beef patties containing 3% skin and/or 3% seed meals and control sample. At higher levels of substitution (9%) the panelists observed that the bitter taste was detected. Accordingly the degree of total acceptability of patties decreased gradually especially for samples contained tomato seeds meal.

Key words: Tomato wastes, beef patties, chemical composition, WHC, cooking loss, sensory evaluation.

INTRODUCTION

Dietary fibers (DF) are composed mainly by remnants of edible plant cells. Parenchmatous tissues are known to be the most important source of vegetable fiber (De Vries and Faubion, 1999). Fiber is a term used to describe many food components. The American Association of Cereal Chemists (2001) described the dietary fiber as the edible parts of plants or analogous carbohydrates that are resistant to digestion and absorption in the human small intestine with complete or partial fermentation in the large intestine. Dietary fiber includes polysaccharides, oligosaccharides, lignin and associated plant substances. They promote beneficial physiological effects including laxation and/or blood cholesterol and glucose attenuation (Singh *et al.*, 2007).

The source of fiber is important because differing arrays of plant cells can affect fiber properties. Dietary fibers from cereals are more frequently intake than those from fruits. However, fruit fiber is considered to be of better quality due to its higher total soluble fiber contents. Also, water and oil holding capacities and colonic fermentability of fruit fiber, lower levels of phytic acid and lower caloric values (Larrauri, 1999; Saura – Calixto and Larrauri, 1996). Thus, dietary fibers (DF) acts as a bulking agent normalizing intestinal motility and preventing diverticular disease. Considerable attention has also been focused on the incidence of a number of non – infectious diseases common in civilized societies, such as coronary heart disease, obesity and several other disorders, which could be attributed to a low DF intake. Some types of DF may also be important in reducing colonic cancer, lowering serum cholesterol levels and preventing hyperglycemias in diabetic patients (Nawirska and Kwasniewska, 2005). For this reason it is interesting to increase the consumption of all foods that can supply fiber to daily foods intake (Larrea *et al.*, 2005).

Dietary fibers (DF) are one of the most common functional ingredients in food products and has been used as fat replacer, fat reducing agent during frying, volume enhancer, stabilizer, binder and improved cooking yield, reduced formulation cost (Ang and Miller, 1991 and Akoh, 1998).

According to Perez-Olleros *et al.* (2000) agricultural by- products are mainly used for animal feeds.

However their high fiber content can be used by the food industry to developed new "fiber – enriched" products for humans (Perez-Olleros *et al.*, 2000). The importance of DF in the diet leads to a search for new sources of DF which can be used as food ingredients (Chau and Huang, 2003; Rodriguez *et al.*, 2006).

During tomato processing, thousands tons of by - products are produced included seed, skin and other fibrous waste, which could represent an interesting source of dietary fibers (Lario *et al.*, 2004; Mandalari *et al.*, 2006). Tomato waste remaning after processing represents about 20% of the original fresh tomato weight (Arad *et al.*, 1996). Tomato processing wastes are promising source of materials which may be used in the food industry because of their valuable technological and nutritional properties (Lopez *et al.*, 2004, 2005; Schieber *et al.*, 2001).

Fiber incorporation in frequently consumed foods (meat, dairy and bakery products) could help to overcome the fiber deficient (Fernandez – Gines *et al.*, 2003). Fiber is suitable for meat products to increase their cooking yield and improve texture due to their high water binding capacity (Cofrades *et al.*, 2000). Various types of fiber have been studied alone or combined with other ingredients in meat products to reduce fat meat (Mansour and Khalil, 1999 and Grigelmo – Miguel *et al.*, 1999) could be used as substituted ingredients. The technological effect on foods differs according to the quantity and nature of dietary fiber (Thebaudin *et al.*, 1997).

The objective of the present work was to utilize some tomato processing wastes (seeds and skin) for preparing low fat high dietary fiber beef patties to evaluate some of their chemicals, physicochemical and sensory characteristics of prepared products.

MATERIALS AND METHODS

Materials

Tomato processing wastes were obtained from EL-Nasr Company for Food Processing (Kaha), Kalubia Governorate, Egypt during July (2007). The wastes were washed with tap water, separated (by water) into seeds and skin and washed again by distilled water. Tomato seeds and skin were sun dried and milled by "Moulinex" (Model Depose) blender at speed 2

for 3 min to pass through 60 mesh sieve. The fine obtained powder was kept in sealed polyethylene bags and stored at freezing temperature (20 °C) until fruther use. Fresh lean beef meat and beef fat were purchased from local market of Tanta city- EL-Gharbia Governorate, Egypt.

Methods

Preparation of Tomato Processing Waste Meal

Dried tomato seed and skin powders were defatted using petroleum ether (60 - 80°C) in a soxhelt apparatus for 6 hours as described by AOAC (2000). The defatted tomato seed and skin powders were de – solventized in air at ambient temperature; then, reground by blender as mentioned above. The tomato wastes powder were kept in sealed polyethylene bags and stored in a deep freezer at – 20 °C for further use.

Preparation of Low Fat High Dietary Fibers Beef Patties

Ground beef patties were prepared using the formula of Hettiarachchy *et al.*,(1996) with slight modification as follows: Lean beef meat was mixed with beef fat (Tallow) (at ratio of 3:1 w/w), and then was minced using an electrical grinder "Moulinex" (Model Depose-France) to pass through 4.8 mm die plate. Sodium chloride (NaCl, 0.8%) and black pepper powder (0.2%) were added to the minced meat mixture and then reground (as control). Defatted tomato seed and/or skin powders were added at levels of 0, 3, 5, 7 and 9 % of meat - fat mixture and reminced. The resulted bulk was divided into equal balls weighting 70 gm and then formed into patties (about 10 cm in diameter and 1 cm thickness) using a formal template. Finally, the formed meat patties were packaged in polyethylene bags and stored in a deep freezer at –20°C until analyses.

Chemical Analyses

Moisture using an electrical oven, crude protein (Nx6.25) by micro Kjeldahl method, fat using petroleum ether (60-80°C) in a sohxlet apparatus, ash, crude fiber contents of beef pattie samples were determined according to AOAC (2000). Ashing was performed at 500 °C for 5 h.

Carbohydrate was calculated by difference. Thiobarbituric acid value (TBA) as mg malonaldehyde/kg oil was determined as described by Vyncke (1970) and Lemon (1975). All determinations were performed in triplicate.

Physicochemical Analyses

Water holding capacity (WHC) (%) and plasticity of prepared beef patties were measured according to the method described by Soloviev (1966), while pH was measured on a suspension resulting from blending 10 g sample with 100 ml of distilled water for 10 min. using a digital glass electrode pH meter type (JENCO digital pH meter 608) at 30°C following the procedure of Aleson- Carbonell *et al.* (2005). For cooking loss and cooking yield of cooked beef patties at 150°C (3-8 min) according to (Aleson- Carbonell *et al.*,2005). Shrinkage in diameter of raw and cooked beef patties was measured according to the method described by Berry (1993). Percent changes in diameter of sample was calculated as follows:

$$\text{Diameter reduction (\%)} = \frac{\text{Fresh pattie diameter cooked pattie diameter}}{\text{Fresh pattie diameter}} \times 100$$

Sensory Evaluation

Different samples of beef patties were grilled and served for panelist within 3 – 8 min. A panel of 10 persons was selected to evaluate the product. The sensory ballots prompted panelists to order a series of 7 randomly placed samples for the following attributes: juiciness. Firmness, chewness, flavour, colour, taste and overall acceptability.

Statistical Analysis

The results were statistically analysed by analysis of variance as described by SPSS (1997). Significant differences among individual means were analyzed by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical Composition of Fresh Beef Meat and Tomato Wastes

Table 1 shows that tomato seed (full-fat and defatted) meal had the highest percentage of crude protein (27.39, 36.22 %), crude lipid (24.52, 2.25%) and ash (4.60, 6.08%) contents, than those of skin. While skin wastes (full-fat and defatted) contained appreciable higher percentage of crude fiber (55.86, 73.86 %). These results are in a good agreement with those reported by Moharram and Messalam (1980), and Moharram *et al.* (1997). Fresh beef meat was characterized by its marked high crude protein (N x 6.25) content (73.36 %), compared to tomato seeds (36.22 %) and

Table 1. Chemical composition (%) of fresh beef meat and different types of tomato wastes (on dry weight basis)

Constituent	Lean beef meat	Tomato skin powder		Tomato seed powder	
		Full fat	Defatted	Full fat	Defatted
Moisture	73.14 ± 0.895^{a}	7.40 ± 0.200^{c}	7.86 ± 0.312^{c}	9.18 ± 0.486^{b}	9.77 ± 0.251^{d}
Crude protein	73.36 ± 0.006^{a}	12.31 ± 0.906^{c}	16.29 ± 0.411^{b}	27.39 ± 0.462^{b}	36.22 ± 0.612^{a}
Crude Lipids	23.03 ± 0.513^{b}	6.48 ± 0.659^{C}	0.59 ± 0.234^{f}	24.52 ± 1.715^{a}	2.25 ± 0.344^{f}
Total ash	3.64 ± 0.100^{ab}	3.05 ± 0.499^{b}	4.03 ± 0.911^{e}	4.60 ± 0.718^{a}	6.08 ± 0.712^{e}
Crude fiber	0.00 ± 0.000^{c}	55.86 ± 1.611^{a}	73.86 ± 0.231^{a}	18.72 ± 0.344^{b}	24.75 ± 0.524^{c}
Carbohydrate*	0.00 ± 0.00^{c}	22.29 ± 0.661^{b}	5.23 ± 0.821^{d}	24.77 ± 0.422^{a}	30.70 ± 0.112^{b}

* Carbohydrate was calculated by difference

M ± SD = Means and standard deviation of triplicate trails.

Means having the same superscript letters are not significantly different at 5% level.

tomato skin (16.29%). Therefore, it could be concluded that tomato seed contained a moderate amounts of protein and high in fiber.

Chemical Composition of Prepared Beef Patties

The proximate composition of fresh beef patties as affected by substitution of tomato wastes (skin and seed meal) as a new source of dietary fiber is presented in Table 2. Data indicate that beef patties formulated with different levels of tomato of skin and seeds (3, 5, 7 and 9%) were higher in moisture content than that control. These results clearly showed that the addition of tomato waste fibers to beef patties resulted in retention of more moisture due to their ability to bind water. Similar results were obtained by Trius *et al.* (1994), Mansour and Khalil (1997). Contradictory to Troutt *et al.* (1992) who found moisture content was reduced in ground beef patties formulated with unhydrated sugar beet, oat and pea fibers or their combinations with potato starch and polydextrose. Addition of tomato seed and skin meals in beef patties led to decrease crude protein content.

Replacement of meat-fat mixture with different levels of tomato wastes resulted differences in fat content, the fat content of beef patties was decreased as the substitution level increased. These results are in agreement with Vural and Javidipour (2002) who indicated that the use of sugar beet fiber as a fat substitute could be a good alternative to offer both high dietary fiber and low fat products.

Crude fiber and ash contents increased in beef patties as a found of tomato waste incorporation. It could be noticed that 9% tomato skin substitution had the highest content of crude fiber (8.6%) among those detected in control or other treatments.

A survey of the literature shows that fat content of different kind of food (e.g. chocolate, liver pates, frankfurter, sausages, genoese cakes and minced beef) can be reduced by replacing fat with fiber (Thebaudin *et al.*, 1997). The carbohydrate content of the different beef pattie samples indicated a reversible trend in relation to the quantity of protein.

Data recorded in Table 2 show that thiobarbituric acid value (TBA) of fresh beef patties was affected by tomato processing wastes substitution level. As the substitution level in beef patties

Table 2. Chemical composition of beef patties containing different ratio of tomato wastes (on dry weight basis)

Samples	Chemical composition (%)						
	Moisture	Crude protein	Crude lipids	Total ash	Crude fiber	Total carbohydrate*	TBA-value**
Control	53.02 ±0.002^{d}	70.58 ±0.000^{a}	23.33 ±0.330^{a}	3.67 ±0.340^{e}	0.61 ±0.001e	1.81 ±0.537^{f}	1.88 ±0.008^{a}
BP(3%sk)	54.99 ±2.092^{c}	66.62 ±0.620^{b}	19.50 ±0.500^{bc}	3.75 ±0.500^{de}	3.27 ±0.578^{c}	10.13 ±0.860^{d}	1.63 ±0.008^{ab}
BP(5%sk)	55.87 ±1.264^{b}	64.13 ±0.130^{c}	16.93 ±0.430^{d}	3.96 ±0.500^{de}	4.36 ±0.006^{b}	14.98 ±0.620^{c}	1.53 ±0.25^{abc}
BP(7%sk)	56.72 ±0.720^{a}	60.86 ±2.646^{d}	15.49 ±0.490e	4.57 ±0.560^{bc}	6.22 ±0.127^{b}	19.08 ±0.200^{b}	1.51 ±0.50^{abc}
BP(9%sk)	56.76 ±0.760^{a}	55.23 ±0.230f	14.09 ±0.000^{f}	5.13 ±0.006^{ab}	8.60 ±0.001a	25.55 ±0.005a	1.44 ±0.191^{bc}
BP(3%se)	53.83 ±1.015^{c}	67.20 ±1.528^{b}	21.65 ±1.000^{a}	4.01 ±0.001^{de}	2.16 ±0.003^{d}	7.14 ±0.001^{e}	1.45 ±0.300^{bc}
BP(5%se)	55.67 ±0.330^{b}	66.79 ±0.346b	20.30 ±0.300^{b}	4.33 ±0.291^{cd}	4.14 ±0.002^{b}	8.58 ±0.110d	1.37 ±0.003^{bc}
BP(7%se)	56.03 ±1.050^{a}	61.46 ±0.460^{d}	19.50 ±1.041^{bc}	4.87 ±0.000^{bc}	5.55 ±0.006^{a}	14.17±0.170^{c}	1.31 ±0.006^{bc}
BP(9%se)	56.43 ±0.430^{a}	57.92 ±0.500^{e}	18.81 ±0.810^{c}	5.60 ±0.173^{a}	6.22 ±0.110^{b}	17.67±0.001^{b}	1.13 ±0.003^{c}

* Total carbohydrate was calculated by difference

* * Thiobarbituric acid as mg malonaldehyde / kg sample

BP (3%sk) = Beef patties with tomato skin (3%)

BP (3%se) = Beef patties with tomato seeds (3%)

M ± SD = means and standard deviation of triplicate trails within the column, values having the same superscript letters means that no significant differences (at 5% level) was noted.

increased, TBA value decreased. The value of TBA in control beef patties (1.88mg malonaldehyde/ kg) was decreased to 1.44 and 1.13 mg malonaldehyde / kg in beef patties containing 9 % skin and/or seed powders, respectively. These results are in agreement with those reported by Gabor (1988) and Wang *et al.* (1996) who reported that TBA values were higher in control sausage samples than in samples with tomato processing wastes fiber. These results could be due to the antioxidant properties of fiber associated compounds such as flavonoids, polyphenols, lycopene and carotenes which protect the product from the photo-oxidation process.

Physicochemical Properties

The effect of substitution of beef meat-fat mixture with different levels of tomato wastes meal on physicochemical properties of prepared patties are shown in Table 3. The results reveal that WHC of the control sample tended to increase with increasing level of substitution. This is in agreement with the findings of Hughes *et al.* (1997) who noted that addition of carrageenan or oat fiber increased WHC and emulsion stability of frankfurter .The highest WHC value was obtained in beef patties containing 9% level of tomato seed meal (88.5%) comparing with control or other treatments. This might be due to higher protein and carbohydrate content in this formula. Vural *et al.* (2004) reported that addition of sugar beet fiber increased the total dietary fiber and water holding capacity of frankfurter. Khalifa, Asmaa (2005) reported that WHC of frankfurter increase as the substitution levels of plant protein increased.

The plasticity of beef meat is one of the most important properties affecting the eating quality of such product (Miller *et al.*, 1980). Trout (1988) reported that plasticity could influence the sensory properties of the product such as juiciness, texture, tenderness and flavour. Therefore, the plasticity of prepared beef patties under investigation was measured as an index of tenderness. The plasticity value of beef patties containing tomato skin and tomato seed powders was significantly ($P< 0.05$) increased by increasing incorporated level up to 7% and decreased afterward.

The pH value of prepared beef patties was 6.68 and recorded 6.41, 6.48; 6.72, 6.68 in beef patties containing 7 and 9 % tomato skin

Table 3. Physicochemical properties of beef patties containing tomato wastes

Samples	WHC (%)	Plasticity (cm^2)	pH-value	Cooking yield (%)*	Cooking loss (%)	Shrjnkage (%)
Control	79.56±0.440^{e}	2.75±0.250^{c}	6.68±0.005^{a}	57.11±0.110^{f}	42.89±0.999	34.38±0.156^{a}
BP(3%sk)	80.21±0.210^{e}	2.80±0.295^{c}	6.37±0.007^{a}	68.69±0.744^{d}	31.31±1.381	34.19±0.190^{a}
BP(5%sk)	83.16±0.160^{d}	4.20±0.200^{ab}	6.38±0.285^{a}	73.87±1.548^{c}	26.13±0.616	29.30±0.300^{b}
BP(7%sk)	85.43±1.637^{b}	4.88±0.363^{a}	6.41±0.410^{a}	78.52±1.169^{b}	21.49±0.521	26.57±0.498^{e}
BP(9%sk)	87.83±0.003^{a}	2.47±0.243^{c}	6.48±0.200^{a}	85.07±0.008^{a}	14.94±0.229	25.00±0.500^{f}
BP(3%se)	83.78±1.110^{cd}	2.84±0.321^{c}	6.58±2.000^{a}	64.58±1.732^{e}	35.42±0.236	28.47±0.200^{bc}
BP(5%se)	84.66±0.191^{bc}	4.00±0.866^{b}	6.63±2.125^{a}	67.90±0.200^{d}	32.10±0.116	27.92±1.005^{cd}
BP(7%se)	85.31±0.165^{b}	4.25±0.250^{ab}	6.72±0.210^{a}	68.24±0.240^{d}	31.76±0.110	26.93±1.770^{de}
BP(9%se)	88.00±1.000^{a}	2.50±0.500^{c}	6.68±1.000^{a}	73.30±1.908^{c}	26.70±1.200	26.17±0.007^{ef}

BP (3%sk) =Beef patties with tomsto skin (3%)

BP (3%se) =Beef patties with tomato seeds (3%)

*Cooking yield (%) = [100 – cooking loss (%)].

M ± SD = means and standard deviation of triplicate trails within the column, values having the same superscript letters means that no significant differences (at 5% level) was noted.

and seeds meal respectively. It was evident that the pH value of prepared beef patties was not significantly influenced by the addition of tomato skin or/and seed at different levels. Similar results Grigelmo - Miguel *et al.* (1999) who found that addition of peach dietary fiber decreased the pH-value of frankfurters.

Cooking loss of prepared beef patties was gradually decreased and cooking yield increased by augmentation the percentage of incorporated tomato wastes. Control sample had the highest cooking loss (42.89%) and the lowest value of cooking yield (57.11%) compared with the other treatments. The obtained results are parallely with those reported by Thebaudin *et al.* (1997) who reported that fiber can be used in cooked meat products such as pates and sausages to increase the cooking yield. Moreover, Pszczola (1991) cited that the addition of an oat – bran ingredient to ground beef and pork sausages resulted in increased cooking yield.

As shown in Table 3, shrinkage value of cooked prepared beef patties was decreased with increasing level of substitution. Shrinkage percentage was more pronounced as substitution level of tomato wastes increased. For instance , shrinkage of control beef patties was (34.38 % diameter), which decreased to 34.19, 29.30, 26.57 and 25.00 % diameter when tomato skin was incorporated in patties at levels of 3 ,5 , 7 and 9% respectively. The corresponding values for beef patties containing 3, 5, 7 and 9% tomato seed were 28.47, 27.92, 26.93 and 26.17 % respectively. Moreover Judge *et al.*, (1974) ascribed the shrinkage in cooked meat as a function of shortening of muscle fibers, coagulation of protein, loss of water and melting fat during frying.

Organoleptic Evaluation

Sensory characteristics of beef patties samples as affected by tomato wastes (skin and seed meals) substitution were given in Table 4. It was clear that no significant ($P<0.05$) differences in overall acceptability were recorded between control and other samples except in 9% tomato skin meal substitution.

Regarding to beef patties substituted with tomato seeds at a proportion of 9% numerically decreased the organoleptic scorces and the decrement was significant ($P < 0.05$) for juiciness, flavour,

Table 4. Organoleptic properties of beef patties containing different levels of tomatoes wastes

Samples	Juiciness	Firmness	Chewness	Flavour	Colour	Taste	Overall acceptability
Control	6.64±1.362^{a}	6.64±1.286^{b}	6.45±1.214^{ab}	7.09±1.221^{a}	7.73±1.272^{a}	7.18±0.982^{a}	7.27±1.009^{a}
BP(3%sk)	6.55±1.695^{ab}	6.64±1.362^{b}	5.64±1.689^{b}	6.64±2.203^{ab}	6.82±1.601^{ab}	6.00±1.897^{ab}	6.27±1.679^{ab}
BP(5%sk)	6.00±1.414^{ab}	6.09±1.514^{a}	6.73±1.902^{a}	6.45±1.809^{ab}	5.64±1.859^{b}	6.18±2.228^{ab}	6.45±1.440^{ab}
BP(7%sk)	6.64±1.362^{a}	7.00±1.342^{a}	6.64±1.362^{ab}	6.09±2.119^{ab}	6.55±2.207^{ab}	6.64±1.859^{ab}	6.73±1.618^{ab}
BP(9%sk)	6.27±2.005^{ab}	6.55±1.864^{b}	6.64±2.111^{ab}	6.00±1.949^{ab}	5.73±1.618^{b}	6.00±2.280^{ab}	6.55±1.916^{ab}
BP(3%se)	6.18±1.601^{ab}	6.45±1.036^{b}	5.82±1.251^{b}	5.91±1.300^{b}	6.36±1.362^{ab}	6.09±1.514^{ab}	6.36±1.206^{ab}
BP(5%se)	5.64±1.859^{b}	6.00±1.483^{b}	6.27±1.737^{ab}	6.91±1.814^{ab}	6.18±1.722^{ab}	6.82±1.940^{ab}	6.45±1.440^{ab}
BP(7%se)	5.73±1.489^{b}	7.09±1.700^{a}	6.73±1.737^{a}	6.55±1.214^{ab}	6.73±1.421^{ab}	6.73±1.679^{ab}	6.91±1.045^{ab}
BP(9%se)	5.91±1.136^{b}	6.36±0.809^{b}	5.73±1.421^{b}	5.73±1.954^{b}	5.27±1.793^{b}	5.64±1.869^{b}	5.91±1.221^{b}

BP (3%sk) = Beef patties with tomato skin (3%)

BP (3%se) = Beef patties with tomato seed (3%)

M ± SD = means and standard deviation within the column, values having the same superscript letters means that no significant differences (at 5 % level) was noted.

colour, taste and overall acceptability, except for firmness and chewiness. Where insignificant ($P<0.05$) difference were recorded. Increasing the levels of tomato seed substitution to 9% can negatively affect the colour of beef patties samples. Appearance and colour are the most important attributes influencing customer choice. Texture also plays a relevant role on the perception of quality of meat products (Aleson – Carbonell *et al.*, 2005). Moharram *et al.* (1984) reported that the addition of tomato seed or tomato seed meal to food items increased the nutritive value but had negative effect on food sensory properties. Also, fat reduction in minced beef and sausages using oat fiber has been achieved without modifying the sensory characteristics (Thebaudin *et al.*, 1997).

Finally, it could be concluded that it is economic and successful to utilizing dietary fiber from industrial tomato wastes (whole seed or skin) specially skin as a substitute for fat or meat protein in meat products. The benefit of use such waste have a positive economic and healthy products due to their high content of dietary fiber.

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الاستفادة من مخلفات الطماطم فى إعداد أقراص اللحم البقرى منخفض الدهن ومرتفعة المحتوى من الألياف الغذائية

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تلعب الألياف الغذائية دور هام فى صحة الإنسان لذا يتم الاتجاه نحو إنتاج أغذية مرتفعة فى الألياف ومنخفضة فى الدهون لتقليل مخاطر الإمراض تنتج مصانع الطماطم كميات كبيرة من المخلفات المتمثلة فى القشور والبذور والتى يمكن استخدامها كمصدر جيد للألياف الغذائية وفى هذه الدراسة تم تدعيم أقراص اللحم البقري بمستويات من مسحوق قشور وبذور الطماطم منزوعة الدهن بعد تجفيفها بمعدلات صفر، ٣، ٥، ٧، ٩ % أشتمل البحث على التقييم الكيماوى – االفيزيائى – الحسى للأقراص المعدة. وقد أوضحت النتائج أن إضافة مخلفات الطماطم أدت إلى ارتفاع الرطوبة – البروتين (فقط فى حالة البذور) – الرماد – الألياف الخام وانخفاض محتوى الدهون والبروتين (فى حالة القشور). وقد وجد أن إضافة مسحوق مخلفات الطماطم منزوعة الدهن كبديل لمخلوط اللحم والدهن المستخدم فى تصنيع أقراص اللحم البقرى أدى الى تحسين قدرتها على ربط الماء (WHC) والمطاطية Plasticity وعائد الطبخ وخفض معدل فقد الوزن – الانكماش فى القطر أثناء الطهى وقيمة حمض الثيوباربتيوريك (TBA). لم يلاحظ أى اختلافات معنوية بين الخواص الحسية لأقراص اللحم البقري المحتوية ٣ % قشور، ٣ % بذور (ماعدا النكهة) وخواص العينات القياسية غير المحتوية على مخلفات تصنيع الطماطم بينما انخفضت درجات التذوق لأقراص اللحم البقري المحتوية ٩ % بذور طماطم بشكل معنوى (ماعدا الليونة – المضغ) عن العينة القياسية.