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Innovative Products from Sweet Bell Pepper, Tomato and Their Pomace

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THE bell sweet peppers and tomato are the most important fruits worldwide. The current study was carried out to utilized from green, yellow, red pepper and tomato for preparation of a new products (dibs and beef burger of high fiber) in order to invade the local and global markets. Moisture, crude fiber, total sugar, pH value, total soluble solids, bioactive compounds, antioxidant activity and organoleptic properties for fresh bell sweet peppers, tomato and dibs were evaluated. It contains of flavonoids and phenolic acids in addition to beta carotene, anthocyanin and lycopene, which are considered beneficial compounds with regard to health benefits. The addition of green, yellow, red and tomato pomace, at different levels (10 and 20%) improves the culinary characteristics and water holding capacity (WHC) of the beef burger. The organoleptic properties of dibs from three stages of colored peppers and tomato showed that they were highly accepted by the panelists. Also, data noticed that red sweet pepper dibs had high scores for all organoleptic characteristics. The organoleptic evaluation indicated that there were insignificant differences in color, texture and odor of meat beef burger blends for the control sample. This work recommended the surplus agricultural production of colored pepper and tomato can be used to produce dibs; also, must be integrated of these promising healthy nutrients for production of meat product.

Keywords: Bell sweet pepper, Tomato, Organoleptic evaluation

Introduction

Fruits are an important part of person's day dieting. They supply the health benefits and helps in disease prevention. Fruits contain quite of nutrients including vitamins, minerals, and phytochemicals, especially antioxidants which help in reducing risk of chronic diseases and are naturally rich in fiber, (Ene-Obong et al., 2016). Sweet bell peppers (*Capsicum annuum* L.) belong to the Solanaceae family and are cultivated worldwide, being a highly consumed food due to its attractive color, pungency, freshness and typical aroma, (Eggink et al., 2012). Pepper is the fourth most important vegetable in the world food economy, and especially popular because of the distinctive red color and sweet taste of the fruit, as reported by Mougiou et al. (2021). The bell pepper has many qualities, but it has a high water content, which leads to deteriorating reactions and growth of microorganisms; however, it is possible to use drying as a conservation method, (Santos et al., 2019). Sweet bell pepper and tomato are an important of agricultural crop, not only due to of its fruit, mainly to the very fact that they are an excellent source of natural colors and antioxidant compounds (Igbokwe et al., 2013). The sweet pepper (*Capsicum annuum* L.) is an agrarian important crop worldwide. It is a good source of vitamins, carotenoids and flavonoids. The sweet pepper fruits contain different pigments (*e.g.* chlorophyll and carotenoids) resulting in leading to, as an example green, yellow, orange and red fruits. Within cultivated pepper germplasm several purple fruited genotypes exist, which might be a valuable source of anthocyanin, (Ghasemnezhad et al., 2011). Also, they reported that the red pepper is of the species *Capsicum annum*. The flavor of pepper alters consistent with their color, with green peppers being unripe and slightly bitter, to red peppers being very mature and really sweet. The sweet peppers

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are rich during a variety of phytochemicals like carotenoids, capsaicinoids, flavonoids, vitamin C, and tocopherols. These compounds exhibit anti-inflammatory and antioxidant activities which optimize human health. Different pepper varieties show variation within nutritional composition and level of metabolites (Guil-Guerrero et al., 2006) and Wahyuni et al., 2011). Currently, the pepper varieties are available in the supermarkets, most of which change from a green color to yellow, orange, red, or purple once they are completely ripeness. Green peppers are often harvested before they completely ripeness, and therefore the maturity stage can partly account for the content in phytonutrients and thus the consumption of antioxidants within the diet (Shotorbani et al., 2013). Tomato is eaten freely all over the world; the consumption is believed to benefit the heart, and other organs. Tomato (*Solanum lycopersicum*) contains lycopene, which belongs to carotenoids but don't convert to vitamin A like beta-carotene when ingest by human (Rao & Agarwal, 2000). Lycopene is a natural food colouring, thus eliminating the adverse effects of artificial food colourants. It provides colour shades ranging from yellow to red (Choksi & Joshi, 2007). In the food industry, lycopene is used as a food additive to enhance storage, stability and nutritional benefits. Due to its strong colour, non-toxicity and fat solubility, it is also used as a natural food colourant (Naviglio et al., 2008). It was reported previously that lycopene especially in cooked tomatoes help in prevention of prostate cancer (Dodukan et al., 2011). Many of the putative biologic effects and health benefits of lycopene are hypothesized to occur via protection against oxidative damage (Cruz et al., 2013). Also, lycopene has been shown to enhance skin's ability to safeguard against harmful UV rays. Food-industry waste is often an environmental problem for the industry, and lots of studies have been carried out on the potential utilization of several vegetable origin wastes for inclusion within the human diet. Utilization of vegetable origin wastes could reduce the economic costs and provide an effective solution for the food processing pollution problem (Lario et al., 2004). In the summer period, we discovered that the quantity of sweet bell pepper increases and is inexpensive because it passes through the ripening stages quickly and is susceptible to damage during a short time. Supported these facts, this study was administered to supply and evaluate the dibs from three stage of bell sweet peppers and tomato and evaluate the variation of the phytochemical composition consistent with the color of the fruits and utilize from pomace for supporting meat burger.

Materials and Methods

Materials

Three varieties of sweet bell pepper (green, yellow and red) (*Capsicum annuum* L.) and tomato (*Solanum lycopersicum*) were purchased from the local market in Giza., Egypt. All chemicals and reagents utilized during this study were of analytical grade and purchased from El-Gomhouria Co. for chemical, Giza, Egypt. Sugar, and ingredients of beef burger (minced meat, sunflower seed oil, salt, starch, garlic, onion and species) mentioned within the present work were of food grade and purchased from the local market, Cairo, Egypt. Textured soy was obtained from Food Technology Research Institute, Giza, Egypt.

Methods

Technological Methods

Preparation of sweet bell peppers and tomato dibs:

The sweet bell peppers (green, yellow and red) and tomato dibs were prepared consistent with the tactic as cited by Arafa et al. (2006). All sweet bell peppers and tomato were washed by water to urge obviate the other impurities. The sweet peppers and tomato were removed immediately, then cut into small slices and put one kg of the sample with one liter from 10% sugar solution in Philips Juicer then mixer (HL1631) to extract juice., then filtered on a narrow holes (41 mesh) of fabric and squeeze is good, then take the filtered solution on low heat at (60) ^{o}C until focus up to 45-49% total soluble solids contents. The obtained final dibs were kept in dark bottles at refrigerator temperature until used and analysis.

Application of sweet bell pepper and tomato pomace in beef burger product

Preparation of beef burger

The suggested burger samples were prepared by Experimental Kitchen Research, Food Technology Research Institute, Agricultural Research Center. The beef burger formulated with 0% (control), ten, twenty, thirty, forty and fifty percent of green, yellow, red pepper and tomato pomace individually by replacing meat. Data analysis of organoleptic evaluation indicated that there were significant differences in all organoleptic characteristic of formulated manufactured burger processing by replacing 30, 40 and 50% of red, yellow, green pepper and tomato pomace to meat and significantly differs from others. Organoleptic evaluation and culinary characteristics were done for these previous percentages; and the best percentages were 10 and 20% in the beef burger samples. The finding could be attributed to the unstabilizing properties of red pepper pomace (RPP), green pepper pomace (GPP), yellow pepper pomace (YPP) and tomato pomace (TP), which restricted the distortion of the burger during culinary. The lowest WHC value (the highest area of squeezed water) was recorded for beef burger integrated with 50 % GPP, 50% YPP, 50% RPP and 50% TP. The best percentages of meat beef burger ingredients are illustrated in Table 1. The ingredients for each beef burger sample are homogenized in Braun Cutter Machine (CombiMax 700 ,USA), then from the homogenized meat mixture and process into a beef burger approximately 60 gm, diameter 9.0 cm and thickness approximately 0.95-1.0 cm. Prepared beef burgers were individually packaged in polyethylene (PE) film to preserve the shape of the beef burger before freezing. Samples were frozen at –18 °C previous analytics.

Determination of total phenolic

Total phenolic content was determined according to the method described by Cosmulescu & Trandafir (2012). Absorbance was detected with a spectrophotometer at 765 nm. Results were compared to gallic acid standard and expressed as mg gallic acid equivalents/100 g sample.

Determination of total flavonoids

Total flavonoids were determined using the aluminium nitrate colorimetric method described by Cosmulescu et al. (2015). Absorbance was measured at 510 nm against a blank and results were compared to a quercetin standard and expressed as mg of quercetin equivalents/100 g sample.

Determination of total soluble solids (TSS)

The total soluble solids for dibs samples were determined employing a digital refractometer (ATAGO HSR-500; Japan), adapted from Cavalcanti et al. (2013).

Determination of antioxidant activity

The The radical scavenging activity (RSA) of the sweet bell pepper and tomato fruit and dibs samples were checked on the basis of the scavenging effect on the stable DPPH radical activity. This method consistent with Braca et al. (2002), it had been supported the reduction of alcoholic DPPH solutions within the presence of a hydrogen donating antioxidant that displays a

TABLE 1. The percentage of ingredient in beef burger samples (g / 100g).

Ingredients	Minced Meat	Green pepper pomace	Yellow Pepper pomace	Red Pepper pomace	Tomato pomace	Spices	Textured soya	Onion	Garlic	Starch	Salt
Control	68.0					1	17	6	1	5	2
GPP 10	61.2	6.80				1	17	6	1	5	2
GPP 20	54.4	13.6				1	17	6	1	5	2
YPP 10	61.2		6.80			1	17	6	1	5	2
YPP 20	54.4		13.6			1	17	6	1	5	2
RPP 10	61.2	-		6.80		1	17	6	1	5	2
RPP 20	54.4			13.6		1	17	6	1	5	2
TP 10	61.2				6.80	1	17	6	1	5	2
TP 20	54.4				13.6	1	17	6	1	5	2

GPP10 = 10% Green Pepper Pomace + minced meat, GPP20 = 20% Green Pepper Pomace+ minced meat , YPP10 = 10%. Yellow Pepper Pomace + minced meat, YPP20 = 20%. Yellow Pepper Pomace + minced meat, RPP10 = 10% Red Pepper Pomace + minced meat , RPP20 = 20% Red Pepper Pomace + minced meat , TP10= 10% Tomato Pomace+ minced meat and TP20= 20% Tomato Pomace + minced meat.

robust optical absorption band at 517 nm and deep violet color appears.

Determination of total chlorophyll content

Total chlorophyll (mg/g FW sample) content in green pepper fruit and dibs samples was appreciated by multiple solvents and, it is measured by using spectrophotometric method as given by Gogoi & Basumatary, (2018).

Determination of anthocyanin content

Anthocyanin in red pepper fruit and dibs samples was extracted by 85 mL ethanol (95%) and 1.5 N. HCL The color of clear extract was measured at 520 nm as reported by Ranganna, (2007).

Determination of beta- carotene content

β-carotene content in yellow pepper fruit and dibs samples was calculated consistent within Nagata & Yamashita (1992), equation: β-Carotene (mg /100 gm) = (0.216 x OD 663 - 1.22 x OD 645 - 0.304 x OD 505+ 0.452 x OD 453), OD = absorbance by using spectrophotometer.

Determination of lycopene content

Absorption determination for lycopene content was made by using Spectrophotometer (UV-vis specord 205 by Analytic Jena). Lycopene within the tomato and red pepper fruit and thus the tomato and red pepper dibs sample were extracted with hexane: ethanol: acetone (2:1:1) (v/v) mixture following the tactic of Gordon & Diane, (2007). One gram of the homogenized samples and 25 ml from hexane: ethanol: acetone, which was then placed on the rotary mixer for 30 min., adding 10 ml distilled water and was continued agitation for an extra 2 min. The solution was left to separate into distinct polar and non-polar layers. The absorbance was measured at 472 nm and 502 nm, using hexane as a blank. The lycopene concentration was expressed as mg/100g sample.

Chemical analysis

Moisture and crude fiber were estimated consistent with the methods of AOAC (2016).

Determination of total sugars

A total sugar was determined using the method of AOAC (2005).

Determination of pH value

pH value was measured by using 3510 pH meter (Jenway) with glass electrode at 25°C consistent with the methods of AOAC (2016).

Culinary parameters of beef burgers

Culinary yield of beef burger samples were decided by measuring the load of samples for every treatment and mathematical calculations of weight differences for beef burger before and after culinary, as follows by (El-Magoli et al., 1996). The share of culinary loss and shrinkage were determined consistent with the methods established by Polizer et al. (2015). The share of culinary loss was calculated as follows: Culinary loss = [(weight of raw sample – weight of cooked sample) / weight of raw sample] × 100. So on compute the share of shrinkage, the quality diameter of the frozen burger was obtained by measuring the cross-section in three distinct regions using a metric ruler. The samples were fried, as described above. The share of size reduction was calculated as follows:

$$\% \text{ Shrinkage} = \frac{(\text{Raw thickness} - \text{Cooked thickness}) + (\text{Raw diameter} - \text{Cooked diameter}) \times 100}{\text{Raw thickness} + \text{Raw diameter}}$$

Physical properties of beef burgers

Moisture retention

The moisture retention value represents the quantity of moisture retained within the cooked product per 100 g of sample. This value was calculated in accordance with the subsequent equations (El-Magoli et al., 1996).

Moisture retention = (percent yield x % moisture in cooked beef burger) / 100

Water Holding Capacity (WHC)

Water holding capacity was measured using the tactic of El-Seesy, (2000) as follows: The burger sample 0.3 g was placed on an ash less paper Whatman, No. 41 and placed between two glass plates, and pressed for 10 minutes by one kilogram weight, two zones were found on the paper, their surface areas were measured by a planimeter. The outer zone resulted from the water separated from the pressed tissues thus indicating the WHC.

Organoleptic evaluation of dibs and beef burger samples

Organoleptic characteristics of dibs samples from sweet peppers and tomato were evaluated by ten members of the department’s staff by method Thabet et al., (2009). Samples were served in closed, transparent glass containers at room temperature. For each sample, they had to score color, odor, texture, appearance, and taste and consistency acceptability. Cooked burgers samples were assessed for a variety of organoleptic characteristics by ten members of the department’s staff, selected on the idea of interest and knowledge in sensory for evaluation. The samples were evaluated for color desirability, odor, texture, taste, tenderness, appearance and general acceptance using 10 point scale as described by AL-Mrazeeq et al., (2010).

Statistical analysis

Data of chemical, physical and organoleptic assessment were subjected to analysis of variance (ANOVA) followed by Duncan's multiple range tests administered using SAS statistical (SAS Inc., 2000). Values were expressed as mean± SE. P value $p < 0.05$ was considered significant (SAS, 2000)

Results and Discussion

Bioactive compounds, antioxidant activity and total soluble solid of the tested samples

The bioactive compounds (total phenolic and total flavonoid content), radical scavenging activity (RSA) and total soluble solid (TSS) of fresh sweet bell pepper and tomato fruits and their treatments are showing in Table 2. Total phenolic content of fresh yellow sweet pepper is 356.0 mg GAE/ 100 g followed by red sweet pepper (298.0), tomato fruits (284.0) and green sweet pepper (247.0) mg GAE /100 g, respectively which decreased after produced dibs to 194.0, 252.0, 189.0 and 186.0 mg GAE /100 g for red sweet pepper dibs, yellow sweet pepper dibs, tomato dibs and green sweet pepper dibs respectively. Rodica et al. (2017) found that the phenolic compounds of sweet pepper varied between 128 mg GAE/100g fresh weight (local population) and 202.6 mg GAE/100g fw. The phenolic content of pepper fruits, varied from 146.87 mg GAE/100g at Blondy to 151.78 mg GAE/100g. The decrease in the phenolic compounds may be related to the oxidation of phenolic compounds to quinone as reported by Dalmadi et al. (2006). Concerning total flavonoids of fresh sweet peppers and tomato fruits , it was observed that green sweet pepper contain high level of flavonoids (1.35) followed by red sweet pepper (0.55), yellow sweet pepper (0.49) and tomato fruits (0.19) mgQE /100g respectively. On the other hand producing dibs led a significant high decrease in total flavonoids of sweet pepper and tomato dibs. Rodica et al. (2017) found that the content of total flavonoids recorded values up to 480 mg QE/100g in sweet pepper with red fruit, and in bell pepper with yellowish-green fruits up to 292 mg QE/100g. Finally the decreases and increase were depending on the ability and sensitivity of every phenolic and flavonoids compound to heat and oxidation during processing and storage as found by (Dalmadi et al., 2006). Results in Table 2 shows that yellow sweet pepper had the high content of radical scavenging activity (98.40%) followed by 97.39, 93.28 and 86.46% for tomato fruit, red sweet pepper and green sweet pepper, respectively. A clear significant decrease was observed for dibs products to 94.28, 92.18, 78.10 and 72.18 for the previous fruit samples respectively. Radical scavenging activity of fresh sweet peppers,tomato fruit and dibs products may be related to non-enzymatic antioxidants (phenolic and flavonoids compounds) and enzymatic antioxidants (peroxidase, catalase and superoxide dismutase) as reported by Awad et al. (2011), and El-Far et al. (2016) which mention that the antioxidant of fruits or vegetables may react with ROS (Reactive Oxidation Species)

Severely damage them directly by donating electrons to eliminate the unpaired condition of ROS and that may reduce the cellular free radicals by enhancing the activities indirectly and expression of antioxidant enzymes that thanks to protection of lipid peroxidation and DNA damage. Also Wang et al. (2010) indicated that the reaction happened during heat processed, synergies between antioxidant vehicles and therefore the food matrix can occur, in other studies, antioxidant activity remained constant or are often decreased (Davidov et al., 2011). Data in Table 2 show that total soluble solid is nearly an equivalent related for end point of making all dibs samples. The total soluble solid for all dibs ranged from 49.0 to 49.6 % for sweet pepper dibs and tomato dibs, respectively. Data in Table 3 show this the entire chlorophyll for green pepper and green pepper dibs are 12.71 and 18.45 as mg/ g fresh weight, respectively. Whilst, beta- carotene had the very best value for yellow pepper (26.22 mg/100g) compared to yellow pepper dibs (4.94 mg/100g). The method of producing dibs led to a significant decrease within the anthocyanin pigment in the red pepper. On the other hand, the method of producing dibs led to a significant increase within the lycopene pigment (16.25 and5.21 mg/100g) in the tomato and red pepper, respectively. Also data in the same Table showed that the lowest lycopene content is noticed in red pepper fruit was 4.50 mg/100g, while the tomato sample recorded the highest lycopene content (14.51mg/100g). These results agreement with Kaur et al. (2008) who found that the peel fraction of tomato waste contains lycopene up to five times more than the pulp (on wet basis). Tomatoes contained about 30–400 mg/kg of lycopene in pulp and about 20–30 mg/kg in peels as found by Naviglio et al. (2008). Rao & Shen, (2002) reported that a daily intake level of 5–7 mg of lycopene in normal healthy humans could also be sufficient to combat oxidative stress and stop chronic diseases. Ripening of peppers fruits means carotenoid biosynthesis which may be seen as fruit color change. Also, Fadupin et al.(2012) found that the lycopene content of red bell pepper was significantly lower than in chili pepper or fresh tomato ($p<0.05$).

TABLE 2. Total phenolic, flavonoid, % RSA and total soluble solid of different samples.

Samples	Total phenolic content as gallic acid (mg / 100g sample)	Total Flavonoid content as quercetin (mg/100g sample)	% RSA*	%TSS**
Green pepper	247.0^{e}±0.865	1.35^{a}±0.096	86.46c±0.112	--
Green pepper dibs	186.0^{h}±1.618	0.36^{b}±0.612	72.18e±0.672	49.0^{a}±0.102
Yellow pepper	356.0^{a}±0.072	0.49^{b}±0.672	98.40a±0.272	--
Yellow pepper dibs	194.0^{f}±0.372	0.29^{c}±0.525	94.28b±0.272	49.5^{a}±0.172
Red pepper	298.0^{b}±0.245	0.55^{b}±0.612	93.28b±0.282	--
Red pepper dibs	252.0^{d}±0.752	0.54^{b}±0.672	78.10d±0.571	49.5^{a}±0.072
Tomato	284.0^{c}±0.072	0.19^{d}±0.172	97.39a±0.172	--
Tomato dibs	189.0^{g}±0.572	0.17^{d}±0.178	92.18b±0.172	49.6^{a}±0.072

Each value is mean of three replicates ± SD, number in the same column followed by the same letter is not much different at $p < 0.05$. RSA* = Radical Scavenging Activity TSS**= Total Soluble Solid

TABLE 3. Total Chlorophyll (mg/g FW sample), beta-carotene, anthocyanin and lycopene contents (as mg/100g) fresh weight samples.

Samples	Total Chlorophyll (mg/g FW sample)	Beta- carotene (mg/100g)	Anthocyanin (mg/100g)	Lycopene (mg/100g)
Green pepper	12.71b±0.072			
Green pepper dibs	18.45a±0.512			
Yellow pepper		26.22a±0.512		
Yellow pepper dibs		4.94b±0.772		
Red pepper			6.14a±0.572	4.50b±0.772
Red pepper dibs			3.35b±0.891	5.21a±0.972
Tomato				14.51b±0.872
Tomato dibs				16.25a±0.072

Each value is mean of three replicates ± SD, number in the same column followed by the same letter is not much different at $p < 0.05$.

Characteristic color changes through which pepper fruits pass are green, when chlorophyll is that the main pigment, brown which is characterized intensive biosynthesis of carotenoids especially red ones and deterioration of chlorophylls, red and crimson when red carotenoids dominate in proportion as reported by Kevrešan et al. (2009).

Table 4 show that the moisture, crude fiber, total sugar and pH value for the tested samples, it might be illustrated that green, yellow, red pepper and tomato (dibs and pomace) contained a low amount (g/100g sample, on fresh weight) of moisture compared with green, yellow, red pepper fresh and tomato fresh. This difference could also be as results of vaporization during concentration of dibs samples. This conclusion is in agreement with Sadiq & Aliyu, (2018) who suggested that the tomato fruit has much higher moisture content of 92.0. As recorded in Table 4, it might also be also observed this, the green, yellow, red pepper and tomato (fresh) contained the low amount of total sugar (3.20, 4.40, 4.20 and 3.80 g/100g fresh weight), respectively. Presented data in Table 4 showed also that total sugar was significantly increased by the addition of sucrose (10%) for a green, yellow, red and tomato dibs samples

TABLE 4. The moisture, crude fiber, total sugar measurements (as g/100g fresh weight) and pH value.

Samples	Moisture	Crude Fiber	Total sugar	pH
Green pepper	91.8^{a}±0.012	2.10^{c}±0.712	3.20^{b}±0.712	6.10^{a}±0.012
Green pepper dibs	26.62^{b}±0.052	-	13.52^{a}±0.615	4.00^{c}±0.112
Green pepper pomace	12.43^{c}±0.072	2.91^{c}±0.612	--	5.19^{b}±0.015
Yellow pepper	92.8^{a}±0.112	2.3^{c}±0.012	4.40^{b}±0.512	6.20^{a}±0.012
Yellow pepper dibs	27.54^{b}±0.112	-	22.73^{a}±0.112	4.20^{c}±0.116
Yellow pepper pomace	13.03^{c}±0.117	3.10^{b}±0.312	--	5.55^{b}±0.012
Red pepper	92.6^{a}±0.018	3.4^{b}±0.512	4.20^{b}±0.112	5.95^{a}±0.012
Red pepper dibs	26.28^{b}±0.212	-	15.19^{a}±0.315	4.80^{c}±0.182
Red pepper pomace	14.92^{c}±0.332	3.3^{b}±0.313	--	5.29^{b}±0.052
Tomato	94.6^{a}±0.712	1.0^{d}±0.712	3.80^{b}±0.112	5.65^{a}±0.042
Tomato dibs	26.50^{b}±0.512	-	16.82^{a}±0.112	4.50^{c}±0.125
Tomato pomace	16.20^{c}±0.112	4.50^{a} ±0.112	--	4.69^{c}±0.012

Each value is mean of three replicates ± SD, number in the same column followed by the same letter is not much different at $p < 0.05$.

As recorded within the same Table, it might be also noticed that the pepper samples and tomato and pomace contained a good amount (mg/100g on fresh weight) of fiber. It also contained a rational amount of fiber for the tested pomace samples. The fibers of tomato and bell sweet pepper represent a material that can be used as an ingredient within the food industry. It might be also utilized in the pharmaceutical industries sector as a nutritional supplement, thanks to the health-related properties of dietary fiber and associated bioactive compounds. To work out the applications of tomato fiber is crucial to distinguish it and evaluating possible applications consistent with its composition and functional properties as reported by Navarro-González et al. (2011). The data given in Table (4) show the pH of fresh samples were 6.10, 6.2, 5.95 and 5.65 for green, yellow, red pepper and tomato, respectively, pH had significantly decreased by processing samples. The rise in pH was found in pomace samples and was affected by processing dibs.

Effect of addition of sweet pepper and tomato pomace on culinary and physical characteristics of beef burger samples

The culinary measurements (culinary yield, culinary loss, shrinkage, moisture retention, and water holding capacity) which are the most important physical changes that occur in a beef burgers during the culinary process due to protein denaturation and the release of fat and water from beef burger samples. Physical properties of meat products are very important because it affect its quality characteristics such as tenderness, juiciness and culinary loss, as reported by Oroszvari et al. (2005). Therefore, the effect of merging the red, green, yellow pepper pomace and tomato pomace alone in proportions of both 10 and 20 % from the meat weight used in beef burger samples on culinary measurements including culinary yield, culinary loss, shrinkage, moisture retention, and water holding capacity of producing burger, compared to the control sample. Data in Table 5 show that the culinary yield was significantly increased in fresh burger incorporated with red, green, yellow and tomato pomace. The comparison sample (control) recorded the significant lowest culinary yield (79.18%). Culinary loss pointing may be attributed to a reduction of weight beef meat during the culinary process (Drummond & Sun, 2006). From the results in Table (5) it might be noticed that culinary loss was affected by the water retention level. In this concern the best samples (lowest culinary loss) were RPP 20, GPP 20, YPP 20 and TP 20 blends. Ammar & Ferdouse, (2017) found that, culinary loss of chicken burger integrated with tomatoes peel powder (TPP) is decreased with increasing the combination level TPP. This may be to come back the fiber components (pectin, cellulose and lignin) of TPP, which could affect the culinary loss of the chicken burger, since pectin could diminish the water loss during culinary by forming gels. Whilst the culinary characteristics of control sample consider within the range the culinary characteristics of commercial burger, there were an inverse relationship between culinary loss and culinary yield with the addition levels of red, green, yellow and tomato pomace to the flesh beef burger formulations. Similar results were found before Lopez-Vargas et al. (2014) who verified that, compared with control treatment, samples with addition of passi on fruits albedo showed an increased culinary yield and it occurred in a concentration-dependent manner. Generally, culinary yield improved when increasingly more fiber was added to the formulation. The differences in the culinary yield of the products might be related to water absorption degrees of the non-meat ingredient used. Data in Table 5 appeared that shrinkage percentage of burger samples containing red, green, yellow and tomato pomace were significant lower than the control sample, and shrinkage percentage decreased the levels of added red, green, yellow and tomato pomace. Also, data in the same table showed that, the significantly low shrinkage was noticed in burger prepared from tomato pomace and there were changes in impact of all the tested blends under investigation on shrinkage, while the control sample recorded the highest shrinkage (15.56%).

TABLE 5. Culinary yield, culinary loss, shrinkage, moisture retention, and water holding capacity of the suggested blends burger.

Item	%Culinary yield	%Culinary loss	%Shrinkage	%Moisture retention	*WHC
Control	79.18^{e}±1.312	20.82a±0.012	15.56^{a}±0.612	39.35f±1.334	1.10^{c}±1.112
GPP 10	91.29^{ab}±0.912	8.70d±1.512	14.89^{b}±1.012	41.13e±1.015	3.03^{a}±0.612
GPP 20	92.94^{a}±0.612	7.06e±0.612	14.00^{b}±0.812	51.76a±0.712	3.45^{a}±0.712
YPP 10	88.63^{b}±0.812	11.36b±1.312	13.13^{b}±0.712	49.25b±1.112	3.55^{a}±0.612
YPP 20	92.00^{a}±0.012	7.99e±2.212	12.51^{c}±1.112	51.29a±0.812	3.87^{a}±0.612
RPP 10	91.45^{ab}±0.012	8.54d±1.112	13.26^{b}±0.812	44.03d±1.012	3.20^{a}±0.882
RPP 20	92.54^{a}±0.012	7.45e±1.212	10.17^{d}±1.112	48.73c±1.112	3.48^{a}±0.615
TP 10	89.75^{b}±1.012	10.24c±1.012	9.47^{d}±1.112	47.96c±1.012	3.50^{a}±0.711
TP 20	90.27^{ab}±0.012	9.72d±0.912	8.24^{e}±1.212	51.25a±0.712	3.70^{a}±0.717

GPP10 = 10% Green Pepper Pomace + minced meat, GPP20 = 20% Green Pepper Pomace+ minced meat , YPP10 = 10%. Yellow Pepper Pomace + minced meat, YPP20 = 20% Yellow Pepper Pomace + minced meat, RPP10 = 10% Red Pepper Pomace + minced meat , RPP20 = 20% Red Pepper Pomace + minced meat , TP10= 10% Tomato Pomace+ minced meat and TP20= 20% Tomato Pomace + minced meat.Each value is means of ten replicates ±SD. Numbers in the same Column followed by the same letter are not much different at $p < 0.05$. *WHC= water holding capacity

The same table revealed that the highest significant differences of moisture retention in the beef burger blends compared with the control sample. Moisture retention was proportionally increased with the increment of sweet bell pepper and tomato pomace content in burger formulations. The culinary of control sample is considered within the range of commercial burger, there were an inverse relationship between moisture retention and culinary yield with the addition levels of red, yellow pepper and tomato pomace to the beef burger formulations. This is probably due to the inability of sweet bell pepper and tomato fibers to create a three-dimensional matrix inside the burgers due to the high moisture content. Modified culinary yields reflect the yields relative to the amount of beef meat used in the formulation (El-Magoli et al., 1996). The water holding capacity is an important factor affects on eating quality, tenderness, juiciness, thawing drip and culinary loss of meat as reported by Yulong & Ertbjerg, (2019). The effect of green, yellow, red and tomato pomace on the water holding capacity of beef burgers is summarized in Table 5. The results in the table showed a significant increase in WHC value of meat burger samples compared to the control sample, the highest value was found in meat burger contained 10 and 20% of sweet bell pepper or tomato pomace. This results agreement with Weiss et al. (2010) who reported that the use of vegetable fibers in meat products has been studied in good combination baked in order to increase culinary yield and improved texture. Ammar & Ferdouse (2017) found that the incorporation of TPP (tomato peel powder) into chicken burger adversely affects the water holding capacity and culinary losses which were decreased with increasing the incorporation level of TPP. When evaluating the partial replacement of meat with sugarcane fibers in meat burgers, Pluschke et al. (2019) found that, one to five percent substitution significantly reduced the culinary loss. According to the researchers, these results may be explained by the ability of the sugarcane fiber to retain water.

Organoleptic characteristics of the tested dibs

Mean values of organoleptic evaluation namely color, odor, texture, appearance, taste and general acceptance of sweet bell peppers and tomato dibs are shown in Table 6.

The data in Table 6 show a significant difference between the yellow pepper dibs, red pepper dibs and tomato dibs for color, odor, texture and taste. Also, the results showed that green peppers dibs had the lowest mean values of all organoleptic characteristic when compared with the other previous dibs. Generally, all the products were agreeable by the panelists expect significant differences were noticed between green pepper dibs, yellow pepper dibs, red pepper dibs and tomato dibs in the mean value of appearance. General acceptance descriptions by the panelists ranged from acceptable to highly acceptable for all products. Finally, it could be clearly noticed that red sweet pepper dibs had high scores for all sensory characteristic of sweet pepper dibs. Sowbhagya et al. (2005) they have stated that, color is a vital characteristic of foods and plays an important role in organoleptic and acceptability of products by consumers. Green pepper cultivars, not only as raw material but as processed food, throughout the food production chain as reported by Mougiou et al.(2021). Results of sensory were evaluation by Thabet et al. (2009), showed a significant difference in some variables due to nature and degree of concentration of the different syrups. Color is the first organoleptic feature that consumers see.

TABLE 6. Organoleptic characteristics of the tested dibs

Item	Color (10)	Odor (10)	Texture (10)	Appearance (10)	Taste (10)	General acceptance (10)
Green pepper dibs	7.1c±1.19	7.1^{c}±1.286	6.0^{b}±0.001	6.2^{c}±0.632	6.20^{b}±0.78	6.2^{c}±0.632
Yellow pepper dibs	8.5b±1.08	8.6^{b}±0.966	8.6^{a}±0.516	8.5^{b}±0.849	8.10^{a}±1.15	8.5^{b}±0.849
Red pepper dibs	9.1a±0.567	9.0^{a}±0.942	8.9^{a}±0.567	9.3^{a}±0.483	8.6^{a}±0.966	9.3^{a}±0.483
Tomato dibs	8.8b±0.632	8.6^{b}±0.699	8.5^{a}±0.527	8.7^{b}±0.486	8.2^{a}±0.788	8.7^{ab}±0.483

-Each value is means of ten replicates ±SD. Numbers in the same column followed by the same letter are not much different at $p < 0.05$.

Organoleptic evaluation of the manufactured beef burger

The samples processed burgers were expose to organoleptic evaluation. The mean scores for color, odor, texture, taste, tenderness, appearance and general acceptance of different samples are presented in Table 7. The color, odor, texture, taste, tenderness, appearance and general acceptance of formulated manufactured burger with 10% and 20% of pomace to meat are similar in the mean values and no significant differences were observed between them and the control except significantly differ in tenderness. Also, these results indicated that the from formulated manufactured burger with 10% and 20% pomace will be accepted by consumers, revealing good perspectives for expanding the application of pomace in food and meat industry. However, in increased concentrations RPP, GPP, YPP and TP can have the opposite effect which may increase the changes of thickness and thereby increase culinary loss, reduce culinary yield and negatively affect the acceptability of the product. Therefore, the levels of GPP, YPP, RPP and TP greater than 20% could lead to formative crushing of the product, possibly due to the decreased moisture content. This result agreed with Khalaf et al. (2014) who reported that, tomato processing pomace is considered a promising source of bioactive compounds and potential natural source of antioxidants. Wastes from food processing are appealing source due to its worthy bioactive components and color pigments. This waste is useful; so, they could be used as functional foods, food ingredients and added to meat products, cosmetic products and nutrition applications as reported by Lario et al. (2004).

TABLE 7. Organoleptic characteristics of the manufactured beef burger .

Formula	Color (10)	Odor (10)	Texture (10)	Taste (10)	Tenderness (10)	Appearance (10)	General acceptance (10)
Control	9.42a±0.767	9.14a±0.467	9.1^{a}±0.467	9.28^{a}±0.467	7.5^{b}±0.427	9.14a±0.158	8.51ab ±0.467
GPP 10	9.28a±0.667	9.28a±0.667	9.57^{a}±0.569	9.51^{a}±0.167	9.28^{a}±0.447	9.24a±0.318	9.14^{a}±0.667
GPP 20	9.0a±0.767	8.57ab±0.657	9.28^{a}±0.468	9.62^{a}±0.417	9.0^{a}±0.417	8.44b±0.258	9.2^{a}±0.767
YPP 10	9.0a±0.717	9.01a±0.567	9.0^{a}±0.368	8.57^{a}±0.717	9.0^{a}±0.567	9.1a±0.268	9.0^{a}±0.767
YPP 20	8.57ab±0.967	8.42ab±0.467	8.57^{a}±0.567	8.28^{a}±0.467	9.0^{a}±0.467	8.57b±0.488	9.0^{a}±0.767
RPP 10	9.7a±0.558	9.28a±0.317	9.42^{a}±0.662	9.28^{a}±0.577	9.71^{a}±0.367	9.42a±0.128	9.31^{a}±0.767
RPP 20	8.8ab±0.967	8.71ab±0.117	8.73^{a}±0.416	8.85^{a}±0.867	9.14^{a}±0.466	8.91a±0.233	9.2^{a}±0.867
TP 10	9.2a±0.867	9.0a±0.267	9.51^{a}±0.262	9.28^{a}±0.467	9.51^{a}±0.567	9.28a±0.058	9.5^{a}±0.667
TP 20	9.4a±0.797	8.7ab±0.767	9.0^{a}±0.564	8.57^{a}±0.362	9.0^{a}±0.261	8.85a±0.358	9.6^{a}±0.561

GPP10 = 10% Green Pepper Pomace + minced meat, GPP20 = 20% Green Pepper Pomace+ minced meat , YPP10 = 10%, Yellow Pepper Pomace + minced meat, YPP20 = 20% Yellow Pepper Pomace + minced meat, RPP10 = 10% Red Pepper Pomace + minced meat , RPP20 = 20% Red Pepper Pomace + minced meat , TP10= 10% Tomato Pomace+ minced meat and TP20= 20% Tomato Pomace + minced meat. Each value is means of ten replicates ±SD. Numbers in the same Column followed by the same letter are not much different at $p < 0.05$.

Conclusion

The conclusion explained this is possible to take advantage of the sweet bell peppers and tomato fruits are abundant in the summer to produce a new product such as dibs. Which can be used in the production of some sauces, also using of the resulting waste to produce a high burger in fibers content and antioxidants, also, can be dried of the resulting waste and use it as a powder and add it to any product baked goods or meat product to increase the nutrition value of those products.

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منتجات مبتكرة من الفلفل الحلو والطماطم وتفلهم

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يعتبر الفلفل الحلو والطماطم من اهم الفواكه على مستوى العالم. أجريت الدراسة الحالية لاستخدام الفلفل الأخضر والأصفر والأحمر والطماطم في تحضير منتج جديد (الدبس وبرجر عالي الألياف) من أجل غزو الأسواق المحلية والعالمية. تم تقييم الرطوبة والألياف الخام والسكر الكلي وقيمة الأس الهيدروجيني والمواد الصلبة الذائبة الكلية والمركبات النشطة بيولوجيا والنشاط المضاد للأكسدة والخصائص الحسية لدبس الفلفل الحلو الطازج والطماطم الطازجة. حيث احتوى على الفلافونويد والأحماض الفينولية بالإضافة إلى بيتا كاروتين والأنثوسيانين والليكوبين ، والتي تعتبر مركبات غنية بالفوائد الصحية. اضافة تفل الفلفل الأخضر والأصفر والأحمر وتفل الطماطم ، كلا على حدا ، بمستويات مختلفة (١٠و ٢٠ ٪) ليحسن قياسات الطهي والقدرة على الاحتفاظ بالماء للبرجر اللحم البقري . أظهرت الخصائص الحسية للدبس من المراحل الثلاث للفلفل الملون الطماطم قبولها بشكل كبير من قبل أعضاء اللجنة.كما لوحظ بوضوح أن دبس الفلفل الأحمر الحلو كان له درجات عالية لجميع الخصائص الحسية. كما أظهرت النتائج الحالية أن نتائج التقييم الحسي لا توجد فروق معنوية فى لون وملمس ورائحة لعينات برجر اللحم البقري وعينة التحكم. أوصى العمل الحالي بإمكانية استخدام فائض الإنتاج الزراعي من الفلفل الملون لإنتاج الدبس ، كما يجب دمج هذه العناصر الغذائية الصحية الواعدة لإنتاج برجر اللحم البقري.