

تأثير اضافة مسحوق (البنجروالفلفل الأحمر وقشر البصل) على جودة البرجر خلال التخزين بالتجميد

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كلية التربية النوعية – جامعة المنيا



مجلة البحوث في مجالات التربية النوعية

معرف البحث الرقمي DOI: 10.21608/jedu.2021.72027.1324

المجلد الثامن العدد ٣٨ – يناير ٢٠٢٢

الترقيم الدولي

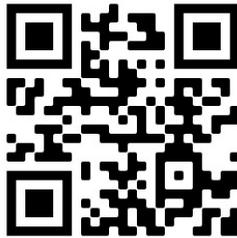
P-ISSN: 1687-3424

E- ISSN: 2735-3346

موقع المجلة عبر بنك المعرفة المصري <https://jedu.journals.ekb.eg/>

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العنوان: كلية التربية النوعية – جامعة المنيا – جمهورية مصر العربية



Effect of Adding (Red Beet, Red Pepper and Peel Onion) Powder on Quality of Beef Burger during Freezing Storage

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ABSTRACT

Beef burgers are important nutritious and desirable foods for human; it's also being a very perishable product and environment convenient for growing microorganism and led to risk in human health risk. For that, this study investigated the use of natural antioxidants for beef burger preservation through the reduction the deteriorations of sensory properties and lipid oxidation during storage to maintaining quality parameters and in improving health benefits. Was evaluated the antioxidant activity, total Phenolic and flavonoid contents for powders of (red pepper RPP; red onion peel ROPP and red beet RBP) and the effect of add 5% of (RPP, ROPP and RBP) to beef burgers with formulation during freezing storage (up to 6 months at -20°C) in terms of microbial examination, color and sensory evaluation. Samples treat with 5% of (RPP, ROPP and RBP) show significantly ($p < 0.05$) lower values of *psychrophilic bacterial* and total bacteria counts, increased in color a^* values (red) during the considered storage period compared to control sample suggesting a protective effect of the powders toward the myoglobin oxidation process. Also, beef burgers with RPP and RBP have highest sensory evaluation in all samples. As a result present, it supported the potential to used ROPP, RBP and RPP for maintaining beef burger formulations as a natural preservative.

Key words: Beef burger - Natural antioxidant - Antioxidant Activity- Bacteriological - Sensory Evaluation.

INTRODUCTION

Meat and meat products are really a wonderful source of bioactive compounds, such as vitamins , minerals, peptides or fatty acids, with a positive effect on human health. (**Pogorzelska-Nowicka *et al.*,2018**).

However, The physical structure and chemical composition of meat as a food are complex and very highly vulnerable to oxidation (**Rather *et al.*, 2016a and Wood *et al.*, 2008**) Or, due to microbial growth or chemical reactions, even meat products spoil quickly, like oxidation, because increased the surface area, free water level and pH of the product, and also promoting the oxidative changes, these changes create a suitable environment for spoilage and pathogenic microorganisms to grow, which mayleadto healthrisk (**Kim *et al.*,2013**). Lipid oxidation adversely affects their color, taste , texture and sensory consistency during the processing and storage of meat and meat products. Therefore, to maintain the best quality during storage, it is important to reduce these changes. Natural and synthetic antioxidants are capable of scavenging free radicals and reducing oxidative stress as a consequence. Anti-oxidative compounds oppose reactive oxygen species, avoid lipid oxidative degradation and thus increase the nutritional value of food (**Kahkonen *et al.*, 1999**). Different kinds of vegetables, fruits and spices have natural antimicrobial and anti-oxidant properties so can used for this purpose (**Hygreeva *et al.*, 2014**). Natural antioxidants via a massive number of plant sources have been studied in meat. Several of these natural antioxidants are also commercially available and several studies by various researchers have been conducted to apply commercially available plant- based natural antioxidants to meat. (**Rather *et al.*, 2016**).Alphatocopherol (vitamin E), Ascorbic acid

(vitamin C), beta-carotene (vitamin A precursor), various flavonoids and other phenolic compounds reflect the total antioxidant ability of plant materials, Spices, vegetables, as well as fruit and oils need products, also including culinary herbs (Velasco and Williams, 2011 & Pennington and Fisher, 2009). Due to the phenolic compounds and betalains present in red beet, red beet is known as a good source of natural colorants and antioxidants (Mattila and Hellstrom, 2007 and Ravichandran *et al.*, 2013). Betalains are pigments containing water-soluble nitrogen that are often used as natural pigments to give a red-purple color to foods (Delgado –Vargas *et al.*, 2000 ; Roy *et al.*, 2004 & Stintzing and Carle, 2004). The antioxidant activity of onions is well recognized and previous studies have indicated that because of their flavonol and phenolic content, onions exert an antioxidant impact (Huber *et al.*, 2009). In particular, the great anti-oxidative properties of the outer dry layer of onion were shown because the concentration of quercetin, one of the flavonols in onion peel, is higher here than in other parts (Prakash *et al.*, 2007). Onion peel ethanol extracts have been shown by (Shim *et al.*, 2012) to inhibit the lipid oxidation of ground meat. Sweet pepper is an excellent source of vitamin A, C and an essential component in the food industry where it's being used as colouring and flavouring agent and is also widely recognised to have antibacterial activities. (Luning *et al.*, 1995; Chuah *et al.*, 2008 and Wahba *et al.*, 2010). For these reasons illustrated from above data we will have application use some natural antioxidant agents such as powder of (red beet, red onion peel and red pepper) food processing.

MATERIALS AND METHOD

Materials:

fresh meat and fat was obtained from the ribs area of cow carcass were purchased from butcher at Minia city red beet,

red pepper and red onions peel and Spices get from the local market at minia Governorate .

Methods

1. Technological method

.Preparation of Plant Samples: Preparation of red onion peel powder , red beet powder and red pepper powder : according to (Sharma et al., 2014).

.Preparation of ethanolic extract of samples : Preparation of ethanolic extract from red onion peel , red beet powder and red pepper powder : according to **Ifesan et al (2017)**.

.Preparation of products: Burger Samples Preparation:

Beef burger was produced from beef carcass immediately after slaughter. Minced meat was with mixed ingredients as following: Four different formulas (control , Red beet powder (RBP), Red pepper powder (RPP) and Red onion peel powder (ROPP) of beef burger were prepared as shown in Table (1). according to (**Ibrahim, et al., 2015**) With some modifications. Other burger formulations (RBP, RPP and ROPP) were prepared by adding red beet powder , red pepper powder and red onion peel powder by 5%.

Table (1): Beef burger formulation prepared by adding red beet powder , red pepper powder and red onion peel powder by 5% .

Ingredients	control	Red- beet powder RBP	Red-Onion peel powder ROPP	Red-pepper powder RPP
Beef meat	625	625	625	625
Beef fat	200	200	200	200
Salt	15	15	15	15
Dried onion	3	3	3	3
Dried garlic	2	2	2	2
Water	100	100	100	100
Soybean flower	40	40	40	40

Spice mixture	15	15	15	15
Cardamom	3.75	3.75	3.75	3.75
Nutmeg	3.75	3.75	3.75	3.75
black pepper	7.5	7.5	7.5	7.5
Red-beet powder RBP	–	0.5	–	–
Red-Onion peel powder ROPP	–	–	0.5	–
Red-pepper powder RPP	–	–	–	0.5

Analytical methods:

-Determination of Total Flavonoids Content (TFC) :

Using a colorimetric method defined by (Zhishen, *et al.*, 1999)

-Determination of Total Phenolic Content (TPC) :

Total Phenolic Content determined depending on the way (Abd El-aal , and Halaweish,2011).

-Determination of antioxidant activity by DPPH radical scavenging activity

Determination of Total Antioxidant Activity Total antioxidant activity was determined depending on the way (Su, and Silva, 2006).

Determination of color (L, a, and b)

Color values (L*, a*, and b*) were measured for burger with a colorimeter (Color Tec PCM Color Meter Tec. NJ. USA) The value L * is a lightness calculation, a * represents the green to red chromatic scale, and b * represents the blue to yellow chromatic scale. On each sample, three random measurement spots were made and the average data collected by (Foh *et al.*, 2011).

-Microbiological analysis**A- Total plate count (TPC):**

Total plate count (TPC) determined by was using pour plate according to **Harrigan and Mc Cance, (1976)** and **ISO 8443 (2003)**. Incubated plates at 37°C for 48 h.

B- Pyschrophilic bacteria:

At 7 ° C for 10 days, plates were incubated according to **Collins et al. (1989)**

C- Escherichia coli :

Most Possible Process Number and medium Lauryl Sulfate broth were used. In Pepton Water and E.Coli broth, confirmation testing was performed according to **ISO 7251 (2005)** .

Sensory evaluation

Members of the faculty and some researchers, students were asked to evaluate sensory quality of burgers samples. Participants record the score for color, taste, texture and general acceptance as described by **Eyo,A (1983)**.

3.2.3 Study of statistics

The data was analysed using a statistical analysis method using the GLM (General Linear Model) software (**SAS, 2003**). Duncan's multiple range test compared mean values.

RESULTS AND DISCUSSION**1- Evaluated antioxidant activity, total phenol and total flavonoid in powder of red beet, red onion peel and red pepper:-**

Table (2): Total phenolic, total flavonoids and antioxidant activity content in (red beet, red onion peel and red pepper) powder.

Sample	TPC (mg/g)	TFC (mg/g)	TAA (%)
Red onion peel powder (ROPP)	59.97 ± 0.09 ^a	16.27 ± 1.15	87.55± 1.26 ^a
Red beet powder (RBP)	42.51 ± 0.04 ^b	14.54 ± 0.93	67.07± 1.09 ^b
Red pepper powder (RPP)	32.52 ± 1.65 ^c	14.00 ±1.04	62.06± 2.25 ^b

TPC - Total phenolic content, TFC - Total flavonoid content; TAA- Total antioxidant activity

Red onion peel powder had the highest TPC values, this increase in TPC values may be related to the increases in free flavanols (**Stewart et al., 2000 and Turkmen et al., 2005**).

That result is agreed with the outcomes achieved by the **Prakash et al., (2007) and Benitez et al., (2011)** whom found the The red onion skin contained the highest phenolic amount.

Data in Table (2) shown value of TFC in ROPP, RBP and RPP the value was (16.27, 14.54 and 14.00 mg/g) respectively. This result was close to the results obtained by (**Elsebaie and Essa, 2018**) whom reported that total flavonoid content in red onion peel was (13.47 and 15.98 mg/g extract) and (**Nahla et al., 2014**) whom found the total flavonoid content in onion skin powder was (18.75 mg/g).

Data in Table (2) shown that ROPP was higher in total antioxidant activity (TAA) than RBP and RPP, the results were as follows (87.55,67.07 and 62.06 %) respectively. Results are agreed with the results mentioned by (**Ly, et al., 2005; Downes et al., 2009 and Sagar et al., 2018**) Who agreed that this was the onion skin was consider rich of dietary flavonoids, polyphenols and antioxidants activity. It is a relationship between antioxidant activity, total flavonoids and total phenolic, with increase of total flavonoid and total phenolic content, show increase in the total antioxidant activity. This outcome is similar to that obtained by (**Sharififar et al., 2009**) whom reported that samples with high level of phenolic content and a good antioxidant source may be rich flavonoid plants that would help increase the overall antioxidant potential and protect it from lipid peroxidation.

Table (3): Effect of adding ROPP, RBP and RPP on colour values (L*) of beef burger during freezing storage for 6 month

Sample	Storage Time (month)			
	0	2	4	6
Control	36.36 ± 2.81 ^b	38.12 ± 2.84 ^a	38.88 ± 2.20 ^a	40.48 ± 1.35 ^a
ROPP	35.91 ± 2.11 ^{ab}	33.2 ± 2.54 ^c	33.61 ± 2.64 ^b	31.33 ± 2.07 ^c
RBP	37.38 ± 2.34 ^a	35.19 ± 1.37 ^b	34.82 ± 2.96 ^b	34.17 ± 3.96 ^b
RPP	35.91 ± 1.61 ^{ab}	35.82 ± 1.46 ^b	33.39 ± 1.96 ^b	32.11 ± 1.84 ^c

L* = lightness

Control sample had increased in L* values during storage period, When the heme protein is denatured, iron is oxidised into ferric in meat when colour changes occur (**Ganhão *et al.*, 2010**). This result agree with **Gil *et al.*, (2018)** whom reported that the brightness of frozen meat was significantly lower compared to the brightness of fresh meat, which indicates the influence of freezing.

On other hand, data present in Fig. (1) showed the major changes occurred in beef burger treat with add ROPP, RBP and RPP which decreased in value of lightness compared control sample during the storage time. Color measures of the antioxidant treated beef burger with RBP had the highest value ($p < 0.05$) In relation to the other treatment samples and control at 0 day. Also, the major changes occurred in L* values in beef burger treat with add RPP wheres have less value of lightness compared control sample during the storage time.

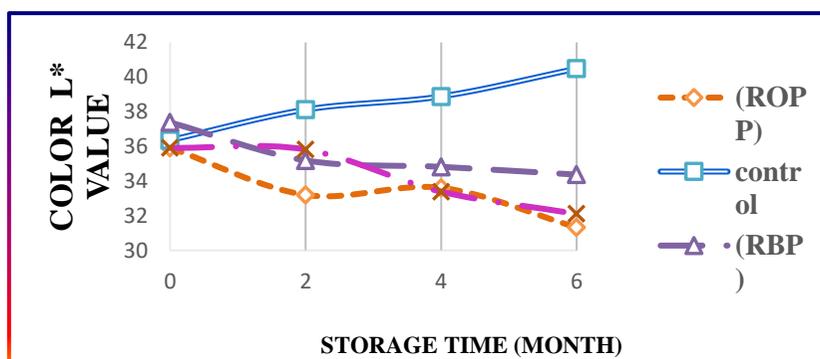
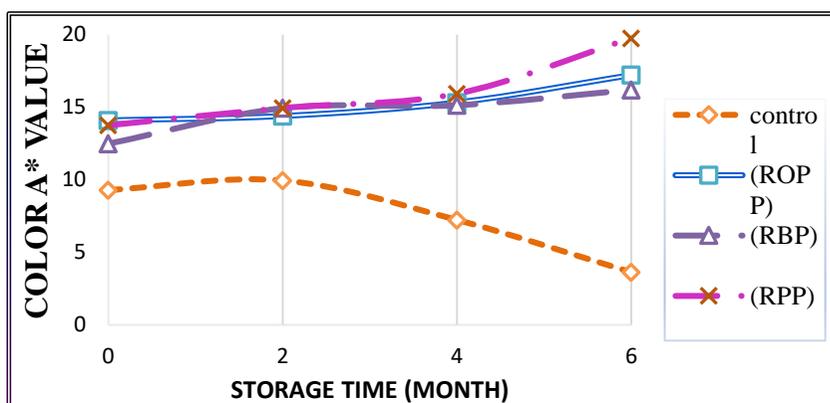


Table (4): Effect of adding ROPP, RBP and RPP on colour values (a^*) of beef burger during freezing storage for 6 month:

Sample	Storage Time (month)			
	0	2	4	6
Control	09.29 ± 2.04^c	9.95 ± 1.69^c	7.23 ± 0.83^c	3.63 ± 2.35^c
ROPP	14.09 ± 3.32^b	14.39 ± 1.48^b	15.32 ± 0.42^b	17.21 ± 2.63^b
RBP	12.48 ± 2.89^a	14.93 ± 2.76^{ab}	15.13 ± 2.91^a	16.19 ± 2.21^b
RPP	13.57 ± 2.40^a	14.94 ± 1.75^a	15.93 ± 2.69^a	19.75 ± 1.63^a

a^* = redness

control sample had decreased in a^* values during storage period. Result is agree with **Rojas and Brewer, (2008)** whom explained that colors decreased during frozen (-20°C) storage, with red color being the most affected. While, samples treat with natural antioxidant ROPP, RBP and RPP have increased in a^* values over all storage months. **Mattila and Hellstrom, (2007) and Oksuz et al., (2015)** Who verified that, due to the phenolic compounds and betalains present in red beet, red beet is known as a good source of antioxidants and natural colourants. Also, in the food industry, red pepper is an important ingredient in the manufacture of sauces, soups, pickles and pizzas as a colouring and flavouring agent. (**Chuah et al., 2008**).



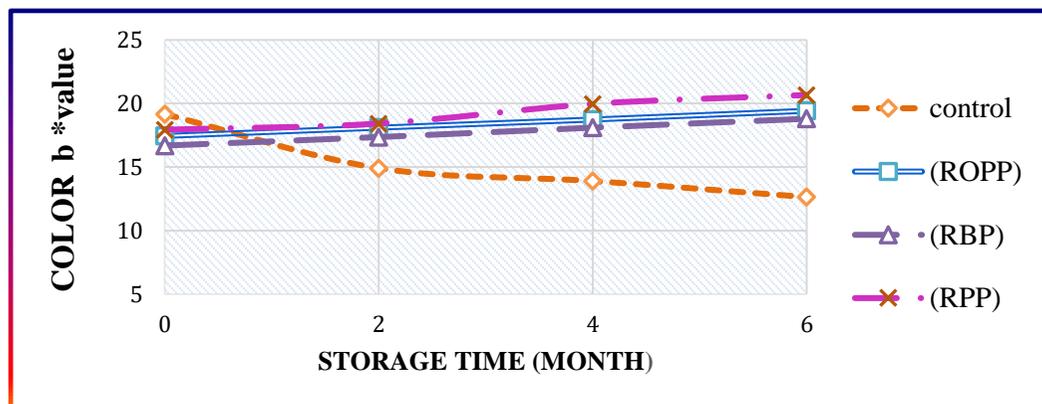
Colour values b*:

No substantial difference (b *) was found between the natural antioxidant incorporated samples and the BHT incorporated samples at development time (day 0). Data in Table observed that color b* values during freezing storage was decreasing trend in the control and increased in all treated samples.

Table (5):Effect of adding ROPP, RBP and RPP on colour values (b*) of beef burger during freezing storage for 6 month:

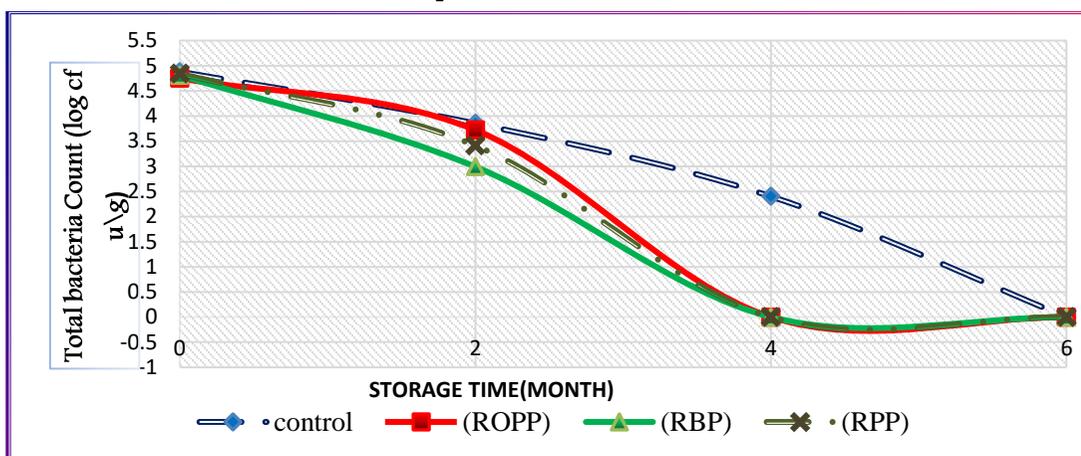
Sample	Storage Time (month)			
	0	2	4	6
Control	19.16 ± 2.63	14.91 ± 1.07 ^c	13.90 ± 1.54 ^c	12.64 ± 0.49 ^c
ROPP	17.45 ± 0.49	18.10 ± 1.77 ^a	18.74 ± 2.66 ^b	19.43 ± 1.59 ^b
RBP	16.69 ± 1.13	17.36 ± 2.17 ^b	18.10 ± 1.46 ^b	18.8 ± 2.18 ^b
RPP	17.94 ± 0.77	18.42 ± 1.79 ^a	19.97 ± 0.05 ^a	21.67 ± 1.46 ^a

The results of the current study indicated that fruits and vegetables are good sources of natural colorants, including those in cured meat, and that natural extracts have high antioxidant activity, which can potentially be used to develop natural colour stabilisers, particularly for frozen beef burger control and values (Herbach *et al.*, 2006).



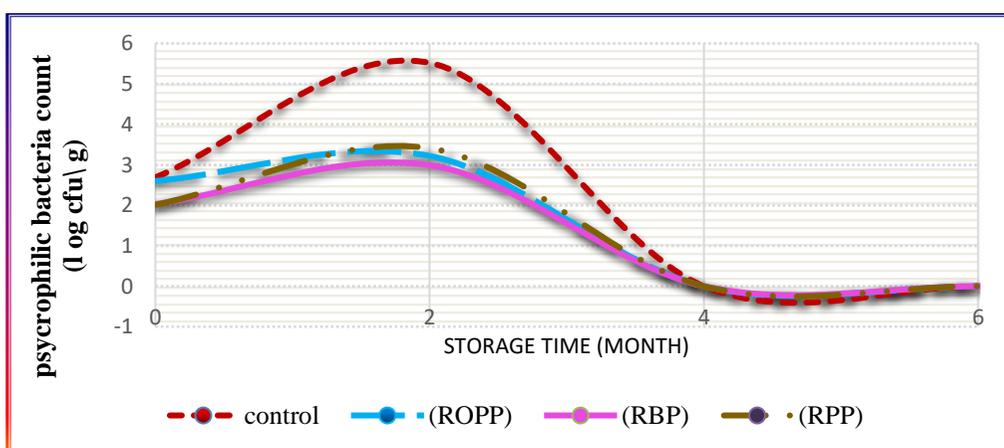
Effect addition powder of (red onion peel, red beet and red pepper) on microbiological analysis of beef burger during freezing storage for 6 month:-

Figures 4,5 displays the microbial counts determined over 6 months of storage on beef burger control sample and those with add ROPP, RBP and RPP. The results in Fig. (4), appeared that the minimum and the maximum total bacteria count in the beef burger samples at zero time were ranged from (4.88- 4.81) log CFU/g, The grinding of the meat is suggested to increase its surface area, favouring microbial growth (Milani *et al.*, 2003). And total bacteria count was decreased at second month where it's ranged (3.85-2.99) log cfu/g. On other hand, at the 4 month beef burger samples with add ROPP, RBP and RPP showed no count of bacteria, while control sample recorded (2.4 log cfu/g). Result's was agree with El-Hosieny, (2015) who found that due to their antibacterial function, the addition of garlic and pepper powder has caused the bacterial count in fish fingers to decrease.

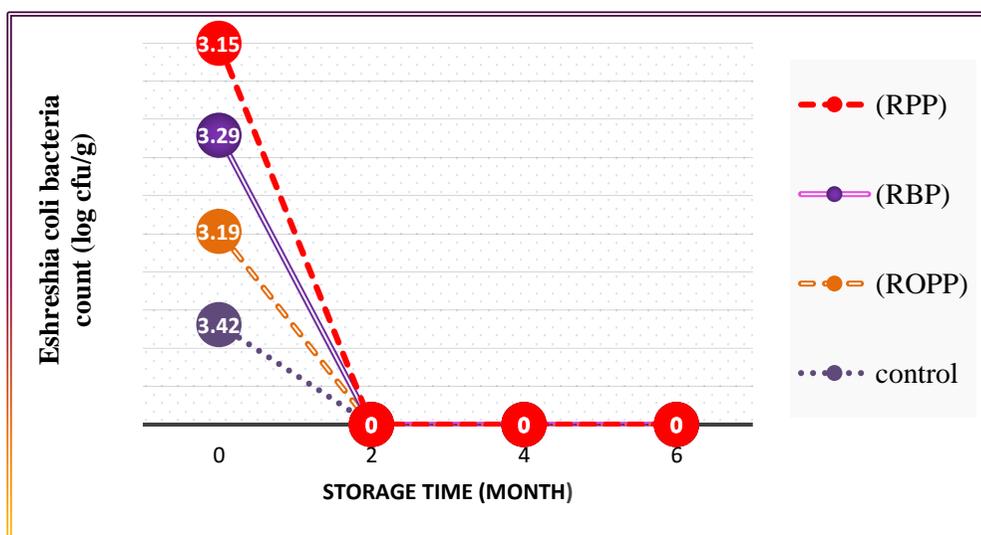


Effect of natural antioxidants on the total bacterial counts of beef burger during storage

Regarding the *psychrophilic bacterial* counts, were found that control sample had the highest count at zero time than those samples with ROPP, RBP and RPP. Although after 2 months of storage Some variations between samples have been reported, the addition of RBP, ROPP and RPP strongly inhibited the growth of *psychrophilic bacterial*, registering at the values a lower in samples was (2.99, 3.22 and 3.41 log CFU/g) respectively in comparison to control (5.52 log CFU/g).



Coliform bacteria are regarded as important microbiological health markers, stressing hygiene in all stages of food preparation and handling. (Darwish *et al.*, 2015). Data in Fig. was observed that control sample had higher *E. coli* count compared to samples with add natural antioxidant (ROPP, RBP and RPP). On other hand the *E.coli* It was not found in all frozen beef burger samples analysed at 2, 4, and 6 months of storage.



Effect of natural antioxidants on *E.Coli* counts of beef burger during storage

Effect addition powder of (red onion peel, red beet and red pepper) on sensory evaluation of beef burger during freezing storage for 6 month:-

Color, taste and texture are the most significant sensory attributes that affect consumer acceptance of meat products (Aliakbarlu and Sadaghiani, 2015).

Sensory assessment findings of beef burgers are seen in Table. Data observed that control beef burger sample had the fewer score than those samples. Generally, adding natural powder The sensory properties were influenced by beef

burger formulations. Beef burger samples with add (RPP, RBP) had the highest taste scores by panelists was (8.37) and acceptability 8.57 and 8.25% respectively.

Moreover, The key explanation for the improved sensory scores of beef burger formulations with the addition of natural antioxidant powders (ROPP, RBP and RPP) was the antioxidant properties of natural powder by avoiding the development of oxidation, off-flavors and off-odors during storage period.

Table (6):Sensory evaluation of different beef burger formulations with adding ROPP, RBP and RPP.

	1	2	3	4	5	6
Formulati on	Texture	Color	Odor	Taste	shape	General acceptabili ty
Control	7.25 ±0.1	7.37±0.8	7.44±0.5	7.12±0.7	6.62±0.1	7.12±0.2
R.P.P	8.57±0.5	7.85±0.3	8.57±0.1	8.37±0.5	8.14±0.1	8.57±0.7
R.B.P	8.37±0.1	8.25±0.1	8.25±0.2	8.37±0.2	7.37±0.5	8.25±0.1
RO.P.P	7.44±0.3	7.55±0.4	7.55±0.1	7.22±0.1	7.77±0.9	7.44±0.1

Reference:

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