EFFECT OF REPLACEMENT NITRITE BY BEET ROOT AND SILYBUM MARIANUM POWDER IN PHYSICAL CHARACTERISTICS AND LIPID OXIDATION FOR PASTERMA

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ABSTRACT

This study was aimed to decreasing the use of nitrite in Pasterma (sausage in Iraq) in traditional condition, beetroot and milk thistle was used with (75% veal meat and 25% pelvic and kidney fat),the treatment were divide (T1): (0.075 ppm milk thistle with 0.075 ppm beetroot), (T2): (0.075 ppm nitrite with 0.075 ppm milk thistle powder),(T3): (0.075 ppm nitrite with 0.075ppm beetroot powder), (T4):Addition of the synthetic antioxidant Betalyted Hydroxy Anisole (0.01%) BHA. The physical properties resulted in cooking loos, WHC, T3the treatment excelled (8.17)%and 39.12% respectively, Fat oxidation measurements (TBA 3.02 Malone Didehyde/kg, and peroxide value 0.56 mEq/kg fat) inT3 sample show significant differences the best value ,the result are consistent with the measurements reducing power assay and DPPH – assay it was better in T3.

Key words: sausage. Nitrite, beetroot, milk thistle, Reducing power, TBA, DPPH.

تأثير استبدال النتريت بمسحوق الشمندر وشوك الجمل في الصفات الفيزيائية واكسدة الدهون للباسطرمة

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المستخلص

هدفت الدراسة تقليل استخدام النتريت في البسطرمة التقليدية، تم استخدام جذر الشمندر وشوك الجمل مع (75٪ لحم عجل و 25٪ دهن حوض وكلى)، اذ قسمت المعاملات الى مايلي: المعاملة 0.075 ppm (T1) شوك الجمل مع 0.075 ppm من الشمندر،(T2) ppm0.075 نتريت مع 0.075 ppm شوك الجمل ، (T3) ,ppm0.075 نتريت مع ppm0.075 شوندر،(T4)مضاد اكدة صناعي BHA 0.01%ودرست الصفات الفيزيائية الفقد بالطبخ، قابلية اللحم على الاحتفاظ بالماء WHC، اذ تفوقت المعاملة T3 اذ بلغت (8.17)٪ و 39.12٪ على التوالي، وقياسات أكسدة الدهون والتي تضمنت اذ سجلت اقل قيمة TBA اذ بلغت (3.02 Malone Didehyde / kg) ، وقيمة البيروكسيد اذ سجلت 0.56 / mEq kg fatوفي المعاملة T3 التي أظهرت اختلافات معنوية وسجلت أفضل قيمة، وبينت نتائج قياسات القوة الاختزالية ومضادات الاكسدة لنبات الشمندر ان المعاملة T3 اذ كانت الأفضل مقارنة بباقي المعاملات.

الكلمات المفتاحية: سجق، نترات، الشمندر، شوك الجمل، القوة الاختزالية، DPPH، TBA.

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INTRODUCTION

Nitrite is widely used as curing agent in sausage and other cured meat products because it inhibits eliminates *Clostridium botulinum*, this bacteria development of food poisoning anaerobic microorganisms, delays oxidative rancidity, develops flavor of sausage and meat production and preserves the red. Nitrite is a source of formation carcinogenic nitrous compounds (15, 17). In developed countries, there is a desire preference for products that are safe, healthy, nutritious and attractive (12, 20), studies have been conducted to add natural materials to replace nitrites (2).Beetroots (BT) have a potential in preference of meat products due to the high nitrate content (25) and it is a gold mine of antioxidants (3, 13) besides that contributing to the development of color in meat products. Beetroot works antiviral and antimicrobial since of betalain pigments (14). beetroots are vegetable that have world-wide distribution., world production of beetroot was found to be 269,714 million tons in 2014 (9), , *Silybum marianum* commonly known as milk thistle (MT) considered a rich source of many active ingredients scavenging Free radical (7, 22) plants have various flavonolignans which is considered rich source In animal nutrition and disease. i.e., silybin being the major one .It is included in protection, SM alone, or in other hepato-active compounds (carnitine, betaine, vitamin B12, etc.), has effects on liver so it is described in human nutrition (22, 26). The objective of this study was to evaluate the possibility of using some vegetable powders (BT) And (MT) as an alternative to nitrates in the production of fermented sausage and assessing its hygienic, sanitary, sensorial and qualitative characteristics.

MATERIALS AND METHODS

Pasterma formulation and manufacture: The pasterma was processed according to the method mentioned (13) and the treatment divided to four groups; First treatment (T1): (0.075 ppm milk thistle with 0.075 ppm beetroot), Second treatment (T2): (0.075 ppm nitrite with 0.075 ppm milk thistle powder) The third treatment (T3): (0.075 ppm nitrite with 0.075 ppm beetroot powder), Fourth treatment (T4): Addition of the synthetic antioxidant Betalyted Hydroxy Anisole (0.01%) BHA. Mixture of the meat with fat for the following 75% veal meat and 25% of the fat pelvic and kidney were cut pure using an electric chopping machine, then add both salt and sugar were .1.5% and 0.5%, spicy 1% per /1 kg, The finely chopped sausage mixture was then packaged in natural casings (from cleaned cow small intestine then sterilized in 15% NaCl with 1% Acetic Acid). the pasterma was kept in the refrigerator at a temperature of 4 Cº for 21 days and the periods were divided into 1,7,14,21 days. Physical measurements and indicators of lipid oxidation .The estimation of cooking loss according to procedure (4).And water holding capacity (WHC) according to (6), Thiobarbituric acid value (TBA),peroxide value (PV) (5, 27), respectively. Reducing Power Assay was following (8). DPPH assay: Antioxidant extract 0.04 g DPPH was dissolved in 100 mL of methanol Note that the concentration of (DPPH) is (400ug/ ml) (21) To prepare the standard solution (vitamin C) and sample , 0.5 g of vitamin c was taken and mixed with a (100 ml) of methanol and distilled water. The concentration of the standard solution was (5000 ppm) and using the dilution law, the other concentrations were prepared (60, 120, 250, 500 ppm) from vitamin C and sample (60, 120, 250, 500 ppm) Then completed the measurement as mentioned (1, 19). The statistical program used statistical analysis (23) in the data to study the effect of treatment and time and their interaction on the studied traits according to a factorial experiment applied completely randomly (CRD), and the significant differences between the means were compared with Duncan multinomial test.

RESULTS AND DISCUSSION

Data in Table (1) shows that there was a significant decrease ($P<0.01$) in the cooking loss percentage (8.17%) for T3 treatment (0.75 beetroot with 0.75 nitrite) in the 21-day storage period, as compared to other treatments. As for the storage periods, the results of the statistical analysis indicated that there were a significant difference ($P<0.01$) between the periods, as the percentage of losing when cooking was at its highest level in the period 1 day and then began to decline with the progress of the storage period until it reached its lowest percentage in the period of

21 days. Because moisture content in the sausages that decreased gradually as the processing time increased (10).

Table 1. Effect of the interaction between the treatments and the period of refrigeration in the percentage of cooking loss (%) ±standard error of manufactured pasterma

Treatment	Peroid /day 1	7	14	21	Average of Treatment
T_1	20.28^c±0.02	17.42^h±0.02	12.36^k ±0.01	9.86^o±0.02	14.98^B±1.54
T_2	18.68^e±0.02	16.45^i ±0.02	12.24^l±0.01	10.00^n±0.00	14.34^C ±1.28
T_3	18.24^f±0.02	17.75^g±0.01	10.43^m±0.02	8.17^p±0.02	13.65^D ±1.67
T_4	27.25^a ±0.02	20.47^b±0.02	18.82^d±0.02	14.88^j ±0.00	20.35^A±1.68
Peroid Avrage	21.11^A ±1.36	18.02^B ±0.56	13.46^C±1.20	10.73^D±0.94	-

Different letters indicate significant differences (p≤0.01) between (T1) : (0.075 ppm milk thistle with 0.075 ppm beetroot), (T2): (0.075 ppm nitrite with 0.075 ppm milk thistle powder) ,(T3): (0.075 ppm nitrite with 0.075 ppm beetroot powder), (T4):Addition of the synthetic antioxidant Betalyted Hydroxy Anisole (0.01%) BHA.n means

Results in Table (2) show significant increase (P<0.01) in the percentage of WHC (39.12%) for treatment T3 (0.75 beetroot with 0.75 nitrite) in the 1 day storage period, as compared to treatment T2 (ppm 0.75) with milk thistle with 75.0 ppm nitrite), which recorded the lowest significant difference (P<0.01) (29.%) in the 21-day period. There are significant differences between the rates of the addition treatments, as it was noted that there is a significant superiority (P<0.01) in flavor of treatment T3 (0.75 beets with 0.75 nitrite), which amounted to 35.74% as compared to treatment T2, which amounted to 32.66% , and there were significant differences between the rates of the treatments. The reason for the decrease in WHC may be due to the evaporation of the water from the surface of the meat and the breaking of the bonds that bind the protein with the water when the protein is decomposed by the decomposing enzymes, and then the meat's ability to bind with water is reduced and its evaporation is easy (18)

Table 2. Effect of the interaction between the treatments and the period of refrigeration in the percentage of water holding capacity (WHC) (%) ± standard error of manufactured pasterma

Treatment	Period /day 1	7	14	21	Average of Treatment
T_1	38.29^b±0.01	35.09^e±0.01	33.73^h±0.04	32.84^k±0.03	34.99B±0.78
T_2	37.73^c±0.02	33.12^i±0.01	30.77^m±0.01	29.05^n±0.04	32.66D±1.23
T_3	39.12^a±0.01	36.18^d±0.01	34.63^f±0.02	33.04^j±0.03	35.74A±0.84
T_4	37.67^c±0.02	34.04^g±0.03	33.00j±0.01	31.54^i±0.03	34.06C±0.85
Peroid Avrage	38.20^A±0.22	34.61^B±0.43	33.03^C±0.53	31.61^D±0.60	-

Different letters indicate significant differences (p≤0.01) between (T1) : (0.075 ppm milk thistle with 0.075 ppm beetroot), (T2): (0.075 ppm nitrite with 0.075 ppm milk thistle powder) ,(T3): (0.075 ppm nitrite with 0.075 ppm beetroot powder), (T4):Addition of the synthetic antioxidant Betalyted Hydroxy Anisole (0.01%) BHA.n means .

Data in Table (3) shows the effect of the interaction between different treatments and storage periods, on the TBA value of the processed pasterma , as it was noticed that there was a significant increase (P<0.01) in the TBA value of Malone Didehyde/kg meat) for the T2 treatment, which amounted to (1.33Malone Didehyde/kg meat) In the storage period of 21 days, as compared to treatment T3, which recorded the least significant difference (P<0.01) in the period of 1 day. The average of the TBA value for T3 (0.75 beetroot with 0.75 nitrite) was recorded the lowest percentage (0.56 Malone Didehyde/kg meat). Data in Table (4) shows the effect of the interaction between different treatments and storage periods, on the peroxide value of the processed pasterma. It was noticed that there was a significant increase (P<0.01) in the peroxide value of (6.01 mmeq/kg fat) for the treatment T2 (ppm 0.75 with milk thistle with 75.0 ppm nitrite) in The period was 21 days, and we noticed a significant decreases (P<0.01) in T3 treatment (0.75 beet with 0.75 nitrite) (11.1 mEq/kg fat) in the1day period, and there were different differences between treatments and for different storage periods. It is noted from Table (4) that there are significant differences between the rates of the addition treatments, as it was noted that there is a significant superiority (P<0.01) in favor of the T2 treatment, which amounted to (3.47

mEq/kg fat) as compared to the T3 treatment, which amounted to (3.02 mEq/kg fat). As the values of TBA and PV was at its lowest level in the period 1 day and then began to rise with the progress of the storage period until it reached its highest value in the period of 21 days.

Table 3.The effect of the interaction between the treatments and the period of refrigeration in the the value of Thiobarbituric acid (TBA) (Malone Didehyde/kg meat) ± standard error of manufactured pasterma

Treatment	Peroid /day				Avrage of Treatment
	1	7	14	21	
T_1	1.22^l ±0.01	2.76^h±0.01	3.52^e±0.01	5.81^b±0.01	3.32B±0.62
T_2	1.36^k ±0.01	2.86^g±0.01	3.68^d±0.01	6.01^a±0.02	3.47A±0.63
T_3	1.11^m±0.01	2.42 ^{j}±0.01	3.43^f ±0.00	5.11^c±0.01	3.02D±0.55
T_4	1.19^l ±0.01	2.71^i ±0.01	3.45^f±0.01	5.78^b±0.01	3.28C±0.62
Peroid Avrage	1.22^D±0.03	2.68^C±0.06	3.52^B±0.03	5.68^A±0.12	-

Different letters indicate significant differences (p≤0.01) between (T1) : (0.075 ppm milk thistle with 0.075 ppm beetroot), (T2): (0.075 ppm nitrite with 0.075 ppm milk thistle powder) ,(T3): (0.075 ppm nitrite with 0.075 ppm beetroot powder), (T4):Addition of the synthetic antioxidant Betalyted Hydroxy Anisole (0.01%) BHA.n means

The increases in the TBA and peroxide values may be due to the progression of the storage period, this causes an increase in fat oxidation and peroxides are broken down, and its production increases with the progression of the period of refrigeration. Also, beetroot additives have a great role in reducing fat oxidation because it is a strong antioxidant (11).

Table 4.Effect of the interaction between the treatments and the period of refrigeration in the the peroxide value (PV) (mEq/kg fat) ± standard error of manufactured pasterma

Treatment	Peroid /day				Avrage of Treatment
	1	7	14	21	
T_1	0.32^k±0.01	0.53^{ih}±0.02	0.84^e ±0.01	1.07^b±0.01	0.69B±0.10
T_2	0.50^i ±0.01	0.66^g±0.00	0.96^{dc}±0.01	1.33^a±0.01	0.86A±0.11
T_3	0.26^l±0.01	0.40^j ±0.01	0.67^g ±0.01	0.93^d±0.01	0.56C±0.09
T_4	0.43^j±0.01	0.56^h±0.01	0.79 ^{f}±0.01	0.97^c±0.01	0.68B±0.07
Peroid Avrage	0.38^D±0.03	0.53^C±0.03	0.81^B±0.03	1.07^A±0.05	-

Different letters indicate significant differences (p≤0.01) between (T1) : (0.075 ppm milk thistle with 0.075 ppm beetroot), (T2): (0.075 ppm nitrite with 0.075 ppm milk thistle powder) ,(T3): (0.075 ppm nitrite with 0.075 ppm beetroot powder), (T4):Addition of the synthetic antioxidant Betalyted Hydroxy Anisole (0.01%) BHA.n means

Reducing power assay of beetroot and milk thistle : Result In Table (5) shows that the beetroot has the greater reducing power assay as compared to the milk thistle to give hydrogen ions or increase the hydroxyl radical and thus increase the reducing power, which is an indicator that reflects the strength of the antioxidant activity of the beetroot (24).

Tabel 5. Reducing power assay (µg ascorbic acid equivalent/mg extract) of beetroot and milk thistle

No	Con (mg/ml)	Reducing Power Assay
Beetroot	20	4.22
	40	4.89
	60	5.46
	80	5.75
Vit C	100	6.22
	100	5.42
Milk thistel	20	4.02
	40	4.38
	60	4.98
	80	5.36
	100	5.79

Estimation of the antioxidant activity of DPPH-assay

Results in Table (6) show that the antioxidant activity of beetroot and milk thistle increases with increasing concentration. The effectiveness of beetroot followed by milk thistle at a concentration of 60ppm showed a higher ability than vitamin C and increased as the concentration of beetroot and milk thistle increased, and the concentration of 120 ppm showed the best results, as it reached 74.1 and 69.5 in beetroot and milk thistle in comparison. With vitamin C 63.7, the reason for the high antioxidant activity of beetroot and milk thistle is due to the effective compounds that the two plants possess, which can be hydrogen and electron donors or have the ability to scavenge free radicals (16, 28,29).

Table 6. Estimation of the antioxidant activity of DPPH- assay of milk thistle and beetroot compared to vitamin C

AA %	60 ppm	120 ppm	250 ppm	500 ppm
Vit C	48.6	63.7	70.5	79.5
beetroot	53.6	74.1	78.9	89.7
Milk thstel	50.9	69.5	74.6	83.9

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