Determination of natural and artificial preservatives in meat products

Dalia, A.E. Salim and Sahar, M.A. El-Baz
Department of Food Hygiene.
Animal Health Research Institute, Dokki, Giza.

Abstract
A total of sixty samples of meat products including locally manufactured beef burger, beef luncheon and canned corned beef (20 of each) were examined for determination of the level of NaCl %, nitrite and ascorbic acid (ppm) .The mean value of NaCl% was 2.59± 0.68, 3.52± 0.66 and 3.74± 0.65 with minimum values 1.5, 2.5 and 2.9 (%) and maximum values 3.9, 5 and 4.6 (%) for the examined beef burger, beef luncheon and canned corned beef samples, respectively. The percentage of the examined meat products samples which exceeded the international permissible limit according to **(FAO, 2007)** for NaCl %was 70%, 70% and 80% of the examined beef burger, beef luncheon and canned corned beef samples. The mean value of nitrite level (ppm) in the examined meat products samples was 106.55± 26.46, 101.4± 23.83 and 43.15± 9.84 (ppm) in the examined beef burger, beef luncheon and canned corned beef samples, respectively with minimum values 58,63 and 25 and maximum values 145, 140 and 59 (ppm) for these products. While no sample from the examined beef burger, beef luncheon and canned corned beef samples, exceeded the international permissible limit of nitrite recommended by **FAO (2007)** for these products. The mean value of ascorbic acid level was 518.9± 86.76 for the examined beef burger samples and 502.7± 46.24 for the examined beef luncheon samples also 60% of the examined beef burger samples exceeded Egyptian permissible limit **(E.S.S, 2005)** for ascorbic acid and 100% of the examined beef burger and beef luncheon samples exceeded the international limit recommended by **FAO (2007).** Ascorbic acid failed to be detected in the examined canned corned beef samples.

Key words: *beef burger, beef luncheon, canned corned beef, ascorbic acid , nitrite.*

Introduction

People have preserved meat naturally for thousands of years, but in recently chemical and synthetic preservatives are often used, various preservatives are added to meat products to extend shelf –life and enhance food safety **(Ruiz-Capillas and Jimenez-Colmenero, 2008).**

Preservation is designed to enhance or protect food with maintaining or improving the product quality. Through inactivating or inhibiting the growth of undesirable microorganisms. Many methods of preservation are available to food processors including addition of chemical preservatives **(Sabreen and El-brens Enas, 2001).** Artificial preservatives as nitrite and ascorbic acid are chemical substances that are added to food, either mixed in or sprayed on the product, in order to prevent discoloration, spoilage or bacterial contamination before it can be consumed. While natural preservatives as NaCl prevent oxidation that lead to spoilage and rancidity, and also form a barrier to other contaminants.

The usual processing of cured meat is to incorporate sodium chloride, sodium nitrite, a reducing agent (such as ascorbate) and other ingredients such as seasonings **(El-Kewaiey and Al-Tedawy, 2012).**

Salt addition to processed meats can help increase water binding in the muscle tissues, leading to increased yields (more products to sell) and greater tenderness. The mechanism by which salt increase water binding is not fully understood, but it is thought to be related to the ability of salt to create repulsion between myofibillar proteins **(Desmond, 2007).**Salt added to meat system serves three main functions: extracting salt soluble proteins, enhancing flavor, and extending the shelf life **(Claus *et al*.,**

1994). Spoilage and pathogenic bacteria such as *Escherichia coli* O_{157} :H_7, *Listeria monocytogenes*, *Salmonella spp., Staphylococcus aureus*, *Clostridium botulinum*, and Lactic acid bacteria have various tolerance and differ in their response to salt. Among other factors, these depend on microbial tolerance to NaCl, type and concentration of NaCl, exposure time, pH, and temperature. *Salmonella spp*., *Staphylococcus aureus*, and *C.botulinium* have ability to grow in brine solutions with high salt concentrations and at low temperatures **(Marsden, 1980).** Therefore, using a combination of ingredients and processing methods, such as curing process, that employ both NaCl and nitrite is important in controlling microbial growth. On the other hand, salt may cause undesirable effects in that it may accelerate oxidation of meat pigments and fats, resulting in brown off colour and rancid taste. Nitrite plays an important role in prevention of these changes **(Muller, 1991** and **Flores and Toldra, 1993).**
Excessive intake of NaCl has been linked to serious cardiovascular diseases causing a recent increase in the development of reduced salt products **(Stollewerk *et al*., 2012).**
Sodium or potassium nitrite is widely used as a curing agent in cured meat products because it inhibits outgrowth and neurotoxin formation by *Clostridium botulinum*, delays the development of oxidative rancidity, develops the characteristic flavor of cured meats, and react with myoglobin and stabilizes the red meat colour . As soon as nitrite is added in the meat formulation, it starts to disappear and the nitrite that has not reacted with myoglobin and it is available corresponds to residual nitrite level **(Viuda -Martos *et al*., 2009).** Nitrite has been a valuable antibotulinal agent in cured meats and may offer some protection from other pathogens in these products .It is impossible to find another single compound to replace it (**Baseler, 2009)** nitrite's use in food has been clouded by suspicions that nitrite could react with amines in the gastric acid and form carcinogenic nitrosamines, leading to various cancers **(Archer, 2002).** Epidemiological evidence showed a relationship between consumption of cured meats and incidence of childhood leukemia, brain tumors, methaemoglobinaemia (blue baby syndrome) and cyanosis due to the reaction of nitrite with hemoglobin in the red blood cells. Some of these signs may appear in young children and elder person **(Sen and Baddoo, 1997).**
Sodium ascorbate is commonly used as reductants that play a role in increasing the rate of color formation in cured meats in which nitrite is converted to nitric oxide and bind to iron which present in myoglobin lead to color formation. Although the reduction of nitrite and myoglobin iron often occurs naturally, reductants can speed up this process **(Hedrick *et al*., 1994).** The other essential role of sodium ascorbate is to retard the formation of N-nitrosamines, carcinogenic compounds that can be formed from residual nitrite especially during high-temperature cooking **(Doyle *et al*., 2001).** Long-term or high-dosage consumption of ascorbic acid may play a role in calcium oxalate kidney stone formation **(Auer *et al*., 1998).** .
Therefore, the objective of the present study aimed to investigate the level of NaCl, Nitrite and Ascorbic acid in locally manufactured (beef burger, beef luncheon and canned corned beef) collected from different supermarkets in menoufia governorate.

Material and Methods

1-Samples collection

A total of 60 randomly collected meat products samples (20 each of beef burger, beef luncheon and canned corned beef) were purchased from different supermarkets all over Menoufia governorate. Each sample was placed separately into polyethylene plastic bag, identified and delivered to the laboratory for chemical examination.

2-Chemical examination:

2-1-Determination of NaCl % **(AOAC, 1990)**
2-2-Determination of nitrite levels **(AOAC, 2000)**
2-3-Determination of Ascorbic acid **(Pearsons, 1991)**

Results and Discussion

Table (1). Statistical analytical results of NaCl % in the examined meat products (n= 20 of each).

Meat products	NaCl %			Samples exceeded international permissible limit (FAO,2007)	
	Minimum	Maximum	Mean ± S.E.	N	%
Beef Burger	1.5	3.9	2.59 ± 0.68	14	70%
Beef Luncheon	2.5	5	3.52 ± 0.66	14	70%
Canned Corned Beef	2.9	4.6	3.74 ± 0.65	16	80%

-According to **FAO (2007)** the permissible limit of NaCl % is 1.5 to 2.2% for Beef Burger, maximum 3% for beef Luncheon and 1.5 to 3% for Canned Corned Beef.
-According to **E.S.S (2005)** the addition of NaCl is related to good manufacturing practice **(E.S.S. No 1688, 1114 and 1563/ 2005)** for beef burger, beef luncheon and canned corned beef.

Table (2). Statistical analytical results of Nitrite levels (ppm) in the examined meat products. (n = 20 of each).

Meat products	Nitrite levels (ppm)			Samples exceeded the international permissible limit (FAO, 2007)	
	Minimum	Maximum	Mean ± S.E.	No	%
Beef Burger	58	145	106.55 ± 26.46	0	0%
Beef Luncheon	63	140	101.4 ± 23.83	0	0%
Canned Corned Beef	25	59	43.15 ± 9.84	0	0%

- According to **FAO (2007)** the permissible limit of nitrite level of meat products up to 200 ppm.
- The nitrite level is added to meat products according to legislations, laws and codex permissible limits **(E.S.S, 2005).**

Table (3). Statistical analytical results of Ascorbic acid levels (ppm) in the examined meat products. (n = 20 of each).

Meat products	Ascorbic acid (ppm)			Samples exceeded the Egyptian permissible limit (E.S.S,2005)		Samples exceeded the international permissible limit (FAO,2007)	
	Minimum	Maximum	Mean ± S.E.	N	%	N	%
Beef Burger	390	630	518.9 ± 86.76	12	60%	20	100%
Beef Luncheon	420	587	502.7 ± 46.24	0	0%	20	100%
Canned Corned Beef	ND	ND	ND	ND	ND	ND	ND

-According to **FAO (2007)** the permissible limit of ascorbic acid represented 300ppm.
-According to **E.S.S. (No. 1688/2005)** the permissible limit of ascorbic acid in beef burger represented 500 ppm.
-**ND:** Not Detected.

Preservatives are substances added to foods to prevent growth of or destroy microorganisms, as well as inhibited the enzymatic and oxidative processes in food. Biochemical mechanisms of action of preservatives are very various. Under normal circumstances and normal amounts of consumption a certain amount of preservatives in food should not have adverse effects on health **(Pisinov *et al.*, 2010)** so Preservative determination is essential for the purposes of legislation and consumer safety **(Ruiz -Capillas and Jiménez-Colmenero, 2009).**

Salt was initially used before refrigeration was available for its ability to preserve meat by decreasing the water accessible to bacteria **(Romans *et al.*, 1994)**. Salt acts by decreasing the water activity (aw), water that is available for use by microorganisms, in meat which inhibits the growth of most bacteria **(Coultate, 2002).**

Sodium chloride is included in meat formulations for its ability to extract protein and aid in protein swelling. **Munasinghe and Sakai (2004)** found that sodium chloride became more effective at extracting protein as meat pH increased from 6.0 to 6.5. As protein swells, there are more locations for water to bind to the protein, this decreases free water available and can increase the cook yield through water retention **(Baublits *et al.*, 2006).**

Table (1) showed that the mean value of NaCl% was 2.59± 0.68, 3.52± 0.66 and 3.74± 0.65 with minimum values 1.5, 2.5 and 2.9 (%) and maximum values 3.9, 5 and 4.6 (%) for the examined beef burger, beef luncheon and canned corned beef samples, respectively. NaCl percentages of the examined meat products samples which exceeded the international permissible limit according to **FAO (2007)** 70%, 70% and 80% of the examined beef burger, beef luncheon and canned corned beef samples exceeded this limit while **E.S.S.(No 1688, 1114 and 1563/ 2005)**for beef burger, beef luncheon and canned corned beef determined the addition of NaCl to good manufacturing practice .

Nearly similar result was recorded by **Abu-Zid (1998)** and **Aktas *et al.* (2003)** who reported that NaCl% concentration in various meat products ranged between 2-6%. Lower values were obtained by **Tolba *et al.* (1994), Aieda-Hoda (1995)** and **El-Khawas (1996)** while higher values was obtained by **Skrökki(1995)** who recorded that most of the examined meat product samples contained large amounts of sodium chloride".

Decreasing salt content considerably affect the textural changes, flavor differences, decreased moisture retention (yield), shortened shelf-life affected safety and even appearance (**Sahoo *et al.*, 2004)**. While excess use of NaCl has undesirable effects on the flavor, color and appearance of meat **(Pearson and Gillett, 1999).**

As a result of the main source of sodium in the diet is sodium chloride and sodium intake exceeds the nutritional recommendations in many industrialized countries that excessive intake of sodium has been linked to hypertension and consequently to increased risk of stroke and premature death from cardiovascular diseases (**Ruusunen- Marita and Eero Puolanne, 2005)**. So the British meat industry has committed to reduce the salt, or more specifically sodium content of its products. To this end an action plan for sodium reduction in meat products has been developed which focuses on those products with the highest sodium contents and encourages producers to seek opportunities to reduce the sodium content of all meat products **(Mathews and Strong, 2005)**

Once nitrite is formed in meat, it is in equilibrium with nitrous acid, this reaction is pushed towards nitrous acid then nitrous acid is converted to nitric oxide The formation of nitric oxide is accelerated when reductants such as erythorbate and ascorbate are present **(Borchert and Cassens, 1998**). Reductants accelerate the production of nitric oxide by reacting with nitrous acid to form nitric oxide, water, and dehydroascorbate **(Izumi *et al.*, 1989).** Nitric oxide then binds to iron in myoglobin, a protein naturally found in muscle, by taking the place of a water molecule bound to myoglobin, to produce nitric oxide myoglobin, which has a bright red pigment and is an unstable molecule **(Fennema, 1996).** Upon heating a meat product to a minimum of 65.6° C the globin portion of nitric oxide myoglobin is denaturated by heat to form nitrosylhemochrome, the stable pink pigment of cured meat **(Fox, 1966)**.The second primary use for nitrite is to inhibit *C.botulinum* growth and toxin formation, although not necessarily spore germination Its effectiveness is affected by temperature and salt concentration. Although 50 ppm (mg /kg) initial nitrite levels are sufficient for the meat color desired, up to 200ppm, depending on the country, is used for antibotulinal activity. The result has been the almost total absence of botulism in cured meat. Its effect on non- spore-formers is distinctly genus dependent. As with the organic acids, lower pH noticeably improves the antimicrobial activity of nitrite **(Labb'E and Nolan, 2009).**

Table (2) showed the mean value of nitrite level (ppm) in the examined meat products samples that 106.55± 26.46, 101.4± 23.83 and 43.15± 9.84 (ppm) in beef burger, beef luncheon and canned corned beef samples, respectively with minimum values 58,63 and 25 and maximum values 145, 140 and 59 (ppm) for these products.

Nearly higher values were recorded by **Tolba *et al*. (1994)**, **Aieda-Hoda (1995)**, **Abu-Zid-Suzan (1998), Ahmad (2004)** and **Farag and Abd-El-Fattah-Noha (2011)** while lower values were reported by **Zahran-Dalia and Kassem-Gehan (2011**) and **El-Kewaiey and Al-Tedawey (2012)**.

Concentration of nitrite added to meat product is affected by several factors including: cooking process, water activity, salt concentration, PH, storage time and temperature. Hence, the lowest level of nitrite to have a protective effect against microbiological risks, such as *C.botulinum*, will differ in different products **(Rahman, 2007).**

Non of the samples was exceeded the Egyptian permissible limit (**E.S.S., 2005**) and international permissible limit recommended by (**FAO, 2007)** for nitrite level in all the examined samples **(table 2)**.

Worldwide, the Permissible limits for residual nitrites in meat products have been established according to the processing condition of the meat product ranged from 40-100 ppm **(E.S.S /3597, 2005, E.S.S /3598, 2005., Shemshadi *et al*., 2006 and Bao-jin *et al*., 2007).** From 1998 to 2006 in Denmark, the maximum in going level of sodium nitrite permitted is 60 ppm for most products with some specialty products allowed to have up to 150 ppm. **(Leth *et al*., 2008).** In Australia nitrites (sodium or potassium salts) are allowed at a maximum level of 125 ppm in cured, dried and slow-dried cured meat and 50 ppm in sterile and canned meat**(Hsu *et al*., 2009).**

The $NaNO_2$ and other additives may react with amines of the foods in the stomach and produce nitrosamines and free radicals. Such products may increase lipid peroxidation, which can be harmful to different organs including liver and kidney **(Choi *et al*., 2002).** Exposure to preformed nitrosamines in food should be minimized by a appropriate technological practices such as lowering the levels of nitrate and nitrite salts added to foods to the minimum required to achieve the necessary preservative effect and to ensure microbiological safety **(EFSA, 2010).**

Nitrosamine production in meats should be avoided since nitrosamines have been shown to be carcinogenic **(Tricker and Preussmann, 1991).** In humans, there seems to be an association between gastric cancer and the ingestion of nitrosamines in cured meat **(Larsson *et al*., 2006; Jakszyn and González, 2006).**

Table (3) revealed the mean values of ascorbic acid level (ppm) in the examined meat products that were 518.9± 86.76 for beef burger and 502.7± 46.24 for beef luncheon. Also from this table we can observe that 60% of the examined beef burger samples exceeded the Egyptian permissible limit **(E.S.S., 2005))** and 100% of the examined beef burger and beef luncheon samples exceeded the international permissible limit **(FAO, 2007)** while ascorbic acid failed to be detected in the examined canned corned beef samples.

Similar to nitrites and nitrates, ascorbate level is regulated by the USDA. A maximum of 550 ppm of ascorbate can be added to meat, which is equivalent to 22.5 grams of sodium ascorbate mixed with 45.45 kilograms of chopped meat **(Romans *et al*., 1994).** The goal is to have adequate levels of residual nitrite to inhibit formation of botulinum toxin, decrease rancidity, and impart a pink cured color and characteristic cured flavor, while at the same time avoiding nitrosamine formation.

At dose of 500 mg. or more of ascorbic acid there was a statistically significant increase in urinary oxalate equivalent to 1.2 to 1.8 % of the millimoles of ascorbate administered. This represented an increase in urinary oxalate excretion of 6 to 13 mg. per day per 1,000 mg. ascorbic acid supplement. This amount would increase the risk of calcium oxalate urolithiasis **(Urivetzky *et al*., 1992).**

In the present study we recorded high level of NaCl% and ascorbic acid in some samples of the examined meat products above the permissible limit which may be attributed to error in the processing or intended to prolong the shelf life of these products for economic purposes. So it is recommended that: 1

Reducing the use of preservatives with the maintenance of their benefits action. -

- Periodic monitoring of nitrite, nitrate and nitrosamine in the meat products in the plant before marketing and in the market should be permitted as a role of authorities for local and imported meat products.
- The primitive meat processing factories should be put under strict control of the specific food hygiene authorities and modern hurdle technology for meat and meat products preservation must be applied.
- Avoid consumption of meat products labeled unknown trade name.
- The use of preservatives should be appropriate in accordance with good manufacturing practice (GMP) they should be of food grade and be prepared and handled as food ingredient. The amount added to food should be appropriate to fulfill their intended purposes.

References

Abu-Zid-Suzan, M.A (1998). Anaerobes in meat and fish products and their ability to toxin production. Ph.D. Thesis (Meat Hygiene), Fac. Vet. Med. Cairo Univ.

Ahmad, A.F. (2004). Studies on cooked meat and chicken products. Ph.D. Thesis, Fac. Vet. Med., Zagazig Univ. Benha Branch.

Aieda- Hoda, A. (1995). Quality investigation into room kept traditional meat products in Egypt. Ph.D. Thesis, Fac. Vet. Med. Cairo Univ.

Aktas, N.; Aksu, M.I. and Kaya, M. (2003). The influence of marination with different salt concentration on the tenderness, water holding capacity and bound water content of beef. Turk. J. Vet. Anim. Sci., 27: 1207-1211

AOAC. (1990). Association of Official Analytic Chemists. Official method of analysis, 15th Ed. Published by Associated of analytical chemists, Inc. Arlington, Virginia, USA.

AOAC. (2000). Association of Official Analytic Chemists. Official method of analysis, 17th Ed. Nitrites in cured meats. Colorimetric method, Adopted as Codex Reference method (Type II).

Archer, D.L. (2002). Evidence that ingested nitrate and nitrite are beneficial to health. Journal of Food Protection, 65(5). 872- 875.

Auer, B.L.; Auer, D. and Rodgers, A.L. (1998). Relative hyperoxaluria, crystaluria and haematuria after megadose ingestion of vitamin C. Eur.J.Clin.Invest., 28(9). 695-700.

Baojin, Y.; Yi-ming, Z.and Jian-chun, W. (2007). Investigation on nitrite residue in meat products and cognition for nitrite in city people. J.Zhengzhou Collage of Animal Husbandry.

Baseler- Laura, J. (2009). A comparison of residual nitrite and nitrate, lipid oxidation, cut -surface color, and sensory and visual characteristics for nitrite-added and no-nitrite- or -nitrate-added Canadian-style bacon. M.Sc. Thesis. Ames, *Iowa State University***.**

Baublits, R.T., Pohlman, F.W., Brown, A.H. Jr., Yancey, E.J., and Z.B. Johnson (2006). Impact of muscle type and sodium chloride concentration on the quality, sensory and instrumental color characteristics of solution enhanced whole-muscle beef. Meat Sci.72 (4).704-712.

Borchert, L.L. and Cassens, R.G.(1998). Chemical hazard analysis for sodium nitrite in meat curing. American Meat Institute. Washington, D.C.

Choi, S.Y.; Chung M.J,and Sung, N.J. (2002). Volatile N-nitrosamine inhibition after intake of Korean green tea and Maesil (Prunus mume SIEB. et ZACC.) extracts with an amine-rich diet in subjects ingesting nitrate. Food Chem. Toxicol. 2002;40:949–957.

Claus, J.R.; Jhung-Won, C. and Flick, G.J. (1994). Processed meat/ poultry/ sea food. In muscle foods: meat, poultry and sea-food technology, edited by Kinsman, D.M, Kotula, A.W. and Breidenstein, B.C. New York: Chapman and Hall.

Coultate, T.P. (2002). Food: the chemistry of its components, 4th edition. Royal Society of Chemistry. Cambridge, UK.

Desmond, E. (2007). In: Reducing salt in meat and poultry products, Reducing salt in foods: Practical strategies, Kilcast, D. and Angus F. editors. Cambridge, UK: Wood head, 233-255.

Doyle, M.P.; Beuchat, L.R. and Montville, T.J. (2001). Food Microbiolgy:Fundamentals and Frontiers. 2nd ed. Washington, DC: ASM press.

EFSA (2010). European Food Safety Authority. Scientific Opinion, statement on nitrites in meat products: EFSA Panel on food additives and nutrient sources added to food (ANS). EFSA J., 8(5). 1538.

El-Kewaiey, I.A. and Al-Tedawy, F.A. (2012). Determination of sodium nitrite in some locally manufactured meat products. Assiut Vet. Med. J. 58(132). 159-174.

El- Khawas, K.M.S. (1996). Public health aspects of canned meat. M.V. Sc. Thesis, Fac. Vet. Med. Cairo Univ.

E.S.S (2005). Egyptian Standard Specification. Or Egyptian organization for Standardization and Quality Control

E.S.S. /3597 (2005). Egyptian Standard Specification. Egyptian Standard Specification for sodium nitrite used in food products.

E.S.S. /3598 (2005). Egyptian Standard Specification. Egyptian Standard Specification for sodium nitrite used in food products.

FAO (2007). Food and Agriculture Organization of the united nations. Regional office for Asia and The Pacific Bangakok, 2007**.** Meat processing technology for small-to medium-scale producers.

Farag, H. El-S.M and Abd-El-Fatah- Noha, R.M (2011). Assessment of Nitrite and Sorbic acid salts level in some meat products and their public health significance. Assiut Vet. Med. J. Vol. 57(129). 1-22.

Fennema, O.R. (1996). Food chemistry, 3rd edition. CRC Press. New York City, NY.

Flores, J. and Toldra, F. (1993). Curing: Processes and applications.In Encyclopaedia of Food Science, Food Technology and Nutrition, editors Macrae,R., Robinson, R., Sadler, M. and Fullerdove, G. Academic Press, London, pp. 1277-1282.

Fox, J.B. Jr. (1966). The chemistry of meat pigments. J. Agr. Food Chem. 14(3).207-210.

Hedrick, H.B.; Aberle, E.D.; Forrest, J.C.; Judge, M.D. and Merkle, R.A. (1994). Properties of fresh meat. Principles of meat science. 3rd ed. Pp .123-131. Dubuque, I.A.: Kendal/ Hunt.

Hsu, J.; Arcot, J. and lee, N.A. (2009). Nitrate and nitrite quantification from cured meat and vegetables and their estimated dietary intake in Australians. Food Chem., 115: 334-339.

Izumi, K.; Cassens, R.G. and Greaser, M.L. (1989). Reaction of nitrite with ascorbic acid and its significant role in nitrite-cured foods. Meat Sci. 26(2).141-153.

Jakszyn, P. and C.A. González, C.A. (2006). Nitrosamine and related food intake and gastric and oesophageal cancer risk: A systematic review of the epidemiological evidence. World .J. Gastroenterol. 12(27).4296-4303.

Labb'E, R. and Nolan, L. (2009). Food preservation techniques other than heat and irradiation. In: Microbiologically safe foods, Chapter 24. John Willy and Sons, INC., Publication

Larsson, S.C.; Bergkvist, L., and Wolk, A. (2006). Processed meat consumption, dietary nitrosamines and stomach cancer risk in a cohort of Swedish women. Int. J. Cancer. 119 (4).915-919.

Leth, T.; Fagt, S.; Nielsen, S. and Andersen, R. (2008). Nitrite and nitrate content in meat products and estimated intake in Denmark from 1998 to 2006. Food Add. Contamin. 1-9 First. Accessed 7/11/2009.

Marsden, J.L. (1980). Sodium containing additives in processed meats: A technological overview. In proceedings of the sodium and potassium in foods and drugs conference, edited by White, P.L. and Crocco-Chicago, S.C., III American Medical Association.

Matthews,K.and Strong, M (2005). Salt – its role in meat products and the industry's action plan to reduce it Nutrition Bulletin, 30(1). 55-61.

Muller, N.D. (1991). Curing and smoking. Fleischwirtsch., 71(1).61-65.

Munasinghe, D.M.S. and T. Sakai (2004). Sodium chloride as a preferred protein extractant For pork lean meats. Meat Sci. 67 (4).697-703.

Pearsons, A.M. (1991). Pearsons composition and analysis of foods, 9th Ed. Pp 500.

Pearson, A.M. and Gillett, T.A. (1999). Processed meats. Gaithersburg, Md.: Aspen.

Pisinov, B.; Kečkeš, J. and Pešić-Mikulec, D. (2010): The importance of sulphur dioxide presence in meat and meat products. Ecologica, 17(59). 407- 410.

Rahman, M.S. (2007). Hand book of food preservation. 2nd Ed., CRC Press Taylor and Francis Group, Boca Raton London, New York.

Romans, J.R., Costello, W.J., Carlson, C.W., Greaser, M.L., and K.W. Jones. (1994). The meat we eat, 13th edition. Interstate Publishers, Inc. Danville, Il

Ruiz- Capillas, C. and Jimenez- Colmenero, F. (2008). Determination of preservatives in meat products by flow injection analysis (FIA). Food Addit. Contam. Part A Chem. Anal Control Expo. Risk Assess., 25(10). 1167-1178.

Ruiz-Capillas, C and Jiménez-Colmenero, F (2009). Application of flowinjectionanalysis for determining sulphites in food and beverages: A review. Food Chemistry, 112, 487- 493**.**

Ruusunen-Marita and Eero Puolanne (2005). Reducing sodium intake from meat products. Meat Science, 70(3). 531-541.

Sabreen, M.S. and El-brens Enas, E.P. (2001). Prevalence of Escherichia coli and effect of different concentrations of nisin on its viability in cream. Assiut Vet. Med. J., 46 (91)

Sahoo, J.; Sajala, K.S.S. and Manish Kumar (2004). Low-salt meat products as health food .Natural Product Radiance, 3(4). 309-317.

Sen, N.P. and Baddoo, P.A. (1997). Trends in the levels of residual nitrite in Canadian cured meat products over the past 25 years. J. Agr. Food Chem., 45(12). 4714-4718.

Shemshadi, B.; Hosseini, H. and Ferdosy, R. (2006). Preservative residue in beef and chicken sausages and bologna as marketed in Iran. IUFOST 1333-1334.

Skrökki, A.(1995). Additives in Finnish sausages and other meat products. Meat Sci., 39 (2). 311–315.

Stollewerk, K.; Jofre, A.; Comaposada, J.; Arnau, J. and Garriga, M. (2012). The effect of NaCl . Free processing and high pressure on the fate of *Listeria monocytogens and Salmonella* on sliced smoked dry-cured ham. Meat Sci., 90(2). 472-477.

Tolba, K.S.; Abdel-Aziz, A.S. and Niazi, Z. (1994). Chemical analysis of locally manufactured meat products. Vet. Med. J., 42, 3: 79.

Tricker, A.R. and Preussmann, R. (1991). Carcinogenic N-nitrosamines in the diet: occurrence, formation, mechanism and carcinogenic potential. Mutat. Res. 259:277-289.

Urivetzky, M.; Kessaris, D. and Smith, A.D. (1992). Ascorbic acid overdosing: a risk factor for calcium oxalate nephrolithiasis. J. Urol., 147(5). 1215-1218.

Viuda- Martos, M.; Fernàndez- López, J.; Sayas- Barbera, E.; Sendra, E.; Navarro, C. and Pérez- Alvarez, J.A. (2009). Citrus co- products as technological strategy to reduce residual nitrite content in meat products. Journal of Food Science, 74(8). R93- R100.

Zahran- Dalia, A and Kassem- Gehan, M.A (2011). Residual nitrite in some Egyptian meat products and the reduction effect of electron bean irradiation. Advance Journal of Food Science and Technology, 3(5). 376-380.

تحديد المواد الحافظة الطبيعية و المصنعة فى منتجات اللحوم

داليا عاطف ابراهيم سالم ، سحر محمد ابوطالب الباز
قسم صحة الاغذية - معهد بحوث صحة الحيوان

الملخص العربى

تمت هذه الدراسة على 60 عينة من منتجات اللحوم شملت البيف همبورجر و البيف لانشون و الكورنيد بيف المعلب بواقع 20 عينة من كل نوع و ذلك لتحديد نسبة كلوريد الصوديوم و مستوى النيتريت و الاسكوربيك أسيد فى هذه المنتجات. حيث كان متوسط نسبة كلوريد الصوديوم (%) 59 ,5 ± 0,68 ,52 ,3± 0,66 ,3,74 ±0,65 لكل من البيف همبورجر و البيف لانشون و الكورنيد بيف على التوالى. كما كانت نسبة العينات التى تعدت الحد المسموح به للمنظمة المصرية القياسية والعالمية (الفاو) لكلوريد الصوديوم فى هذه المنتجات 70%, 70 %و 80% على التوالى. بلغ متوسط مستوى النيتريت لهذه المنتجات 106,55± 26,46, 101 ±23,83 و 43,15±9,84 (جزء فى المليون) على التوالى. كما كانت نسبة العينات التى تعدت الحد المسموح به للمنظمة المصرية القياسية لمستوى النيتريت 65%, 50% و 25% على التوالى و أى من هذه العينات لم تسجل أى زيادة عن الحد المسموح به لمستوى النيتريت تبعا لمنظمة الفاو العالمية.و بقياس مستوى الاسكوربيك أسيد فى هذه المنتجات وجد أن المتوسط كان 518,9±86,76 (جزء فى المليون) للبيف همبورجر و 502,7±46,24(جزء فى المليون) للبيف لانشون كما لم يتم تسجيل أى نسبة فى الكورنيد بيف العلب. وتم تسجيل 60% و 45% من عينات البيف همبورجر و البيف لانشون زادت عن الحد المسموح به للاسكوربك أسيد لكيلتا المنظمتين وتم مناقشة الخطورة الصحية لزيادة المواد المقاسة على الانسان.