5.SUMMARY AND CONCLUSION

Nitrates are present naturally in soil , water and plant materials as a consequence of nitrogen fixation . In addition, the wide use of nitrogen-based fertilizer in agriculture contributes to the total nitrate present in the soil and water. Nitrate is therefore likely to be present in most things we eat or drink.

The determination of nitrate and nitrite in foodstuffs has become increasingly important because of concern over excessive human dietary intake of these species. The toxicity of nitrite , especially in relation to nitrosamine production, has been well stablished and whilest nitrate not very toxic, their ready to conversion into nitrite means that levels of nitrate must be carfully monitored.

Subsequently, this investigation was designed to demonstrate the followin points:

* Effect of location of market on the nitrite, nitrate and nitrosamine compounds of some selected fresh vegetables, fruits, meat and meat products as well as some types of fish and baby foods.

* Effect of storage conditions (at room temperature, refrigeration and freezing) on NO_2 and NO_3 levels of some vegetables.

* Effect of cooking on NO_2 and NO_3 concentration of some selected vegetables.

* Effect of soaking in NO_2 and NO_3 solutions with different concentrations for different time on the NO_2 and NO_3 residues of old and

young beef meats.

* Effect of different cooking methods (boiling in water, frying and grilling) on the NO_2 and NO_3 residues of meats.

* Evaluation of ascorbic acid and ∝-tocopherol as inhibitors of N-nitrosamine formation in cured meats.

The obtained results could be summarized as follow:

1. Nitrite, nitrate and N-nitrosamine compounds in foods as affected by location of market:

A. Data indicated that, leafy vegetables had the highest NO_3 content comparing with fruit vegetables , pulses and tuber vegetables. However , some root crops such as beet roots and radish roots contained substantial levels of NO_3 . Nitrite concentrations in most vegetables under investigation are low of little concern, provided vegetables consumed within the normal shelf life.

B. Soybean was found to contain a higher amounts of NO_2 and NO_3 being 7.55 and 9.87 ppm, respectively compared with mung beans However, NDMA was only the nitrosamine compound detected in both types of legumes , and mung beans was found to contain a levels (0.16 ppm) compared with soybean (0.54 ppm).

C. Data indicated also that strawberry contained a higher levels of NO_2 , NO_3 and NDEA compared with banana and orange.

D. Five samples of baby foods were analyzed for NO_2, NO_3 and N-nitrosamine compounds. Results showed that samples contain rice had a higher concentrations of NO_2 , NO_3 and NDMA

followed by samples contained meats, wheat, vegetables and apples.

E. Veal meat had the lowest levels of NO_2 compared with other types of meats. However, beef meat contained higher concentrations of NO_3, while Buffalo and Lamb meats were found to contain the lowest levels. The highest levels of total nitrosamine compounds were observed in Veal meat (116.89ppm) followed by Lamb meat (88.00 ppm) and Buffalo meat (34.93 ppm).

F. Luncheon meat had the highest levels of NO_2 (112.78 ppm) followed by Bastirma (75.13 ppm) , Sausage (34.45 ppm) and Frankfurter (22.26 ppm) . While, the highest values of NO_3 were found in Bastirma (131.89 ppm) and the lowest levels were in Frankfurters (12.29 ppm). On the othet hand, Bastirma had the highest levels of total N - nitrosamine compounds (395.43 ppm) , while Luncheon meat and Frankfurters were found to contain a moderate contents of total N-nitrosamine compounds.

G. Data revealed that Karmout fish contained a higher NO_2 (3.49 ppm) followed by Bolti (2.44 ppm), Denis (2.09ppm) and Bayad (2.00 ppm) compared with other types of fish. However , Macaroni , Baury , Denis , Bayad and Karmout contained a higher levels of NO_3 , it ranged from (10.21 ppm) in Macaroni to (14.94 ppm) in Karmout. Data indicated also the highest levels of total N-nitrosamine compounds was observed in Macaroni fish (157.02 ppm)

followed by Baury, Bolti, and Sardin. Moreover, the lowest levels were found in Denis (0.48 ppm).

H. Generally , the location of market makedly affect the NO_2, NO_3 and N-nitrosamine content in previous studied samples.

2.Inhibition of nitrite and nitrate in vegetables:

* Effect of Storage:

The storage of fresh vegetables at room temperature, under cooling and frozen state reduced the nitrate and increased the nitrite contents of most vegetables under investigation.

* Effect of cooking:

Cooking process reduced the total NO_2 content between (8.07 %) in green beans to (99.50 %) in carrots. It could be noticed also NO_3 contents of raw vegetables reduced signi - ficantly in all tested vegetables as affected by cooking . The greatest reduction were found in leafy vegetables such as cabbage (77.64 %) , spinach (90.04 %) and jew's mallow (94.76 %) , followed by green beans (73.76 %) , carrots (71.27 %) , squash (62.54 %) , potatoes (60.54 %), okra (52.78 %) and peas (33.32 %).

3.Effect of soaking on the NO_2 and NO_3 residues in meats:

Soaking of yuong and old beef meats in NO_2 and NO_3 solutions with different concentrations ranging from 50 to 500 ppm for 30 min and 24 hr caused an increases in NO_2 and NO_3 contents.

4. Inhibition of NO_2, NO_3 and N-nitrosamine compounds in cured meats:

* Effect of cooking:

The effect of different cooking methods (boiling in water, frying and grilling) was carried out using the previous soaked samples in NO_2 and NO_3 which contain a higher levels of NO_2 and NO_3 . Data indicated that NO_2 and NO_3 reduced with different levels as affected by cooking methods. The higher reduction in NO_2 and NO_3 was noticed in old and young beef meats as affected by grilling.

* Effect of ∝-tocopherol and ascorbic acid:

The obtained results indicated that the reduction rate of N-nitrosamine formation in dry and brine-cured beef and buffalo meats increased gradually as the levels of ∝-tocopherol or ascorbic acid increased. The higher reduction was observed in buffalo meats than beef meats. Moreover, ascorbic acid had a higher effect on the N-nitrosamine formation than ∝-tocopherol.

* Effect of cooking on N-nitrosamin formation in ∝-tocopherol and ascorbic acid - treated meats:

Samples of old and young meats (beef and buffalo) treated by ∝-tocopherol and ascorbic acid with different levels either in dry or brine curing were cooked using different methods (boiling in water, frying and grilling). Results showed that all different methods of cooking reduced NO_2 and N-nitrosamine formation with different levels and the reduction rate was higher in old meats than young meats.

From the affomentioned results, it could be conclded that ∝-tocopherol and ascorbic acid could be used as an inhibitors of N-nitrosamine formation in cured meats.

In view of the above mentioned results regarding the risk to human health posed by N-nitrosamine compounds it is prodent to attempt to reduce exposure. Examples of the ways in which this might be achieved are:

* By reducing the use of NO_2 to minimum level necessary to prevent growth of *Clostridium botulinum*.
* Ensuring that the NO_2 is distributed as evenly as possible.
* Avoiding the use of concentrated curing preparations in which N-nitrosamines can be formed before used.
* Adding ∝ - tocopherol or ascorbic acid as an inhibitors of N-nitrosamine formation.