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Determination of Nitrite in Nigerian Foods as its implicated as a Carcinogen

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ABSTRACT

Nitrite standard in some Nigerian foods were determined using N-(1NapthyL) ethylenediamine dihydrochloride (NED) reagent, sulphanilic acid and standard nitrite using spectrophotometer at wave length of 530nm. Nitrite standard graph was plotted using various dilution concentration of sodium nitrite and treatment with above reagent and colour development observation and graph of optical density (O.D) plotted against concentration. Various food materials were extracted and treatment with reagent and colour development and observation of optical density and nitrite concentration determined from extrapolation from plotted standard nitrite graph and result showed Beer 0.0ppm, Bitter leaf 0.0ppm, Fluted Pumkin 40 ppm, Green Amaranth 35 ppm, Guinea Corn 4 ppm, Pumkin 11 ppm, Rice 2.7 ppm, Crayfish 30.8 ppm, Dried Fish 23.4 ppm, Beans 7.17 ppm, Tap water 2.5 ppm, Dried groundnut 4.8 ppm, Palmwine 0.60 ppm, Smoked meat 23.1 ppm, Dried corn 2.5 ppm, Garri 0.0 ppm, Raw Meat 0.0548 ppm, Pigeon pea 2.013 ppm, and Garden egg 1.12 ppm, nitrite concentration per gramme w/w. Those foods that contained above lethal doses of 22mg per kilogram of body weight are possible carcinogen and should be avoided.

Keywords: *NED, Nitrite, O. D., Concentration, Carcinogen, Nitrosamines*.

INTRODUCTION

Nitrite recently has been implicated to react with certain amines to form nitrosamines which are carcinogenic. There is need to determine the amount of nitrite in Nigerian food since recently around the country there are upsurge and increase cases of cancer diseases in various towns and villages. Because of the relatively high toxicity of nitrite (the lethal dose in humans is about 22 milligrams per kilogram of body weight), the maximum allowed nitrite concentration in meat products is 200ppm. Under certain conditions especially during cooking-nitrite in meat react with degradation products of amino acids, forming nitrosamines, which are known as carcinogens and are implicated in risk of cancer formation (Ezeagu and Ibe, 2004 and Swann, 1971).

In Nigeria many people have been wondering the actual causative agent of cancer due to wide outbreak of it to be caused by witchcraft , others suggest that it may be caused from certain foods material taken by people now. The truth of the matter should be scientifically be examined by carrying out the determination of nitrite in foods taken by people since it is now implicated that it reacts with certain amines to form nitrosamines which are carcinogenic. Since the lethal doses of nitrite for humans are known the determination will help to evaluate various foods taken by people to a certain the level of our nitrite in them.

Nitrite can react readily with amines and amides to form N-nitroso compounds most of which are highly carcinogenic (WHO, 2009; Merusi *et al*., 2010 and Rezaei *et al*., 2014). Nitrate does not react in this way, and nitrate is relatively not toxic, but nitrate has to be considered in this context because it can be reduced to nitrite commonly by bacterial action. This reduction occurs during bacterial spoilage of nitrate- containing foods, and the bacteria both in the mouth of the adult, and in the upper gastrointestinal tract of the human infant, are also able to reduce nitrate to nitrite (Swann,1975 and Ezeagu, 2006). Nitrite is used as a preservative in cured meat and cheese and previously it was though that this food additive was the major source of nitrite in man's diet. However, it has recently been realized that most of man's intake of nitrite comes from reduction of the nitrate in the saliva (White, 1975 and Kirovska-Cigulevska, 2002).

Nitrosamines have been found in human food, and the nitrosation reaction, which proceeds most rapidly in weak acid (Mirvish, 1970) on also occur when dietary amines and nitrite are mixed in the stomach (Merusi *et al*., 2010). Because they are potent carcinogens effective in most animal species, and in most organs, efforts have been made to discover whether man is exposed to appreciable amount of carcinogenic nitroso compounds. This endeavour has had to face considerable difficulties, both practical and theoretical. The controversy surrounding nitrite, which began in the early 70's with imports that the chemicals, used to cure processed meats, might cause cancer, was rekindled by a recent report of the National Academy of Sciences. The report said that nitrite in cured meats account for "only a small proportion of the total exposure to nitrosamines" a suspected cancer- causing agent and that eliminating them would not have a major effect on the risk of cancer during a lifetime. What's more, the report said that nitrites and nitrates from other sources, such as vegetables, baked goods and cereals, might present more of a hazard than those in cured meats (Ezeagu, 2006 and Kirovska-Cigulevska, 2002). The aims and objectives of this research work is to determine the level of nitrite in some foods taken by people in Nigeria since it is implicated that above lethal doses there is risk of cancer. The result of the outcome of the evaluation will help to advice people to avoid those foods that contained high level of nitrites.

MATERIALS AND METHODS

The official AOAC method 17th edition, 2000 was employed for this determination. Modified criess solution preparation was done by dissolving 0.5g sulphanilic acid in 150ml of 15% volume/volume acetic acid to give solution A. Also 0.1g of NED (N_(1 Napthylethy Lene diamine dihydrochloride) in 150ml of distilled water to give solution B. Then solution A and B was mixed to give NED reagent. Also 0.1lg of sodium nitrite in 100ml of distilled water to give standard nitrite solution 1ml of the stock of nitrite solution was taken and made up with distilled water to 10ml and in the same way prepared dilution of the solution ranging from 0.11X10^{-2}/ml to 0.11 X 10^{-6}g/ml. Then into 6 test tubes transferred 0ml, 2, 4, 6, 8 and 10ml of this solution and made up all to 10ml with distilled water. Then 2ml of NED reagent was added to each of the test tubes and allowed colour to develop for 15mins then measured the optical density (O.D.) at 530nm using spectro photo meter. The standard Nitrite curve was plotted (O.D.) optical density against concentration. The result showed in Table 1 & 2, Fig1.

To the foods material, weigh 5gm prepared sample in a 50ml beaker. Add about 40ml of water and heated to 80^{0}C. Mixed thoroughly with glass rod taking care to break all lumps

and transfer to 500ml volumetric flask. Thoroughly wash beaker and glass rod with successive portions of hot water adding all washings to flask. Add enough hot water to bring volume to about 300ml. The flask transferred to steam bath and let stand for 2 hours shaking occasionally. It was cooled to room temperature and diluted the volume with water and remixed, Filtered. If turbidity remains after filtration it was centrifuged which will usually clear the solution. 2.5ml of sulphanilamide solution was added to the aliquot containing 5-50µg in 50ml volume flask and mixed. After 5mins, 2.5ml of NED reagent was added and mixed and colour was allowed to develop for 15mins. Transferred portion of solution to spectrophotometer call and determined absorbance at 530mm against blank of 45ml water and 2.5ml of sulphanitamide reagent and 2.5ml NED reagent. The nitrite concentration present by extrapolation from the standard nitrite curve.

RESULTS AND DISCUSSION

Table 1
Nitrite Standard

Volume	0	2	4	6	8	10
Conc.	0	$2.0X10^{-6}$	$4.0X10^{-6}$	$6.0X10^{-6}$	$8.0X10^{-6}$	$10.0X10^{-6}$
O.D	0	0.25	0.50	0.80	1.00	1.10

Nitrite Standard Curve Measured at Wavelength of 530nm

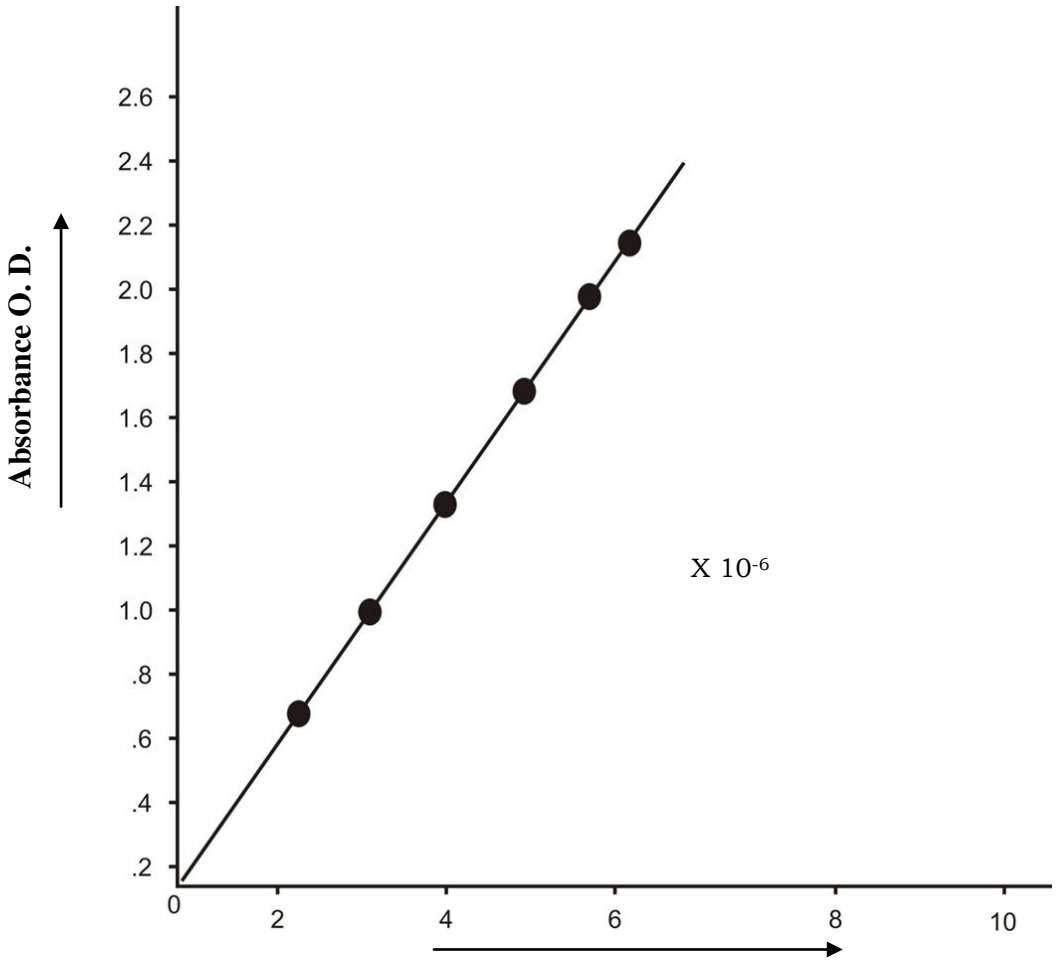

Fig1. Concentration in grams X 10^{-6}

Table 2
Nitrite concentration in some Nigerian foods

Food Material	Nitrite cone (ppm) X 10^{-6}g w/w.
Beer	NIL
Bitter leaf	NIL
Fluted Pumkin	40X10^{-6}g w/w *
Green Amaranth	35X10^{-6}g w/w *
Guinea corn	4X10^{-6}g w/w
Pumpkin	11.0 X10^{-6}g w/w
Rice	2.7X10^{-6}g w/w
Cray fish	30.80X10^{-6}g w/w*
Dried Fish	23.04X10^{-6}g w/w*
Beans	7.17X10^{-6}g w/w
Tap water	2.5X10^{-6}g w/w
Dried groundnut	4.8X10^{-6}g w/w
Palm wine	0.60X10^{-6}g w/w
Smoked meat	23.1X10^{-6}g w/w*
Dried Corn	2.5X10^{-6}g w/w
Garri	NIL
Raw meat	0.0548X10^{-6}g w/w
Pigeon pea	2.013X10^{-6}g w/w
Garden Egg	1.12X10^{-6}g w/w

From the above result obtained some various foods materials contained various concentrations of nitrite above the lethal doses which was 22mg per kilograms of the body weights. From the result it therefore showed that those material containing nitrite above the lethal level / doses were possible carcinogen. If the body does not metabolized them and they accumulates above the lethal level they can lead to causative measures of cancer. From the result the food materials with nitrite concentration asterisked (*) are above the lethal doses. Since nitrite react with amides and amine to form N-nitroso compounds most of which are highly carcinogenic (Afzali and Elahi, 2014 and Alexander *et al*., 2016). Nitrosamines have been found in human foods, and nitrosation reaction which proceeds most rapidly (Mirvish, 1970) can also occur when dietary amines and nitrite are mixed in the stomach (Swann, 1971) because they are potent carcinogens in most animal species.

CONCLUSION

From the above results, it is clear that those foods materials with nitrite concentrations above the lethal level should be avoided since they are possible carcinogens. We therefore recommend that further works should be done on those other foods regularly consumed by people in Nigeria to determine their nitrite level to advice people about their consumption. Government should sponsor research to determine the various food materials consumed by the Nigerian populace.

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