Vet.Med.J.,Giza. Vol.46, No.4A. (1998) 349-354.

FACTORS INFLUENCING HISTAMINE LEVEL IN MEAT PRODUCTS

BY

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SUMMARY

Three hundred random samples of meat products including (minced meat,beefburger,dry sausage,) collected from Giza markets allover the year were screened for determination of histamine, pH and Enterobacteriaceae. The obtained results revealed that low pH, high Enterobacteriaceae count and storage tepmerature of the samples have clear influence on histamine releasing. The different isolates recovered from the examined samples were identified as citrobacter, enterobacter, *Proteus morganii, Proteus vulgaris,* providencia and *E. coli.* The highest frequency of microflora were *Proteus morganii* 56%, *Proteus vulgaris* 48% and *E. coli* 50% from dry sausage samples.

The public health significance and suggestive measures were discussed.

INTRODUCTION

Biogenic amines in processed meat products can be useful as indices of poor quality raw material, but they can also be related with microbial activity involved in fermentation process. . Many later reports have supported the theory that biogenic amine formation is a protective mechanism of bacteria against acidic environments Eitenmiller et al (1978, 1981).

Histamine occurs in food primarily as the result of microbial decarboxylation of histidine. The small amount of histamine normally occuring in foods constiutes no appreciable hazard to consumers. The minimal concentration of histamine in food which would elicit a toxic response has been estimated to be 100mg/100gm (Simidu and Hibiki, 1955; Arnold and Brown, 1977). Storage temperature has a clear influence on the formation of biogenic amines in foods, several studies seem to agree that significant level of histamine leading to

histamine toxicity are formed at temperatures above 15.C (Kimata and Kawai, 1953; Edmunds and Eitenmiller, 1975; Hardy and smith, 1976; Baldrati, et al. 1980 and Smith et al., 1980).

Fresh meat containing only small amounts of biogenic amines while ripened sausages have the highest biogenic concentrations (Cantoni, 1995). The low pH occurring in fermented dry sausage favoured formation of biogenic amines. Moreover the natural fermentation process can also result in accumulation of high histamine levels. Moussa et al. (1973), Foster et al. (1977), Taylor et al. (1978), Mossel et al. (1979) and Lotfi et al. (1986) recommended the use of Enterobacteriaceae as indicator of food safety, as they were involved in diarrheal diseases. Because sausage, minced meat and beefburger were prepared from raw meat, the initial levels of contamination may be unacceptably high. Several microorganisms may be associated with the formation of toxic levels of histamine, *Proteus morganii* is a frequently associated microorganism (Omura et al., 1978). Therefore, this work was carried out to determine the role of bacterial load & pH in the formation of histamine in local meat products .

MATERIAL AND METHODS

A total of 300 random samples of meat products including 100 each of , minced meat , beefburger and dry sausage were collected at seasonal intervals from different markets. The samples were directly transferred to the laboratory and subjected to the following examination.

I- Bacteriological examination:

a- Enumeration of Enterobacteriaceae: the total Enterobacteriaceae count was carried out according to ICMSF (1978) using VRBG agar.

b- Isolation and identification of Enterobacteriaceae was carried out according to Edward and Ewing, 1972. The biochemical activities were recommended by Cruickshank, et al., 1975 , Bailey and Scott , 1974 and Thatcher and Clark , 1978.

II- Chemical examination:

a- Measurment of pH: pH was measured by direct reading using a pH meter,
after trituration and homogenization of samples with distilled water (Sanchidrian, 1985).

b- Estimation of histamine level:
The technique recommeded by A.O.A.C. ,1975, Schutz et al. , 1976,
Voigt and Eitenmiller (1977) and Hui and Taylor , 1983 were applied using thin layer chromatography (T.L.C.).

RESULTS AND DISCUSSION

In this study, the relation between histamine release and load of Enterobacteriacea, pH in minced meat , beefburger and dry sausages,was illustrated. From the results achieved in table (1,2,3), it could be concluded that frequency distribution of histamine content in dry sausage samples had larger and more variable amount specially in summer and spring seasons, lower pH

Table (1): Histamine level in meat product samples (mg/100gm)

Samples	Autumn			Winter			Spring			Summer		
	Min	Max	mean	Min	Max	mean	Min	Max	mean	Min	Max	mean
Minced meat	15	20	16	7	9	8	17	23	19	20	30	21
Beefburger	10	15	11	0	0	0	12	18	13	15	25	17
Dry sausage	18	23	19	8	11	9	20	26	24	25	35	26

Table 2 : pH values in meat product samples :

Samples	Autumn			Winter			Spring			Summer		
	Min	Max	mean	Min	Max	mean	Min	Max	mea	Min	Max	mean
Minced meat	5.6	6.0	5.8	5.6	5.9	5.7	5.6	6.0	5.8	5.6	6.1	5.8
Beefburger	5.0	5.7	5.5	5.0	5.8	5.5	5.0	5.9	5.5	5.1	5.9	5.6
Dry sausage	4.7	5.6	4.5	4.7	5.5	5.3	4.8	5.6	5.4	4.8	5.7	5.4

Table 3 : Enterobacteriaceae count in meat product samples

Samples	Autumn			Winter			Spring			Summer		
	Min	Max	mea	Min	Max	mean	Min	Max	mea	Min	Max	mea
Minced meat	$<10^2$	$2x10^2$	$2x10^2$	$<10^2$	$<10^2$	$<10^2$	$2x10^2$	10^4	$2x10^3$	$4x10^2$	$5x10^4$	$7x10^3$
Beefburger	10^2	$9x10^3$	$9x10^3$	$<10^2$	$5x10^2$	$2x10^2$	$2x10^2$	$8x10^3$	$3x10^2$	$3x10^2$	10^2	10^4
Dry sausage	$2x10^2$	$5x10^4$	$5x10^4$	$<10^2$	$9x10^3$	$2x10^3$	$3x10^2$	$6x10^6$	$4x10^4$	$6x10^3$	$9x10^6$	10^5

Table (4) : Incidence of isolated microogrnisms in meat product samples

Isolate / Sample	Citrobacter sp.		Enterobacter sp.		*Pr. morganii*		*Pr. vulgaris*		Providencia		*E. coli*	
	No	%	No	%	No	%	No	%	No	%	No	%
Minced meat	0	0	3	3	44	44	50	50	0	0	30	30
Beefburger	1	1	3	3	48	48	35	35	8	8	35	35
Dry sausage	4	4	12	12	56	56	48	48	6	6	50	50

was also observed in this products with the highest frequency of enterobacteriaceae count comparing with that of minced meat and beefburger. The levels of histamine in dry fermented sausage were previously reported by Rice et al. (1975), ranged from 0.07 to 0.78mg/100 gm. Henry (1960) reported levels of histamine ranging from 0.2 to 10mg/100 gm, while Cantoni et al. (1974) found histamine concentration ranging from 0.2 to 2.49 mg/100 gm. Vandekerckhove (1977) reported histamine levels ranging from non-detectable to 19.7 mg/100 gm for Belgian dry fermented sausages and 2.6 to 28.6 mg/100gm in fresh air-dried sausages which were inagreement with the obtained results.

Also lower histamine value was reported in minced meat and beefburger samples in comparison with those reported from dry sausage. It can be attributed to high pH value and low storage temperature of these products, some findings were reported by Cantoni (1995). Non of examined samples showed histamine content exceeding toxic level.

Most of examined samples were proved to be contaminated with Enterobacteriaceae organisms and this may be attributed to contamination of flesh used during processing of such products (Kleeberger et al., 1980).

From table (4) it is clear that *E. coli, Proteus morganii,* and *Proteus vulgaris* were detected in 50%, 56% and 48% from dry sausage respectively and it is higher than that revealed from minced meat and beefburger, which were 30%, 44%, and 30% and 35%, 48% and 35% respectively. These results were in accordance with the findings of several researchers (Surkiewiez et al., 1972; Foster et al., 1977; Lotfi et al., 1986; Refaie and Nashed, 1989 and ElGohary, 1993).

The presence of proteus species in large numbers in unrefrigerated food may lead to food poisoning (Fraizier, 1967). Moreover, Ababouch et al. (1991) stated that histamine production was more active by three proteus species at pH value 5 than 7.

In conclusion, the results of such investigation proved that the examined food samples were considered seriously contaminated by Enterobacteriaceae organisms, and thus reflex the unsatisfactory measures of food production and handling. Therefore more care and more governmental supervision should be directed towards good quality raw materials in order to minimize the numbers of possible amine forming bacteria and proteolytic activity.

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