

# Studies on the effect of adding hydrogen peroxide as a milk preservative

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**SUMMARY AND CONCLUSION** Prevention of raw milk spoilage during storage and transportation can help to improve and enhance increased milk production and utilization. The use of hydrogen peroxide as a milk preservative was recommended by FAO in 1957. The use of H<sub>2</sub>O<sub>2</sub> must be with high concentrations to prolong the milk keeping quality which usually leads to deleterious effects in the liquid phase and the manufactured products. An alternative to preserve a high milk quality is to activate the naturally occurring lactoperoxidase system (Lp-system). The IDF in 1988 reported that the Lp-system is an indigenous antibacterial system in milk and human saliva and its use in the preservation of raw milk have been recommended without any health hazards. Therefore, this investigation was planned to provide some data on the effect of H<sub>2</sub>O<sub>2</sub> per se and the Lp-system in the preservation of raw cows' and buffaloes' milk under local conditions. It was worthwhile also, to evaluate the feasibility of using such milks in making low salt Domiati cheese and yogurt. The investigation was carried out in three parts. Part I: using hydrogen peroxide as a milk preservative. The H<sub>2</sub>O<sub>2</sub> concentration in milk of some collecting centers that provide Misr & Food Company was determined. The H<sub>2</sub>O<sub>2</sub> concentration was followed up during the manufacture of milk. Also, some factors which affect the use of H<sub>2</sub>O<sub>2</sub> in preserving milk were studied. The results can be summarized as follows: 1-The average concentration of H<sub>2</sub>O<sub>2</sub> in milk of some collecting points ranged from 262.5 to 597.03 ppm. 2-The average residual H<sub>2</sub>O<sub>2</sub> in raw milk received by Misr Milk & Food Company ranged from 2.43 to 18.38 ppm for all collecting centers of the surveyed governorates. The bulk milk from large farms was free from H<sub>2</sub>O<sub>2</sub>. 3-Milk samples containing 10 ppm H<sub>2</sub>O<sub>2</sub> or lower produced pasteurized milk (90°C/15 sec.) free from residual H<sub>2</sub>O<sub>2</sub>. The higher content of H<sub>2</sub>O<sub>2</sub> in raw milk produced more residual H<sub>2</sub>O<sub>2</sub> in pasteurized milk. In Domiati cheese the residual H<sub>2</sub>O<sub>2</sub> either in curd or whey was detected when the milk contains 25 ppm or more. The percentage of H<sub>2</sub>O<sub>2</sub> decomposition decreased with increasing the H<sub>2</sub>O<sub>2</sub> concentration during heating of milk. 4-The changes of pH were very limited in the low concentrations (200-350 ppm) when the milk stored at room temperature and the decomposition of H<sub>2</sub>O<sub>2</sub> was high. The pH of milk with high levels of H<sub>2</sub>O<sub>2</sub> (400-650 ppm) remained unchanged compared with the control. The percent of recovery increased as the amount of added H<sub>2</sub>O<sub>2</sub> increased. Under cooling condition of milk storage the H<sub>2</sub>O<sub>2</sub> decomposition takes place in a low rate. 5-Heating milk containing H<sub>2</sub>O<sub>2</sub> showed that H<sub>2</sub>O<sub>2</sub> is less stable at higher temperatures and the rate of decomposition is accelerated at higher temperatures. Low levels of H<sub>2</sub>O<sub>2</sub> added to milk are very unstable and decompose rapidly. 6-Addition of H<sub>2</sub>O<sub>2</sub> to raw milk increased the keeping quality of milk as evaluated by the bacterial count, titratable acidity and COB test. The time of storage is dependant on the level of H<sub>2</sub>O<sub>2</sub> added. The cows' milk was found to be more stable than buffaloes' milk. 7-There was a great reduction in H<sub>2</sub>O<sub>2</sub> during milk separation, and the rate of decomposition was affected by the H<sub>2</sub>O<sub>2</sub> level in the separated milk. Part II. Using lactoperoxidase system as a milk preservative. In this part some trials were carried out in order to attain the maximum keeping quality of cows' and buffaloes' milks, which was evaluated by bacterial count, titratable acidity and COB test. The results were as follows: 1-The thiocyanate content in different kinds of milk varies greatly. Sheep milk recorded the highest thiocyanate content as it reached up to 20.63 ppm. cows', buffaloes', goats' milks and bulk raw mixed recorded 6.1, 5.13, 4.38 and 3.73 ppm respectively. 2-Three combinations of SCN<sup>-</sup>:H<sub>2</sub>O,

were used for application in preservation of cows' and buffaloes' milk at ambient temp. These are 10:7.5, 14:30 and 25:15 ppm of SCN-H<sub>2</sub>O<sub>2</sub>. The preservation effect was more conspicuous by employing combination of 25:15 followed by 14:30 and the lowest effect was 10:7.5 ppm of SCN-H<sub>2</sub>O<sub>2</sub>. The keeping quality of cows' milk was higher than buffaloes' milk in all treatments. 3-The effect of second dosing at 4 and 8 h interval showed that the selection of the 14:30 followed by adding 30 ppm H<sub>2</sub>O<sub>2</sub> after 4 h is more re-seamable for application. The preservation of cows' and buffaloes' milk was prolonged to 18 and 16 h successively. 4-The electrophoretic patterns of preserved milk proteins in both cows' and buffaloes' were discussed, Part III. Utilization of preserved milk in the manufacture of some dairy products. This part was undertaken to use cows' and buffaloes' milk treated with H<sub>2</sub>O<sub>2</sub> (at levels of 200 and 250 ppm respectively) or treated with Lp-system (14:30 ppm SCN-H<sub>2</sub>O<sub>2</sub>) followed after 4 h by a second dose of 30 ppm H<sub>2</sub>O<sub>2</sub> in the manufacture of Domiat cheese-like and yoghurt. The results can be summarized as follows:

**Section A: Domiat cheese**

Seven treatments were done: cheese with 10% salt, 5% salt, Lp-system + 5% salt, H<sub>2</sub>O<sub>2</sub> + 5% salt, unsalted, Lp-system (unsalted) and H<sub>2</sub>O<sub>2</sub> (unsalted).

- 1-The treatment of milk cheese with the preservatives increased the coagulation time and yield while it slightly decreased the curd tension. The effect was more pronounced in the treatment with H<sub>2</sub>O<sub>2</sub> than Lp-system. Also the effect of salt was discussed.
- 2-The unsalted cheese was spoiled after the manufacture either treated or untreated.
- 3-Treatment of cheese milk with preservatives e.g. Lp-system/H<sub>2</sub>O<sub>2</sub> or salt increased the moisture content and decreased the acidity in the resultant cheese.
- 4-Using Lp-system and H<sub>2</sub>O<sub>2</sub> treatments have no effect on salt content of the cheese. This is obvious in salt/water ratio. Storage of cheese decreased the salt content. Also, the treatments have no effect on fat content.

**S-Treatment of cheese milk with preservatives have no effect on T.N. content of the resultant cheese but the differences are due to variations in the moisture and salt contents. The T.N. decreased gradually during storage.**

- 6-The soluble nitrogen increased gradually during ripening. It was decreased as the salt content increased. However, decreasing the salt (5% salt) raised the acidity and inhibited the proteolysis of protein and lowered S.N. content. Activation of Lp-system or H<sub>2</sub>O<sub>2</sub>-treatment reduced the S.N. content especially in the latter. The same trends were observed with tyrosine and tryptophan content, shilovitch No. and TVFA content.
- 7-There were no apparent differences in the electrophoretic patterns of cheese protein due to the Lp-system or H<sub>2</sub>O<sub>2</sub>-treatments.

**a-The microbiological analysis of the cheese (T.C, coliforms, lipolytic and proteolytic bacterial count) showed that Lp-system and H<sub>2</sub>O<sub>2</sub>-treatments have an inhibitory effect on all the flora existed, and that H<sub>2</sub>O<sub>2</sub>-treatment has a stronger antimicrobial effect than Lp-system.**

- 9-Using Lp-system treatment produce cheese with satisfactory quality and ranked high scores within the vicinity of that made by the traditional method (10% salt). H<sub>2</sub>O<sub>2</sub>-treatment acquired lower scores.

**Section B: Yoghurt**

- 1-Lp-system and H<sub>2</sub>O<sub>2</sub>-treatments delayed the sitting time in cows' and buffaloes' milk.
- 2-The curd tension and curd syneresis from Lp-system treatment was almost the same as control in both cows' and buffaloes' while the H<sub>2</sub>O<sub>2</sub>-treatment caused a softening in the curd with high amount of whey exuded.
- 3-There was a slight decrease in the pH and increase in the acidity of the yoghurt made from preserved milk than the control in both cows' and buffaloes'.
- 4-No probable differences could be seen in T.S., Fat and T.N. of yoghurt due to preservatives. But, they were higher in buffaloes' yoghurt than that of cows'.
- 5-A slight variations were observed in N.P.N., T.V.F.A. and acetaldehyde contents due to Lp-system and H<sub>2</sub>O<sub>2</sub>-treatment of yoghurt milk and also due to kind of milk.
- 6-The electrophoretic patterns of yoghurt protein made from untreated, Lp-system and H<sub>2</sub>O<sub>2</sub>-treated milk were almost similar in both cows' and buffaloes'.
- 7-The lactic acid bacteria, coliform and yeast & moulds counts were the highest in untreated yoghurt and they decreased in Lp-system and H<sub>2</sub>O<sub>2</sub>-treated yoghurt and the reduction was more drastic in the latter.

**B-The Lp-system treatment has no effect on the quality of yoghurt as the sensory scores were almost the same as control. While the H<sub>2</sub>O<sub>2</sub>-treatment affected the quality of yoghurt and it ranked the lowest score points. Yoghurt prepared from buffaloes' milk of different treatments scored higher points than that from cows' milk. Storage improved the quality of yoghurt till 5 days after which the quality decreased.**

- 9-The effect of storage for 5 and 10 days was discussed for all parameters.

**Conclusion-** The keeping quality of raw milk can be prolonged to 10 h by activation of the lactoperoxidase system using 14:30 ppm of SeN:H<sub>2</sub>O<sub>2</sub>. While the storage period can be prolonged to over 16 h by adding second dose of 30

ppm HzOz after 4 h from the first dose.-The previous preserved milk (16 h) by Lp-system treated milk canbe manufactured to low salt Domiati cheese (5% salt) with a goodquality.-The Hzoz-treated milk with a concentration of 200 and 250 ppm(for cows and buffaloes) can be manufactured after preservation(16 h) to yoghurt and the treated milk can be manufactured to lowsalt Domiati cheese (5% salt) with an acceptable quality.