INFLUENCE OF FORMALIN AND HYDROGEN PEROXIDE ON THE PROPERTIES AND CONSTITUENTS OF MILK AND CHEESE

BY

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B.Sc. Agric. Co-oper.., Higher Institute of Agriculture Co-operation, Shoubra El-Kheima, 1996

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ABSTRACT

Meranda Abd El-Megaly Tawfek, Influence of Formalin and Hydrogen Peroxide on The Properties and Constituents of Milk and Cheese. Unplublished Master of Science Thesis, Department of Food Science, Faculty of Agriculture, Ain Shams University, 2005.

The aim of this work was planned to study the effect of formaldehyde (FA) and hydrogen peroxide (H_2O_2) on the milk constituents properties especially the protein and its reflection on the milk coagulation properties and hence the resultant cheese.

Raw buffalo's skimmilk samples each with 100 ml were spiked using FA (40%) or H_2O_2 (35%) at the level of nil (control), 0.025, 0.050, 0.100, 0.200, 0.300, 0.400, or 0.500%. Moreover, cast UF-white soft cheese was made using precheese spiked either with FA or H_2O_2 at the level of nil or 0.3% whether further heat treated at 72^{o}C for 20 sec. after preservative adding or not. The resultant cheese was kept at 5^{o}C for 4 weeks (W).

The obtained results indicated that, all coagulation properties of milk involving, clotting time, curd firmness and synersis were significantly harmed by both kinds (especially FA) and as their levels raised. An increased in the caseins (Cns) peak at the expense of other two peaks of whey proteins (β-lactoglobulin, β-Lg and α-lactalbumin, α-La) fractionated by Sephadex G100 was found to be associated with FA adding *vs* the opposite trend when, H_2O_2 was added. The sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE)-fraction of α_{s1}-Cn and β-Cn raised while γ-Cns decreased by FA on the contrast to H_2O_2. Significant reductions in the level amino acids of lysine, methionine, cysteine, leucine, total essential amino acids (TEAA), histidine, arginine,

serine, aspartic acid, alanine, total non-essential (TNEAA)and total amino acids (TAA) were occurred due to adding 0.3% preservatives regardless their kinds. Likewise, the protein efficiency ratio (PER), biological value (BV) and net protein utilization (NPU) of milk proteins were harmed by any type of preservative level studied. Neither dry matter (DM), fat/DM, protein/DM nor ash content of cheese was significantly affected either by the kind or the level of the preservative added. However, the fat/DM as well as the ash contents raised and that of protein/DM decreased due to the further heat treatment of the precheese after preservative adding prior cheesemaking. The water soluble nitrogen/total nitrogen (WSN/TN%) and pH value of cheese lowered by FA than H_2O_2. While, the titratable acidity (TA%) of cheese increased in the presence of FA than H_2O_2. Considerable depressing in the absorbancy of most proteins fractions (especially β-Lg) gained by Sephadex G100 due to precheese treating either by H_2O_2 adding or further heating, opposite to that occurred when FA was added, which inhibited the heat-induced dissociation of casein (Cn) contributed to the further heating of precheese. While, H_2O_2 retarded but did not completely prevent the heat-induced association between k-Cn and β-Lg. Except of α_{s1}-Cn, the level of α_{s2}-Cn, β-Cn, k-Cn and γ-Cns of cheese protein fractionated by SDS-PAGE were increased by FA and decreased by H_2O_2 as compared with the control. However, the levels of lactoferrin (placed also with the cheese ripening proteinous product of α_{s1}-I-fragment), immunoglobulins (Igs), β-Lg and α-La of UF cheese protein raised by adding H_2O_2 to precheese as compared either with those containing FA or even the control. The precheese further heating led to peak diminishing of most whey proteins fractions (except of those of Igs and α-La), α_{s2}-Cn as well as β-Cn and increasing in both of k-Cn and γ-Cns. The prolonging of cheese cold storage period was associated with

decrement in all casein fractions except of γ-Cns, those increased similarly as exhibited by β-Lg and α-La fractions. Cheese firmness weakened due to preservatives adding, regardless their kinds, and strengthened by the further heating of precheese. The behaviour of cheese firmness during cold storage period tended to weaken after 2W and to restore after 4W. The addition of 0.3% preservatives regardless their kinds to the precheese or/and further heating of precheese led to obtained cheese with decreased total viable bacterial count, which gradually raised by prolonging the cold storage period. All cheeses, those made from preservative-containing precheese, were free from the coliform bacteria as well as yeasts and moulds.

The considerable changes in the properties whether those of milk or cheese are making it possible to design measurement procedures for preservative detection based essentially on those occurred in the milk protein fractions and properties.

Key words : Rennet clotting time, Curd firmness, Curd synersis, Sephadex G100, SDS-PAGE, Amino acids composition, Protein efficiency ratio (PER), Biological value (BV), Net protein utilization (NPU), Cold stored cast UF-white soft cheese, Cheese firmness, Ripening indices.

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LIST OF ABBREVIATIONS

AOAC	: Association of Official Analytical Chemists.
^{o}C	: Degree centigrade.
cm	: Centimeter.
ddH2O	: Double distilled water.
DNA	: Deoxyribonucleic acid.
e.g	: for example.
EOSQC	: Egyptian Organization Standardization and Quality Control.
EPA	: Environmental Protection Agency.
et al	: and others
f	: Fento = 10^{-15} .
FAO	: Food and Agriculture Organization.
FMOC	: 9-Fluorenylmethylchloroformate.
g.	: Gram.
h	: Hour.
HPLC	: High Performance Liquid Chromatography.
^{131}I	: Iodine-131.
kg	: Kilogram.
l	: Liter.
M	: Mole.
m^2	: Square meter.
mg	: Milligram.
min	: Minute.
ml	: Milliliter.
mm	: Millimeter.
nm	: Nanometer.
OPA	: O-phtalaldehyde.
PAGE	: Polyacrylamide Gel Electrophoresis.
R_F	: Relative front.
RNA	: Ribonucleic acid.

RP-HPLC	: Reverse phase High Performance Liquid Chromatography.
SDS	: Sodium dodecyl sulfate.
sec	: Second.
SPSS	: Statistical analyses according to statistical system.
$T_{1/2}$	: Half-shelf life.
TEMED	: N, N, N, N Tetramethylethylindiamine.
UF	: Ultrafiltration.
w	: Weeks.
WPF	: Whey Protein-Free.
µg	: Microgram.
µl	: Microliter.
%	: Percent.