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THE EFFECT OF ASCORBIC ACID ON LIQUID EGG PRODUCTS

MAJD ELAYAN - ADRIENN TÓTH - MUNKHNASAN ENKHBOLD - LÁSZLÓ FRIEDRICH - CSABA NÉMETH

Department of Refrigeration and Livestock's Products Technology, Hungarian University of Agriculture and Life Sciences, Gödöllő

INTRODUCTION

Eggs are considered the magical food that contains most of the micro and macro nutrients needed to support cell growth and replacement. With an amino acid score of 100 egg whites are known to be a good source of high-quality proteins, studies have shown that the net protein utilization value for egg white proteins, whether it is cooked or uncooked, is higher than that of both whey and soybean proteins (Matsuoka *et al*, 2017). Egg products manufacturing was started in the late 1980s due to increased consumption and demand for stable products with diverse applications. Food manufacturers used dry egg products because it's easy to handle and relatively cheap (Sharif *et al*, 2018). Ascorbic acid (vitamin C) is well known for its antioxidant properties and the ability to increase iron absorption. Fortifying food with ascorbic acid can increase antioxidant and anti-inflammatory properties. The aim of this study is to determine the effect of fortifying 4 different liquid egg products with different dosage of ascorbic acid on the product's physical and chemical properties. Ascorbic acid was added to 3 samples of 200 g of weight of 4 different products which are the following: liquid whole eggs (LWE), liquid whole egg with salt (LWES), liquid egg white (LEW), and liquid egg yolk (LEY). 3 different concentrations were added to three samples of all products with the following dosage: 1%, 2% and 3% respectively in comparison to a blake sample of the same product, then dry matter content, pH, color, and viscosity was measured. Fortifying egg products with vitamin C can affect the pH, color, and viscosity in all four liquid egg products. The importance of this research underlines the fact that a new egg product

fortified with vitamin C with a better nutritional value and functional properties can be created.

Keywords: Liquid whole egg, Liquid egg white, Liquid egg yolk, Vitamin C, Viscosity.

LITERATURE REVIEW

Eggs are considered the magical food that contains most of the micro and macro nutrients needed to support cell growth and replacement, they are inexpensive sources of high-quality protein with a good content of minerals and vitamins. With an amino acid score of 100 egg whites are known to be a good source of high-quality proteins, studies have shown that the net protein utilization value for egg white proteins, whether it is cooked or uncooked, is higher than that of both whey and soybean proteins (Matsuoka *et al*, 2017). Due to eggs' ability of providing 9 essential amino acids making them a great source of high biological value. Scientifically speaking, egg content of protein is usually used to compare the protein quality of other food (Herron & Fernandez, 2004). Egg products manufacturing was started in the late 1980s due to increased consumption and demand for stable products with diverse applications. Food manufacturers that use dry egg products because it's easy to handle and relatively cheap (Sharif *et al*, 2018), they also prefer using liquid whole egg products because of its processing convenience if compared to fresh eggs. Food industry in Europe uses both grade "A" fresh eggs and grade "B" second quality eggs. products which fit human consumption (Rossi *et al*, 2010). On the other hand eggs must be clean, dry, fully developed with no cracks, if there are any cracks eggs can be used in the processed products if used as soon as possible and minimal contamination from egg shells is required (Rossi *et al*, 2010). Liquid egg products are highly sensitive to microorganisms that's why they are pasteurized before packaging to ensure its safety for human consumption(Lee *et al*, 2001). Due to eggs thickening, emulsifying coloring and foaming abilities food industries use it in many ways such as pasta, mayonnaise, pastry and other baked foods (Kiosseoglou & Paraskevopoulou, 2006). Vitamin C (ascorbic acid), well known as one of the water-soluble vitamins and the most powerful antioxidants, was first isolated by the Hungarian biochemist and Nobel Prize winner Szent-Györgyi in 1928 (Matsuoka *et al*,2017). One of the most special properties of vitamin C is that it can work as both acid and base. Vitamin C is a very important vitamin in plant foods, which is found in 2 forms ascorbic

acid and dehydroascorbic acid, and characterized by its degradability in processing and food preparation. As many studies mentioned, the degradation of vitamin C is not completely understood but the impact factors are known for model solutions only (Aka *et al*, 2013).

MATERIALS AND METHODS

Experimental design

4 different pasteurized liquid egg products: liquid whole eggs (LWE), liquid whole eggs salted (LWES), liquid eggs white (LEW), liquid eggs yolk (LEY) were obtained from (Capriovus Ltd., Hungary) and fortified with 0%, 1%, 2%, 3% ascorbic acid, which was added to 200 ml sample of each product respectively and dissolved completely. Then pH, viscosity, color, dry matter content measurements were done.

Rheological Measurements

A 30 ml sample was obtained from the original 200 ml of all products with different ascorbic acid concentrations (0%, 1%, 2%, 3%) to examine the rheological behavior of all products. To perform the test aMCR 92 rheometer (Anton Paar, France) in rotational mode equipped with a concentric cylinder (cup diameter 28.920 mm, bob diameter 26.651 mm, bob length 40.003 mm, active length 120.2 mm, positioning length 72.5 mm) was used. Anton Paar RheoCompass software (version 1.21.852) was used to control the equipment. The temperature of rheo- logical measurements was kept constant at 15 °C. Shear stress was measured by increasing and decreasing shear rate between 1 and 1 000 s^{-1} for 31 measurement points with a period of 3 s. The Herschel-Bulkley model was used to analyze the flow curves (shear rate-shear stress dia- grams). This model was used to describe the rheological properties of liquid whole eggs (LWE), liquid whole eggs salted (LWES), liquid eggs white (LEW), liquid eggs yolk (LEY) at 15 °C.

RESULTS AND DISCUSSION

Rheological Properties

The importance of studying rheological properties in food science is due to its ability to utilize food processing operations and sensory characteristics, it can also give a great

amount of information about the microstructure of food. knowing the rheological properties can make material handling easier in industrial manufacturers. Figure 1, 2, 3, 4 show the results of the rheo- logical analysis obtained in this study, where samples were examined freshly. The effect of vitamin C on all products viscosity is seen clearly and parallelly with the increase of its concentration. It Is known that vitamin C can decrease the pH of solution due to its ability to work as an acid which will have a direct effect on viscosity. Benoit and his colleagues found that by decreasing the pH an increase in viscosity is observed (Benoit et al, 2011).

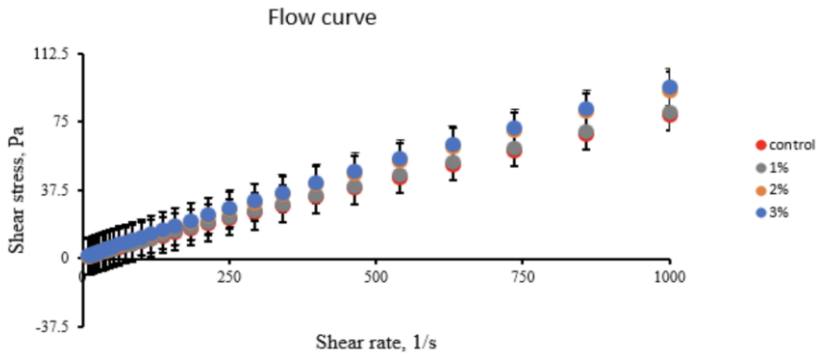

Figure1: Effect of different concentrations of ascorbic acid (1%, 2%, 3% w/w) on liquid egg yolk viscosity in comparison to the control sample (0% of ascorbic acid).

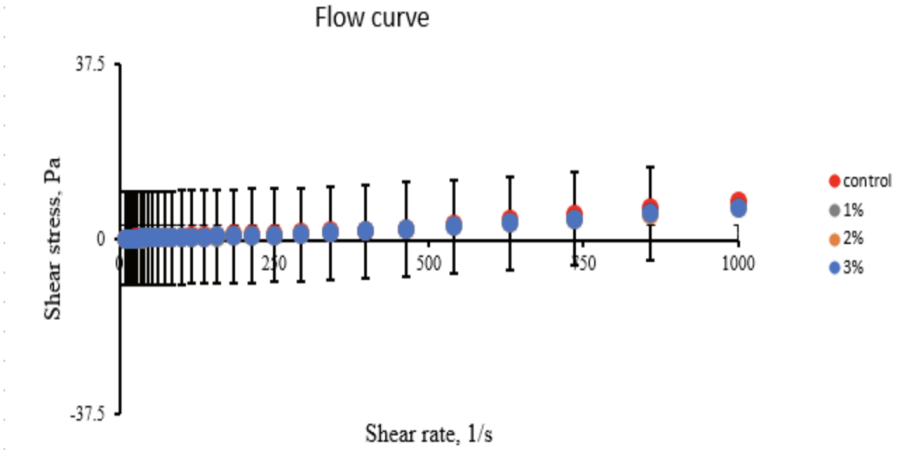

Figure 2: Effect of different concentrations of ascorbic acid (1%, 2%, 3% w/w) on Liquid egg white viscosity in comparison to the control sample (0% of ascorbic acid)

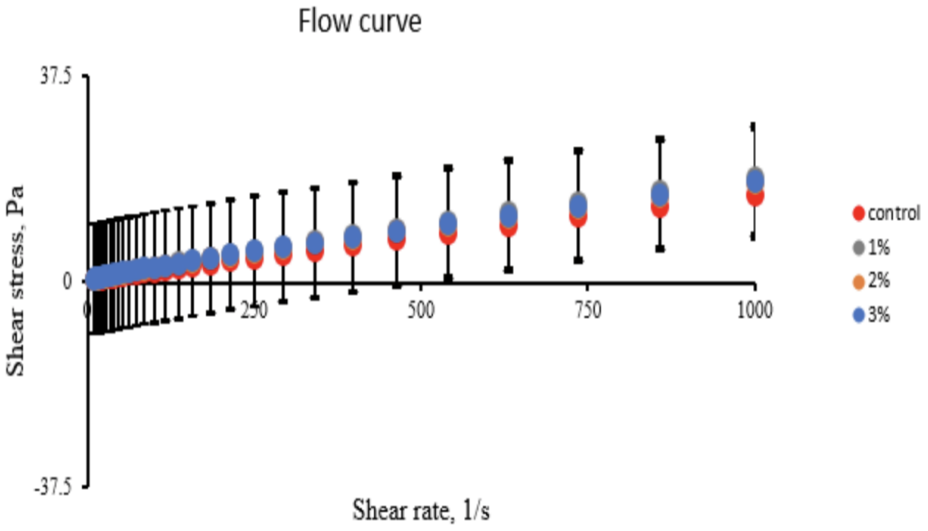

Figure3: Effect of different concentrations of ascorbic acid (1%, 2%, 3% w/w) liquid whole eggs viscosity in comparison to the control sample (0% of ascorbic acid).

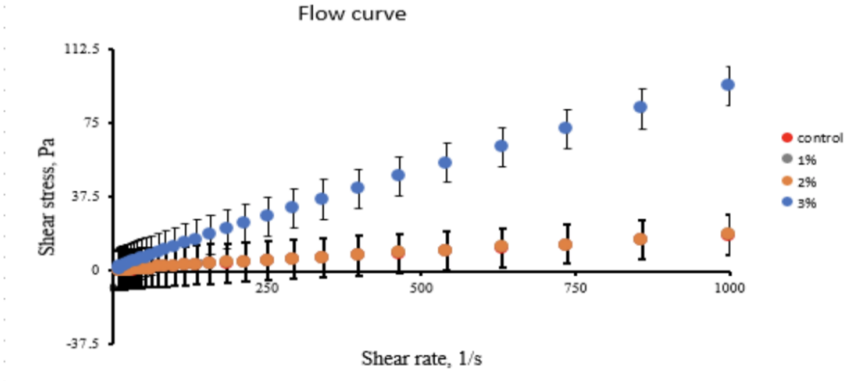

Figure 4: Effect of different concentrations of ascorbic acid (1%, 2%, 3% w/w) salted liquid whole eggs viscosity in comparison to the control sample (0% of ascorbic acid).

CONCLUSION

Vitamin C has a positive direct relation to liquid whole egg, liquid whole egg salted, liquid egg white, and liquid egg yolk viscosity by lowering the products pH.

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A szerzők levélcíme – Address of the authors:

Majd Elayan
Department of Refrigeration and Livestock's Products Technology,
Hungarian University of Agriculture and Life Sciences, Gödöllő
Corresponding Author:Elayan.majd10@gmail.com