The development of a novel whole egg pasteurisation system.

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ABSTRACT:
As a highly nutritious and inexpensive protein food, chicken eggs are accepted in most cultures. The safety of eggs has become an issue of global concern with the emergence of the pathogen *Salmonella enteritidis* as a major hazard associated with the consumption of eggs. The susceptibility to and mortality rate of Salmonella infection is higher in immuno-compromised individuals, leading to an increased demand for safe eggs for the local and export markets.

The primary aim of this research was to design and develop an effective pasteurisation system to produce raw, whole eggs free from *Salmonella enteritidis*, and other Salmonella contaminants, that have the same sensory and functional properties as untreated eggs. The secondary aim was to have a dry pasteurisation system to replace the need for dipping eggs in water as a heat transfer medium. Water heating systems are very difficult to manage as the water damages the egg shell outer coating, making it susceptible to post process contamination. Heated water systems also tend to be a safety hazard, because it provides an ideal environment for growth of microorganisms. Water is contaminated by broken eggs - a frequent occurrence in commercial environments handling large quantities of eggs.

A working system was achieved by a novel combination of microwave and dry heat technology that was developed in cooperation with industry partners.

METHODOLOGY:
A system was developed consisting of a rolling bed of eggs with eight lanes in which eggs are heated to an even temperature varying between 54 and 58^{o}C, depending on the oven power and exposure time settings. A novel microwave cavity design was developed in order to prevent overheating of eggs (Fig 1).

Figure 1: Loading of the rolling bed with eggs going into the microwave cavity of the pasteuriser.

Egg processing quality control is achieved by using infra-red sensors, giving an indication of the egg shell temperature of each individual egg, which is highly correlated with egg internal temperature. Egg internal temperatures were measured using optic fibre technology.

Target temperatures for processing were determined based on inoculating *Salmonella enteritidis* in known quantities into the eggs[1], and determining survival rates after heat exposure. Specific challenges regarding egg temperature distribution, and inoculation methods developed for ensuring repeatable results suitable for quality control were overcome.

RESULTS AND DISCUSSION:

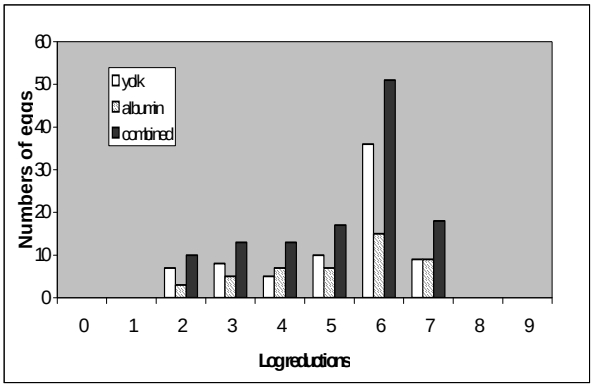

Figure 2: Graphic representation of log reduction data for all *Salmonella enteritidis* inoculated eggs after processing in the combined heat pasteuriser

Microwave heat absorption is affected by various parameters, of which weight distribution and egg shape are the most important. Specific challenges linked to the variability in size, shape and weight of eggs had to be addressed, as current egg classification standards were not sufficiently selective to allow for a narrow range of heat absorption.

The numbers of *Salmonella enteritidis* artificially introduced[2] into the eggs were reduced by at least two logs (Fig 2). A six log reduction was achieved in most trials. This reduction is sufficient to indicate that the process contributes significantly to whole egg safety.

CONCLUSION:

Pasteurised eggs from this process are available commercially in South Africa, and international interests are being pursued after granting of a PCT patent.

REFERENCES:

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2. GAST, R. K., BEARD, C.W. (1992) Detection and enumeration of *Salmonella enteritidis* in fresh and stored eggs laid by experimentally infected hens. *J. Food Prot*. **55** 152-156