

The great industrial bake-off

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Not everyone can rustle up a Victoria sponge, lemon drizzle cake or a jam roly-poly, so shop-bought cakes remain a mainstay of high tea for many a household. Thankfully, quality control on food production lines continues to improve. Now, a research paper to be published in the International Journal of Industrial and Systems Engineering shows how a simple set of rules can spot critical points in the cake-making process and through careful design improve even exceedingly good cakes.

Marina Pouliou of TEI Piraeus, in Athens, Greece, working with George Besseris of the University of the West of Scotland, in Paisley, UK, have turned to the "Taguchi methods" - suite of statistical tools developed by Japanese engineer Genichi Taguchi that focus on variation and deviations from the norm. The team explains that by using proven quality methods, such as design of experiments, finding the most significant factors that affect the baking process of a cake product and carrying out trials offline it should be possible to make a higher quality product more consistently and reduce the percentage of "defective" cakes coming off the production line.

The team has applied a three-tier approach to the statistical analysis using Taguchi methods and focused on two particularly important factors when it comes to any bake-off: cake weight and surface peak. The team took into account the different variables that arise in production of a loaf cake: the rates of mixing and blending of ingredients, baking duration, temperature. The analysis using a variation on Taguchi methods allowed the team to glean an optimal set of baking conditions for a standard large-scale cake product.

Mixing time and baking duration were the two most important factors affecting cake weight, the team reports. Tweaking the baking duration allowed them to get close to the perfect sponge weight. "It is important that the weight be around what we call a specification value such that there is not much [fluctuation](#) from batch-to-batch after production," Besseris says. "In other words, this is to give the consumer a standardized amount of the food item."

The Taguchi analysis fell short, however, when testing baking conditions for the optimal peak surface. This factor seeming not to be affected by mixing times, baking temperature or duration. The team will investigate other variables to find the optimal conditions for peak in future research, perhaps tweaking ingredient proportions. They also intend to use the same approach to optimise taste and smell, texture and overall cake structure, and colour of the final product. Proof of the pudding, of course, is in the eating.

More information: "Robust screening of cake product characteristics by the Taguchi method" in Int. J. Industrial and Systems Engineering, 2013, 14, 207-229

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