



The big breakfast test

Using the EZ Test EZ-X texture analyzer

Foods as a basic need of human existence are subject to constant inspections. The Shimadzu News regularly reports on new analytical capabilities.

In addition to taste and the inspection of ingredients, questions are always raised on the physical properties of our food: how quickly does our bread get stale? How crisp are our sausages? What are the

differences between eggshells originating from different egg farming methods? ... These are the questions that will be addressed in this and in subsequent issues of the Shimadzu News – using the foods that make a continental breakfast.

Part 1: How do you like your eggs?

Eggs are part of a rich, healthy breakfast – whether boiled, fried or as an omelet. On average, the egg consumption per capita per year is 218 in the European Union. Whereas the Spanish eat 285 eggs per person per year, each Briton consumes only 176. Germany nearly meets the average of 217 eggs per person per year.

This high level of consumption requires a high production rate, which can only be attained by keeping high populations of laying hens in egg farming systems. Ever since the ban on battery cages, a change in mindset has been triggered with respect to egg production, and the number of production facilities for organic eggs or free-range eggs is increasing. What is the influence of egg farming methods on the product itself?

The eggshell could be used as an index for natural egg farming methods, since it can be assumed that due to better animal welfare conditions, eggs may grow at a slower rate, and in turn the eggshell can absorb more calcium and thus may be stronger.

Hard center, hard shell?

The hardness of eggs from various egg farming methods have been compared. Eggs were obtained from a random supermarket and were subjected to a pressure test using the EZ-X texture analyzer. The eggs were from barn-raised, free-range and organically raised laying hens as well as from free-range laying hens that received special grain feeds. All eggs were clamped in the testing machine and compressed at a constant crosshead movement until remove age. To level possible natural unevenness of the shell, the bottom support surface as well as the bottom of the pressure plate was covered with a 40 mm thickness foam board.

All test measurements were carried out on raw eggs as well as eggs that had been hard-boiled for 10 minutes

Egg farming methods and eggshell strength

Table 1 shows inconsistent values. While there were hardly any differences between the values for boiled and raw barn-raised eggs

Egg farming method	Raw (in N)	Hard-boiled for 10 min (in N)
Barn-raised, Grade A	142.74	135.39
Free-range, Grade A	181.27	172.26
Grain-fed free-range, Grade A	162.79	193.30
Organic eggs, Grade A	109.41	161.39

Table 1: Test measurements of raw and boiled eggs



and free-range eggs, the values between raw and boiled organic eggs and for grain-fed eggs increased significantly.

Also the strength profiles between the individual egg farming methods were not as expected. While eggs produced according to increasingly more ecological farming methods, have harder shells when boiled, this was not the case for raw eggs. Surprisingly, organic eggs exhibited significantly lower values than free-range eggs.

Consequently, it cannot be concluded that the egg farming method has a significant influence on the eggshell. However, it must be noted here that organic eggs exhibited the lowest measured value fluctuations and the most uniform break patterns.

Part 2: The daily bread

Bread has been a basic food in the Western world for thousands of years. With an average bread consumption per capita of approximately 66 kg, Europe holds a leading position in the worldwide consumption of bread. With nearly 70 percent, fresh baked bread dominates, prior the frozen bakery products, fast food bread and long-life bakery products.

Bakery or supermarket – which offers the freshest products?

It is not surprising that freshly baked goods are usually found at the European breakfast table. Depending on local tastes, these could be breads, baguettes or ciabattas; the main issue is the freshness of the products. In addition to traditional bakeries, freshly baked goods from on-site baking ovens are increasingly being offered in supermarkets.

Yet, how fresh are these baked goods and are there any differences in texture and shelf life? Shimadzu has tested several baked goods from a bakery and supermarket chosen at random.

To get upon the freshness' track

Various baked goods were subjected to a compression test using the EZ Test-X Texture Analyzer, where pressure plates simulate a pressure test applied with the palm of a hand. In this way, the stiffness/chewiness of the crust as well as the crumb is tested. The baked goods were removed from their commercial packaging, and each set was tested one hour after purchase, thereafter 24 hours and 72 hours after purchase.

As expected, a very strong increase in the texture of all breads has been measured. This is mainly due to drying out of baked goods that were packaged in paper bags. Only in the case of the crusty rye



bread bought at the supermarket could a lower value be measured after 24 hours of storage.

As a slight increase could also be measured for the crusty bread obtained from the bakery, it can be concluded that the crumbs in these baked goods have a much higher moisture content compared to the small baked goods. This ensures that the bread dries out much more slowly. For baked goods from the discount supermarket, the crust apparently softened over 24 hours. This is why a decrease in force was registered. This could, however, also indicate that the baking time was too short so that the bread was not completely baked.

Overall, it can be concluded that the measured values for products purchased at the supermarket and the bakery were similar and were still edible after 24 hours. Significant changes could only be observed after 72 hours. Many products had by then become so hard that they were no longer fit for consumption. Another proof of why Europeans like to enjoy their baked goods freshly baked each day ...

Baked goods	Discount supermarket (A) / bakery (B)	Max. force (N) after 1 hour	Max. force (N) after 24 hours	Max. force (N) after 72 hours
Croissant	A	5	16	85
	B	4,5	24	82
Ciabatta	A	47	255	700
	B	36	291	305
Wheat bread rolls	A	35	57	160
	B	30	44	80
Multigrain roll	A	65	142	1,700
	B	100	160	1,900
Baguette	A	50	125	670
	B	47	100	520
Crusty rye breadbrot	A	36	32	125
	B	20	26	90

Table 2: Compression test of bread

Part 3: About knackwursts and sausages

Those who wish to supplement their breakfast consisting of bread and eggs, might like to try some sausages. Depending on local taste, these may vary in type and can be prepared either fried or boiled. Regardless, however, of their production and preparation: all sausages are expected to be tender but still firm, as in addition to the intense flavor, consumers also want an equivalent bite sensation.

Taste and bite sensation

Additionally to the question which type of sausage best offers this bite sensation, the question on possible differences between industrially produced or home-made type sausages needs to be answered as well. To avoid any differences caused by the method of preparation, the sausages were also tested in the raw state.

All tests were carried out using the EZ Test EZ-X texture analyzer. As cut resistance and firmness are proportional, the sausages were cut using a blade test method, in order to exclude differences in chewing behavior.

As can be seen in the table above, the cutting force for sausages that are mainly eaten warm (for instance Krakauer Polish sausages or Bavarian veal sausages) is significantly higher for the raw state compared to after being cooked. This may be explained by the fact that the raw sausage is considerably softer in its initial raw consistency and, therefore, a much higher force is required to be able to make the first incision. During cooking, the sausage mass expands and the casing tightens.

In contrast, although Vienna sausages show no differences between the raw and cooked state, as they are suitable to be eaten cold as well as warm, there is however a significant difference with respect



to cutting force between Vienna sausages obtained from a discount supermarket or from a butcher shop.

The results for Bavarian veal sausages and Nuremberg grilled sausages, however, appear to vary. While the Bavarian veal sausage can be cut into much more easily in the cooked state than when raw, the Nuremberg sausage is much crispier when fried compared to the cold version.

Sausage type	Discount supermarket (A) / butcher (B)	Cutting force [in N] raw	Cutting force [in N] boiled/fried
Krakauer – Polish sausage	A	87	49
	B	94	70
Mettenden – beerstick sausage	A	111	98
	B	91	84
Vienna sausage (Wiener)	A	17	20
	B	42	44
Bavarian veal sausage	B	43	31
Nuremberg grilled sausage	B	13	27

Table 3: Sausage cutting test