COOKED PASTA RETAINS UP TO 80% OF ADDED B-VITAMINS

In many countries, pasta products are made with flour that has been fortified to improve its nutritional value. But during manufacturing, drying and cooking, sensitive vitamins such as riboflavin, thiamine, niacin and folic acid are lost. In the specialist literature, vitamin B losses through cooking of over 90 percent are mentioned. In order to gain more background knowledge of the subject, Mühlenchemie has done its own stability tests in its new pasta laboratory. According to this study, between 40 and 80 percent of added B-vitamins are retained in the cooked pasta.

In over 80 countries flour is fortified with vitamins and minerals to protect consumers from nutritional deficiencies. While some micronutrients show high stability during processing, water-soluble B-vitamins can react very sensitively to outside influences.

This sensitivity causes them to degrade in pasta products in particular. High cooking temperatures and UV light exposure lead to losses of micronutrients and so reduced nutritional value.

Micronutrients are lost to some extent in manufacture and drying as well. These losses are usually taken into consideration when defining the amount of fortification or setting standards, whereas the effect of the cooking process is not considered in the calculation since preparation differs from one household to another. Thus, the target fortification values always refer to the dried product, although for the consumer the only thing that matters is the vitamins remaining after preparation.

Realistic test series in the new pasta laboratory

The data given in the literature varies greatly, so Mühlenchemie's ingredient specialists wanted to find out for themselves how much vitamin B is lost when cooking fortified pasta, by analysing the vitamin B1, B2, niacin and folic acid content during manufacture, storage and preparation.

At the company's pasta laboratory there is a Pavan pilot system that can simulate the process parameters of most industrial production plants. On it, spaghetti was made using enriched type 550 wheat flour. The process parameters were 95 bar pressure

Sensitivity of Vitamins

Vitamin	Light	Oxidizing Agents	Reducing agents	Heat	Humidity	Acids	Alkalines
Vitamin B1	++	+	+	+++	++	+	+++
Vitamin B2	+++	+	++	+	+	+	+++
Niacin	+	+	++	+	+	+	+
Folic Acid	++	+++	+++	+	+	++	++

+ = hardly or not sensitive ++ = sensitive +++ = very sensitive

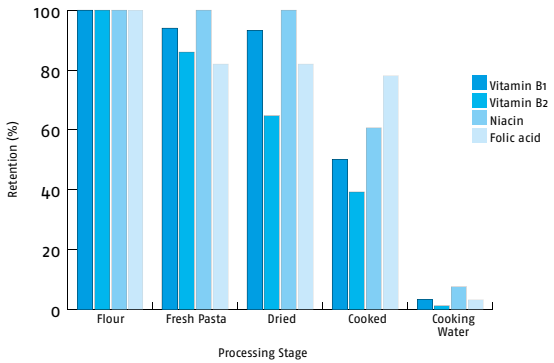
and 40 – 45 °C; drying time was five hours, with temperature and humidity varying between 68 – 87 °C and 45 – 79 % r.H. in the respective drying and relaxation phases. The 1.5 mm diameter spaghetti was then cooked for nine minutes in unsalted water.

The pasta was made in-house, but vitamin analysis was sourced to an accredited outside laboratory. Since quantitative vitamin content analysis can give high fluctuations of 20 to 30 percent, Mühlenchemie had quadruple measurements done in order to get reliable averages. Fresh, dried and cooked pasta was investigated, as was the cooking water.

Vitamin loss in manufacturing, storage and preparation

Table 1 (Cumulative losses of B-vitamins during the different processing steps of spaghetti)

Cumulative losses of B-vitamins during processing and cooking of spaghetti



shows vitamin reductions in the individual manufacture and processing operations. All B-vitamins showed losses, but to differing extents.

For example, niacin proved to be unaffected by dough kneading, extrusion and drying. Niacin content remained stable throughout the manufacturing process; losses did not occur until cooking. The prepared pasta still had over 60 percent of the original niacin. Some had gone into the cooking water.

The situation was the other way round with folic acid. 18 percent of the original content was lost during processing of the flour to fresh pasta. Drying had no effect, while loss during cooking amounted to only about four percent. Folic acid proved to be the stablest vitamin, with almost 80 percent remaining in the product.

Vitamin B1 (thiamine) is known for its high sensitivity to temperature, and this was reflected in the analysis results, with thiamine degeneration taking place mostly during cooking. The final product had only half of the original vitamin B1 content.

Vitamin B2 (riboflavin) had the highest loss. This vitamin is extremely sensitive to light and lost a third in manufacture and drying. Due to leaching losses during the cooking step, retention of riboflavin in the cooked pasta was just 40 percent.

The results of this test series by Mühlenchemie largely confirm existing data in the literature. However, they did not confirm the maximum losses of over 90 percent mentioned in a study from 2007.

High riboflavin losses during storage

The pasta test series was supplemented by another test to gain information on vitamin losses during storage. The only vitamin tested for was riboflavin, which is light-sensitive. Test conditions replicated those of most consumer households – the dry spaghetti was stored in a cupboard that was opened several times a day. The vitamin B2 content was measured three times over the course of a month. Analysis showed that even these short periods of light exposure were enough to massively reduce the riboflavin content, and after 28 days the spaghetti only had a little over 40 percent of the original amount (see table "Losses of vitamin B2 in spaghetti during storage (predominantly stored in the dark)."

These tests show how important it is for manufacturers, retailers and consumers to protect enriched pasta from light and package it properly. The transparent container on the shelf popular as a storage method in many homes is the worst possible alternative. Ideally, packaging should be UV-protected and the product should be stored in the dark.

Preparation should also minimise the loss of nutrients. Vitamin loss can be reduced by a few percentage points simply by minimising cooking time. Soft, overdone noodles have less micronutrients than al dente pasta.

Compensating cooking losses through higher vitamin enrichment

Although some of the vitamin B added to pasta gets lost, vitamin-fortified pasta remains important in the fight against nutritional insufficiency. Every additional fortification means a better nutrient supply. Vitamin B losses in bread are between 5 and 10 percent; those in pasta are much higher. Yet through careful manufacture and packaging, and short cooking times, losses can be reduced to a minimum. Mills and pasta makers also have the option of increasing the amount of vitamin fortification to counteract cooking losses. Normally, the higher vitamin content of the flour or pasta can be shown on the packaging as a sales benefit.