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In this report… We are well aware of the importance of dietary fiber, thanks to its beneficial health effects. Whole wheat flour contains four times more dietary fiber than extracted wheat flour. But did you know that the viscoelastic properties of wheat flour dough have a significant impact on dough machinability? Read how researchers determined the optimum pH and concentration levels of whey protein isolate needed in a post-breading dip to reduce oil absorption in deep-fried, battered and breaded products. Acidic whey protein beverages can be astringent. If they are extremely astringent, they'll displease consumers. Whey proteins may directly cause the astringency, but no proof of this relationship exists.

Type of flour influences rheological properties of dough

The health benefits of wheat strongly depend on the form in which it is consumed. The most common wheat product, which is bleached white flour, contains about 60% of the original wheat grain. On the other hand, whole wheat products contain 100% wheat grain.

Whole wheat flour contains four times more dietary fiber than extracted wheat flour. We all know about the importance of dietary fiber, thanks to its beneficial effects on reducing cholesterol levels, reducing the chance for coronary heart disease and the risk of colon cancer. Even with the health benefits they offer, whole grain foods have not been attractive to consumers because of the higher levels of bran and germ in whole grain flour. These reduce the quality and sensory value of the end product.

In recent research, scientists at the University of Illinois and elsewhere focused on the effect that various levels of whole wheat flour have on the rheological behavior of pizza dough. It appears that the viscoelastic properties of wheat flour dough have a significant impact on the dough's machinability and the textural characteristics of the finished product.

The researchers evaluated changes in the rheological properties of dough samples that contained 0%, 25%, 50%, 75% and 100% whole wheat flour (WWF) and which contained whole ingredients—yeast, olive oil and salt—as well as samples without

ingredients. The viscoelastic properties of the dough samples and baked pizza crusts were tested using a commercial rheometer and dynamic mechanical thermal analyzer. The dough made from 100% whole wheat flour had a dense texture. It absorbed more water and was less elastic. The elasticity of the dough samples decreased as the amount of whole wheat flour increased in the formulation. Incorporating ingredients—olive oil, salt and yeast—improved the elasticity of the samples. The pizza crust with 25% whole wheat flour was the one that behaved rheologically similar to regular pizza crust with 100% wheat flour.

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Whey protein isolate offers oil barrier properties for deep-fried, battered, breaded chicken patties

As consumers become more aware of the deleterious effects of a high-fat diet, industry has stepped up its efforts to lower the fat content of foods.

Scientists at Ohio University wanted to determine the optimum pH and concentration levels of whey protein isolate (WPI) that would be needed in a post-breading dip to reduce oil absorption in deep-fried, battered and breaded chicken patties. They found that WPI exhibits oil-barrier properties which are dependent on its pH and concentration when used as a post-breading dip in fried foods. Furthermore, WPI does not significantly affect the flavor of the product, making it a promising alternative for lowering the fat content of fried foods.

In their research, the scientists applied a full factorial design using three levels of pH—2, 3 and 8—at four concentrations of WPI: 0%, 2.5%, 5% and 10%. The tests were replicated three times. Treated 20-gram chicken patties were battered, breaded with cracker meal, dipped in a WPI solution and immediately deep-fried to an internal temperature of 74 C before being placed into frozen storage. The control patties were not dipped in the WPI solution. The investigators analyzed the lipid and moisture content of defrosted patties at 21 C, while texture, color and sensory analyses were performed on rethermalized patties at 71 C.

The dipped patties had a significantly lower lipid content than did the control patties across all WPI concentrations. Adjustments to the pH caused a significant reduction in lipid content. An analysis of the pH and concentration levels showed that the highest reduction of lipid content occurred at pH 2 and pH 3 using a 10% WPI concentration, with 25% and 35% lipid reductions occurring, respectively.

The moisture content of the samples was significantly lower across all concentrations and pH levels compared to the control. For color, both pH and concentration levels were negatively correlated with L* and b* values, but were positively correlated with a* values. Dipping the patties in the WPI solution increased their hardness and crunchiness but did not change their flavor profile.

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Astringency of whey protein beverages caused by their acidity

Beverages containing whey proteins continue to gain popularity. Although whey proteins are soluble over a wide range of pH, whey protein beverages are often formulated to be acidic in order to improve their clarity and microbial stability. For example, whey protein isolate can add a functional aspect to a wide range of beverages, including juices, because it remains stable across various levels of pH. This is not the same for the other milk-derived protein, casein, nor for whey protein's chief competitor, soy protein.

Acidic whey protein beverages can be astringent. If they are extremely astringent, consumers find the sensation to be unpleasant.

Whey proteins may directly cause the astringency, but no proof of this relationship exists. The high acidity of these beverages may also cause their astringency. Acids are known astringents, and the effectiveness of whey proteins as a buffer necessitates a high acid concentration to reduce the beverage's pH to targeted levels.
Scientists at the University of Minnesota wanted to determine if the acidity of the beverages, and not the whey proteins themselves, is responsible for astringency. Their results indicate that it is the high acid concentration, and not the whey proteins directly, that causes astringency in whey protein beverages. Knowing this will better enable scientists to alter beverage formulations in order to reduce their astringency levels.
Twenty subjects trained to recognize and rate astringency participated in one test session in which they were presented with six test solutions. Two of the test solutions were prepared by mixing whey protein isolate at 6% and 1% levels into distilled water and adding phosphoric acid until the pH reached 3.4. The researchers named these samples W6 and W1.
The same amounts of acid were also added into distilled water without any protein. These samples were named A6 and A1. The control solutions included distilled water and distilled water with phosphoric acid at a pH of 3.4. Panelists found the samples containing whey proteins (W6 and W1) to be less astringent than the protein-free samples with equal acid concentrations (A6 and A1).
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Soy protein, gluten hydrolysates suppress oxidation in pork meat patties

Lipid oxidation occurs in food when it is cooked and stored. These processes induce deterioration of a product's flavor, texture, shelf life, appearance and nutritional profile.

Chemically synthesized antioxidants have been added to foods to delay the onset of oxidation or to slow the propagation rate. However, consumer preference has driven the development of natural antioxidants for foods.
Amino acids and peptides have been reported to have antioxidant activity. In previous research, Japanese scientists reported that enzymatic hydrolysates of soy protein and gluten show higher antioxidant activity than those of milk protein. More recently, they evaluated the effect of peptide fractions from soy protein and gluten on lipid oxidation, both *in vitro* and in food systems.
The protein hydrolysates were fractionated on the basis of the amphoteric nature of the peptides. This technique is known as autofocusing. As you may know, an amphoteric substance is one that can react as either an acid or base. The autofocusing fractions were evaluated by 2,2-diphenyl-1-picrylhydrazyl (DPPH) spectroscopy for their radical scavenging activity and antioxidant activity against linoleic acid oxidation.
The raw and cooked pork meat patties with the fractions added were stored at 4 C for up to seven days, at 20 C for two days and at 40 C for six hours in the dark. After incubation, the meat patties were tested for the formation of thiobarbituric acid reactive substances (TBARS), which are products of lipid peroxidation. Acidic peptide fractions from both hydrolysates showed higher DPPH radical scavenging activity, while the basic fraction suppressed the oxidation of linoleic acid in the emulsion system. Soy protein and gluten hydrolysates also showed antioxidant activity against lipid oxidation in both the raw and cooked pork meat patties.
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Sauerkraut-spent media could be substitute for skim milk powder for bacterial cultures

A starter culture can provide particular characteristics in a more controlled and predictable fermentation. The primary function of lactic starters is the production of lactic acid from lactose. Bacterial lactic starter cultures are traditionally produced on synthetic media and then freeze-dried on a skim milk powder-based media. They are most often used in dairy-based applications.
There have been concerns that there may be traces of milk in starter cultures used in fermented vegetables. These traces of milk could end up in vegetable products incorporated by starter adjunctions and cause health problems for those who have a milk allergy.
To address this issue, scientists at Agriculture and Agri-Food Canada evaluated the use of a sauerkraut-spent medium for its growth and freeze-drying viability and active components. They found that sauerkraut-spent media could be a good substitute for skim milk powder for freeze-drying bacterial cultures. This processing approach could eliminate any traces of milk in vegetable products.

In experiments, the scientists grew a wild strain of *Leuconostoc mesenteroides* BLAC 1 and a laboratory strain of *Lactobacillus plantarum* NK312 during a 24-hour period in a fermented cabbage juice medium. The medium was supplemented with and without sugars or yeast extract. Final populations of bacteria totaled 9.11±0.05 logs CFU per mL and 9.30±0.02 logs CFU per mL, respectively.
Both sets of biomass were freeze-dried using four different freezing formulations. The formulations were based on fermented cabbage juice supplemented, or not, and on a reference freeze-drying media containing 20% skim milk powder. In terms of viability, the laboratory strain *Lb. plantarum* was more sensitive to the freeze-drying formulation than was the wild strain *Lb. mesenteroides*. Nevertheless, over a 60-day storage period, the activity of both strains was not significantly different in comparison to the control treatment, which contained the usual skim milk powder.
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Undertake analysis of skim milk powder flavor profiles, volatile compounds stored up to 29 years

Skim milk powder (SMP) purportedly has an optimum shelf life of two to five years. The powder may be stored for longer periods of time, but little information is available regarding the flavor of SMP after extensive periods of storage.
So, scientists at North Carolina State University wanted to characterize the flavor and volatile components in SMP that had been stored up to 29 years. Their research provides further insight into the volatiles and flavors that can occur in SMP during aging.
Twenty samples of fresh SMP, ranging from less than a month old to powder stored for 29 years, were reconstituted to 10% solids. These were evaluated by sensory and instrumental volatile analysis.
The powder was stored at ambient temperature in No. 10 cans under reduced oxygen atmospheres. Volatiles were analyzed in triplicate using solid-phase microextraction with gas chromatography-mass spectrometry. A 10-member trained panel conducted descriptive analysis in duplicate. Data were analyzed using analysis of variance with means separation, as well as correlation analysis and principal component analysis.
Descriptive analysis characterized differences between the various samples in terms of these attributes: cooked, sweet aromatic, animal, cardboard, fatty, grape candy, sweetness and astringency. Key differentiating volatile compounds in the SMP included 3-methylbutanal, 2-methylbutanal, dimethyl disulfide, hexanal, 2-hexanone, toluene, 2-heptanone and heptanal. SMP characterized by high levels of these volatiles was also characterized by fatty, cardboard and animal flavors.
Several powder samples were characterized by a grape candy flavor, and these contained unique volatiles, including 2,2,6-trimethylclyclohexanone. Cooked and sweet aromatic flavors and sweet taste were negatively correlated with age, while animal and cardboard flavors were positively correlated with age.

The volatiles that significantly correlated with the age of the samples included: 3-methylbutanal, dimethyl disulfide and toluene. Headspace oxygen was significantly correlated with animal flavor and hexanal.
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Stabilize PUFA-rich oils from salmon heads

In Alaska, discarded heads of salmon are actually a food-grade source of valuable long-chain n-3 polyunsaturated fatty acids (PUFAs). However, these highly unsaturated marine oils are susceptible to oxidation.
USDA-ARS scientists explored smoke-processing technology as a way to limit the oxidation of salmon oil during its storage. They found that preserving salmon heads using high-temperature smoking exposes tissues to phenolic derivatives, which reduce the oxidation of valuable PUFA-rich oils.
In experiments, heads from pink salmon *(Oncorhynchus gorbuscha)* were smoked for 1 hour to 5 hours at 55 C to 95 C. The heads underwent a composition analysis in which researchers examined lipid, protein, moisture and ash content. Oils were extracted, and lipid oxidation was assessed. The scientists also measured fatty acids for their n-3 PUFA content and antioxidant activity. The shelf life stability of the extracted oils and oils stored within the smoked salmon heads before extraction were evaluated at 4 C and 35 C for eight days.
The investigators found fewer products of oxidation in the oils extracted from the hot-smoked fish heads—processed at 95 C for 5 hours—than in the oils from raw salmon or those that were traditionally extracted at 95 C for 50 minutes. As smoking times and temperatures increased, the levels of oxidative products in the oils decreased. After seven days of storage, oils from the smoked heads displayed consistently lower oxidative values than did the raw oils. Additionally, oils protected within the fish heads when they were smoked at 70 C for 4 hours retained n-3 PUFA quantities equal to the frozen controls.
The smoking process also extended the shelf life of the salmon heads. More acidic products accumulated in the 5-hour smoked fish heads than during shorter smoking intervals. After oil was extracted, the remaining smoked material decreased to pH 4.8 within seven days, with no offensive fishy odor detectable during storage. Extending the storage time of salmon oils will facilitate long-distance transport of the materials before spoilage occurs.
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Proteins may not be ideal for encapsulating flavors

If you're looking for different ways to encapsulate flavors, you might consider encapsulating them in proteins. Researchers at the University of Minnesota tested three proteins—sodium caseinate, whey and soy protein isolates—as alternative materials to gum acacia and modified starch, which are traditionally used to encapsulate flavors in a spray-drying process. Limonene and different aldehydes were among the flavors used in experiments.

Proteins may react with the flavors, causing nonenzymatic browning or oxidation to occur.

The primary criteria for performance were flavor retention during drying and protection against losses during storage. Limonene oxidation and nonenzymatic browning were investigated as two possible deterioration routes.

The scientists found that gum acacia, with a 94% retention rate, was able to retain the flavor. This was followed by modified starch with an 88% retention rate, and whey protein isolate, at an 87% rate. Gum acacia also was the best at retaining aldehydes at levels ranging from 37% to 58% during storage for 28 days at 40 C. But it did not afford good protection against limonene oxidation. The other protein materials limited limonene oxidation, retaining more than 70% of the flavor.

It appears that many flavor compounds contain carbonyl groups—ketones and aldehydes—that can react with the amino groups of a protein. This in turn can start a Maillard reaction and lead to brown pigments and loss of flavor. Protein materials generally inhibited limonene oxidation. And the researchers saw nonenzymatic browning occur in all powders prepared with proteins, especially with whey protein isolate. But no browning occurred with traditional materials.

The investigators indicate that more research is needed to examine the reactivity of proteins with other chemical groups, such as the saturated aldehydes, ketones and esters, during the storage of spray-dried powders. Moreover, the sensory impact of using proteins as wall material must be examined since the release properties of dried flavors in a final product can be changed by chemical interactions.

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Lupine-enriched bread could decrease blood pressure

Lupine kernel flour is a novel ingredient rich in protein and fiber. It appears that bread enriched with lupine kernel flour, as a substitute for wheat flour, could reduce blood pressure and optimize the health of our hearts. The average protein content of lupine is a little more than 30%. It's used in bakery and pasta products where it replaces eggs and butter and improves product color. Also, lupine flour contains non-starch polysaccharides which act like soluble and insoluble fiber.

Overweight and obese men and women who consumed lupine-enriched baked bread experienced decreases in their systolic and diastolic blood pressures of 3.0 mm Hg and

0.6 mm Hg. Researchers at the University of Western Australia believe, based on this research, that a diet moderately higher in dietary protein and fiber can significantly reduce blood pressure.

The scientists recruited 88 overweight and obese men and women with an average age of 57.9 and an average BMI of 30.6 kg per m^2. They received either a white bread group or a lupine kernel flour-enriched bread group for 16 weeks. Both interventions contributed between 15% and 20% of the participants' usual daily energy intake.

Results for the 74 people who completed the study showed that their systolic and diastolic blood pressures decreased by 3.0 mm Hg and 0.6 mm Hg, respectively, in the lupine group. The pulse pressure of participants in the lupine flour group also decreased by 3.5 mm Hg. Any decrease in blood pressure could result from an improvement in vascular tone mediated by nitric oxide, a potent endothelium-derived relaxing factor, according to the scientists, but they are not certain about this.

In 2006 the scientists reported that lupine flour may increase satiety and play a role in weight loss. Consuming a breakfast containing lupine bread resulted in significantly higher self-reported satiety than did eating white bread, and a lower energy intake—488 kJ less—at lunch than did the white bread breakfast. Eating lupine-enriched bread at lunch also reduced meal energy intake.

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Executives. . .FYI

Scientists have examined two strategies designed to improve the **crunchiness of fish nuggets** for microwave final cooking. They involved adding dextrin into a batter formulation, and using a package containing a susceptor material, which improves heat transmission and increases the temperatures reached in the microwave.

In this research, researchers used two dextrins, one of high solubility and the other of medium solubility, to study their effects on battered, prefried fish nuggets. The nuggets were cooked using three different procedures: deep frying, microwaving and microwaving with susceptor packaging. In addition, all tests were performed with and without batters containing methylcellulose in order to assess the effect of oil uptake.

The researchers evaluated the crunchiness of the nuggets using a technique that simultaneously registered texture and sound measurements during the cutting of the nuggets. The profiles of the fried nuggets had numerous force and sound peaks and a typical jagged plateau shape. Those of the microwaved samples had force peaks that disappeared, and the profiles adopted a smooth ascending curve. However, the use of the susceptor slightly improved the number of sound peaks. The dextrin-containing nuggets cooked by microwave and susceptor were perceived as crunchier as and oilier than the other samples by trained panelists.

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Flavors in liquid form are difficult to handle or incorporate into foods. Encapsulating them by spray-drying provides protection against unfavorable ambient conditions. Various forms of modified starches are used for flavor encapsulation.
The initial step in spray-drying a flavor is the selection of a suitable wall material. Researchers prepared hydrolyzed, phosphorylated and succinated oat starches and compared their emulsifying properties with those of native oat starch. The starches were hydrolyzed with hydrochloric acid; succinated with octenyl succinate anhydride; and phophorylated by heating them in the presence of sodium tripolyphosphate. Emulsions were prepared with 30% starch wall material and 20% orange peel oil. The phosphorylated starch had the highest water adsorption index (2.98) and native starch the lowest (2.35). The native starch showed the lowest solubility (1%). All the emulsions showed a concave curve that means they are suitable for lipid encapsulation. The viscosity of the modified starches was reduced as the hydrolysis products were of a smaller molecular weight than the native starch. The succinated starch had the highest stability. Modified starches showed good emulsifying properties that make them a good alternative wall material for low-cost flavor encapsulation.
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