

Developing and Manufacturing Low-/No-Fat Products and Processes

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The Market

The fastest growing segment of processed meats is low- and no-fat meat products. In general, this growth is not expanding meat consumption, which is relatively flat. (Table 1). Instead, people are purchasing low- and no-fat versions of their favorite products or switching from higher fat categories i.e. Smoked Sausage to lower fat categories i.e. Turkey Breast (Table 2). Some analysts say that this is just a short-term trend explaining that people will try anything once. I can assure you that the growth is real and sustained, as evidenced by IRI data. The key to future growth is *not* consumer demand. Consumer demand is extremely strong. We at Healthy Choice frequently see top two box (definitely and probably by) scores well above historical norms. The key to future growth is quality of products and, to a lesser extent, price of the product. This is extremely good news to everyone reading this paper and/or sitting in this room. It means that, more than ever, the industry will become technically driven though the areas of expertise required will be more food-oriented rather than meat-oriented.

Innovative Change

The traditional protein, water, fat emulsion does not exist in a low-fat frank. It has been replaced by protein, water, carbohydrate matrix. It is as likely that a cereal chemist could formulate this product as could a meat scientist. In fact, non-meat analogs and vegetarian products are experiencing amazing growth and are a potential threat to low/no-fat processed meats.

What this all adds up to is a category that relative to the rest of the market is evolving at light speed. The products improve logarithmically. A low-fat frank today is 10 times

better than its predecessor only two years ago. It is not uncommon for my company to improve a product line a couple of times a year to take advantage of improvements in process and/or ingredient technologies.

The Regulations

I don't believe that five years ago a discussion on the definition of the terms low/no-fat would have been necessary. However, since the implementation of NLEA, nothing is simple.

Definition

Low-fat is defined as 3 grams of fat per Recommended Amount Customarily Consumed (RACC) or serving size, whichever is greater. Keep in mind that the RACC varies according to product category. As an example, the RACC for franks is 55 grams, therefore the maximum fat content for a low-fat frank is 5.45% fat. The RACC for Breakfast Strips is 18 grams, but because of the low serving size (30 grams or less), USDA requires 3 grams of fat or less per 50 grams. So, the maximum fat content for a low-fat Breakfast Strip is 6%. The point of these examples is to demonstrate that low-fat means a slightly different fat content, depending on the product category. Raw cuts of meat have a comparatively large RACC of 114 grams. As you can easily calculate, 3 grams of fat per 114 gram serving is something less than 3% fat.

As many of you are already aware, the claim "No-fat" really means virtually no fat. Similarly, the more popular phrasing "Fat Free" really means virtually fat free. As in the "Low-fat" claims determination, the RACC is a critical parameter in determining a "No-fat" claim. In essence, the fat grams per RACC and serving must be .5 grams or less. That is, the fat grams must round down to 0 and not up to 1. For a product with a 55 gram RACC like franks, the actual fat percentage can be as high as .9% fat. But the same fat percentage on a turkey breast with a RACC of 114 grams would not support a "Fat Free" claim.

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TABLE 1. Lunch Meat Data.

TOTAL US	52 WEEKS ENDING MAY 5, 1996	52 WEEKS ENDING MAY 7, 1995	52 WEEKS ENDING MAY 8, 1994
CATEGORY - SLICED LUNCH MEAT			
Volume Sales	814,567,680	808,195,072	793,315,520
Volume Sales % Chg vs Yr Ago	0.8%	1.2%	NA
TOTAL LEAN (EXCLUDING FAT FREE)			
Volume Sales	263,961,328	268,020,688	NA
Volume Sales % Chg vs Yr Ago	-1.5%	NA	NA
Dollar Share of Cat	45.6%	48.0%	NA
TOTAL FAT FREE			
Volume Sales	36,308,752	14,951,466	NA
Volume Sales % Chg vs Yr Ago	142.8%	NA	NA
Dollar Share of Cat	6.5%	2.8%	NA

Source IRI

Modified Products

Low- and no-fat breakfast sausage, cooked sausage and fermented sausage products are modified food products. As such, these products may contain ingredients that would be precluded or restricted in the traditional product. To qualify for a modified food product, the precluded or restricted ingredient must be used to replace fat and must be GRAS. This is outlined in Policy Memo 123 which is unfortunately being challenged by rulemaking as I speak. As outlined in Policy Memo 123, the precluded or restricted ingredients must be appropriately identified by an asterisk. A statement such as "Ingredients not found in or in excess of amounts permitted in regular franks" shall define the asterisk. In addition, the product name shall include the expressed nutrient content claim, e.g. "Low-Fat Frank." I can assure you that the quality and success of low- and no-fat processed meats is at least partially due to this policy.

Technical Challenges

The message to take home from this brief discussion of the regulations of low and no-fat claims is that you must not only understand the regs but must be able to analyze accurately and precisely for fat. With fat contents under 1% this is more difficult than you might imagine, especially with rapid methods. The typical variance of $\pm 20\%$ does not allow much room for error at a fat content of .9%. To avoid 10,000lb. surprises an overly cautious sampling plan is cheap insurance. Rapid methods such as CEM are AOAC approved and can be used successfully at fat contents less than 1%.

The Strategy

Before mixing one pound of meat, I encourage you to develop appropriate goals and assumptions as well as a strategy to deal with the assumptions and help you achieve your goals. Unless you work for a very unusual company, you

TABLE 2. Hot Dog Data.

TOTAL US	52 WEEKS ENDING MAY 5, 1996	52 WEEKS ENDING MAY 7, 1995	52 WEEKS ENDING MAY 8, 1994
CATEGORY - HOT DOGS			
Volume Sales	797,806,848	797,028,864	844,218,624
Volume Sales % Chg Yr Ago	0.1%	-5.6%	NA
TOTAL LEAN MINUS FAT FREE			
Volume Sales	25,567,200	31,147,808	26,577,392
Volume Sales % Chg Yr Ago	-17.9%	17.2%	NA
Dollar Share of Cat	5.0%	6.2%	5.0%
TOTAL FAT FREE			
Volume Sales	22,282,736	1,951,189	0
Volume Sales % Chg Yr Ago	1,042,0%	NA	NA
Dollar Share of Cat	4.9%	0.4%	0.0%

Source IRI

TABLE 3. Frank Formulation Example.

INGREDIENT	% FAT	LOW FAT		NO FAT	
		% OF FORMULATION	FAT CONTRIBUTION	% OF FORMULATION	FAT CONTRIBUTION
Turkey Breast	0.6	0		40	.24
Turkey Scapula	2	10	.2	10	.2
Turkey Thigh	9	45	4.05	0	
Water	0	35		40	
Starch	0	3		4	
Salt	0	2		2	
Sugar/Dextrose	0	1		1.97	
Spice	15	3.97	.59	2	.3
Sodium Ascorbate	0	.02		.02	
Sodium Nitrite	0	.0085		.0078	
TOTAL		100	4.84	100	.74
Cook & Chill Yield		.88		.88	
Finished Fat			5.5		.84

will have production, equipment, time and cost constraints. Even in a purely academic environment, time and money are limited. Consumers will have expectations based on your existing product offering and low/no-fat products already on the market. These consumer expectations should help guide the product development effort. Part of the success of Butterball Fat Free and Healthy Choice Low-fat products can be attributed to a very strict consumer acceptance expectation.

Consumer Feedback

All products should be consumer tested prior to launch to ensure the consumer is not disappointed. The method of testing and the desired result should be agreed upon before product development makes the first prototype. For most product categories, the low/no-fat products do not have to score as good as full fat counterparts to be successful. However, they should be at least as good as the major competitors offerings. Constant comparisons to the competition during the product development effort are required. In addition, I would include competition in any sensory or consumer research.

A strategic checklist for a low-fat frank product development might look like this:

<u>GOALS/ASSUMPTIONS</u>	<u>EXAMPLE</u>
Quality Level	Equal to competition
Raw materials	What species, MSG, kosher
Cost/Margins	Retail sales price? Cannibalism
Equipment	Continuous houses, bowl chop
Shelf life	70 days

The Product

Formulating a low/no-fat breakfast sausage, cooked sausage and fermented sausage presents multiple challenges. The most obvious challenge is replacing the fat. Fat texture

can be simulated with a variety of ingredients: Starches, Carrageenan, Milk Proteins, and Gelatin all work to some degree. Most of the flavor houses make fat flavors that work reasonably well, although the flavors’ ingredient statement may read like a salad dressing. Interestingly, it is not usually necessary to replace fat appearance as consumers apparently want the product to look like it has less fat. The possible exception to this is the dry sausage category where there is not yet a low-fat example to learn from.

Flavor balance is a problem with low/no-fat versions of traditional cooked sausages such as smoked sausage, franks and bologna. In particular, the aromatic herbs and spices tend to taste artificially strong in the absence of fat. The use of fat substitutes (either texture or flavor) does not seem to help this situation much.

In addition to addressing flavor, texture and appearance challenges, the formulation must also address shelf life challenges. Low/no-fat processed meats essentially replace fat with non-meat ingredients and water. The additional water will lower the brine and cause shelf-life issues. Raising the brine by adding additional salt is the typical, but less than optimal, solution. (See Frank formulation example).

Can low/no-fat products be made with existing equipment? Generally, the process flow for low/no-fat products is similar enough to traditional products that a new plant is not required. However, there are technologies that make the job easier and cheaper, especially in the no-fat arena. In my opinion, most low/no-fat products benefit from advances in ingredient technology more than they benefit from advances in process technology. However, there are key technologies that make the process more efficient.

For example, with few exceptions, I believe every major processed meats company holds a defatting patent. As demonstrated in Table 3 - Formulation Example, this is a very useful technology to someone wishing to make a 100% fat-free cooked sausage type.

Defatting Processes: Chemical and Physical

Chemical defatting relies on a solvent to wash away the fat. The solvents used are extremely volatile at room temperature and pressure. Chemical defatting works well with larger chunks of meat. Physical defatting takes advantage of the density differences between lean meat and fat in a process similar to the making of skim milk. It has the perceived advantage of being solvent-free. The main benefit of defatting is the ability to create a very low-fat raw material from a low-cost raw material.

The Process

Batching, Blending, Emulsifying

The other processes relative to producing low/no-fat processed meats are basically traditional processes. However, the process control parameters are slightly different. For instance, the ability to control vacuum levels and temperature is more difficult and more important with low/no-fat meats. Generally, high levels of vacuum are required to achieve optimum shelf life on traditional products. The need for high levels of vacuum during blending, stuffing and packaging is even more critical for low/no-fat products. I believe this is related to the proportionally greater amount of water in low/no-fat formulations. These batters are less viscous, making them difficult to transfer from process to process. As mentioned earlier, the brine levels are usually lower, further emphasizing the need for tight, high vacuum (low O₂) packages in order to ensure optimum shelf life. The quantity of water used in low/no-fat formulation also affects process temperature control. The ability to control water temperatures precisely, either through chilling systems or the use of ice is critical. Unlike traditional emulsions, low/no-fat emulsions do not require high emulsification temperatures to form stable emulsions. Instead, low/no-fat blends and emulsions bind optimum amounts of water at temperatures below 40°F. Another result of the large amount of formulated water in low/no-fat products is a longer mix cycle. Longer mix cycles are also the result of the generally greater amounts of non-meat binders used. It is not uncommon to mix low/no-fat sausages twice as long as traditional products. Even after long mix cycles, the batter will still be less viscous. In the case of a low/no-fat frank, this may mean using a smaller emulsification plate hole size to achieve the same degree of cutting that takes place with a more viscous traditional batter. Non-meat ingredients can also be used to control batter viscosity and degree of cutting.

Heat Processing

While normal batch houses can be used to cook/smoke low/no-fat cooked sausages, much better results are obtained

with continuous houses. Again, this is related to the amount of formulated water in low/no-fat formulations. It is difficult to dry wet products evenly in batch houses. The result is uneven smoke color and varying piece weights. In continuous cooking/smoking systems the product surface is dried more evenly, resulting in a uniform smoke color and uniform piece weights. In either cooking system, it is easy to overdry and/or oversmoke low/no-fat products, resulting in an unacceptable thick rind or wrinkled product. Certain ingredients can help minimize this tendency as can a carefully designed cook cycle. Generally low/no-fat product will not require quite as much smoke to achieve the same surface color.

Packaging

Refrigerated low/no-fat processed meats tend to exhibit greater amounts of package purge than traditional products. As mentioned earlier, this can be minimized with good vacuumization and proper temperature control during processing. Certain packaging technologies lend themselves to low/no-fat processed meats. Franks, for instance, perform better in a single-layer twin package than in traditional two-layer single package. This is because the film conforms more closely to the product in a single-layer frank package. Gas flush (MAP) packages are also ideally suited to low/no-fat processed meats because they do not pull moisture out of the product over time.

Processing Opportunities

In general, I feel the ingredient suppliers have done a better job responding to the demand for low/no-fat product than have the process equipment suppliers. There are two big process-related opportunities.

- Continuous low-fat analyzers (accurate at <1 fat)
- Commercially available defatting equipment.

The Future

Low/no-fat processed meats are here to stay and will continue to improve. The variety of product offerings and the companies participating will expand rapidly. Stiff competition will come from non-meat and vegetarian analogs and reduced meat versions of traditional products. Low/no-fat demand will expand to export markets and niche markets (Kosher, exotic meats). Products that are just "Lean" will disappear.

In addition to low/no-fat products, consumers will demand low-calorie and reduced-calorie products. Designer foods, targeting the special physiological needs of certain individuals, will become popular.