

Closing the Supply Side Gap: Making Whole Grains the Healthy and Easy Choice

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SUMMARY

With the current backdrop of rising obesity, diabetes, and associated diseases, there exists a need to increase the whole grain content of our food supply as part of the solution (6,8). As with all change, there exists resistance and inertia for multiple reasons. The goal of this presentation is to briefly identify some of the possible causes for this resistance and to offer some suggestions for future development. Additionally, techniques that may be used in product development for complex problems such as whole grain incorporation will be discussed.

There seem to be at least four areas pushing back on the movement to increase whole grain content in our food supply. These are: 1) economics, 2) consumer acceptance, 3) technical hurdles, and 4) a focus on wheat as the main whole grain source. Even though we have the need and desire to make the change toward more whole grain content, it's not a process like switching to paper or plastic. Desire is certainly a good first step and new young consumers are a group willing to embrace and experiment with new, healthier products (1).

- 1) **Economics.** There is an economic hurdle to the incorporation of whole grains into currently existing well-established products. Curiously, materials that were once used as animal feed (9) in many cases now command a premium price. Also, companies with well-known products are very reluctant to make changes (2) which might diminish sales. Companies, while vigilant about the safety of their products, will not make changes purely for the sake of health unless under pressure. These pressures could be reduced sales, controversial ingredients, bad press, or the opportunity for healthier products to bring increased sales. An example of companies trying to change under pressure would be the ad campaign by Phillip Sokolov (3) in the eighties attacking the use of tropical oils in foods. Lastly, healthy ingredients tend to cost more than traditionally used materials as health benefits are almost always roughly proportional to cost.
- 2) **Consumer Acceptance.** Consumer acceptance is the next challenge and is, of course, tied to the economics of the

situation. Consumers tend to eat what they like and avoid the rest despite their health until a crisis emerges. Whole grains are often an acquired taste with the changes they can bring in terms of taste, color, and texture. Sales of a product are usually directly proportional to consumer acceptance so the incorporation of whole grains often must be done invisibly. Unless everyone changes, no one changes.

- 3) **Technical Hurdles.** The next factors impeding the progress of whole grains in food products are the technical hurdles associated with the performance of whole grains in foods versus their refined counterparts (4). As previously mentioned, simple substitution of whole grain wheat flour for refined wheat flour will result in bread with a darker color, lower loaf volume, and a slightly bitter taste. Stability of products can also be an issue, with flavor changes occurring earlier than in refined wheat products. Some of these problems have been creatively addressed, but 100% substitution of whole grain flours usually requires new research, techniques, and technologies to become acceptable. For breakfast cereals that are extruded and directly expanded, expansion may be reduced by the use of whole grain and often product final stability or texture can be an issue.
- 4) **Focus on Wheat.** Additionally, much of the work on whole grain addition has focused on the grain that our food system has been built around: wheat. Our farming system has been built around wheat and wheat milling, so much of the whole grain effort has centered on using whole grain wheat with its taste and texture liabilities. Early bread was made from mixtures including wheat, acorns, nuts, millet, barley, rye, oats, peas, beans, and whatever weed seeds were harvested along with the grain. Since wheat is the best source of gluten, making it most suitable for producing a light, risen loaf, its use soon predominated over that of other grains (10). This has begun to change with the rediscovery of the so-called ancient grains exploited by our ancestors. These ancient grains include quinoa, teff, chia, kamut, spelt, hemp, millet, sorghum, and amaranth. Some millers have begun to utilize these grains but costs are still high relative to wheat. This creates an opportunity for both farmers and millers as we go back into the future. Legumes are also underutilized for bread and cereal-making and we have yet to discover the levels and processing

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techniques that may allow their incorporation into common foods. One can envision breakfast cereals, baked products, pasta, and the like someday incorporating these materials at meaningful levels.

With regard to the incorporation of these new materials, food products are designed to have certain predictable tastes, textures, and processing characteristics. Food systems by nature are full of what statisticians call “interactions” (5). That is, the function of one material (e.g., whole wheat flour) is different depending on the level of other ingredients or processing conditions. This is both a conundrum and an opportunity as it suggests that using these new materials in bread will require different levels of yeast, salt, and water, as well as altered proofing times, baking times, and temperatures. Without sophisticated experimental plans and techniques, the solutions can be elusive. It can be said we have not found it because we have not looked. Even seemingly simple changes toward “healthy” food can require innovation and some development efforts. Previously, efforts to add increased calcium to a popular breakfast cereal that had rice, corn, and wheat varieties resulted in a product with an off-grey/green color in some varieties. It turns out calcium interacted with phytic acid in the grains and caused the discoloration. The solution required development of a patented technology to solve the issue (7).

Fortunately, there are techniques to aid in the development challenges associated with the increased levels desired for whole grains. Traditionally and commonly, a food developer will move one variable at a time in order to assess the impact of adding whole grain components to a certain recipe or formula. After all, this is the tried and true “scientific method.” As stated above, interactions are rampant in food systems, which means trial and error experimentation is doomed to failure without great luck or at least results will be discouraging. The use of statistical experimental design is recommended for such problems whereby interactions can be identified and exploited. In a nutshell, the technique identifies ranges of ingredients and processing conditions and then combines them into one grand symmetrical experiment. These are the “factors” for an experiment. “Responses” for the experiment may be whatever data are important for the desired outcome of the testing. For an experiment on whole grain bread, for example, factors might be whole grain flour, refined flour, yeast, water, baking time, and baking temperature. Responses might be loaf volume, taste rating, off-flavor appearance, etc. Anything that can be quantified can be a response, including raw material costs. It takes a computer and software to be able to execute the technique, as well as the assistance of a statistician to avoid common mistakes. Experimentation with this method can lead quickly to

the optimal balance of the selected factors to yield the balanced optimum of responses. It can quickly answer questions such as:

- How much whole grain can be used before taste preference drops off?
- What baking conditions will yield the best loaf volume?
- What’s the best overall formula for taste, cost, and baking performance?

The technique does not guarantee absolute success if there is really no great solution, but it does cut down the time and resources needed to completely understand the possibilities. Often surprise interactions are uncovered in systems, which give a great “leap ahead” improvement over the existing product.

In summary, it is clear the switch to refined flours 150 to 300 years ago was a choice for taste and flour stability versus good nutrition. In retrospect, we find we must find ways to return to past practices of using whole grains and various whole grain sources to combat rising disease rates associated with poor nutrition, mainly stemming from too much carbohydrate, empty calories, and a chronic lack of fiber. The challenges facing new healthier product are real but can be met and conquered with techniques such as statistical experimental design, expertise, and common sense.

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