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Whole Seed—Better Than Whole Grain?

There is a battle royal in semantic discourse underway regarding whole grains. Let me explain. Nobody disputes the nutritional advantages of whole grains. The underlying foundation of the “whole grain advantage” is that much of the fiber and phytonutrient value, including the antioxidants, vitamins, and minerals of a seed, are located in the outer bran layers of the seed. Thus, when seeds are refined by removing the outer bran layers, much of that phytonutrient value is lost. The current multipronged effort by industry, industry associations, academia, and government to promote the value of “whole grain nutrition” is an effort to build appreciation among consumers about the value of consuming whole seeds, rather than the refined flours thereof. This, I hope that we agree, is a noble objective.

Whole Grain Definitions

Where problems arise is in the definitions of “whole grains.” The government has an interest to ensure that foods marketed as “whole grain” legitimately provide whole grain (or “whole seed”) nutritional value to consumers. In early 2006, the FDA issued proposed guidelines for “whole grain” labeling, “distributed for comment purposes only,” that emphasized the “whole seed” nature of whole grains. Under this proposed definition, pearled (i.e., rubbed) barley and soybeans would not be included because they are not typically consumed in whole seed form. Seeds, such as wheat, rice, corn, amaranth, and quinoa, were included in the definition, because they can be and are typically milled into and consumed similarly to whole seed flours. Oilseeds, such as sunflower seeds, were excluded from the proposed definition, but then, sunflower seeds aren’t typically milled into flours or consumed as whole seeds. Although the FDA’s proposed regulatory definition has generated volumes of commentary, the FDA (at the time of this writing) has yet to issue a final definition for what constitutes a “whole grain,” perhaps underscoring the issue at hand.

The etymology of the word “grain” is the Latin “*granum*,” or in old French, “*graine*,” both of which mean “seed”—any seed. Ergo, “whole grain” simply means “whole seed.” Wheat, rice, and corn are cereals, a taxonomic classification that applies broadly to members of the grass family Gramineae. Amaranth and quinoa, also included in the proposed FDA definition, are pseudocereals, which is not a taxonomic term per se but a term applied to noncereal plants for which the seeds are used as food in a manner similar to cereal grains. To be sure, there are other definitions as well. University of Pretoria Professor John R. N. Taylor describes “pseudocereals” as “starchy cereal-like seeds from plants other than grasses, by far the most common being amaranth, quinoa, and buckwheat.”

The proposed FDA definition includes both cereals and pseudocereals and why not? The underlying objective of the FDA’s definitional effort is to emphasize and encourage the consumption of whole seeds (i.e., granum or graine) for their nutritional value. The objective is nutritional, not, if I can so bold as to presume, taxonomic or semantic hairsplitting.

The proposed FDA regulatory definition specifically omits oilseeds, citing sunflower as an example. “Oilseeds,” however, is not taxonomically defined, but rather it is defined through its “end use,” much like “pseudocereals.” The term oilseed describes seeds that are utilized to produce commercial oils for food and nonfood uses. Thus, books (4) describing oilseeds will also include cereal seeds (rice, corn); pseudocereals (flaxseed); cultivated wildflower seeds (rapeseed); legume seeds (soybeans); and tree seeds (coconut) under this definition, irrespective of their other food uses.

What About Flaxseed, Chia, and Hemp?

Consumer interest in “ancient grains” (a loose definition used to connote food grains relatively unchanged in form or composition since ancient times) has sparked interest in exotic seeds that can be milled and used in many of the same food applications as cereal grain flours. By historical definitions, this includes pseudocereals.

Now begin the complications. The argument has been posited by certain groups that seeds, such as flaxseed, chia, or hemp, should not qualify as “whole grains” under an FDA definition because a) they are oilseeds (see above) and b) they are “compositionally different” from cereals. This is a mistake.

There is no good historical argument to be made for a compositional definition of pseudocereals, especially given the wide range of compositional differences exhibited between cereals themselves. For example, total dietary fiber (TDF) contents can range from 3.0 to 4.6% in whole grain rice to 13.0% in whole corn flour and 15.0% in both barley and amaranth (a pseudocereal) (1). Compositions also vary in quality. The 9–15% protein content typically found in wheat is deficient in lysine, methionine, and threonine (2), while the 6–12% protein in corn is severely deficient in tryptophan (6). Similarly, the fiber in corn is virtually all insoluble, whereas oats are rich in soluble β -glucans.

The argument that pseudocereals are defined by end-use application—that they can be used as foods in manners similar to cereal grains—is hardly new. Under this definition, seeds, such as flaxseed, chia, and hemp, should certainly qualify as pseudocereals. Similar to wheat, corn, oats, and cereal grains, flaxseed is milled into flours, added to breads and tortillas (where flaxseeds’ film-forming properties help trap gas like gluten—a big advantage in making gluten-free products), used in hot cereals and gruels, and used in batters, breadings, and toppings.

Now, suppose that a “new” composition-based definition of “whole grains” declaring them compositionally similar to cereals were to prevail. What would that mean?

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Oil Content

Flaxseed contains 40% oil, whereas whole grain corn contains only 2.6–4.9%, pearl millet contains 5.4%, and wheat contains 1.9%. Cereals have the advantage, right? But wait, the oil in

flaxseed is 96% unsaturated. Half of the oil content of flaxseed is in the form of omega-3 fatty acids, deemed essential to and deficient in the typical American diet. This should make flaxseed’s oil content desirable, right? Whole seed cereals contain only trace amounts of omega-3s (if at all) and their omega-6 oils are agonistic to the nutritionally deficient omega-3s. It could be argued that a salient distinguishing characteristic of cereal grains is the mediocre to poor nutritional quality of their edible oil fractions as compared to flaxseed, soybeans, hemp, or chia (all sources of omega-3s).

AACC International Defines Whole Grain

In 1999, AACC International wrote a definition of whole cereal grains: “Whole grains shall consist of the intact, ground, cracked or flaked caryopsis, whose principal anatomical components—the starchy endosperm, germ, and bran—are present in the same relative proportions as they exist in the intact caryopsis.” This was done because cereal grains were often separated and sold as refined components—with these components, for many years, having the lion’s share of the marketplace. The noninclusion of any other food type in the definition did not in any way say that foods not included were in some way less nutritious. In fact, all on the Whole Grain Task Force agreed unanimously that plant foods, such as nuts, seeds, and legumes, are nutritious and should be included in the diet. The inclusion or noninclusion in the definition was not based on fiber content. The fiber contents of brown rice and barley are indeed quite different. Furthermore, most classes of fiber-containing foods—vegetables, fruits, nuts, seeds, and legumes—were not in the whole grain cereal definition.

The following rationale was used for not including other seeds or grain types in the definition.

1. For foods, such as nuts and seeds, there was no need for a whole grain definition because a food such as flaxseed is not sold on the consumer market or added to food formulations in flour forms other than those which would contain the whole seed and would not have the outer layers of the seed removed in order to sell or incorporate the inner layers separately as “flax flour or meal.” Flax flour or meal always contains the various seed components unless it has been defatted and then it is labeled as “defatted flax seed meal.” Hence, with no separate components being sold and used in the marketplace, there is no need for their inclusion in the definition. (In the USDA database, flax has two entries—flaxseed and flaxseed oil. Soy has eight entries—these vary by fat content, e.g., defatted, etc. Wheat, for example, has 22 entries just for flour.)
2. In dietary guidance, nuts, seeds, and legumes are not in the bread and cereal food group. When dietary guidance suggests that consumers make “half their grains whole,” this does not imply that consumers eat one serving of breakfast cereal, one slice of whole grain bread, and one serving of an ounce of nuts or flaxseed. In dietary guidance, these foods would be part of the meat and protein group. In this dietary guidance it suggests that plant protein be used as a protein source for several meals per week.

The following rationale was used by the Whole Grain Task Force for including pseudocereals.

1. The macronutrient and amino acid compositions of the pseudocereals are similar, while the macronutrient content of nuts, seeds, and legumes is dissimilar. From the small sampling (Table I), it can be seen that the carbohydrate is lower in the seeds and legumes than in the whole grains and pseudocereals and that the protein is the same or slightly higher and the fat is significantly higher.

Furthermore, the limiting amino acid lysine is similar in whole grain cereals and pseudocereals. Dietary guidance suggests that lysine-limited cereals be eaten with lysine-rich foods, such as seeds, nuts, and legumes, to complete their protein.

Table I. Macronutrient content of a sampling of nuts, legumes, and cereals compared^a

Type (28 g)	Grain Type	Carbohydrate (per 28 g)	Fat (per 28 g)	Protein (per 28 g)
Seeds/Legume	Flax	8.09	11.80	5.21
	Soy flour (full fat)	9.85	5.78	9.67
	Sesame seed	8.86	10.39	5.78
	Walnuts	3.84	18.26	3.84
Whole Grains	Whole wheat flour	20.32	0.52	3.84
	Oats	18.91	1.75	3.56
Pseudocereals	Buckwheat	19.77	0.87	3.53
	Quinoa	17.96	1.70	17.96

^aU.S. Department of Agriculture Food Composition Data, Nutrient Data Laboratory Composition Data. Published online at www.ars.usda.gov/main/site_main.htm?modecode=12-35-45-00.

2. Pseudocereals are eaten in the same way that whole grain cereals are eaten. For example, buckwheat and amaranth are used as pancake flour; quinoa and kasha (buckwheat) are used like bulgur and rice to make pilafs, tabouleh, and side dishes; and soy and legumes are used to make spreads, dals, or tofu, which again provide protein to the meal and are a spread on pita bread, an accompaniment to tef bread (injera) or to a rice and a curry. Nuts and seeds are used as parts of pilafs, along with fruits, vegetables, and other ingredients for flavor and nutrition. They also are used as accompaniments to curries, but not the basis of side dishes per se.

More on the AACC Intl. definition of whole grains can be found online at www.aaccnet.org/definitions/wholegrain.asp.

—Julie M. Jones, AACC Intl. Whole Grain Task Force chair

Fiber

The dietary fiber content of the seed bran layers is one of the underlying nutritional reasons for promoting the consumption of whole seeds. Increased dietary fiber consumption is a stated nutritional goal of the U.S. government. How does whole flaxseed's 26–28% TDF content, a healthy mix of soluble and insoluble fibers, compare with that of cereal grains? For whole grain rice, TDF is 4.6%, for whole-grain wheat it climbs to 10%, and for corn it leaps to 13.4% or less than half that of flaxseed.

Protein

What about protein? Earlier, we addressed cereal protein quality. The typical protein content of brown rice ranges from 6 to 10% and for wheat, 6 to 15%. The protein content of flaxseed is 20–23% and contains all of the essential amino acids.

Antioxidants

Antioxidant value is a major and so very *nouveau* reason for promoting whole grain nutrition. Much of the phytonutrient antioxidant value of grains is found in the bran layers. A web-posted publication by Medallion Laboratories (3) gives antioxidant values for various foodstuffs measured in trolox equivalents (TE) per 100 g, using the 1,1-diphenyl-2-picrylhydrazyl (DPPH) method pioneered by Medallion Laboratories. Blueberries, a benchmark for antioxidant value, generated 3,300 TE/100 g, refined wheat flour measured a paltry 600 TE/100 g, but wheat bran generated a whopping 4,620 TE/100 g—significantly more than blueberries. An independent evaluation of whole milled flaxseed flour conducted for Enreco, Inc. (Sheboygan Falls, WI, U.S.A.) using the same DPPH methodology, generated 15,000 TE/100 g.

Starch and Sugars

Alas, here I must concede defeat in my argument and admit that very low glycemic flaxseed (<2.0%) and hemp seed (~5%) cannot compete with wheat (65%) or corn (73%) as sources of starch and sugar calories. Should sugar and starch ever be deemed deficient in our diet, whole seed flaxseed or hemp would not be the answer.

What Is the Point?

The point here is not to disparage the nutritional value of whole grain cereal seeds. However, let it be said that, should some groups succeed in selectively declassifying certain edible seeds as whole grains for whatever reasons and on the basis of loosely defined proximate compositions, the purveyors of phytonutrient-rich edible seeds, such as hemp, chia, and flaxseed, will be on very firm ground to claim that their “whole seeds” (Latin “*granum*” or French “*graines*”) are nutritionally superior to “whole grains,” a definitional distinction that could not help but force the FDA into new rounds of regulatory and semantic contortions, not to mention muddying the consumer objectives underlying whole grain marketing. Is this really where we want to go as an industry?

The entire point of the FDA's efforts to encourage the increased consumption of whole grains is nutritional, based on a recognition that consumers benefit from consuming seeds in whole form rather than in refined fractions thereof. Preferential treatment of specific edible seed categories over others on non-nutritional grounds only serves to clutter rather than clarify a very noble public health imperative.

References

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