

The Future of **FOODS**

From satiety to relaxation, ingredients such as omega-3s, proteins, dietary fiber and other nutritional create in-demand consumer products.

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Life is stressful; it is filled with the demands of family, job, finances, health and time pressures, among others. Many people reach for less-than-healthy comfort foods (“mood foods”) in an attempt to “self-medicate.” Often, weight gain is the result, exacerbating the stress. In a random sample of 1,000 U.S. adults, the “2011 IFIC Functional Foods/ Foods for Health Survey” found the primary motivator to healthier living— noted by 77% of respondents— was the desire to lose and/ or manage weight. Of note, only 43% are satisfied with their progress toward losing or maintaining their weight. And, over 30% mentioned mental alertness and a desire to relieve stress as key motivators to choosing certain foods and supplements.

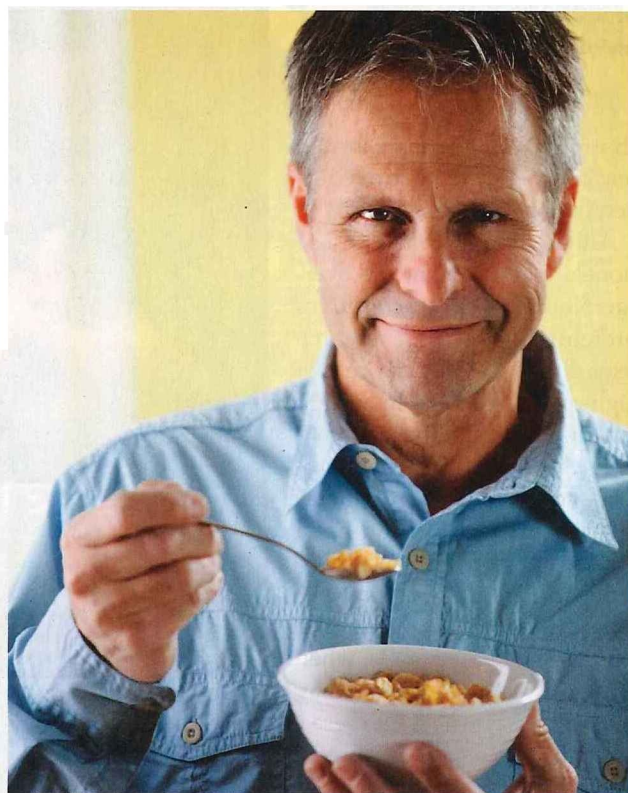
There is a desire to develop ingredients that will help consumers deal with stress and assist in relaxation. And, the need to provide foods that can assist in appetite control is directly correlated with the growing waist size of consumers.

Ingredients to Control Appetite

The development of ingredients for satiety is a goal of the food industry in its efforts to responsibly address the serious issue of overweight and obesity, as well as take advantage of a lucrative market. Foods with satiety properties provide fullness more quickly and reduce eating between meals.

Well-recognized ingredients are being investigated for their ability to assist in weight control and weight reduction. Most research has focused on protein and fiber, while emerging science is suggesting provocative effects of omega-3 fatty acids.

Data from the “Coronary Artery Risk Development in Young Adults (CARDIA) Study,” a multicenter population-based study of 2,909 healthy African American and Caucasian adults, showed that over 10 years, individuals with the highest dietary fiber intake (>21g/2,000Kcal) gained approximately 8lbs less than did those with the lowest intake (<12g/2,000Kcal)¹. And, a study of diet records of 27,082 men, over an eight-year period, revealed that every 20g/d increase in fiber intake was negatively correlated to weight gain².



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Fiber’s ability to modulate appetite ratings has been associated with a reduction of blood glucose and ghrelin, a hormone that stimulates hunger, and an increase of peptide YY, which enhances satiety.

As part of the well-known “Nurses’ Study,” Liu, et al. followed more than 74,000 women from 1984-1996; they found those with the highest fiber intakes gained an average of 1.52kg less and had a 49% lower risk of major weight gain than did those with the lowest intake³.

In another study, a barley-based breakfast and snack containing 3g of soluble fiber reduced hunger more than did foods of refined rice⁴. Even though energy intake at lunch did not differ, subjects’ perceptions of fullness were increased, while their desire to eat and the amount they consumed was lower, following barley consumption. The ability of fiber to modulate appetite ratings has been associated with a reduction of blood glucose and *ghrelin*, a hormone that stimulates hunger, and an increase of peptide YY, which enhances satiety⁵.

When fiber is consumed, overall energy consumption is reduced, due to lower energy density; gastric emptying is delayed, resulting in earlier feelings of fullness during a meal; and satiety is enhanced, due to gastric and intestinal bulking effects. Fiber intake also reduces glucose and fat

Carbohydrates, such as candy, cereal and pasta, can produce a temporary increase in brain serotonin and a subsequent anxiety-reducing effect. Also, carbohydrates increase the rate that the amino acid tryptophan, the precursor of beneficial serotonin, enters the brain.

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absorption and increases insulin sensitivity—resulting in a reduction in postprandial glycemia^{6,7}.

Although some health professionals maintain that the average North American consumes protein in excess, research regarding the beneficial role of high-quality protein in weight reduction is gaining momentum. Some studies show protein is more satiating, promotes lower energy intakes and has a higher thermogenic effect (diet-induced energy expenditure) than carbohydrates or fat. The oxidation of amino acids, when protein is eaten in excess, may be partly responsible for these effects⁸.

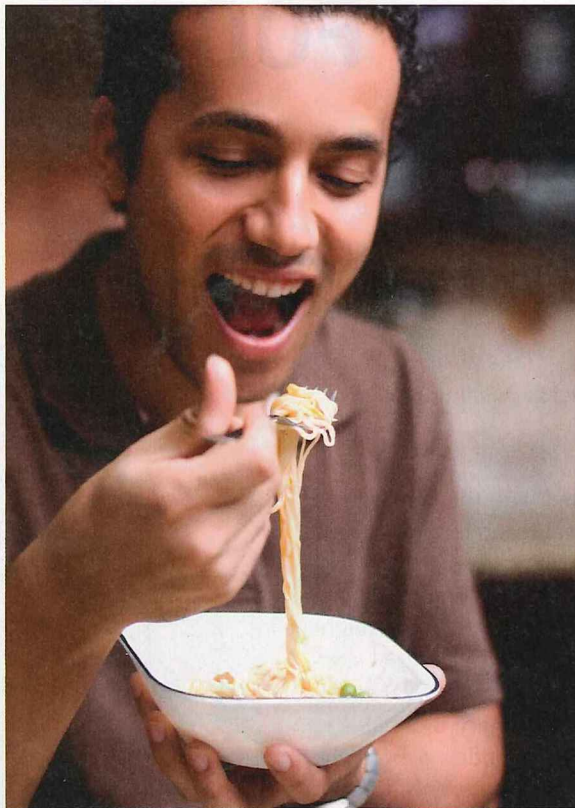
Higher protein intakes are believed to stimulate greater lean body mass, lower fat mass and improved metabolic profiles⁹. Protein consumption is also associated with the release of the satiety-signalling molecule cholecystokinin¹⁰. And, higher protein diets could be easier to adhere to over the long term.

A recent review of clinical studies noted protein intake stimulates protein synthesis and seems optimal at a level of 30g/meal⁸. The literature assessed suggests animal proteins seem to have greater beneficial acute effects on protein synthesis than plant proteins. However, evidence to support their greater effectiveness in the long term is lacking.

The Omega Effect

Omega-3 fatty acids affect adipose tissue metabolism, possibly by stimulating the production of leptin, a hormone involved in appetite regulation. In a randomized, controlled, clinical trial of 63 overweight, mildly hypertensives, the subjects consumed a daily fish meal (3.65g omega-3 fatty acids) or a weight-loss regimen; or those two regimens combined; or a control diet for 16 weeks. The greatest decrease in weight occurred in the combined regimens of fish and weight loss (mean 5.6 ± 0.8 kg)¹². Leptin levels fell only in the fish plus weight-loss group and were significantly associated with reductions in serum insulin, blood pressure and heart rate¹³.

Fish is rich not only in omega-3s but in high-quality protein. Thorsdottir, et al.¹⁴ found that following a restrict-



ed protein diet containing lean or fatty fish or fish oil for eight weeks resulted in more weight loss than an isocaloric (similar caloric value) energy-restricted diet without marine food.

An intriguing mechanism whereby omega-3 fatty acids may alter appetite involves the endocannabinoid system, which plays a role in the regulation of energy intake and metabolism. Fish oil supplementation in obese rats shifted the balance of fatty acid-derived signalling lipids (less omega-6-derived and more omega-3-derived lipids), which was associated with improvements in metabolic dysfunction and re-equilibration of body fat deposition¹⁵.

Evidence suggests protein and fiber intakes result in increased satiety and decreased hunger; however, whether this will lead to long-term weight

loss remains debatable. Gilbert, et al.⁸ evaluated the effects of protein consumption from different food sources on body composition and energy balance and concluded that plant proteins provide similar effects as animal proteins. Controversy, however, does exist as some studies, but not all, reported higher satiating effects of whey and fish proteins in comparison to other protein sources.

Additional research is needed to determine the amounts and types of both protein and fiber required to produce the greatest effects on managing body weight, both in healthy and overweight subjects. Research on omega-3s is emerging and shows promise.

Ingredients to Aid Relaxation

Proteins, carbohydrates and fats serve not only as an energy source but as precursors to a variety of neuroactive substances. Although difficult to study, science is revealing that certain bioactives can influence a person's mood by altering brain neurotransmitters—in particular, dopamine, norepinephrine and serotonin.

Serotonin production is associated with calming and an overall positive mood state¹⁶. Carbohydrates, such as candy, cereal and pasta, can produce a temporary increase in brain serotonin and a subsequent anxiety-reducing effect. Also, carbohydrates increase the rate that the amino acid tryptophan—the precursor of serotonin—enters the brain, leading to an increase in this neurotransmitter.

Dopamine and norepinephrine, which are derived from protein-rich foods, are believed to produce a feeling of alertness, an increased ability to concentrate and faster reaction times.

Chronic stress can cause the body to produce excess cortisol, a hormone that increases appetite and encourages cravings for sugary or fatty foods. Another hormone is neuropeptide Y, which encourages fat accumulation and is released during stress and following a meal high in fat and sugar¹⁷.

The effects of meal composition on mood may be different for men and women¹⁸. Females reported greater sleepiness after a carbohydrate, as opposed to a protein meal, whereas male subjects described greater calmness following meals rich in carbohydrates.

Epidemiological and clinical studies suggest deficits in omega-3 fatty acids contribute to mood disorders, while supplementation may provide therapeutic relief¹⁹. A recent trial concluded omega-3 fatty acids may reduce anxiety symptoms in healthy young adults²⁰. The participants, 68 medical students, received either omega-3 (2.5 g/d, 2,085mg eicosapentaenoic acid-EPA and 348mg docosahexaenoic acid, DHA) or placebo capsules. A 20% reduction in anxiety symptoms associated with reductions in plasma omega-6: omega-3 ratios was reported.

In mice fed low-omega-3 fatty acid diets, certain receptors in the central nervous system—which play a strategic role in neurotransmission—suffer a complete loss of function, suggesting a potential mechanism for the effects of omega-3s on mood²¹. Specifically, omega-3 deficiency affects receptors that normally respond to endocannabinoids leading to impaired emotional behavior.

Science also supports the impact of chocolate on mood, cravings of which increase when one feels emotionally low. Chocolate's mood-elevating properties have been attributed to compounds including anandamines, caffeine, phenylethylamine and magnesium²². However, many scientists argue that, like many palatable foods, chocolate stimulates endorphin release in the brain—which elevates mood.

A deficiency of several vitamins has been linked to alterations in mood states. Folate and vitamin B12 deficiencies are associated with depression; both may be corrected with as little as 7-11 months of supplementation²³. In four double-blind studies, an improvement in thiamine status with a small dose of 2mg was linked to improved mood²⁴. In addition, iron-deficiency anemia can lead to apathy, depression and rapid fatigue. Magnesium, tryptophan and low-glycemic foods have also been studied to assess their impact on mood. The results are mixed but seem to show an association with improved mood¹⁷. Of note, enhanced micro-nutrient

status is also correlated with improved memory, attention and scores on intelligence tests²⁴.

There appears to be strong associations between food and supplement intakes and mood. There is growing scientific evidence demonstrating the relationship between carbohydrate, protein and even omega-3 fatty acid intakes and emotional well-being. Long-term, controlled clinical studies on the effects of diet on mood states, although logistically difficult to conduct, are required. As the stresses of modern life increase, the role nutrients can play becomes even more important. **NS**

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