Marketing Monograph:

Whey Protein in Breakfast Foods

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DAIRY + adds the difference.

Breakfast may indeed be the most important meal of the day, but many people either skip breakfast entirely or choose breakfast foods that are low in protein. A balanced breakfast, including high-quality whey protein, starts the day off right, provides important fuel for morning exercise, increases satiety throughout the day and may ultimately aid in weight management.

The Importance of Breakfast

Emerging research has indicated physiological differences after consumption of a protein-rich breakfast versus a carbohydrate-rich breakfast. A number of studies[1,2] indicate that eating protein at breakfast promotes satiety, lean body mass preservation, weight management and nitrogen balance.

Eating a healthy breakfast sets the tone for the day. Nutritionists have frequently stated that breakfast is the most important meal of the day, but with today's busy lifestyles, many people skip or skimp on breakfast. Many of those who do eat breakfast choose breakfast foods that are low in protein. In the U.S., breakfast consumption is lowest among young adults 20 to 29 years of age, with only 62 percent of men and 71 percent of women eating breakfast.[3] One study indicated that teen girls, especially African-American girls, are most likely to skip breakfast.[4]

Individuals who skip breakfast often compensate by overeating in the evening. This same trend is seen worldwide. A lifestyle study of Japanese adolescents found that skipping breakfast, eating quickly, excessive eating, physical inactivity and long hours of TV-watching were positively and significantly associated with being overweight in both boys and girls.[5] Recent studies in Germany[6] and Iran[7] both indicated that skipping breakfast was associated with childhood obesity. Breakfast practices vary around the world, but similar trends are seen in many countries.

In addition, numerous studies have revealed that breakfast improves learning and cognition in children. Research has proven the benefits of breakfast, which is especially important as brain food for young adults. Short-term studies, particularly among undernourished or hungry children, suggest that participation in the U.S. School Breakfast Program has beneficial effects on cognitive function, academic performance, school attendance, punctuality and psychosocial function.[8,9,10] In addition, breakfast may help children achieve a healthy weight and establish lifelong healthful habits.[11]

Breakfast and Protein Intake

Most Americans typically consume a relatively small amount of dietary protein at breakfast (15 percent of total daily protein[12]), often less than 10 grams of protein.[13,14] Although more seniors consume breakfast, the diets of many seniors tend to be low in protein. One study showed that elderly females (71+) and teen girls (14 to 18) were the two groups most likely to consume less protein than the estimated average requirements.[12] From 1965 to 1996, analysis of four national cross-sectional surveys indicated that among U.S. adolescents (11 to 18)[15] total energy intakes increased, while intakes from protein declined from 16.1 percent to 14.2 percent. A study of meal and snack patterns in the U.S. indicated that adult breakfast-skippers had the lowest intakes of all micronutrients examined except sodium.[16]

Worldwide, dairy foods improve the nutrition of the vast majority of the world's population by providing not only protein but also essential micronutrients.[17] Whey protein is a versatile ingredient that can be added to a variety of breakfast foods to boost overall nutrition of the diet. The American Dietetic Association recommends that students start their day with some powerful protein: "Protein, a missing component in many morning meals, helps children go strong and stay focused until lunch. Go lean with protein choices..."[18] Whey protein is in fact a lean source of protein. A 20-gram serving of Whey Protein Concentrate 80% (WPC80) will contain approximately 1 gram of fat. A 20-gram serving of Whey Protein Isolate (WPI) will contain less than ½ gram of fat. Both ingredients are also low in lactose, making them ideal for formulating a variety of healthful breakfast foods with wide consumer appeal.

Protein is an essential daily nutrient. It plays many important roles, such as repairing the body's cells, building and repairing muscles, helping build and maintain bones and helping control many metabolic processes. Whey protein is a high-quality protein naturally found in dairy. It is a complete protein containing all of the essential amino acids the body needs.

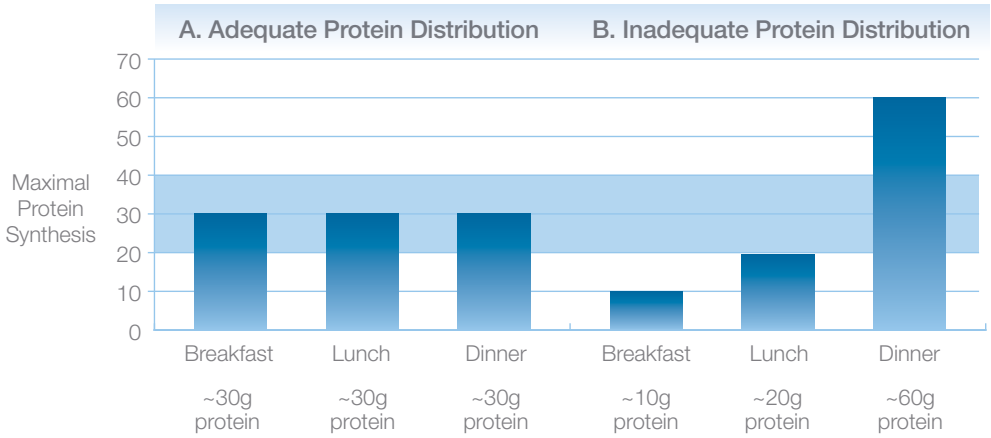
Seniors and Breakfast

Efficiency of protein utilization decreases throughout adult life,[19] and so adequate protein intake is of particular importance for aging populations. It is important that mature adults with declining appetites maintain intake of important nutrients with fewer calories, and protein is one nutrient that is often skimped on. Many seniors also have difficulty with chewing or swallowing, and liquid meal replacements may be one way to boost and ensure adequate protein intake.

Sarcopenia is defined as chronic muscle wasting, and may affect as many as 30 percent of individuals older than 60, and more than 50 percent of individuals older than 80 in some populations.[20] It is a complex, multifactorial condition, but one of the confounding factors is suboptimal protein intake. Research indicates that beginning at age 40, skeletal muscle declines approximately 0.5 percent to 1.0 percent per year.[21]

Sarcopenia is associated with increased likelihood of disability for elderly individuals. However, increased consumption of protein likely promotes greater functional status of the muscle, improving gate and mobility in the elderly.[22] Thus, there may be less likelihood for fall-related injury to the bone, such as hip fractures.

Figure 1.[23]



By age 60 years and older, more than 90 percent of men and women eat breakfast, but statistics show that typically daily protein intake is not distributed across meals, but rather skewed to the evening meal. (See Figure 1.) For an individual consuming 90 grams of total protein per day, protein intake is typically skewed toward the evening meal, rather than a more optimal distribution of 30 grams at each meal. One strategy to combat the progression of sarcopenia is to target a combination of frequent protein intake and regular physical activity, including resistance exercise. Paddon-Jones's research suggests that elderly consume a moderate amount (25 to 30 grams) of high-quality protein with each meal and incorporate regular exercise in close proximity to meals.[23]

Breakfast Foods

Typical American breakfast foods, such as toast, bars, waffles, pancakes, juice and pastries are low in protein. Breakfast cereal is a staple for much of North America and western Europe, but many popular breakfast cereals contain only 2 to 3 grams of protein per serving. Adding a ½-cup (118mL) serving of milk only provides an additional 4 grams of protein. Adding a 1-cup (237mL) serving of whey-protein fortified milk[24] provides an additional 10 to 15 grams of protein, or a scoop of whey protein contributes 20 grams of high-quality protein to round out the breakfast meal.

Whey protein is a versatile ingredient that can be added to a variety of breakfast foods, including convenience foods that can be eaten on the go. Data shows that more than 25 percent of U.S. adults eat breakfast away from home.[12] Therefore, let's explore some breakfast options.

Smoothies:

Smoothies are an ideal way to get protein and are often a combination of whey protein and fruit, or whey protein and milk or yogurt. The popularity of smoothies has prompted the food industry to provide them in a variety of formats including shelf-stable, refrigerated and frozen. Many consumers also prepare their own whey protein smoothies at home.

Grain-based Products:

Whey protein can be incorporated into a variety of grain-based products, including nutrition bars, oatmeal, waffles and bagels, as well as more indulgent bakery items, such as cookies and brownies. A combination of whey protein, nuts and whey crisps can yield a crunchy breakfast treat. Levels of whey protein in some bakery items may be limited due to competition for water, but careful formulation can maximize whey protein content. Whey proteins also work well in bakery mixes, which allow foodservice establishments or consumers the option of preparing a fresh, piping-hot pancake, muffin or other breakfast treat, with an added boost of high-quality protein.

Coffee-based Beverages:

Whey protein is an ideal component for latte and coffee-based beverages. One refrigerated cappuccino product includes low-fat milk, coffee, whey protein and apple juice concentrate. This product contains 10 grams of dairy protein per 8-ounce (237mL) serving, and claims that it is all-natural and contains no added sugar. Hydrolyzed whey proteins also work well in both coffee-based and chocolate-type beverages, where their slightly bitter notes blend well with the overall flavor profile. Some athletes prefer partially hydrolyzed whey proteins for their faster absorption, and these proteins offer some formulation advantages in ready-to-drink beverages because of their added heat stability.

Yogurt:

Whey combines well with yogurt, a popular food throughout the world. Ethnic varieties include Arabic *lahne*, Indian *raita* and Greek *tzatziki*. One U.S. yogurt has been successfully fortified with whey protein to provide 15 grams of protein per 6-ounce (177mL) serving (three times more protein than regular yogurt).

International Breakfast Foods:

Breakfast traditions vary around the world. Breakfast in South America tends to be lighter and continental in style. In this region, whey protein could be used to fortify traditional breads, such as *pan dulce* or *medialunas*, or create new versions of popular morning beverages such as *café con leche* or *yerba maté*. Whey proteins complement a variety of grain products, such as African *uji* (grain gruel), Indian *khichri* (rice, lentils and spices) and Japanese *asagohan* (morning rice).

Whey protein can be easily incorporated into breakfast meals. Sample menus that include 20 grams of protein in breakfast menus are available at Wheyforyou.org/Recipe.aspx. Foods that are featured in these menus include: whey-protein fortified instant oatmeal, yogurt and whey protein smoothie, foodservice smoothie with whey protein for on-the-go individuals, yogurt/whey/granola parfait, protein waters,

and cappuccino and café au lait beverages with whey protein. Whey can also be formulated into breakfast sandwiches, which may contain meat or cheese to achieve a 20- to 30-gram protein target. Food manufacturers who want to develop foods with whey proteins can find a variety of starter formulations at www.InnovateWithDairy.com.

For more breakfast and other recipes that include high-quality whey protein, go to www.wheyforyou.com/Recipes.aspx.

Benefits for Weight Management and Healthy Living

The traditional view of energy balance has been that caloric intakes and expenditures needed to be balanced within a 24-hour period. However, recent research indicates that the deviations in within-day energy surpluses and deficits are important factors in determining body fat, performance and the ability to concentrate. Muscle catabolism occurs as an adaptation of inadequate fuel delivery and/or infrequent eating. Large meals can result in higher fat storage, even if the total daily caloric intake is the same. Studies have shown that insulin, blood sugar and leptin are all controlled more easily with frequent small meals that match energy expenditures.[25,26]

Many people skip breakfast to cut calories but may be sabotaging their weight maintenance efforts. The American Dietetic Association's public relations team notes, "There is no evidence to support the belief that eating breakfast will make you gain weight. In fact, skipping meals has been shown to lead to overeating at snack time or the next meal."[27] Breakfast consumption is inversely associated with weight gain and/or increased BMI in a majority of cross-sectional studies.[1] One study revealed that breakfast-skipping in overweight Latino adolescents was related to increased visceral fat independent of age, gender, total fat, total lean tissue and total energy intake. Even occasional breakfast consumption appeared to result in lower visceral adiposity.[28]

Maintenance of a healthy body weight involves multiple factors including appetite regulation and maintenance of a good ratio of lean body mass to adipose tissue. As part of a reduced-calorie diet, higher-protein diets may improve the quality of weight loss by helping people lose more fat and/or maintain more lean muscle.

Satiety:

Diets higher in protein have also been shown through scientific research to increase satiety — a feeling of fullness after or between meals. When individuals feel fuller longer, they are less likely to reach for unnecessary snacks between meals. Calorie for calorie, consuming protein can increase the feeling of fullness more than carbohydrates or fats.[29] The most practical way for individuals to attain a higher-protein diet is to incorporate protein into foods throughout the day, including at breakfast. Food manufacturers may find a particular opportunity to boost the protein content of breakfast and snack items, where protein content is generally low. "The feeling of fullness, or satiety, that comes with diets higher in protein, may lead to a subsequent decrease in ad libitum calorie intake, which, over time, may help with weight management," said Matt Pahnke, Ph.D., R.D., the Dairy Research Institute™. A study by

Rolls noted that improved satiety response required more than 30 grams of protein at a meal, and that breakfast had the greatest impact on total daily energy intake.[30]

Another trial involved 16 normal men using a crossover design. The subjects consumed an isocaloric breakfast containing 60 percent of energy as either protein, fat, carbohydrate or a mixture of the three. Subjects on the meals containing high protein were significantly less hungry before lunch than those on either the high-fat or high-carbohydrate preload ($P<0.001$).[31]

Research indicates that different proteins affect appetite differently and that whey appears to reduce hunger most when consumed at breakfast.[32] Subjects were fed a 600-calorie breakfast consisting of either 10 percent or 25 percent of the meal from different protein sources. At the level of 10 percent protein (about 15 grams), whey protein decreased hunger more than soy or casein. The author indicated that this effect appears to be linked to the amino acid levels and appetite hormones in the blood.

Appetite Hormones:

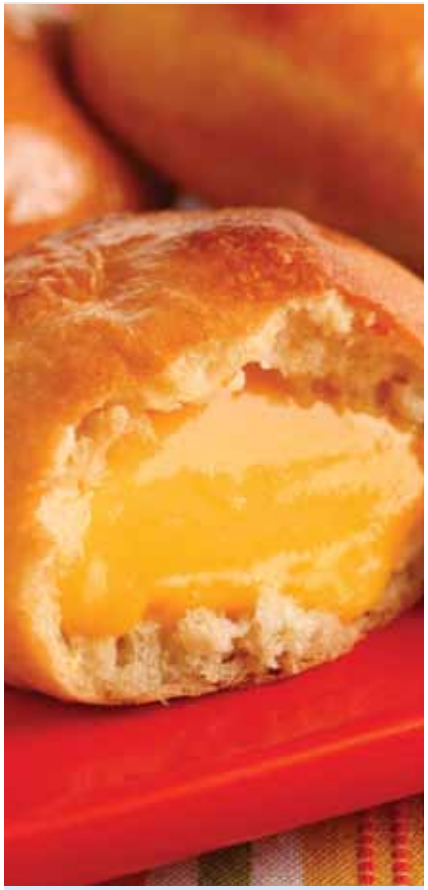
Hormones have been hypothesized as one of the mechanisms involved in weight management. Changes in hormones such as ghrelin for appetite-stimulation, and appetite-suppressing hormones, such as glucagon-like peptide-1, cholecystokinin or PYY may play a role.

A recent study by Leidy revealed that breakfast consumption led to increased satiety through increased fullness and concentrations of PYY (a protein released by the digestive system that appears to reduce appetite) in "breakfast-skipping" adolescents.[2] These researchers suggested that a breakfast rich in dietary protein might be an effective strategy to improve appetite control in young people. The same author explored satiating properties of dietary protein in adults, and found that consumption of dietary protein at breakfast led to greater initial and sustained feeling of fullness compared to consumption at lunch or dinner.[33]

Ghrelin is a digestive hormone that regulates hunger. Ghrelin levels decrease after a meal, and high ghrelin levels may slow metabolism and decrease the body's ability to burn fat. A study by Blom revealed that a high-protein breakfast (energy 58.1 percent from protein and 14.1 percent from carbohydrate) decreased postprandial ghrelin concentrations more strongly over time than did a high-carbohydrate breakfast (energy 19.3 percent from protein and 47.3 percent from carbohydrate).[34] The high-carbohydrate breakfast included yogurt, and the high-protein breakfast consisted of a dairy product enriched with whey protein isolate. In the same study, a high-protein breakfast also reduced the rate of gastric emptying and stimulated cholecystokinin and GLP-1 secretion.

Thermogenesis:

Research also suggests that a high-protein breakfast can increase thermogenesis more than a normal protein breakfast.[35] One study compared diet-induced thermogenesis and appetite suppression in young adults who consumed a breakfast yogurt drink. This study showed that consumption of a breakfast yogurt drink with 41 percent of energy from either total whey protein or α-lactalbumin-enriched whey



protein increased energy expenditure, protein balance and decreased fat balance compared with a control breakfast containing 17 percent of energy from protein.

Glycemic Control:

Work by Layman suggests that replacement of carbohydrates with protein also improves glycemic control as measured by reduced post-prandial hyperinsulinemia, and in Type 2 diabetes mellitus, corrects hyperglycemia and glycated hemoglobin (HbA1c).[36] A balanced breakfast with optimal protein may prove beneficial for many at-risk groups.

Muscle Synthesis:

One key to long-term weight management is the maintenance of a higher ratio of lean tissue to fat. Leucine is one of the nine essential amino acids and has been shown to play a role in regulating muscle protein synthesis, specifically signalling the body to build and preserve more muscle. Leucine is unique as a metabolic signal that helps muscles burn calories, and whey protein is one of the best sources of leucine.

Both protein type and timing of protein ingestion affect muscle anabolism and catabolism. Studies by Boirie indicate that whey protein stimulates amino acid oxidation and protein synthesis without modifying proteolysis, whereas casein increases amino acid oxidation and protein synthesis to a lesser extent and strongly inhibited proteolysis.[37] Therefore, "fast" protein (whey) may be more beneficial than a "slow" protein (casein) in elderly subjects, who may have limited absorption in order to limit body protein loss.

Popular Weight Management Programs

As the body of science grows for the benefits of whey protein and weight management, many popular diet programs are recommending a scoop of whey protein daily.[38] ***This publication is not intended to promote or endorse any of these diets or programs.*** Within the U.S., WedMD® suggests: Check with your health-care provider before making major dietary changes.[39] Individuals who are obese or have other health issues should consult a medical professional before beginning any diet program. The American Dietetic Association continues to emphasize the importance of sustained, moderate weight loss and increased physical activity for people who are overweight or obese and at risk for diabetes or living with diabetes.[40] All of these weight management programs recommend breakfast, and several recommend that participants eat breakfast within 30 to 60 minutes of waking to jump-start the body's metabolism.

The Big Breakfast Diet by Daniela Jakubowicz, M.D., recommends two servings of dairy in the morning, one of which may be a scoop (3 tablespoons) of whey protein powder. Jakubowicz conducted a study of 94 women where both groups consumed a low-carbohydrate diet. The Big Breakfast (BB) group consumed 610 to 850 calories and 37 percent of calories from protein at breakfast, while the Low Carbohydrate (LCH) group ate a breakfast of 250 to 350 calories with 28 percent of calories from protein. Total daily calories for both groups were approximately 1,100 to 1,450 calories. While both groups lost similar weight in the initial four months, adherence to the BB plan

was better, and after the maintenance phase of the study, the LCH group had lost an average of nine pounds, while the BB group had lost an average of 40 pounds (18kg).[41]

The Biggest Loser is a popular U.S. television reality show. Tufts University obesity clinician and researcher Michael Dansinger, M.D., developed the weight loss program accompanied by dietitian and chef Cheryl Forberg, R.D., and trainers Bob Harper and Jillian Michaels.[42] Contestants consume a breakfast of about 375 calories.[43] The diet recommends 30 percent of calories from protein, and a typical breakfast in their "Jump Start" book contains 30 grams or more of protein.

The Food Lovers Fat Loss System® recommends that each meal, including breakfast, include a serving of protein, a serving of fast carbs and a serving of slow carbs. For this program, a serving of protein can be a scoop of whey protein, and in fact Robert Ferguson M.S., C.N., recommends a serving of whey protein daily as part of his program to maintain a healthy weight. In his book, *Diet-Free for Life*,[44] Ferguson recommends making protein the centerpiece of every meal.

The Ideal Chocolate Milk Diet™, developed by a clinical dietitian with over 30 years in the weight-loss field, recommends three servings (1.5 scoops each) of "Chocolate Milk Reinvented," with 30 grams of protein from whey protein isolate, each day. One serving should be consumed at breakfast with a 12-ounce glass of skim milk for a total of 42 grams of protein. The diet recommends 30 percent of calories from protein, versus an average American diet, which provides 15 percent of calories from protein. Typically customers lose 1 to 2 pounds per week, and that can translate to 26 to 52 pounds over six months.[45]

In late 2010, Weight Watchers® within the U.S. revised their program and developed a new ProPoints™ or PointsPlus™ program that is calculated by a proprietary formula that now includes grams of fat, carbohydrates and fiber.

A Smart Breakfast

While there is no absolute definition for a smart breakfast, clearly a good breakfast should include a balance of macronutrients and a significant portion of the day's

Figure 2. Dairy Breakfast Choices

Food	Portion	Calories	Protein (g)	Calcium (mg)	Fat (g)	Sugars (g)
1 Scoop Unflavored Whey Protein	23g	80	20.0	105	0.0	0.0
1 Scoop Flavored Whey Protein	25g	90	20.0	125	0.0	0.0
1 Scoop Milk Protein Concentrate 85	25g	91	21.0	11	0.4	0.0
Low-fat White Milk	240mL	102	8.2	290	2.4	12.7
Fat-free White Milk[1]	240mL	83	8.2	306	0.2	12.5
Yogurt, Plain, Low-fat	8oz/227g	143	11.9	415	2.6	16.0
Yogurt, Plain, Fat-free	8oz/227g	127	13.0	452	0.4	17.4
Better Whey of Life™ Protein Yogurt, Plain 'n Tart	170g	130	15.0	300	0.5	7.0
Bolthouse® Farms Mocha Cappuccino	240mL	178	10.0	450	2.5	28.0

[1]Source: Quick-Reference Guide. Nutrition claims for Dairy Products, National Dairy Council/Dairy Management Inc. 2009

calories: 25 percent to 33 percent might be a good target. One project Hochberg-Garrett suggested is that a healthy, "3 Star Breakfast" should include a serving each of dairy product, whole grain and fruit, each with an emphasis on being foods low in fat and sugar.[46] In addition, many popular diet programs include breakfast foods that contain a significant level of both protein and fiber to promote satiety. The Weight Watchers website suggests: "The ideal breakfast is based on carbohydrate and protein," says G. Harvey Anderson, Ph.D., a professor in the department of nutritional science at the University of Toronto. He theorized that the most satisfying breakfast delivers a quick shot of energy (by raising blood sugar levels rapidly) and then a longer-term energy boost from high-fiber, complex-carbohydrate, protein-containing foods that slow digestion.[47] The attached chart compares various options for the dairy component of breakfast. These dairy components can be served as separate foods or combined with other foods to create smoothies or breakfast entrees.

Protein and Morning Exercise

Many adults wake from an evening fast to perform their morning exercise without any breakfast. When athletes skimp on protein, their bodies borrow from muscle, thus decreasing lean muscle mass. A combination of protein and carbohydrates before exercise may be optimal, depending on the activity, duration and intensity of exercise. Eating prior to exercise has actually been shown to improve performance, but each athlete must tailor the pre-exercise meal to their workout type and intensity, as well as their individual gastrointestinal sensitivities.

A joint position statement of the American Dietetic Association, Dietitians of Canada and the American College of Sports Medicine stresses the importance of adequate protein intake for active adults and athletes. "Energy and macronutrient needs, especially carbohydrate and protein, must be met during times of high physical activity to maintain body weight, replenish glycogen stores, and provide adequate protein to build and repair tissue."[48,49] This same paper advises athletes against skipping meals, especially breakfast.

Morning is a popular time for exercise but often leaves active adults with the question of whether to eat before or after exercise. A recent study indicated that in order to maximize muscle protein synthesis and muscle mass in younger individuals, the window of time during which protein should be consumed is likely 30 to 45 minutes before and/or less than two hours after resistance exercise.[50] For older individuals, the data suggest that the window for optimal protein intake may be within one hour after resistance exercise. SCAN (the Sports, Cardiovascular, and Wellness Nutrition practice group of the American Dietetic Association) recommends "…including small amounts of protein in your pre-exercise meal(s). Protein helps build and repair muscle tissue. Adequate protein before exercise may help reduce post-exercise muscle soreness."[51]

Optimal food intake before exercise should be tailored to both individual needs and type of exercise. One fitness trainer recommends that individuals who do light cardio exercise can begin their workout on an empty stomach and consume a post-workout meal (i.e., breakfast) of carbohydrates and protein.[52] Individuals who do

resistance training can consume a pre-workout snack (mini-breakfast) that contains 5 to 10 grams of protein prior to workout, and then consume a post-workout snack (second breakfast) of an additional 10 to 20 grams of protein. Whey protein contains high-quality protein, and the highest concentration of branched-chain amino acids, making it ideal for both pre- and post-workout breakfast snacks and meals. Bars and gels containing whey protein are ideal for athletes who perform extended morning exercise, such as long bike rides, and want a portable source of high-quality protein.

Morning exercise, combined with whey protein supplementation, may be a powerful routine to optimize desired changes from strength training. In a 10-week, single-blind randomized study, 17 resistance trained males were matched for strength and placed in two groups. One group consumed a protein/creatine/glucose supplement before and after a workout, while the second group consumed the same supplement in the morning before breakfast and late evening each training day. The group that consumed the supplement before and after their workout showed significantly greater improvements in strength and body composition.[53]

Another question that active adults often ask is what is the ideal carbohydrate-to-protein ratio. Again this will depend on the type of exercise and the time spent exercising. For light exercise, a 2:1 ratio of carbohydrate to protein may be sufficient, and for more extended exercise, a 3:1 or 4:1 ratio of carbohydrate to protein may be required because of the higher energy requirements of extended exercise.[54] As little as 10 grams of whey protein has been shown to stimulate muscle protein synthesis,[55] and a total of 20 to 30 grams may be optimal.

Conclusions

The body of knowledge about the benefits of protein at breakfast has grown significantly in recent years. The food industry has begun offering breakfast items with whey protein and other dairy ingredients but innovation is still needed to meet the demand for better breakfast foods. While some diets/experts recommend slightly more or less protein at breakfast, a good general recommendation would be 20 to 30 grams of protein as the goal for most populations to consume at breakfast for optimal benefits.

[1] Rampersaud GC. The benefits of breakfast for children and adolescents: update and recommendations for practitioners. *Am J Lifestyle Med.* 2009;3:86-103.
[2] Leidy HJ, Racki EM. The addition of a protein-rich breakfast and its effects on acute appetite control and food intake in "breakfast-skipping" adolescents. *Intl J Obes*. 2010;34:1125-1133.
[3] What We Eat in America, NHANES, 2001-2002, individuals 2 years and over (excluding breast-fed children), MEC sampling weights. U.S. Department of Agriculture, Agricultural Research Service, Beltsville, Human Nutrition Research Center, Food Surveys Research Group (Beltsville, MD). Table 5. Available at: http://www.ars.usda.gov/Services/docs.htm?docid=18349. Accessed May 26, 2011.
[4] Breakfast consumption by African-American and white adolescent girls correlates positively with calcium and fiber intake and negatively with body mass index. *J Am Diet Assoc.* 2005;105(6):938-945.
[5] Sun Y, Sekine M, Kagamimori S. Lifestyle and overweight among Japanese adolescents: the Tayama Birth Cohort Study. *J Epidemiol.* 2009;19(6):303-310. Epub 2009 Sept 9.
[6] Nagel G, Wabitsch M, Galm C, et al. Determinants of obesity in the Ulm Research on Metabolism, Exercise and Lifestyle in Children (URMEL-ICE). *Eur J Pediatr.* 2009;168(10):1259-67. Epub 2009 Jun 28.
[7] Maddah M, Nikooyeh B. Factors associated with overweight in children in Rasht, Iran: gender, maternal education, skipping breakfast and parental obesity. *Public Health Nutr.* 2010;13(2):196-200. Epub 2009 Jun 23.
[8] Rampersaud GC, Pereira MA, Girard BL, Adams J, Metzl JD. Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. *J Am Diet Assoc.* 2005;105(5):743.
[9] Affenito SG. Breakfast: a missed opportunity. *J Am Diet Assoc.* 2007;107:565.
[10] Food Research and Action Center. *School Breakfast Scorecard* 2007. Washington, D.C.: FRAC, December 2007. Available at: http://www.frac.org. Accessed May 26, 2011.
[11] McBean, LD. School breakfast: improving students' minds and bodies. *Dairy Council Digest.* March/April 2008;79(2):7.
[12] What We Eat in America, NHANES, 2001-2002, individuals 2 years and over (excluding breast-fed children), MEC sampling weights. U.S. Department of Agriculture, Agricultural Research Service, Beltsville, Human Nutrition Research Center, Food Surveys Research Group (Beltsville, MD). Available at: http://www.ars.usda.gov/Services/docs.htm?docid=18349. Accessed May 26, 2011. [CAN WE GET A TABLE OR PAGE REFERENCE?]
[13] USDA/NHANES. What We Eat in America. Individuals 2 years and over (excluding breast-fed children), MEC sampling weights. U.S. Department of Agriculture, Agricultural Research Service, Beltsville Human Nutrition Research Center, Food Surveys Research Group (Beltsville, MD). NHANES 2001-2002. Available at: http://www.ars.usda.gov/SP2USERFiles/Place/12355000/pdf/Table_1_BIA.pdf. Accessed May 26, 2011.
[14] USDA/NHANES. What We Eat in America. Individuals 2 years and over (excluding breast-fed children), MEC sampling weights. U.S. Department of Agriculture, Agricultural Research Service, Beltsville Human Nutrition Research Center, Food Surveys Research Group (Beltsville, MD). NHANES 2001-2002. Available at: http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/Table_9_BIA.pdf. Accessed May 26, 2011.
[15] Cavadini C, Siega-Riz AM, Popkin BM. US adolescent food intake trends from 1965 to 1996. *West J Med.* 2000;173(6):378-383.
[16] Kerver JM, Yang EJ, Obayashi S, Bianchi L, Songo WO. Meal and snack patterns are associated with dietary intake of energy and nutrients in U.S adults. *J Am Diet Assoc.* 2006;106:46-53.
[17] Bruinsma J, ed. *World agriculture: towards 2015/2030. An FAO perspective.* Rome, Food and Agriculture Organization of the United Nations/London, Earthscan, 2003.
[18] American Dietetic Association. Better Breakfasts. Available at: http://www.eatright.org/Public/content.aspx?id=6747. Accessed May 26, 2011.
[19] Layman, DK. Dietary Guidelines should reflect new understanding about adult protein needs. *Nutr Metab* (Lond). 2009;6:12.
[20] Baumgartner RN, Koehler KM, Gallagher D, et al. Epidemiology of sarcopenia among the elderly in New Mexico. *Am J Epidemiol.* 1998;147:755-763.
[21] Doherty TJ. Invited review: aging and sarcopenia. *J Appl Physiol.* 2003;95:1717-1727.
[22] Wolfe RR. The underappreciated role of muscle in health and disease. *Am J Clin Nutr.* 2006;84(3):475-482.
[23] Jones DP, Rasmussen BB. Dietary protein recommendations and the prevention of sarcopenia. *Curr Opin Clin Nutr Metab Care.* 2009;12(1):86-90.
[24] Dairy Product Technology Center, Cal Poly State University, San Luis Obispo, CA. Available at: http://www.calpoly.edu/~dptc/Prototypes/Recovery%20Beverages.pdf. Accessed May 26, 2011.
[25] Leibel RL, Rosenbaum M, Hirsch J. Changes in energy expenditure resulting from altered body weight. *N Engl J Med.* 1995;9:332(10):621-8.
[26] Hawley JA, Burke LM. Effect of meal frequency and timing on physical performance. *Br J Nutr.* 1997;77:S91-103.
[27] American Dietetic Association. Available at: http://www.eatright.org/Public/content.aspx?id=4294967960&terms=breakfast. Accessed May 26, 2011.

[28]Alexander KE, Ventura EE, Spruijt-Metz D, Weigensberg MJ, Goran MI, Davis JN. Association of breakfast-skipping with visceral fat and insulin indices in overweight Latino youth. *Obesity*. 2009;17:1528-1533.[advance publication May 7, 2009].
[29]Institute of Medicine: Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids. Washington D.C. National Academies Press, 2005.
[30]Rolls BJ, Hetherington M, Burley VJ. The specificity of satiety: the influence of foods of different macronutrient content on the development of satiety. *Physiol Behav.* 1988;43:145-153.
[31]Stubbs RJ, O'Reilly LM, Johnstone AM, Harrison CLS, Clark H, Franklin MF. Description and evaluation of an experimental model to examine changes in selection between high protein, high carbohydrate and high fat foods in humans. *Euro J Clin Nutr.* 1999;53:13-21.
[32]Veldhorst MA, et al. Dose-depending satiating effects of whey relative to casein or soy. *Physiol Behav.* 2009;96(4-5):675-682.
[33]Leidy HJ, Bossingham MJ, Mattes RD, Campbell WW. Increased dietary protein consumed at breakfast leads to an initial and sustained feeling of fullness during energy restriction compared to other meal times. *Br J Nutr.* 2009;101(6):798-803.
[34]Blom WA, Lluch A, Stafleu A, et al. Effect of a high-protein breakfast on the postprandial ghrelin response. *Am J Clin Nutr.* 2006; 83(2):211-20.
[35]Hursel R, van der Zee L, Westerterp-Plantenga MS. Effects of a breakfast yoghurt, with additional total whey protein or caseinomacropeptide-depleted α-lactalbumin-enriched whey protein, on diet-induced thermogenesis and appetite suppression. *Br J Nutr.* 2010;103(5):775-780.
[36]Layman DK. Dietary Guidelines should reflect new understandings about adult protein needs. *Nutr Metab.* 2009;6:12.
[37]Boirie Y, Dangin M, Gachon P, Vasson M-P, Maubois J-L, Beaufrère B. Slow and fast dietary proteins differently modulate postprandial protein accretion. *PNAS.* 1997;94(26):14930-14935.
[38]Designer Whey Company. Available at: http://www.designerwhey.com/the-biggest-loser/all-products.htm. Accessed May 26, 2011.
[39]WebMD®. Available at: http://www.webmd.com/diet/slideshow-high-protein-diet. Accessed May 26, 2011.
[40]American Diabetes Association. Available at: http://www.prnewswire.com/news-releases/ada-issues-new-clinical-practice-recommendations-58920432.html. Accessed May 26, 2011.
[41]Jakubowicz D. *The Big Breakfast Diet.* New York: Workman Publishing Company, Inc.; 2009:4-9.
[42]WebMD®. Available at: http://www.webmd.com/diet/features/biggest-loser-diet. Accessed May 26, 2011.
[43]Forgerg C, et al. NBC Universal, Inc. *The Biggest Loser 30-Day Jump Start.* New York: Rodale Inc.; 2009:31.
[44]Ferguson R. *Diet-Free for Life: a revolutionary food, fitness, and mindset makeover to maximize fat loss.* New York: Penguin Group (USA) Inc.; 2011:53.
[45]The Ideal Chocolate Milk Diet™. Available at: http://www.chocmilkdiet.com. Accessed May 26, 2011.
[46]Hochberg-Garrett HF. The Skip to Breakfast Project: Development, Implementation, and Feasibility Evaluation of an Intervention to Increase Healthful Breakfast Consumption Among Fifth Grade Students and Their Families. Master of Public Health Thesis, The University of Texas Health Science Center at Houston School of Public Health, Houston, Texas, 2008.
[47]Weight Watchers®. Available at: http://www.weightwatchers.com/util/art/index_art.aspx?tabnum=1&art_id=841. Accessed May 26, 2011.
[48]Joint position statement ACSM, ADA, Dietitians of Canada; Nutrition and Athletic Performance. *Med Sci Sports Exer.* 2000:2131-2145.
[49]Position of the American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance. *J Am Diet Assoc.* 2009;103(3):509.
[50]Phillips SM, Tang JE, Moore DR. The role of milk- and soy-based protein in support of muscle protein synthesis and muscle accretion in young and elderly persons. *J Am Coll Nutr.* 2009;28(4):343-354.
[51]American Dietetic Association. Sports, Cardiovascular, and Wellness Nutrition (SCAN). Available at: http://www.scandpg.org/local/resources/files/2009/SD-USA_Fact_Sheet_Eating_Before_Exercise_Apr09.pdf. Accessed May 26, 2011. 2009:1.
[52]Ferguson R. *The Carbs, Exercise & Fat Loss Report.* Ventura, CA: Diet Free Life, LLC; 2010:14.
[53]Cribb P, Hayes A. Effects of supplement timing and resistance exercise on skeletal muscle hypertrophy. *Med Sci Sports Exerc.* 2006;38(11):1918-1925.
[54]Ferguson, R. *The Carbs, Exercise & Fat Loss Report.* Ventura, CA: Diet Free Life, LLC; 2010:11-26.
[55]Tang JE, Manolakos JJ, Kujibida GW, Lysecki PJ, Moore DR, Phillips SM. Minimal whey protein with carbohydrate stimulates muscle protein synthesis following resistance exercise in trained young men. *Appl Physiol Nutr Metab.* 2007;32(6):1132-1138.