

Why muscle mass matters



In this brief review (or refresher), delve into the issues of muscle, body composition and aging, plus learn tips on how to promote muscle health and counteract muscle loss through lifestyle

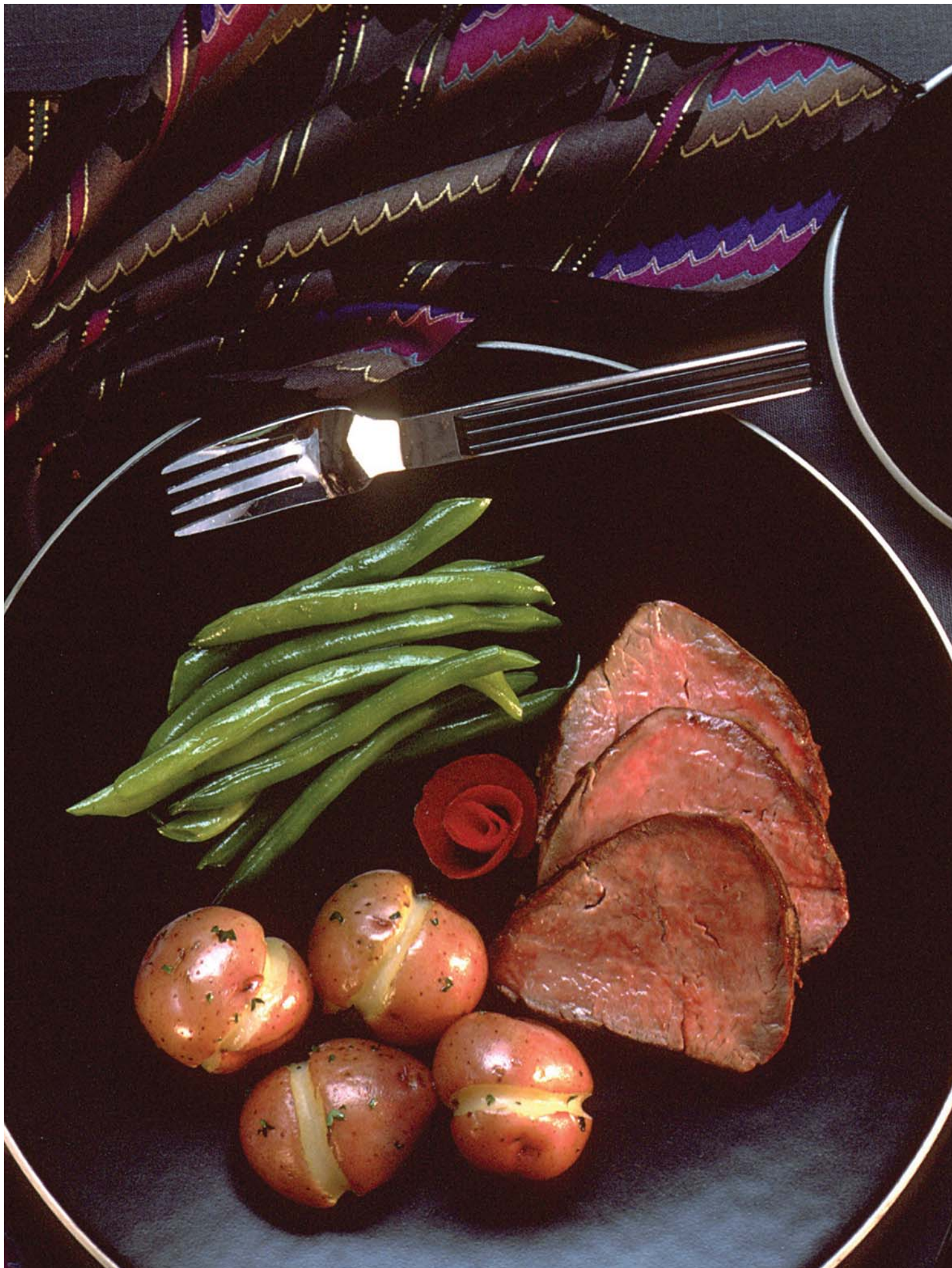
by Ashley Bronston, MS, RDN, and Menghua Luo, MD, PhD

People are living longer than ever before. A report from the US Department of Health and Human Services¹ showed that, in 2013, there were 67,347 persons aged 100 or more in the United States. In combination with longer life spans, the Boomers are reaching older adulthood. As of 2013, there were 44.7 million adults aged 65 and older living in the US—which is one in every seven Americans.¹ By 2030, older adults will account for roughly 20% of the nation's population.²

In Canada, an estimated one in six adults were aged 65 and over in 2015—16.1% of the population—and the oldest Canadians outnumbered the youngest (aged 0–14 years) for the first time.³ According to Statistics Canada, nearly one in four Canadians will fall into the 65-and-over age group by 2030.⁴

Although populations are aging in many countries, our knowledge on the mechanisms of aging remains limited. We know that aging causes changes in body composition; a decrease in muscle and an increase in fat tissue. The loss of muscle mass has been well documented in older adults. Further, many people become less active with age and pay little attention to the quality of their diet. Studies have shown that after the age of 40, adults may lose up to 8% of their muscle mass per decade.⁵ The

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process then accelerates substantively after 70 years of age, where the rate of muscle loss almost doubles to up to 15% per decade.^{6,7} This loss of muscle mass and strength is referred to as *sarcopenia*, the Greek term meaning “poverty of the flesh.”

The following pages offer a review (or refresher) on muscle, body composition and the older adult for active-aging professionals. The older adults with whom these professionals work cover the functional spectrum—from frail individuals who need ongoing assistance, to athletes who challenge themselves to improve their performance. While their fitness levels and functional abilities will differ, clients or residents can all take steps to enhance muscle health. The question is: Why does muscle matter?

Muscle matters for more than just strength

Muscles are the largest component of lean body mass (or LBM), which is everything that makes up the body except for fat. In fact, muscles account for up to 50–60% of a person’s body weight.⁸ The role of muscle extends far beyond supporting movement and balance. Muscles help to maintain posture, circulate blood through the body, regulate breathing, generate heat, stabilize joints, aid digestion, and protect vital organs. Muscles are storage sites for glycogen, a stored form of carbohydrate energy needed for the brain, central nervous system and red blood cells. The human muscle can also be broken down to get amino acids, or the building blocks of protein, which the body can use to build and repair structures. As one can imagine, loss of these functions can significantly impact health status.

What happens to aging muscle?

It may come as a surprise, but muscle begins to age around the third decade of life. When a person ages, muscle fibers begin to shrink. Muscle tissue is replaced

more slowly, and lost muscle tissue may be exchanged with a tough fibrous tissue. These changes within the muscle, combined with normal aging changes can cause muscles to have less function, tone, strength and contractibility.⁹ Muscle shrinkage also reduces the body’s protein supply and the ability to balance protein production with breakdown. Factors such as malnutrition, inactivity, illness and injury can all accelerate the loss of muscle mass.

It is important to note here that malnutrition is often an unrecognized player in muscle mass loss, and frequently goes untreated in older adults. Malnutrition affects an estimated 30–50% of adult hospitalized patients, but only 3.2% of these patients are discharged with a malnutrition diagnosis.^{9,10} Malnutrition is not just a hospital-based problem either. Approximately 35–50% of older adults living in long-term care centers are malnourished. One in three older adults are malnourished upon hospital admission, meaning that there are many unidentified cases out in the community setting as well.¹¹ In a 2009 study that assessed malnutrition risk among community-living older adults who received nursing services, 34.5% of individuals were at risk for malnutrition while 8.1% met the diagnostic criteria for malnutrition.¹²

Although muscle loss is a natural process of aging, the scientific literature demonstrates that diet modifications and regular exercise can help older adults maintain current muscle mass or even restore lost muscle.

If individuals do not plan for the future of their muscle health, they can develop sarcopenia, resulting in a significant decline in strength, mobility, independence and quality of life. Muscle loss also increases the risk for other health-related problems. These include a higher prevalence of falls and fractures, frailty, increased infection rates, decreased healing abilities and premature mortality.

The impact of exercise on muscle mass

Is it possible to intervene for muscle health? The short answer is, yes. Exercise and nutrition can have a substantial impact on muscle health. While aerobic exercise (such as walking, jogging and swimming) helps improve cardiovascular health, studies show that resistance training can be an efficient approach for building muscle. Resistance can be provided by weights, exercise bands, machines or one’s own body weight (e.g., squats, lunges). This method is successful in that it stimulates the synthesis of muscle protein and increases muscle mass.^{13,14}

In a seminal study, Fiatarone et al.¹⁵ studied the effects of an 8-week high-intensity resistance-training program in frail older adults (average age 90 years). At the end of the training program, the participants’ leg strength (measured by the quadriceps one-repetition-maximum strength) increased 175% and leg muscle mass (measured by thigh muscle area) increased 9%.²⁴ This study showed that resistance training with appropriate intensity is a viable strategy to prevent muscle loss associated with aging.

Protein counts

Physical activity may also improve digestion, absorption and utilization of protein and other nutrients. An adequate intake of protein is important for muscle health. The majority of studies reviewed^{16–20} suggest that moderate-to-large servings of protein at each meal increase the synthesis of muscle protein.

As we know, protein is commonly found in animal products (i.e., meat, dairy), but is also present in other sources (i.e., nuts, legumes). What many do not know is that when adults reach 50 years old, their bodies cannot process protein as well as when they were younger. This phenomenon results in the need for older adults to consume more protein per kilogram of body weight.

| Protein recommendations based on weight and health status | | |
|---|---|---|
| Body weight (lbs) | Recommended protein intake (g) for healthy adults | Recommended protein intake (g) during illness or injury |
| 100 (45 kg) | 45–54 | 54–68 |
| 120 (55 kg) | 55–66 | 66–83 |
| 140 (64 kg) | 64–77 | 77–96 |
| 160 (73 kg) | 73–88 | 88–110 |
| 180 (82 kg) | 82–98 | 98–123 |
| 200 (91 kg) | 91–109 | 109–137 |
| 220 (100 kg) | 100–120 | 120–150 |
| 240 (109 kg) | 109–131 | 131–164 |
| 260 (118 kg) | 118–142 | 142–177 |
| 280 (127 kg) | 127–152 | 152–191 |
| 300 (136 kg) | 136–163 | 163–204 |

** For adults 50+

** Recommended protein intake based on 1.0–1.2g/kg

** Recommended protein intake during illness/injury base on 1.2–1.5g/kg

Excludes kidney dysfunction and other specific diseases that impact protein metabolism

Table 1. Protein recommendations based on weight and health status.

Optimal protein intakes are critical for the preservation of muscle mass, functionality and quality of life in older adults. Based on current scientific evidence, experts recommend a diet that includes at least 1.0–1.2 grams of protein per kilogram of body weight daily in healthy older adults.²¹ For older adults who have acute or chronic illnesses, 1.2–1.5 g protein/kg body weight daily may be needed, with even higher intakes recommended for individuals with severe illness or injury.²¹ (See Table 1 on this page to find appropriate protein recommendations based on weight and health status.)

Protein quality and timing

When trying to increase protein in the diet, keep in mind that not all protein is created equal, meaning that some sources are better absorbed by the body. Animal-derived proteins (i.e., poultry, dairy, eggs, beef) have higher “bio-

logical values” than plant-based protein sources. The biological value of protein is numbered from 100 down to 0 to describe how well the protein is absorbed by the body. Vegans and vegetarians will need to consume larger quantities of protein, for example, since plant-based proteins have lower biological values. (Refer to Table 2 on page 56 for excellent sources of protein.)

Timing protein intake is another consideration when trying to build and maintain muscle mass. The daily recommended value for protein should not be consumed at one meal, but rather distributed throughout the day.

Symons and colleagues²² found that consuming a very large amount of protein at one time did not enhance muscle protein synthesis. The human body can use only a moderate amount of protein for synthesis at one time. It is more beneficial,

therefore, for older adults to consume a portion of protein at each meal and snack rather than all at once. Adequate protein intake can lead to gains in muscle growth and functionality, especially when paired with exercise.

Other considerations to help improve muscle mass

Amino acids form together to make protein. The human body can produce 11 out of the 20 amino acids used to make human proteins, while the remaining 9 need to be consumed in the diet. Known as essential amino acids, these 9 are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine.

When leucine is broken down, or metabolized, it creates a compound called beta-hydroxy-betamethylbutyrate (HMB). Small amounts of HMB can be found in foods such as avocado, citrus fruit, cauliflower, alfalfa and catfish; however, it is extremely difficult to get enough HMB through diet alone to have an effect on muscles. To put this into perspective, a person would need to eat approximately 6,000 avocados for just 3 grams of HMB (the recommended amount).²³ HMB supplementation may help older adults maintain muscle mass if they become immobilized or ill. The recently published NOURISH Study, sponsored by Abbott Nutrition, found that when high-protein oral nutritional supplements enhanced with HMB were given to malnourished older adults with chronic diseases, they significantly lowered 90-day death rates following hospitalization²¹ (see “Resources” on page 57).

Other nutrients can also be involved with body composition and muscle health. Energy balance throughout life is essential for optimal muscle retention in older age, which is another reason why eating well is important. When the

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| Excellent sources of protein | | |
|--------------------------------------|----------|-------------|
| Food | Serving | Protein (g) |
| Whey protein powder | 2 scoops | 25 |
| Tuna (canned, water) | 3 oz | 21 |
| Lean beef | 3 oz | 20 |
| Chicken (breast, skinless) | 3 oz | 19 |
| Shellfish (shrimp, raw) | 3 oz | 17 |
| Greek yogurt | 6 oz | 17 |
| Tempeh | 3 oz | 16 |
| Nuts (almonds) | ½ cup | 15 |
| Cottage cheese (1% milk fat) | ½ cup | 14 |
| Egg | 2 large | 12 |
| Buckwheat | ½ cup | 11 |
| Ensure (oral nutritional supplement) | 8 fl oz | 10 |
| Soy milk (fortified) | 8 fl oz | 10 |
| Lentils (cooked) | ½ cup | 9 |
| Tofu (firm) | 3 oz | 9 |
| Edamame | ½ cup | 9 |
| Milk | 1 cup | 8 |
| Quinoa (cooked) | 1 cup | 8 |
| Chickpeas | ½ cup | 8 |
| Nut butters | 2 tbsp | 7 |

** Information derived from the USDA National Nutrient Database

Table 2. Excellent sources of protein.

body's energy needs are not met because energy intakes are insufficient or because of increased requirements due to infection, illness or other causes, muscle protein breakdown will occur. Even if a meal contains a large amount of protein, the body also needs carbohydrates and fat—otherwise, the protein consumed will be used as fuel.

Lastly, while crucial to bone health, vitamin D appears linked with muscle health as well. Low vitamin D levels are associated with muscle weakness, putting older adults at an increased risk for falls and fractures.²²

Tips on how to counteract muscle loss

Active-aging professionals know that lifestyle changes have a significant impact on various aspects of health. The good news is, aging muscles respond to specific lifestyle changes as well. Here are some useful tips to counteract muscle loss:

1. **Engage in physical activity.** Older adults should avoid inactivity. Keep in mind that some physical activity is better than none, so individuals with functional limitations should be as physically active as possible. For sub-

stantial health benefits, older adults should perform at least 150 minutes a week of moderate-intensity aerobic exercise or 75 minutes of vigorous-intensity aerobic exercise. Preferably the exercise should be spread throughout the week in episodes of at least 10 minutes.^{24,25}

If it becomes difficult for people to track their activity, suggest they use a pedometer to keep track of the number of steps taken during the day. These devices can act as an incentive to be active and are easily worn on waistbands. Research shows that 7,000–10,000 steps is the baseline for improving health and reducing the risk for chronic disease.²⁶ Muscle-strengthening activities are also recommended on two or more days per week, as these activities have a greater effect on the conservation of muscle.^{24,25}

2. **Eat more protein.** As mentioned previously, older adults require additional protein to help build cells and repair tissue. Tables 1 and 2 (shown on pages 55 and 56, respectively) provide a list of protein sources and individual protein recommendations.
3. **Eat right.** Everything that a person eats matters. The right balance of foods can help individuals achieve healthier lives. For healthy older adults, the US Department of Agriculture (USDA) recommends a daily intake of 1½–2 cups of fruit, 2–2½ cups of vegetables, 5–6 ounce equivalents of whole grains, 3 cups of dairy, and enough protein to support individual need.
4. **Have food ready.** Sometimes, older adults may not have easily accessible meals or nutritious snacks. If people have reduced appetites, it is important that they carry single-serving packages of healthy snacks (i.e., dried fruits, nuts, granola bars) with them

to eat when they feel hungry. When cooking, individuals should prepare extra servings to freeze or refrigerate for another time.

5. **Make food appealing.** Since older adults may have diminished senses, making food flavorful is important. Active-aging professionals can suggest cooking with salt-free blends (if needed), garlic, onions, wine, lemon, and fresh and dried herbs (basil, oregano, thyme, cilantro). They may also advise adding different-colored foods to keep meals from looking bland and boring. Food presentation is important, especially when someone lacks an appetite. Readers are encouraged to talk within their organizations to come up with solutions that make food appealing without compromising nutrient content.

6. **Try oral nutritional supplements.** The aim of oral nutritional supplements (ONS) is to improve overall

food and fluid intake, while supplying the body with additional protein, calories and micronutrients. ONS have been recognized to increase lean body mass^{27,28} and measures of functionality, specifically hand-grip strength.^{27,29} Available in a variety of flavors, these supplements can be easily added to the normal diet when diet alone is insufficient to meet daily nutritional requirements. [Ed. The *Journal on Active Aging*[®] always recommends that older adults consult with a physician or registered dietitian for advice about their specific nutritional needs.]

7. **Get connected.** If concerned about someone's muscle health, readers may want to suggest that he or she talk with a healthcare provider. Older adults identified as at risk for malnutrition can be referred to a registered dietitian nutritionist (RDN), who will provide diet instruction and nutritional support. In addition, where appropriate, RDNs can refer individuals to community-based nutritional services for other types of support.

A call for action

Muscle is vital for healthy aging. Active-aging professionals need to recognize the importance of muscle health, and the many ways in which it pertains to overall well-being in older adults. Proper nutrition and exercise not only promote muscle health, but also counteract muscle loss. For this reason, programs should highlight healthy eating and physical activity, as well as educate older adults about the impact of these lifestyle behaviors on muscle.

Whether professionals measure hand-grip strength or test gait speed or use a timed get-up-and-go test, they should regularly evaluate muscle health in their clients or residents. Repeated evaluations of muscle strength and functionality help in identifying at-risk older adults, who will benefit from early lifestyle interventions. Such assessments



also show when muscle strength and functionality improve. For individuals at any level of function, positive results are motivators to continue exercising and eating well.☺

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Resources

Abbott Nutrition: The NOURISH Study
<http://nourishclinicalstudy.com>

Choose My Plate (US Department of Agriculture): MyPlate
Nutrition recommendations
www.choosemyplate.gov/MyPlate

Eat Right (Academy of Nutrition and Dietetics): Find an Expert
Find a Registered Dietitian Nutritionist
www.eatright.org/find-an-expert

NIH SeniorHealth: Exercise: Exercises to Try
Strength exercises
<http://nihseniorhealth.gov/exerciseandphysicalactivity/exercises/01.html>

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tions, such as malnutrition, critical illness, short bowel syndrome, diabetes, chronic obstructive respiratory diseases and others, including the recently published *NOURISH Study*.

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