Protein for the Aged

Lon Kilgore PhD

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kilgoreacademy.com
director@kilgoreacademy.com

How much protein we eat is a topic of interest and conflict in and between individuals and groups within the medical, sport, and fitness industries. At present, given the greying of America, there has been more attention given specifically to aging populations. More attention in research as the aged were of less broad interest previously and more attention commercially as the number of "old" people is creating a massive customer pool for anything that can be linked to "successful" aging. Older individuals are considered likely to consume too little protein (Wolfe et al, Clinical Nutrition 27: 675-684, 2008). This inadequacy in protein consumption is often used to explain the loss of muscle mass (atrophy) and muscle cells (sarcopenia) seen in this population. But how much protein in the diet is enough? How much is too much?

Too little protein in the diet, aside from its atrophic effects, has also been proposed as a driver of excess consumption of other foods (Simpson & Raubenheimer, Obesity Reviews 6: 133-142, 2004). The conjecture holds that when low protein foodstuffs are consumed, the body recognizes the shortcoming in available protein to satisfy biological need and stimulates appetite to promote continued eating in order to close the protein deficit. Such a phenomenon may be a mediator in overconsumption leading to overweight and obese conditions.

It appears that eating too little protein can decrease lean body mass and drive fat accumulation, so how do we know how much is enough?

The first quantification and publication of a recommended level of dietary protein consumption for the masses was 1.0 grams of protein for each kilogram of bodyweight per day (League of Nations, The Problem of Nutrition, 1936). It is important to note the time in history this recommendation occurred was when World War 1 (1918) had recently ended, the stock market had crashed (1929), and the great depression and dust bowl was in full effect (1930 to 1939). As such, there was a great nutritional availability problem. Crop production failures and a devastated economy made simply obtaining food of any kind to eat a daily ordeal for all. Dietary recommendations created at that point in history intended to inform the public on minimal consumption methods to meet individual, familial, and social survival needs. Since then various governments, international political bodies, and professional organizations have modified and published lower recommended consumptions levels of between 0.66 grams/kilogram/day in 1957 up to 0.83 grams/kilogram/day in 2007. In general these later recommendations were for more for public health rather than public survival.

The most cited recommendations for protein consumption, derived from research on diabetic populations, are often 0.8 grams of protein per kilogram of body weight (0.0282 ounces of protein per 2.204 pounds bodyweight). This "minimum to prevent malnutrition" and "disease based" recommendation continues to be reiterated in

modernity because the research intending to develop new recommendations is inconsistent, of poor quality (in general), and may lead to dietary inadequacies when used in the real world. In fact, some data from over four decades ago demonstrated that the 0.8 grams/kg bodyweight/day, when tracked over a 10 day period was actually inadequate in providing adequate protein to 46.6% of over-70 age group subjects (Gersovitz et al, American Journal of Clinical Nutrition 35(1): 6-14, 1982).

Currently, government and clinical recommendations on protein consumption still reference the 0.8 grams/kilogram/day. This value is referred to as the recommended daily allowance (RDA) or the daily reference intake (DRI). The term and acronym DRI was intended to replace public use of the term and acronym RDA. However the use of the term and acronym RDA persists in the public and the media as it has been entrenched in the public psyche stretching back to 1941. The dietary reference intake (DRI) term change for protein need was proposed in 2002. The names of the concepts have changed but the 0.8 grams/kilogram/day has not, and moreover additional terms and acronyms have and add to public confusion (within research and academia the new terms are useful). Another such term referent to modern clinical recommendations given the public is in the form of a percentage range, where 10 to 35% of total calories consumed each day should be from protein delivering foods. This percentage range is known as the acceptable macronutrient distribution range (AMDR). To scrutinize this percentage range we can adapt that broad range into three levels:

Low protein = 10% of caloric consumption
Medium protein = 22.5% of caloric consumption (*the calculated mid-point of recommendations*)
High protein = 35% of caloric consumption

Below the 10% level is considered unhealthy and unsupportive of normal body function and systems maintenance and repair. Above the 35% level is suggested to promote kidney damage and be unnecessary (not proven in any way in <u>healthy</u> populations).

If we put the above consumption recommendations into a real world dietary perspective, we can do a few calculations to consider the veracity and utility of current percentage-based recommendations. The first obvious step is to consider how following the recommendations affect consumption of the three major sources of dietary protein in the USA; chicken, beef, and pork. Let's assume an individual of interest here that weighs 75 kilograms (165 pounds). Given the base figure for caloric consumption used in development of these recommendations, 2000 calories per day (2000 kcal/d), how do the recommendations stack up to providing at least the 0.8 grams per kilogram bodyweight recommendation?

Chicken

10% 83.7 grams of chicken per day = 200 kcal/d = 0.30 g/kg bodyweight
22.5% 188.3 grams of chicken per day = 450 kcal/d = 0.68 g/kg bodyweight
35% 292.9 grams of chicken per day = 700 kcal/d = 1.05 g/kg bodyweight

Beef

10% 99.0 grams of beef per day = 200 kcal/d = 0.38 g/kg bodyweight
22.5% 222.8 grams of beef per day = 450 kcal/d = 0.85 g/kg bodyweight
35% 346.5 grams of beef per day = 700 kcal/d = 1.32 g/kg bodyweight

Pork

10% 82.6 grams of pork per day = 200 kcal/d = 0.30 g/kg bodyweight
22.5% 186.0 grams of pork per day = 450 kcal/d = 0.67 g/kg bodyweight
35% 289.3 grams of pork per day = 700 kcal/d = 1.05 g/kg bodyweight

If the 0.8 grams per kilogram bodyweight per day recommendation for minimal dietary protein need is accurate, then in no instances does the low modern recommendation, 10% of total caloric consumption, supply protein at a level remotely close to that needed to sustain a healthy life. It is a poor and misguided recommendation. At the medium modern recommendation, 22.5% of total caloric consumption, only beef provides protein at a level – 0.85 grams per kilogram bodyweight per day – that meets or exceeds the 0.8 g/kg/day recommended to sustain a healthy life. At the high modern recommendation, 35% of total caloric consumption, all three protein sources provide more than enough to exceed the 0.8g/kg/day recommendation (Chicken = 1.05 g/kg/d; Beef = 1.32 g/kg/d; Pork = 1.04 g/kg/d). In fact, this level of consumption can sustain health and provide additional nutritional support needed for physiological adaptation to exercise (fitness improvement).

If we consider a couple other common animal based foods, eggs and cheese, none of the levels of consumption recommendations meets needs. Even at the highest level of recommendations, consuming 700 calories of eggs (7.8) each day only provides 0.64 grams of protein per kilogram of bodyweight, far short of the historical 0.8 g/kg/day guideline. If we look at a common plant based "high protein" foodstuff, cooked chickpeas, consumption at the 35% of total calories level delivers only 0.51 grams of protein per kilogram of bodyweight per day. An additional consideration is that vegetable proteins do not provide all essential amino acids (not a bad thing, it just requires added attention to detail in the composition of meals to consume all essential amino acids).

So how much of these foodstuffs do we need to consume each day, specifically in terms of the cooked weight of each, and how much does that recommended daily quantity cost at the store?

Foodstuff	Weight of 700 kcal	Cost at Grocery Store*	% of Dietary Protein Minimum
Chicken	10.3 ounces	$1.61	132%
Beef	12.2 ounces	$3.62	130%
Pork	10.2 ounces	$3.02	165%
Eggs	7.9 eggs	$1.94	80%
Cheese	6.2 ounces	$1.82	67%
Chickpeas	26.8 ounces	$1.66	63%

** Costs are based on a June 2024 web search of the lowest grocery store prices proximal to the author.*

In terms of quantity of protein delivered within the constraints of recommendations and affordability, chicken appears to be the best choice in current economic circumstances.

Another Common Protein Source

Protein supplement drinks, once the domain of bodybuilders, athletes, and fitness buffs, have moved into a very lucrative corporate position of being recommended for consumption by all older individuals. If we delve into the research literature around protein drink supplementation for the aged, it does show a positive effect on survivability of hospital or institutionalized elders who are nutritionally deficient or already frail, but it has little to no effect on those who are not nutritionally compromised, in any setting (Milne et al, Annals of Internal Medicine 144: 37-48, 2006). Yet it remains extremely common to see clinicians recommend that all elderly patients drink a high protein supplement daily. A basic understanding of physiological adaptation logically informs us that low protein consumption is far less powerful in driving atrophy and sarcopenia than the lack of exercise seen in this population. Protein supplementation alone appears to be ineffectual in improving or maintaining body mass, strength, walking speed, and the ability to stand from a seated position in the aged (Ten Haaf Dominique et al, American Journal of Clinical Nutrition 108(5): 1043-1059, 2018). Supplementation is also not beneficial if the aging person consumes adequate dietary protein (0.8 g/kg/day or more) as a course of normal eating habits. The bottom line here is that protein supplementation in the elderly has limited utility unless the person is already suffering from poor diet and or frailty, but, it can be beneficial in providing metabolic support for fitness maintenance or gain in older individuals who do exercise but lack adequate protein in their normal diet.

Protein supplements are aggressively marketed to the elderly, the fastest growing and largest segment of the population. Their advertising presents the benefits of basic dietary protein consumption derived from data on protein's role in body maintenance and from data on hospitalized, institutionalized, and dietarily deficient persons. So the information used does have at least a basis in science to avoid false advertising claims, but it is misleading as it is not relevant to the apparently healthy aged individual. Nor

does it consider the economic wellbeing of half or more of older age groups. The cost of protein supplementation marketed to seniors is quite high.

Supplement	Volume of 700 kcal	Cost at Grocery Store*	% of Dietary Protein Minimum
Brand 1	35.0 ounces	$9.09	117%
Brand 2	35.0 ounces	$8.25	154%
1% Milk	56.0 ounces	$1.57	96%
0% Milk	53.3 ounces	$3.04	116%

* *Costs are based on a June 2024 web search of the lowest grocery store prices proximal to the author.*

If we are specifically considering the eldest populations, many live on minimal and fixed incomes. A massive number are considered low income, with the US median income for those aged 65 or older at $29,740 per year or $572 per week (US Department of Labor – Bureau of Labor Statistics, 2022). This means that it is very likely a disservice to them to heavily promote spending 250% more money on a supplement to receive the same protein amount as the most expensive meat protein source, beef. This is especially true if they are not currently hospitalized, in a care facility, or presently frail. Chicken, the most inexpensive meat protein source, is over five times cheaper than protein supplements marketed to the elderly. Simple consumption of 1% or 0% milk spread throughout the day (to minimize potential of gastric discomfort) can also be nearly as plentiful and effective of a protein source and it is far more financially prudent than purchasing and consuming processed supplement drinks.

Mix it up

Obviously, only consuming one source of protein is not a normal approach to eating. We tend to eat multiple types of foods from multiple sources. However, interviews with the oldest living people on earth have shown that some extremely old individuals state they have very restricted dietary inclusions. One 110+ year old man touted his reliance on fat back and toast (fried with the fatback) as a reason for his long lifespan. A similarly aged woman stated that she credited her longevity, in part, to fried eggs with toast and jam. While these two had very specific and singular protein sources, it remains that most people of all ages will get their protein from a variety of sources. In many ways, it's how we are built.

Humans developed as omnivores in primitive times. The dentition and the gastrointestinal structures of the human exist in the continuum between herbivores and carnivores. Human teeth possess structural and functional similarities to both ends, meaning that both vegetable matter and meat can be effectively bit, crushed, chewed, and prepared for further digestion. The human digestive system is about 5 times the length of body height. In herbivorous animals, like cattle, intestinal length is about 20 times the length of the body. In carnivorous animals, like feline species, intestinal length

is about 4 times body length. In this instance, human gastrointestinal characteristics are more similar to carnivores than to herbivores.

Such anatomical evidence suggests that we, modern humans, can derive nutritional benefit from both plant and animal sources, and unless there is a compelling reason not to (i.e., adoption of a vegan diet for personal or social reasons), we should consume both to effectively feed our anthropological heritage and our bodies. How we structure our meal plans to meet our nutritional needs requires a bit of knowledge and effort, but the knowledge and methods to do so are easily available and implementable by anyone. For those who want to have it done for them, paid guidance from dieticians, nutritionists, health coaches, sport coaches, fitness trainers, and more can be delivered to customers anywhere (in person or online). For about $200 per week you can also get 18 pre-designed and pre-prepared meals, or measured sets of meal ingredients, shipped to your door. Most such services provide complete data on provided nutrition to aid in tracking total protein consumption. One major issue of the cheapest options (which are not actually cheap) is that they are generally designed to meet RDA/DRI values. Some however, provide pricier options that include relevant dietary trends or dietary approaches, including higher protein content.

Pushing the Limit

If we are led to believe that consuming more than 35% of our calories in the form of protein is hazardous, surely there is overwhelming evidence that it is. We can get a crude idea of how much protein is too much from data on digestion and elimination of consumed protein over time. If we consider an 80 kg (176 lb) individual we can easily estimate current recommended consumption:

80 kilogram bodyweight
x 0.8 grams of dietary protein/kilogram bodyweight
= 64 grams of protein needed per day

If we counterpoise that figure against the maximal rate of protein digestion and elimination we find something interesting. That same 80 kg individual's digestive system can deaminate (convert into urea) over 300 grams of protein per day without producing symptomatic hyperammonemia or hyperaminoacidemia. However, elimination of products of protein digestion occurs at about 221 grams per day (Rudman et al, Journal of Clinical Investigation 53: 2241-2249, 1973). Superficially, as balancing rate of digestion and rate of elimination is a logical goal, this appears to set the maximal consumption of protein (for an 80 kg individual) at 221 grams per day, over three times the recommended 64 grams from the 0.8 gram/kg/day formula. However, not all protein is converted to urea and eliminated in waste, it is a building block of the body and much is incorporated into body tissues for growth, maintenance, and adaptation to environmental stressors. This means that an intake above 221 grams

per day likely remains harmless to non-diseased populations (of this body mass). Prudence leads us to use the 221 gram value as the upper limit as accurate estimations of maximal rate of protein incorporation into tissues are not readily available, those that do such are extremely limited in scope and applicability to healthy bodies. So, the potential maximal amount of protein that we can safely consume – IF NO PATHOLOGIES ARE PRESENT – can be calculated for our hypothetical person:

221 grams of protein consumed per day
÷ 80 kilogram bodyweight
= 2.76 grams of protein/kilogram bodyweight/day

Consuming this magnitude of protein within a 2000 calorie (kcal) per day diet is exceedingly difficult and uncommon, but "overdosing" on protein is an extreme rarity in non-diseased populations.

The take home points here are that protein consumption is important for the elderly and the original 1936 recommendation of consuming 1.0 grams of protein per kilogram of bodyweight each day is likely more relevant to older people than the current 0.8 grams/kilogram/day recommendation. Further the lower AMDR percentage of 10% recommendation appears non-useful except in infinitesimally rare instances. Only the upper recommendation, 35% of total calories consumed being from protein sources, delivered enough protein to meet elderly needs, especially if the older individual exercises regularly. Further, the economic realities of older life suggest that chicken is the most affordable means of delivering dietary protein. Protein supplement drinks specifically advertised to older age groups are far more expensive that consuming even the most expensive meat source, beef. The only true benefit of protein supplement drinks are convenience (no cooking required) and portability (as they are highly processed to have long shelf lives). While these benefits are desirable in certain instances, supplements should be used sparingly and not replace traditional high protein non-processed foodstuffs in the diet.

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