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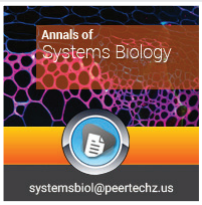

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Mini Review

A Biochemical Explanation of Some Nutritional Truths and Falsehoods

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Introduction

This article was written in response to prevalent misinformation when the media is constantly bombarding the nutritionally uninformed public, often presented with potentially misleading information driven by commercial interests. If you look at human physiology and biochemistry from an outside and neutral position one would be forced to view the human animal as an herbivore or at least a mild omnivore. For an in depth article dealing with the pros and cons of the herbivore or mild omnivore debate see [1]. However, if you compare humans to our closest relatives in the animal kingdom (the great apes) adult humans, have significantly less muscle mass compared to adult gorillas, orangutans, and chimpanzees. Therefore, by commonly accepted logic, we should need far less protein than the average chimpanzee. Furthermore, we have the weakest teeth and claws/nails of any of the large primates (which also lack evolutionary adaptations for carnivory). In fact the chimpanzee, which is the most carnivorous of the large primates, man excluded, only gets ~ 5% of its calories from meat protein in the wild [2], while gorillas and orangutans are much more vegetarian (foliage and fruit eaters) [2,3]. However, humans in the USA get approximately 20% of their calories from meat protein [4,5]. Paradoxically, despite this high protein consumption, we currently have the highest body fat (average American men and women have ~28% and 40% body fat, respectively) and the lowest percentage muscle mass of all the large primates [6]. In fact, current obesity levels in the U.S. are among the highest in the mammalian kingdom (~30% fat) [7]. The extreme muscularity and muscle mass is very apparent in this video [8] of adult hairless male chimpanzees. Their hairlessness lets you see their muscles clearly [8]. It should be noted that these are captive chimpanzees and have an almost totally vegetarian diet [9,10].

Nitrogen balance studies on human beings

These studies were performed in the early 1970s in both the USA and at Oxford, UK using male volunteers, 18 - 22 years old. The studies indicated the low protein requirements of these subjects to maintain their nitrogen balance. However, the subjects also needed to consume > 120 grams of carbohydrate per day, otherwise they would go into a net negative nitrogen balance. If they consumed 25 grams of protein/day or less, some additional protein was required to synthesize the glucose needed by some tissues (which have an absolute requirement for this component) [11,12]. The data/references are for healthy males maintaining nitrogen balance. However people involved in sports and bodybuilding would argue that they are aiming to gain muscle mass, and a much greater protein intake is required to support this action. Recent research still does not support this contention. The protein impact on resistance exercise-induced muscle hypertrophy is difficult to detect, when compared to an isoenergetic source of carbohydrate [13,14]. Humans consume significantly more protein than other primates, despite the fact that this disagrees with our physiology and our biochemistry. We should, based on our relative muscle mass, need far less protein than our vegetarian relatives, the chimpanzees. Humans, like the other great apes, are in fact poor at gluconeogenesis compared to carnivorous animals. Thus we can easily fall victim to the negative health consequences of excessive protein [15]. Humans recycle amino acids very well. Furthermore, our protein requirements are small, and excess amino acids are catabolized. Half of the amino

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acids we eat are ketogenic; if you eat more than you need they just make you fat, and decrease artery elasticity and increase blood pressure. The excess amino acids are in part converted to fat largely within the liver, then distributed around the body for storage/fuel. The very high protein recommendation by many 'nutrition authorities' of 2.5 grams protein/pound of body weight/day for athletes, are easily thrown into question by a few 'back of the envelope calculations'. This intake would allow your body to gain ~ 4 pounds of muscle/day or 120 lbs. of muscle/month. Muscle is approximately 20% protein. Therefore, one pound of muscle contains (454 grams x 0.2) ~ 90 grams of protein. Consuming this quantity (90 grams) above maintenance needs would allow you to build 1 pound of muscle per day, a totally unrealistic rate of gain. The satiating effect of high protein foods is often toted as a reason for eating a protein rich diet, and inhibiting weight gain. However, we believe that this satiating effect of protein is your body telling you to not eat too much of this dietary component.

Assuming evolutionary adaptations reflect optimal dietary needs, and look at the time in our life when we grew at the fastest rate, our early infancy, we will see that this high growth rate was fueled essentially entirely by our mother's milk. During this period we increase our body mass approximately 100% in the first six months of life. Thus, human milk has the appropriate composition to support this fast growth rate. The composition of human milk is 87% - 88% water, and 124 grams/L solid components as macronutrients, including about 7% (60 - 70 g/L) carbohydrates, 1% (8 - 10 g/L) protein, and 3.8% (35 - 40 g/L) fat. Therefore, even under these most rapid growth rate circumstances only 7% of the babies calories come from protein. This is equivalent to only 0.8 grams of protein/lb. of body mass. This supports the idea that a huge protein intake is not required by humans to support their maximum permissible growth rates [16].

Plant/vegetable materials are high in nitrates (nitrates themselves are not carcinogenic despite what is frequently touted in nutritional advice). These nitrates in plants/vegetables reduce blood pressure and aid athletic performance [17]. Therefore, the high complex carbohydrate diet from plant sources has additional health benefits. However, one should not get a large proportion of carbohydrates from refined sugars such as fructose, sucrose and high fructose corn syrup [18].

Omnivorous and vegetarian animals (such as pigs, rats, mice etc.) live the longest when they get the bulk (not the entirety) of their calorie requirements from complex carbohydrates. The next longest lived group were those who derived the bulk of their calories requirements from fats. The shortest lived group are the ones that obtained the bulk of their calories requirements from protein [19]. If one regards longevity as a marker of heath, one is also obliged to concede that plant/vegetable starches should fulfill the bulk of one's calories. Moreover, consuming a relatively large proportion of fruit and vegetable material in the diet results in greater concentrations of large intestinal butyrate which inhibits the development of colon cancer [20]. The only exception to this high complex carbohydrate diet is in the case of people performing vast amounts of mechanical work at a relatively low intensity, for prolonged periods of time (heavy manual labor, especially in very cold environments). In this case, due to the bulky nature of most complex carbohydrate-based foods, and the relatively limited stomach volume of humans, one would need to consume some high calorie and fat-rich foods to fuel our activities [21].

The danger of red meat

There are other considerations for avoiding high protein, such as the high environmental impact of its production, and in the case of red meat (beef/buffalo/bison), the high levels of the detrimental 'nutrient' carnitine. This is also a component of many energy drinks and food supplements. While L-carnitine is an essential cofactor in the transportation of fatty acids into the mitochondria for oxidation [12], it can be synthesized by the body and thus dietary carnitine is not required [12]. The medical community is still largely telling people that saturated fat and cholesterol are the main causes of heart disease. However, solid data indicates that carnitine in the diet is actually the primary factor that is strongly detrimental to cardiovascular health. Additionally, why would saturated fat be the body's preferred lipid for the storing excess caloric energy if it was so toxic? There is concern that some in the medical community may continue with their outdated story for many years before it is corrected. Beef and buffalo are the only meats with significant levels of carnitine. In Norway (a country that keeps great medical records) at the start of the WWII, the Nazis invaded and confiscated all the beef cattle. Thus the whole nation was switched to fish and poultry. This had an amazing effect on deaths due to heart disease in Norway (Figure 1) [22].

Asian Indians are generally Hindus and have eaten extremely little beef over their history. This may be the reason Asian Indians generally have relatively narrow coronary arteries, and when they switch to a red meat diet, they suffer from a high incidence of coronary heart disease. The body can synthesize carnitine and that synthesized within your body does no harm. However, oral carnitine is the problem because one's intestinal flora may metabolize this carnitine to trimethylamine. Then the body further metabolizes this compound to trimethylamine-N-oxide which leads to arterial damage/plaque deposition and heart disease [22,23]. Therefore, we strongly recommend not consuming on a regular basis products high in dietary carnitine, such as red meat and certain supplements.

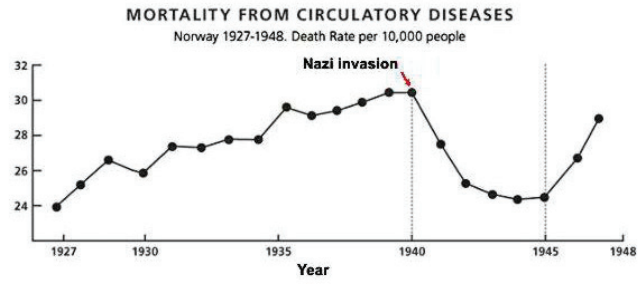

Figure 1: Mortality from circulatory diseases.

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The authors personally believe much of the protein hype is based on the outdated assumption that consuming large amounts of protein directly correlates with muscle gain due to its composition. This notion has evolved over the years into a major money-making industry. Hence, there is a lot of commercial pressures that may reinforce current practices. If one has no medical contraindications, the authors suggest undertaking a personal experiment to evaluate how a plant-focused Mediterranean diet affects your health and physical performance.

Other food supplements: The good and the bad

There is no doubt that vitamins and various minerals are essential for healthy cell function [24]. However, most people already get more than the recommended dose levels of these nutrients from their diet, which is frequently enriched with vitamins and minerals. Many people regularly take multi-vitamins and other vitamin-containing supplements. There is ample evidence that excessive vitamin supplementation can have negative health effects [25-27]. Amongst some anti-aging commercial interests, there remains a dogma that all ROS (Reactive Oxygen Species) and oxygen radicals are bad. However, this idea which originated in 1956 [28] has been more recently thoroughly debunked [29,30]. Furthermore, several ROS play important roles as signaling molecules [31,32]. Thus, the use of non-physiological, high-dose vitamin C in attempt to prevent oxidative damage due to ROS may mute ROS signaling. This attenuates some positive training adaptations and impairs athletic performance improvements [33].

Good for you, good for the earth

The Earth's human population is currently around 8 billion people [34]. This seemingly ever increasing number takes a considerable amount of feeding, and the effects of climate change are likely to further exacerbate this challenge [35]. The conversion of the calorific value of corn to the calorific value of the meat is very inefficient: for actively growing pigs and chickens it is very approximately 25% [36]. It is much more efficient, planet-friendly, and healthy to derive our sustenance from plants directly.

Conclusion

The average human dietary recommendations for protein intake are, in the authors' opinions, vastly overstated. Excess protein is detrimental to health and longevity. Evidence is provided to support these contentions. A predominantly plant-based Mediterranean diet, where the bulk of the calories come from vegetable/plant starches, is significantly healthier for most people. In addition, the consumption of such a diet essentially may reduce or eliminate the need for additional vitamin supplementation in individuals with no deficiencies. Regular consumption of foods such as red meat or supplements which contain L-carnitine can be harmful to one's cardiovascular health. The consumption of antioxidant supplements, such as high-dose vitamin C, can impair ROS signaling and impair athletic performance and performance improvements.

Disclaimer

The information given in these pages represents the authors' opinions and ideas, and those of other scientists, based upon our interpretations of data from major metabolic pathway studies, and articles by the scientific community. Moreover, some topics have been oversimplified to aid in easy comprehension and therefore minor oversimplifications may exist. These opinions and interpretations are not necessarily those of all others in these fields, or the opinions of many MDs and nutrition supplementation marketing companies. These nutritional guidelines are for people in good general health and who are physically active. There are health conditions which may preclude a person from following the suggested guidelines, therefore always consult your physician to confirm that such changes in diet will not be detrimental to your health.

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