Alkaline Diets Increase Muscle Mass

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"His daily regimen consists of two hours of cardiovascular activity as running on a treadmill, two hours of weight lifting and six meals. He eats about 600 grams of protein a day -- mostly chicken, steak and supplements. He insists his diet is all natural, although he said he hates vegetables."

Ronnie Coleman didn't eat vegetables but new research suggests that vegetables may enhance muscle mass by reducing blood acidity according a new study released. For years, nutritionists and anti-aging doctors have suggested that an acidic diet is associated with a wide range of health problems but more importantly to bodybuilders is that acidic diets are associated with a reduction in lean muscle mass2. Acidosis is an increased acidity (i.e. an increased hydrogen ion concentration). The term acidosis describes the state of low blood pH. At least 3 signals have been identified as causing loss of muscle mass: defective insulin action, glucocorticoids, and a less well known mechanism: acidosis22. In disorders that cause chronic metabolic acidosis, protein degradation in skeletal muscle is accelerated, which increases the production of nitrogen end-products that are eliminated in the urine, thereby inducing negative nitrogen balance18, 19, 20. Although it's unlikely that bodybuilders would ever have severe acidosis which occurs in kidney dysfunction; researchers have found that consumption of high protein, high sodium, low vegetable diets can cause a mild acidosis in normal healthy individuals. The purpose of the article is not to condone a vegetarian diet, but to emphasize the importance of the role of vegetables in the diet. The following article is going to be especially important for those bodybuilders following a low carb diet that consume little to no vegetables.

Among the many health problems resulting from this mismatch between our genetically determined nutritional requirements (Paleolithic diet) and our current diet (Western Diet), some might be a consequence in part of the deficiency of potassium, which are amply present in the plant foods that our ancestors ate in abundance, and the exchange of those salts for sodium chloride (NaCl),which has been incorporated copiously into our current diet, which at the same time is inadequate in potassium-base-rich plant foods. For example, an estimated 3000 kilocalorie diet of a Paleolithic man, meat constituted 35 percent of the diet by weight and plant foods were 65 percent by weight. By contrast, modern humans consume less than one-half that amount of animal protein, and only about one-third that amount of plant protein, per kilocalorie of diet consumed. Sodium intake was estimated at about 29 milliequivalents per day, and potassium intake, in excess of 280 milliequivalents per day. By contrast, modern humans consume between 100-300 milliequivalents of sodium per day, and about 80 milliequivalents of potassium per day. That is, in the switch to the modern diet, the K/Na ratio has been reversed. Thus, the electrolyte mix of the modern diet is profoundly mismatched to its processing; additionally with age there is a natural increase in the acid production in the body due to a normal decline in kidney function. Age and diet both contribute to blood acidosis, whereas diet has a slightly smaller effect than age on blood acidity14. As a consequence of the diet-kidney mismatch, contemporary humans are not only overloaded with Na+ (sodium) and Cl- (chloride) but also deficient in K+ (potassium) and HCO3 (bicarbonate). Here some to consider next time you stop at McDonalds for a Big Mac and Fries (loaded with sodium): intravenous infusions of sodium chloride have been shown to induce metabolic acidosis26. Normally, Ketogenic diets include copious amounts of cheese, read meat, nuts, bacon, ect all which are high in sodium chloride. Researchers have identified three variables which are the best predictor of net acid production in the body27:

•ü Net acid production of the diet (amount of acid producing foods)

•ü The degree of age related decline in renal function regulatory function.

•ü The amount of sodium chloride in the diet

Low Carb Diets without Vegetables Increases Acidosis

I once listened to a famous bodybuilder whom mentioned that during his low carb diet he consumed a half of cup a green beans a day for greens. Low consumption of vegetables is associated with a mild acidosis, before I go any further this is not diabetic acidosis! Diabetic ketoacidosis is characterized by extreme disturbances in acidosis, and high levels of circulating ketone bodies. It is understandably difficult to think "metabolic acidosis" when the values for plasma acid-base composition are in the range traditionally considered normal. What researchers are now discovering is that even though blood pH is in the normal range, a mildly acidic state over a number of years can accelerate muscle loss2. For example, researchers measured endogenous net acid production in normal healthy adults. All subjects consuming the traditional western diet were considered mildly acidic; however administration of potassium bicarbonate resulted in a net alkaline resulting in normal pH balance21. It has been found that the net acid-producing diets do indeed characteristically produce a low-grade systemic metabolic acidosis in otherwise healthy adult subjects.

Fruits and Vegetables are Alkaline Producing

The current typical Western diet is largely composed of acid-forming foods (proteins, cereals, sugars). Alkaline-producing foods as vegetables are eaten in much smaller quantities. Stimulants like tobacco, coffee, tea, and alcohol are also extremely acidifying. The uses of artificial chemical sweeteners like NutraSweet, Sweet ‘N Low, Equal, or Aspartame are also acid forming chemicals. See Figure 1. An imbalanced diet high in acidic-producing foods as animal protein, sugar, caffeine, and processed foods puts pressure on the body's regulating systems to maintain pH neutrality. pH (potential of Hydrogen) is a measure of the acidity or alkalinity of a solution - the ratio between positively charged ions (acid-forming) and negatively charged ions (alkaline-forming.) The pH of any solution is the measure of its hydrogen-ion concentration. The higher the pH reading, the more alkaline and oxygen rich the fluid is. The lower the pH reading, the more acidic and oxygen deprived the fluid is. The pH range is from 0 to 14, with 7.0 being neutral. Anything above 7.0 is alkaline, anything below 7.0 is considered acidic. Human blood pH should be slightly alkaline (7.35 - 7.45). Below or above this range means symptoms and disease.

Chronic Low Grade Acidosis Reduces Muscle Mass

So you may be asking how real this phenomenon of mild acidosis occurring with low consumption of vegetables is. As early as 1987, researchers reported that when endurance runners were switched to a normal diet to a low carbohydrate diet resulted in the onset of a mild acidosis and suggested the acidosis may play a role in the fatigue process1. Additionally, researchers reported in 1996 when subjects were switched from a normal diet (14.5% protein, 37.5% fat, 47.5% carbohydrates) to a low carb/high protein diet (33.6% protein, 64.4% fat, 2.2 carbohydrates) resulted in a mild metabolic acidosis. After just 24-hours on the low carb diet, blood pH, bicarbonate, and base excess (In human physiology, base excess refers to the amount of acid required to return the blood pH of an individual to the normal value pH 7.4) were lower than on the normal diet. Some researchers have suggested that high protein, low vegetable diets

results in low grade chronic acidosis, habitual ingestion of typical net acid-producing diets might chronically sustain a slightly increased state of protein breakdown and consequent nitrogen wasting. Two studies have documented that normal healthy adults whom have their pH lowered to a mild acidic state resulted in increased amino acid breakdown and negative nitrogen balance4, 8. Conceivably, low grade acidosis may account for the nitrogen wasting accounting for the normal progressive decrease in muscle mass as adults get older. Indeed, diet-dependent acidosis-induced muscle wasting might be amplified by age because diet-dependent metabolic acidosis tends to increase in severity with age14, 15, which, in turn, appears to result from the normal age-related decline in the function of the kidney17.

Proteins Increase Acidity

Proteins and cereal grains are metabolized to acidic residues, mainly sulfuric acid, and fruit and vegetables are metabolized to alkaline residues, mainly potassium bicarbonate. Muscle wasting appears to occur when the body is in an acidic state. When the body is an acidic state, amino acids are used as a substrate for the synthesis of glutamine. Glutamine is then synthesized by the kidney to synthesize ammonia. Ammonia molecules spontaneously accept protons and are excreted as ammonium ions; the excretion of ammonium thus removes the protons and lessens the effect of acidosis. In other words, a "trade-off" occurs - the body loses protein, stored mostly in muscle, in order to help get rid of the positive net acid load.

New Study: Alkaline Diets Favor Muscle Mass

Fruits and vegetables are generally considered alkaline. A recent study released in the American Journal of Clinical Nutrition reported an alkaline diet favors muscle mass. Since consumption of fresh fruits and vegetables have high potassium content; researchers enrolled 384 men and women and examined the relationship between dietary potassium and lean mass. Results of the study indicate that a higher consumption of potassium rich foods was associated with greater lean body mass in older men and women. The researchers suggested that a positive consumption of potassium rich foods may be counteracting the acid forming production of high protein foods, cereal grains, coffee, and other net acid-producing foods. I am not suggesting switching to a vegetarian diet, but consumption of vegetables in conjunction with protein seems to favor muscle mass.

Neutralizing Ph Reduces Nitrogen Breakdown

Acidosis has been shown to have a detrimental impact on body protein metabolism and to promote negative nitrogen balance, protein wasting, and loss of body weight. Some in-vitro studies (test tubes) demonstrated that decreasing medium pH resulted in inhibition of protein synthesis in muscle cells12. Experimental acidosis induced with doctors administer ammonium chloride (an acid forming solution) has been shown to result in negative nitrogen balance - an indication that body protein is being lost5. Acidosis can therefore induce protein wasting by inhibiting protein synthesis, stimulating protein degradation or by promoting a combination of the two processes. Several studies have investigated the impact of acidosis on whole-body protein turnover using tracer infusions of labeled amino acids. The results have consistently shown that metabolic acidosis stimulates the degradation of whole-body protein and promotes amino acid oxidation6-9. The effects on protein degradation have been shown to result from a stimulation of the ATP-dependent ubiquitin-proteasome pathway - one of the major enzyme systems for proteolysis - by acidosis10-11. Stimulation of proteolysis by acidosis is associated with activation of the ubiquitin-proteasome pathway at the muscle level and appears to be dependent on the concomitant presence of glucocorticoid hormones (cortisol), which may therefore represent important mediators of the proteolytic response.

Mild Acidosis Diet May Also Decrease GH.

Not a lot of research has been conducted on the hormonal responses to acidosis but one study in women found that chronic mild acidosis was associated with a decrease in GH. Researchers corrected the pH balance of aged women by correcting their diet induced low grade metabolic acidosis with potassium bicarbonate (a alkaline supplement) in amounts that just neutralized their daily diet net acid load, which was also accompanied by an increase in 24-hour mean growth hormone secretion. The average total serum GH secretion, calculated as the 24-hour integrated serum GH concentration, increased from 826 pg/ml before potassium bicarbonate to 915 pg/ml after potassium bicarbonate supplementation, approximately an 11% increase over baseline21. Unfortunately, no studies involving the hormone responses to men have been investigated.

How to prevent acidity...

The protein: potassium ratio is a reliable predictor of diet net acid load in the diet2. It was reported that no matter what kind of diet that researchers examined (they examined 159 hypothetical diets); they found that the protein to potassium intake independently predicted net acid production accounting for 99% of the variability among diets25. So if acidosis increases muscle protein breakdown, will increasing alkalosis increase protein synthesis. One study investigated the

effects of alkalosis on protein synthesis on intensive care patients with head trauma. These patients were hyperventilated, resulting in respiratory alkalosis. Measurements of muscle protein synthesis were made while they were alkalotic and again 24 h after cessation of hyperventilation. The rate of muscle protein synthesis during alkalosis was significantly higher than that measured at normal pH, suggesting the possibility that alkalosis stimulates muscle protein synthesis13. Interestingly, dietary treatment with sodium bicarbonate was able to prevent stimulation of proteolysis and the up-regulation of ubiquitin-proteasome pathway gene expression in rats with chronic renal failure (severe acidosis)24, suggesting that correction of acidosis in acidotic patients may have beneficial effects in reversing the enhancement of protein degradation and maintaining muscle mass.

Another study reported that with age there is an increase in acidity and reducing their mildly acidic diet to nearly zero with potassium bicarbonate (KHCO3) significantly reduces blood acidity and increases the plasma bicarbonate concentration, indicating that the unsupplemented normal diet net acid load was significantly affecting the blood acid-base balance, causing a low grade metabolic acidosis. Correcting the diet-dependent metabolic acidosis causes a significant reduction in urinary nitrogen excretion, comprising nearly equal reductions in urinary ammonia and urea excretion and this nitrogen-sparing effect is reversed by withholding the exogenous base for twelve days16. Another diet consisting of high dietary protein intake generated substantial acidity; however potassium administration neutralized the acid load23. Sodium bicarbonate also has a pH buffering effect that can raise alkalosis. For example, when researchers placed runners on a low carb diet (33% protein, 64% fat, 2% carbohydrates) there was a mild acidosis occurring, however when sodium bicarbonate was ingested, blood pH was restored to normal3.

Eat Your Veggies!!

Bodybuilding is a way of life, eating a high protein/high fat rich in sodium chloride without vegetables can cause a chronic state of mild acidosis. I am not condoning a vegetarian diet, but based on the new research eating vegetables with your high protein meals can neutralize the acidity and result in a more alkaline state. The blood is supposed to be slightly alkaline, yet modern western diets promotes acidosis which causes muscle protein loss, both by enhancing protein degradation and by inhibiting protein synthesis. This evidence suggests that maintenance of normal pH will help to preserve muscle mass and thereby improves health. Modifying the effect of dietary sodium chloride and potassium-base can prevent the age-related decline in muscle mass, kidney stones, and perhaps age related decline in renal function. Re-exchanging the NaCl in our present diet for the potassium-base that our ancestral species ate in abundance can be shown to correct diet-induced low-grade metabolic acidosis, and the consequent biochemical evidences of decreased growth hormone secretion, and increased protein catabolism. Beyond that, the supplementation of the diet with potassium-base can override the effects of NaCl loading on blood pressure and urinary calcium excretion. Thus, increasing dietary potassium-base to levels approaching those of our stone-age forebears, either with fruits and non-grain plant foods, or with supplemental potassium-base, would seem to hold particular promise for preventing or delaying expression of these age- and diet-related diseases and their consequences.

•Ø The best way to get adequate potassium in the diet is not through supplements or vitamins. Eating a wide variety of healthy foods that contain potassium is usually the best. Consuming too much potassium may lead to heart problems and or death.

•Ø Adding avocados and almonds which are alkaline will decrease the acid load of a meal.

•Ø Add Supplemental Glutamine - glutamine supplementation has been shown to neutralize acids. Interestingly, during metabolic acidosis intestinal glutamine uptake is increased, which shows the body is trying to increase its glutamine content in order to correct its acid imbalance.

•Ø Add Sodium Bicarbonate (Baking Soda) To Your Workout Shake - sodium bicarbonate is a great buffering agent and may also increase athletic performance.

Key Points:

A high protein/high fat diet without vegetables can result in a mild chronic acidosis.
Sodium Chloride consumption is associated with increased acidosis.
Acidosis has been shown to increase muscle tissue breakdown.
Supplementation with potassium/sodium bicarbonate/glutamine will neutralize blood pH.

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