MD MRP LoCarb

The Ultimate Anabolic, AntiCatabolic, Fat Burning, Meal Replacement Shake

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MRP LoCarb, the ultimate low carb, high protein meal replacement, is also engineered to increase the anabolic hormones and decrease the catabolic ones, increase fat burning, increase energy, and provide the body with an enhanced immune response to help recovery and combat overtraining.

MRP LoCarb is by far the most complete and best meal replacement on the market today. It's been a leader for decades in meal replacements for those that are on a ketogenic diet or anyone that is carb conscious.

MRP LoCarb was originally meant for my ketogenic and phase shift diets, and is ideal for those following my Radical Diet, a stricter and the best version of a ketogenic diet, and for the ketogenic phase of my phase shift diets including the Anabolic Diet, the Metabolic Diet, and the Anabolic Solution Diets.

I formulated MRP LoCarb to help you achieve your fat loss, body composition and performance goals. MRP LoCarb contains a high protein/low carbohydrate/ moderate fat meal replacement powder, containing dozens of other ingredients that additively and synergistically enhance its beneficial effects.

One serving of MRP LoCarb contains 250 calories, A total of 5 grams of carbs of which 3 grams is fiber, 45 grams of protein (42 grams of whole protein and 3 grams of glutamine peptides), healthy fats and fiber, and a complete balanced Vitamin and Mineral profile, making it the highest quality, most nutritionally complete meal replacement low carbohydrate ketogenic diet shake on the market today.

But MRP LoCarb is much more than just a low carb, high protein meal replacement. It's also engineered to increase the anabolic hormones and decrease the catabolic ones, increase fat burning, increase energy, and provide the body with an enhanced immune response to help recovery and combat overtraining.

MRP LoCarb Nutrition Panel

Nutrition Facts

Serving Size: 1 packet (64g of dry powder)
Servings Per Contain

Amount Per Serving		
Calories 250	Calories from Fat 60	
		% Daily Value*
Total Fat	7g	**11%**
Saturated Fat	1g	**5%**
Polyunsaturated Fat	2g	
Monounsaturated Fat	4g	
Cholesterol	less than 5mg	**1%**
Sodium	410mg	**17%**
Potassium	220mg	**6%**
Total Carbohydrate	5g	**2%**
Dietary Fiber	3g	**12%**
Soluble Fiber	2g	
Insoluble Fiber	1g	
Sugars	less than 1g	
Protein	42g	**84%**

Vitamin A 50% (40% as Beta Carotene) · Vitamin C 80%
Calcium 20% · Iron 2% · Vitamin D 25%
Vitamin E 50% · Vitamin K 30% · Thiamin 70%
Riboflavin 60% · Niacin 50% · Vitamin B-6 50%
Folic Acid 60% · Vitamin B-12 70% · Biotin 35%
Pantothenic Acid 50% · Phosphorus 20% · Iodine 35%
Zinc 35% · Selenium 35% · Copper 25%
Manganese 50% · Chromium 25% · Molybdenum 40%

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Saturated Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Potassium		3,500mg	3,500mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g
Protein		50g	65g

Calories per gram:
Fat 9 · Carbohydrate 4 · Protein 4

Ingredients: Protein Blend (ion exchange whey protein isolate, calcium caseinate, egg albumin, and soy protein isolate), high oleic sunflower oil, soy lecithin, natural flavors, psyllium husk, oat fiber, flax seed oil, choline bitartate, enzymatically hydrolyzed wheat gluten (as a source of glutamine peptide), inositol, L-carnitine, cellulose gum, apple pectin, carrageenan, xanthan gum, mono and diglycerides, evening primrose powder, conjugated linoleic acid, dipotassium phosphate, fructooligosaccharides, fish oil, sucralose, D-ribose, borage oil, lactobacillus acidophilus, alpha lipoic acid, ascorbic acid, beta carotene, dl-alpha tocopheryl acetate, zinc picolinate, xylitol, acesulfame K, niacinamide, D-calcium pantothenate, vitamin A palmitate, copper citrate, manganese sulfate, ferrous fumarate, pyridoxine hydrochloride, riboflavin, thiamin mononitrate, folic acid, chromium picolinate, vitamin D3, biotin, sodium molybdate, potassium iodide, selenomethionine, vitamin K, and cyanocobalamin.

Directions: Add packet contents to 8-12 fl. oz. of cold water, milk or juice (depending on the carb level of the diet you're on) and mix/blend thoroughly.

The information below on MRP LoCarb is in near final draft form and will be expanded and revised over the next several months. For now, this latest information will give you the flavor of just what MVM will do for you in helping you achieve your health, anti-aging, body composition and performance goals.

MRP LoCarb has a complete complement of macro and micro-nutrients, including:

1. A sophisticated blend of proteins (CFM whey protein isolate, calcium caseinate, egg albumen, soy protein isolate, and glutamine peptides) that give fast and intermediate spikes of amino acids that increase protein synthesis, and long duration increases in amino acids that decrease muscle breakdown. For more information about the properties of the protein blend, see the description of Myosin Protein.

2. Choline and L-carnitine. This combination of ingredients has recently been shown to aid fat and weight loss.[1] The combination of ingredients increases fat loss by both increasing the breakdown and burning of body fat and, interestingly enough, actually flushing fat (in the form of acylcarnitines, which are actually chunks of fatty acids combined with carnitine) into the urine and out of the body.

3. Compounds (including choline and L-carnitine) that improve training, recovery and body composition by increasing energy, decreasing muscle damage, increasing protein synthesis, and increasing the mobilization and burning of body fat, including:

    - L-carnitine (1,000 mg per serving)
    - Lecithin
    - Choline
    - Inositol
    - CLA (conjugated linoleic acid)
    - Xylitol
    - D-ribose
    - ALA (alpha lipoic acid - 200 mg per serving)
    - Chromium picolinate
    - Phosphates
    - A complete vitamin and mineral blend that includes 24 vitamins, minerals (many as complexes with Krebs Cycle intermediates, and amino and organic chelates) and antioxidants.

    For example, **L-carnitine** is essential for fatty acid transport and burning of fat for energy. As well, it's essential for proper muscle function and some studies have shown that carnitine supplementation improves exercise performance.[2]

    Natural **phosphates**, as present in MRP LoCarb have also been shown to prevent a decrease in T-3 and increase the BMR.

    Choline, lecithin and **inositol,** acting as neurotransmitter precursors and lipotropic agents, help optimize energy and fat metabolism.

    Chromium enhances insulin sensitivity and decreases insulin resistance, and helps you to lose body fat.

    Conjugated Linoleic Acid (CLA) has significant weight and fat loss properties. Studies in mice fed CLA showed a marked reduction in body fat

and an increase in body protein levels.[3] Other animal studies demonstrated similar or even better results.

But CLA has marked effects in humans as well.[4] A study published in the International Journal of Obesity found that those who were given CLA for a four-week period had significant decreases in abdominal fat.[5] As well, a one study concluded that long term CLA supplementation not only helps to decrease body fat but also helps to maintain weight loss in the long term.[6]

Combining chromium with CLA enhances insulin sensitivity and body composition even more when used together. A recent study found that CLA alone lowered body weight, total body fat mass, and visceral fat mass, the last of which decreased further with the combination of CLA and Chromium.[7]

Alpha lipoic acid (**ALA**), a potent antioxidant[8][9][10] that can recycle other antioxidants such as vitamin C, vitamin E and glutathione.[11][12] ALA was added to MRP LoCarb to increase insulin functioning and sensitivity[13][14] and decrease body fat by its actions on the pro-inflammatory cytokines[15][16] and on secondary cortisol elevations. A combination of ALA and CLA, also in MRP LoCarb, has a synergistic effect on increasing insulin sensitivity.[17]

D-ribose is used to increase muscle metabolism and energy.

Xylitol and ribose make up the bulk of the carbohydrate content of MRP LoCarb, and increase its palatability. But there are other reasons why both of these were included in the formulation.

Studies have shown that xylitol affects metabolism in different ways than sugars and most other carbs and as such not impacting on insulin or fatty acid oxidation.[18][19] As well, other studies have shown that xylitol may improve nitrogen balance, increase fat oxidation and decrease carbohydrate oxidation (likely spares glycogen) as compared to glucose (likely secondary to a decreased insulin response).[20][21] Xylitol is also used to help preserve muscle mass.[22]

4. Significant amounts of the monounsaturated, polyunsaturated, and essential fatty acids, including mono and diglycerides, GLA from evening primrose and borage oil, fish oil (EPA and DHA), alpha linoleic acid, alpha linolenic acid, and oleic acid.

   Diglycerides (also known as diacylglycerol or DAG) have been shown to enhance weight and fat loss.[23] Several studies have shown that DAG may be a valuable nutritional supplement to decrease body weight, reduce abdominal body fat, enhance fat oxidation.[24]

5. Soluble and insoluble fibers (psyllium husk, oat fiber, cellulose gum, apple pectin, carrageenan, xantham gum, and pre and probiotics (including fructooligosaccharides, inulin and lactobacillus acidophilus) that keep the bowel

and your body healthy, increase insulin sensitivity, and also help keep cholesterol levels in check.

MRP LoCarb, because it's a complete low carbohydrate meal replacement powder, can be used in confidence by anyone on my stricter ketogenic diet (the Radical Diet) and the ketogenic phase of my phase-shift diets (Metabolic and Anabolic Diets) and any low carbohydrate diet plain including all the diets out there that have taken on my low carb diet phase as their own.

It's also useful for those on the Metabolic Diet higher carb plans, or other higher carb diets, because the level of carbs can be easily modified by mixing the powder with milk or juices instead of water or simply by adding carbs in the form of fruits or another carb source.

The use of MRP LoCarb within a few hours of training increases the training response and protein synthesis, maximizes rebound macronutrient replenishment and improves recovery. The special blend of proteins in MRP LoCarb, like the Myosin Protein blend, maximizes protein synthesis and minimize protein breakdown for several hours.

Easy to prepare and use, MRP LoCarb simplifies meal planning and can be taken in place of any meal, as an in between meal and/or before bed snack, and as a post training meal.

A More Detailed Look at Some of the Ingredients in MRP LoCarb

Alpha Lipoic Acid

Alpha lipoic acid (ALA) has significant biological activity and therapeutic potential secondary to its potent antioxidant and anti-inflammatory properties including its ability to increase levels of intra-cellular glutathione, and to recycle other antioxidants such as vitamin C, vitamin E and glutathione.[25,26,27,28,29,30,31,32,33,3435]

Alpha lipoic acid also has several useful and diverse properties. In a review[36] the author states "LA improves glycemic control, polyneuropathies associated with diabetes mellitus, and effectively mitigates toxicities associated with heavy metal poisoning. As an antioxidant, LA directly terminates free radicals, chelates transition metal ions (e.g. iron and copper), increases cytosolic glutathione and vitamin C levels and prevents toxicities associated with their loss." ALA and glutathione have been shown to have significant effects in decreasing mercury toxicity in the body.[37]

ALA has significant anti-inflammatory properties and has been shown to inhibit IL-1, a proinflammatory cytokine and inhibit the synthesis of PGE2 by inhibiting COX-2 activity. This latter mode of action simulates the anti-inflammatory effects of the present class of NSAIDS such as Celebrex, Advil, Aleve, etc. As well, the anti-inflammatory effects of ALA are increased since it decreases both the pro-inflammatory cytokines[3839] and secondary cortisol elevations.

ALA was also added to MRP LoCarb not only because of its actions on decreasing pro-inflammatory cytokines and cortisol levels, its protective effects, but also its protective effects on enzymes from stress factors and its effects on alleviating pain.[4041]

It has been shown to inhibit cross-linking among proteins, a process that contributes to the aging process in the body and especially in collagen-heavy tissues such as skin. Alpha-lipoic acid activates a collagen-regulating factor known as AP-1 that turns on enzymes that digest glycation-damaged collagen and thus make the skin more supple and youthful looking.

Besides having potent antioxidant and anti-inflammatory effects, ALA also has significant anabolic effects secondary to its beneficial effects on insulin sensitivity, growth hormone and IGF-I secretion, and energy metabolism, all factors involved in maintaining, repairing and regenerating musculoskeletal tissues.[42,43,44,45,4647]

Along with these effects ALA has been shown effective for weight loss and decreasing hip circumference in conjunction with EPA and on its own.[48495051525354] As well, alpha lipoic acid has been shown to decrease inflammation and have a beneficial effect on serum lipids and cardiovascular health.[555657]

ALA is also useful in reversing mitochondrial dysfunction, especially in the brain and in aging mitochondria.[58,59606162]

A recent study (2019) stated the following on the combined use of ALA and vitamin D3 (both in MRP LoCarb)[63] "**In our study, the combination of LA and vitD showed beneficial effects on viability of astrocytes, since the substances are able to cross the brain barrier. In addition, combined LA and vitD attenuated the H2O2-induced apoptosis through the mitochondrial-mediated pathway. The combination was also able to counteract the adverse conditions caused by iron, preventing its accumulation. All these data support the hypothesis of the synergistic and cooperative activity exerted by LA and vitD in astrocytes indicating a possible new strategy to slow down ageing.**

Glutamine peptides

MRP LoCarb contains glutamine peptides, which have anabolic (increases protein synthesis and muscle mass) and anticatabolic (decrease muscle breakdown) effects, above those normally associated with glutamine, as the peptides themselves have some physiological effects. Also, the peptide form is better absorbed than free glutamine that is not peptide bonded.

As well, the glutamine in the glutamine peptides:

- Regulates protein synthesis and increases body composition and performance
- Increases both aerobic and anaerobic energy systems
- Has beneficial effects on the immune system
- Aids in the prevention and treatment of the overtraining syndrome.
- Increases insulin sensitivity when a protein hydrolysate is combined with creatine.[64]

Glutamine has significant effects on body composition and performance as it favorably affects growth hormone and cortisol levels, protein synthesis, cell volume, muscle catabolism (inhibits it) and gastrointestinal and immune function.[6566676869] It's used for energy by most cells in the body but especially by the GI tract, liver, kidney and the immune system. The process for energy production is by successive deamination of glutamine to glutamate, then to alpha-ketoglutarate that enters the TCA/Krebs cycle and through the oxidative phosphorylation forms ATP, the main energy source on which the body functions.

Glutamine is also used as a basis for the synthesis of the ATP molecule itself, nucleic acids (DNA and RNA synthesis and repair), other amino acids and proteins, glucose through gluconeogenetic pathways, carbamoylphosphate, and other metabolites. As well glutamine increases glutathione, a powerful endogenous antioxidant that mitigates the counter-productive effects of exercise on excessive muscle damage without affecting the positive effects of exercise.

The interconversions, reactions, pathways and signaling that glutamine is involved in are complex and impacts many metabolic processes that are beyond the means of this information piece. As an example, glutamate can be used (besides conversion to glutamine) in an alanine aminotransferase reaction to produce alpha-ketoglutarate (AKG) and alanine or by the reverse reaction alpha-ketoglutarate can be aminated by ammonia or via a transamination reaction from other amino acids to

form glutamate and pyruvate. The resulting alanine and pyruvate are involved in complex interactions and so the complexity of how glutamine affects metabolism soon increases exponentially.

A recent paper found that glutamine supplementation improves some parameters of sport and exercise performance, and chronic supplementation appears to be of special importance for increasing tolerance to intermittent exercise, lowering feelings of fatigue, and optimizing recovery from muscle damage.[70] Glutamine may also act as a relevant resource for rehydration during strenuous and prolonged physical activity.

Zinc

Exercise can lead to an increased need for certain nutrients. For example, one study found that there is an increase in selenium requirements with exercise.[71] Problems can arise from exercise induced mineral loss, which is further enhanced by the finding that many of us don't consume adequate amounts of many essential minerals.

Studies have shown that many athletes, and female athletes, in particular, consume diets that have been found to be inadequate for certain key minerals such as zinc, magnesium, copper, and iron. The combination of strenuous exercise and compromised mineral status ultimately leads to low endurance capacity, depressed immune function, and the development of a variety of disease conditions.

One study looked at the effects of zinc deficiency on physical performance and found that low dietary zinc was associated with impaired cardiorespiratory function and impaired metabolic responses during exercise.[72]

Zinc deficiency in humans is widespread[73] and athletes may be particularly prone to lower plasma zinc levels.[74] Zinc is a constituent of more than a hundred fundamentally important enzymes, so zinc deficiency has many negative effects on almost every body function.[75] As well, zinc deficiency can adversely affect the reproductive hormones and as such impair athletic efforts.[76]

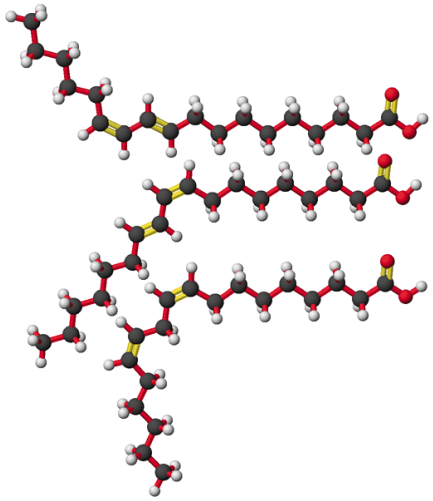
Zinc deficiency adversely affects protein synthesis. In one study the effects of zinc deficiency in rats, on the levels of free amino acid in urine, plasma and skin extract were investigated.[77] Zinc deficiency adversely affected skin protein synthesis. Especially where a deficiency may be present, supplemental zinc has resulted in an increase the secretion of growth hormone and IGF-I,[78] and testosterone[79] and to raise plasma testosterone and sperm count.[80,81]

A study looking at the effects of zinc supplementation on wrestlers found that the results obtained at the end of the study indicate that zinc supplementation (as well as several other ingredients in MRP LoCarb, including NAC and ALA) prevents production of free radicals by **activating the endogenous antioxidant system**.[82]

This activation is important as it coincides with the effects of exercise, which also activates the endogenous antioxidant system and leads to endogenous antioxidants that enhance the beneficial effects of exercise on body composition and performance. The authors concluded that “physiologic doses of zinc supplementation to athletes may beneficially contribute to their health and performance.”

It’s been shown that there is an improvement in insulin resistance with **zinc** supplementation and that zinc is involved in controlling some of the aspects of obesity.[83] Zinc also improves calcium metabolism and thus the beneficial effects that calcium has on fat metabolism.

Conjugated Linoleic Acid



Conjugated Linoleic Acid (CLA), while not an essential fatty acid, has significant effects on body composition. It’s a mixture of isomers of linoleic acid, which is found preferentially in dairy products, meat, and in cheese, milks and yogurt that have undergone heat treatment.

CLA has been shown to have properties above and beyond those of linoleic acid. And has a wide range of biological effects.[84] It has shown potential as a powerful anticarcinogen[858687] and exhibits potent antioxidant and anti-inflammatory activity.[88899091929394] Studies have suggested that

CLA may be cytotoxic to human cancer cells in vivo.[95]

CLA has been shown to have significant anti-inflammatory properties[96] and to inhibit inflammatory mediators such as PGE2, IL-6, and TNF-alpha,[97],[98] and acts as a COX-2 inhibitor.[99],[100]

Studies in animals and humans indicate that CLA supplementation decreases body fat and increases lean muscle mass. The increase in lean muscle mass is most pronounced in individuals who are exercising regularly.

CLA appears to reduce the ability of fat cells to take up fats from the bloodstream; it also inhibits the formation of new fat cells.[101] CLA also helps cells burn fat at a higher rate, while fueling and preserving muscle, leading to a reduction in fat and an increase in lean muscle mass.

Numerous physiological effects in relation to body-weight control have been attributed to CLA in animals. In different animal models, CLA has been shown to reduce body fat and to increase lean body mass.[102,103,104] But CLA has marked effects in humans as well and has been found to decrease body fat mass and support muscle mass in overweight humans. [105,106,107,108]

For example, a study published in the International Journal of Obesity found that those who were given CLA for a four-week period had significant decreases in abdominal fat.[109]

As well, a study concluded that long term CLA supplementation not only helps to decrease body fat but also helps to maintain weight loss in the long term. A long-term study found that a mixture of the two CLA isomers significantly lowered body fat mass in overweight humans at both 1 and 2 years.[110111] It likely does this by affecting various enzymes involved in lipid formation and to a lesser extent enhancing fat breakdown.[112, 113, 114]

As well, CLA seems to have significant effects on weight regain, as it reduces fat uptake into adipocytes by decreasing the formation of fat and but not affecting fat breakdown. It likely does this by affecting various enzymes involved in lipid formation rather than enhancing fat breakdown, known as lipolysis.[115,116,117,118]

Thus, there is an overall increase in fat breakdown since the two processes are usually in dynamic equilibrium with as much fat being produced as is broken down. Decreasing fat formation changes the dynamics to one of overall increased fat breakdown and subsequently a decrease in overall body fat.

Of equal importance, for those wishing to maximize lean body mass, is the possible anti-catabolic effects of CLA.[119],[120]

Another study found that CLA reduces body fat mass in specific regions of the body, especially the abdominal area in both men and women, and maintains or increases lean body mass.[121]

Adding to CLA's effects on body composition, one study found that CLA supplementation even increased fat oxidation and energy expenditure during sleep.[122]

The bottom line is that MRP LoCarb has significant effects on weight and fat loss, and increases overall health and wellbeing.

L-Carnitine

L-carnitine is mainly known for shuttling fatty acid acyl units into mitochondria so that beta oxidation of these acyl units provides acetyl units to fuel the TCA cycle and through oxidative phosphorylation to increase ATP production. In this respect, L-carnitine functions much like a gas pump in that it puts fuel in the gas tank so that your car engine can use it to provide energy to run the car. LC also acts to maintain mitochondrial function and suppresses oleic acid-mediated MPT through acceleration of beta-oxidation.[123]

But L-carnitine (LC) is much more than just the shuttle mechanism to get fatty acids into mitochondria and facilitate beta oxidation, it also functions in the opposite direction when there's an overload of acyl and acetyl units in the mitochondria that can result in mitochondrial dysfunction and insulin resistance.[124] LC thus acts more like a regulator of mitochondrial function both by providing nutrients that can be used efficiently and removing nutrients that are clogging up the mitochondrial machinery.

Studies have shown that the more fat is shuttled into the mitochondria and used as fuel, the more L-carnitine is needed. So, unless the body's metabolism is primed epigenetically to deal with utilizing fat as a primary fuel, and that also means a sufficient amount of LC to deal with the use of fat as a primary fuel (i.e. avoiding a relative carnitine insufficiency which can also be caused by aging and vegetarian diets), the result can be high rates of incomplete fat oxidation and intramuscular accumulation of fatty acylcarnitines, byproducts of lipid catabolism produced under conditions of metabolic stress including exercise.[125][126]

Although it seems counter intuitive given LC role in fat metabolism, LC also increases insulin sensitivity and is a regulator of glucose metabolism and may be used to counter the metabolic syndrome and help treat type II diabetes. [127][128]

A recent study found that the combination of L-carnitine, alpha lipoic acid, and betaine, all in Metabolic, had beneficial effects on health and body composition.[129] As well, LC is essential for proper muscle function and some studies have shown that carnitine supplementation improves exercise performance.[130]

LC has antioxidant properties directly but also ramps up endogenous antioxidant systems including glutathione, catalase, and SOD. The dual action decreases the effects of ROS produced with higher intensity resistance and aerobic exercise. L-carnitine also decreases the production of some of the pro-inflammatory cytokines and has anti-inflammatory and immunomodulating effects.[131][132][133]

A pilot study showed that the use of **L-carnitine** to obese subjects resulted in a remarkable rate of body-fat loss and thermogenesis,[134] which pointed to an uncoupling

of fatty-acid oxidation – that is the energy from the burning of fat was thrown off mostly as heat, and thus took some fat out of the metabolic equation.

The increased flux, combined with the activation of fatty acid oxidation induced by the trio increases fat breakdown and the oxidation of fatty acids, along with an increase in uncoupling protein. The overall result is an increase in fat breakdown and an increase in heat production from the metabolism of fat.

Vitamin D3

Vitamin D is important for augmenting calcium dynamics. However, it also has other important effects,[135] for example on insulin resistance,[136] inflammation[137][138] and obesity[139][140]

Vitamin D deficiency is associate with rickets and growth retardation in children and osteoporosis and osteomalacia in adults, many acute and chronic illnesses including some cancers, autoimmune diseases, cardiovascular disease, type 1 and type 2 diabetes mellitus, thyroid disorders, infectious diseases and neurocognitive dysfunction and other diseases, as well as infertility and adverse pregnancy and birth outcomes.[141][142][143][144]

Vitamin D deficiency has also been linked to decreases in muscle function, strength, exercise, sports performance and body composition, increases in injuries and inflammation, and an increase in illness along with a decrease in immunity.[145][146][147][148][149][150][151][152][153][154][155][156]

Although getting adequate amounts of vitamin D is crucial to health, vitamin D deficiency is relatively common and is a global health problem.[157][158][159] So, checking your vitamin D status is important and if not optimal supplementing with vitamin D is primary to realize all the benefits that it offers.

Potassium

Potassium helps correct the potassium loss often seen with dieting and in some people under some circumstances. Marginal potassium levels are often seen in women who lose it secondary to their menses and fluid retention.

Loss of potassium can lead to fatigue and lethargy, which can decrease wellbeing and can be counterproductive to dieting.

Biotin

Biotin is a water-soluble vitamin that acts a cofactor for several of the carboxylases involved in fatty acid synthesis, gluconeogenesis, and branched-chain amino acid (BCAA) metabolism.

The ketogenic phase of my diets and any ketogenic/low carb diet increases biotin bioavailability and consumption, and hence, promotes energy production by gluconeogenesis and branched-chain amino acid metabolism, which can result in biotin

deficiency. A recent paper concluded that “It is suggested that individuals that consume the ketogenic diet have an increased biotin requirement.”[160]

Information for Those on the Metabolic Diet or Any Lower Carb Diet

Several studies have shown the effectiveness of meal replacements for weight and fat loss.[161][162][163]

MRP LoCarb is the perfect meal replacement for anyone on lower carb diets. The blend of macronutrients is optimal for utilizing the beneficial effects of insulin on protein metabolism while at the same time avoiding the unwanted effects of insulin on fat metabolism.

One of the reasons is that when you're fat adapted insulin doesn't do the same things as when you're carb adapted. For example, insulin has less of an effect on lipogenesis and on decreasing lipolysis when you're fat adapted than if you're carb dependant.

As well, MRP LoCarb is ideal for maintaining body weight after weight loss. Not only does it provide high levels of quality proteins,[164] but also ingredients that increase metabolism and promote muscle retention and fat loss.

Post Training Nutrition

MRP LoCarb is the perfect post training drink for anyone on a low carb diet as it dramatically increases protein synthesis, and replenishes all of the muscle cell energy sources including glycogen (partly through the gluconeogenic process) and the important intramuscular triglycerides pool, while at the same time limiting fat formation and storage and increasing recovery.

The special blend of proteins in MRP LoCarb, similar to the one that’s in the Myosin Protein blend, maximizes protein synthesis and minimize protein breakdown for several hours, thus making efficient use of the increased protein synthesis that occurs up to 24 hours after training.

Since the presence of fat combined with protein and limited carbs does not decrease the insulin response or the absorption of amino acids and protein as it does with those who are carb adapted, MRP LoCarb is the perfect post workout meal supplement for those who are fat adapted and are on a lower carb diet.

The problem with taking in a lot of carbs post training is that while it increases insulin, something that amino acids and protein can do quite well, it also decreases GH and IGF-I expression. On the other hand, using protein and amino acids to increase insulin also increases GH and IGF-I levels and provides a much more anabolic effect overall while at the same time preserving lipid oxidation post exercise.

Also the use of amino acids and fat, with a minimum of carbs post workout, in someone who is fat adapted, besides leading to an increase in insulin (without as much of an adverse effect on fat metabolism - at least for our purposes) and not affecting the

absorption of protein and amino acids from the GI tract, it also dramatically increases intramuscular triacylglycerol levels, which is the fat that is first used up with exercise, before blood levels of FFA.

At the same time, there is also a moderate increase in glycogen levels, both hepatic and muscular, first through the small amounts of carbs that are part of MRP LoCarb, and more importantly through the gluconeogenic process in which the body forms only the carbs it needs by making glucose mainly from fats (the glycerol portion) and protein (various amino acids).

The slow increase in glycogen levels initiated by MRP LoCarb actually serves to keep insulin sensitivity high for long periods of time and thus increases amino acid transport and protein synthesis for several hours after training.

On the other hand, because of its sophisticated blend of ingredients, MRP LoCarb can also be used for those on higher carb diets. Using MRP LoCarb as the base, they can mix it in milk and/or add fruit, honey, ice cream, or other sources of carbs. Below is an example of a Metabolic Shake for those on lower and higher carb diets.

Dr. D's Low Carb Metabolic Shake: Uses only the three mixed together to minimize carb intake and is especially suited for the Radical Diet and the Cutting Phase of my Metabolic and Anabolic diets.

MRP LoCarb
(Creatine Advantage – optional)
Myosin Protein

Dr. D's Carb-Enhanced Metabolic Shake: Includes extra carbs and is especially suited for the Mass and Strength Training Phases:

MRP LoCarb
(Creatine Advantage – optional)
Myosin Protein
Add any combination of sweeteners, artificial or otherwise, and if the higher carb phase of my phase-shift diets other carbs, preferably honey and/or fruit, to your desired carb level.

References:

[1] Hongu N, Sachan DS. Carnitine and choline supplementation with exercise alter carnitine profiles, biochemical markers of fat metabolism and serum leptin concentration in healthy women. J Nutr. 2003 Jan;133(1):84-9.

[2] Neumann, G. Effects of L-carnitine on athletic performance. Seim, H. Loster, H. eds. Carnitine: Pathophysiological Basics and Clinical Applications 1996:61-71 Ponte Press Bochum, Germany.

[3] DeLany JP, Blohm F, Truett AA, Scimeca JA, West DB. Conjugated linoleic acid rapidly reduces body fat content in mice without affecting energy intake. Am J Physiol 1999 Apr;276(4 Pt 2):R1172-R1179.

[4] Blankson H, Stakkestad JA, Fagertun H, Thom E, Wadstein J, Gudmundsen O. Conjugated linoleic acid reduces body fat mass in overweight and obese humans. J Nutr 2000; 130:2943-2948.
[5] Riserus U, Berglund L, Vessby B. Conjugated linoleic acid (CLA) reduced abdominal adipose tissue in obese middle-aged men with signs of the metabolic syndrome: a randomised controlled trial. Int J Obes Relat Metab Disord. 2001; 25(8):1129-35.
[6] Gaullier JM, Halse J, Hoye K, Kristiansen K, Fagertun H, Vik H, Gudmundsen O. Supplementation with conjugated linoleic Acid for 24 months is well tolerated by and reduces body fat mass in healthy, overweight humans. J Nutr. 2005 Apr;135(4):778-84.
[7] Bhattacharya A, Rahman MM, McCarter R, O'Shea M, Fernandes G. Conjugated linoleic acid and chromium lower body weight and visceral fat mass in high-fat-diet-fed mice. Lipids. 2006 May;41(5):437-44.
[8] Packer L, Witt EH, Tritschler HJ. Alpha–lipoic acid as a biological antioxidant. Free Radic Biol Med. 1995;19:227–250.
[9] Jones W, Li X, Qu ZC, et al. Uptake, recycling, and antioxidant actions of alpha-lipoic acid in endothelial cells. Free Radic Biol Med 2002;33:83-93.
[10] Bast A, Haenen GR. Lipoic acid: a multifunctional antioxidant. Biofactors. 2003;17(1-4):207-13.
[11] Packer L, Tritschler HJ, Wessel K. Free Radic Biol Med. 1997;22(1-2):359-78. Neuroprotection by the metabolic antioxidant alpha-lipoic acid.
[12] Podda M, Tritschler HJ, Ulrich H, et al. Alpha–lipoic acid supplementation prevents symptoms of vitamin E deficiency. Biochem Biophys Res Commun. 1994;204:98–104.
[13] Faust A, Burkart V, Ulrich H, Weischer CH, Kolb H. Effect of lipoic acid on cyclophosphamide-induced diabetes and insulitis in non-obese diabetic mice. Int J Immunopharmacol. 1994; 16(1):61-6.
[14] Burkart V, Koike T, Brenner HH, Imai Y, Kolb H. Dihydrolipoic acid protects pancreatic islet cells from inflammatory attack. Agents Actions. 1993; 38(1-2):60-5.
[15] Packer L. Alpha lipoic acid: a metabolic antioxidant which regulates NF- kappaB signal transduction and protects against oxidative injury. Drug Metab Rev 1998;30:245–75.
[16] Lee HA, Hughes DA. Alpha-lipoic acid modulates NF-kappaB activity in human monocytic cells by direct interaction with DNA. Exp Gerontol. 2002 Jan-Mar;37(2-3):401-10.
[17] Teachey MK, Taylor ZC, Maier T, Saengsirisuwan V, Sloniger JA, Jacob S, Klatt MJ, Ptock A, Kraemer K, Hasselwander O, Henriksen EJ. Interactions of conjugated linoleic acid and lipoic acid on insulin action in the obese Zucker rat. Metabolism. 2003; 52(9):1167-74.
[18] Natah SS, Hussien KR, Tuominen JA, Koivisto VA. Metabolic response to lactitol and xylitol in healthy men. Am J Clin Nutr 1997;65(4):947-950
[19] Diabetologia 1982 Jun;22(6):480-482 The effects of xylitol on the secretion of insulin and gastric inhibitory polypeptide in man and rats. Salminen S, Salminen E, Marks V
[20] Georgieff M, Pscheidl E, Moldawer LL, Bistrian BR, Blackburn GL. Mechanisms of protein conservation during xylitol infusion after burn injury in rats: isotope kinetics and indirect calorimetry. European Journal of Clinical Investigation 1991; 21(2):249-58.
[21] Hamberg O. Regulation of urea synthesis by diet protein and carbohydrate in normal man and in patients with cirrhosis. Relationship to glucagon and insulin. Dan Med Bull 1997;44(3):225-241

[22] Schricker T, Kugler B, Trager K, Anhaupl T, Vogt J, Georgieff M. Effects of xylitol on carbohydrate and protein metabolism after trauma and during sepsis. Nutr Hosp. 1993 Nov;8(8):471-8.

[23] Maki KC, Davidson MH, Tsushima R, Matsuo N, Tokimitsu I, Umporowicz DM, Dicklin MR, Foster GS, Ingram KA, Anderson BD, Frost SD, Bell M. Consumption of diacylglycerol oil as part of a reduced-energy diet enhances loss of body weight and fat in comparison with consumption of a triacylglycerol control oil. Am J Clin Nutr 2002 Dec;76(6):1230-6.)

[24] Rudkowska I, Roynette CE, Demonty I, Vanstone CA, Jew S, Jones PJ. Diacylglycerol: efficacy and mechanism of action of an anti-obesity agent. Obes Res. 2005 Nov;13(11):1864-76.

[25] Bast A, Haenen GR. Lipoic acid: a multifunctional antioxidant. Biofactors. 2003;17(1-4):207-13.

[26] Packer L, Witt EH, Tritschler HJ. Alpha–lipoic acid as a biological antioxidant. Free Radic Biol Med. 1995; 19:227–250.

[27] Jones W, Li X, Qu ZC, et al. Uptake, recycling, and antioxidant actions of alpha-lipoic acid in endothelial cells. Free Radic Biol Med 2002;33:83-93.

[28] Packer L, Tritschler HJ, Wessel K. Neuroprotection by the metabolic antioxidant alpha-lipoic acid. Free Radic Biol Med 1997; 22(1-2):359-78.

[29] Podda M, Tritschler HJ, Ulrich H, et al. Alpha–lipoic acid supplementation prevents symptoms of vitamin E deficiency. Biochem Biophys Res Commun. 1994;204:98–104.

[30] Smith AR, Shenvi SV, Widlansky M, Suh JH, Hagen TM. Lipoic acid as a potential therapy for chronic diseases associated with oxidative stress. Curr Med Chem. 2004 May;11(9):1135-46.

[31] Koufaki, M. 2014. Therapeutic applications of lipoic acid: a patent review (2011–2014). Expert Opin. Ther. Pat. 24(9): 993–1005.

[32] Goraca A, Huk-Kolega H, Piechota A, Kleniewska P, Ciejka E, Skibska B. Lipoic acid - biological activity and therapeutic potential. Pharmacol Rep. 2011;63(4):849-58.

[33] Rochette L, Ghibu S, Richard C, Zeller M, Cottin Y, Vergely C. Direct and indirect antioxidant properties of a-lipoic acid and therapeutic potential. Mol Nutr Food Res. 2013 Jan;57(1):114-25.

[34] Rochette L, Ghibu S, Muresan A, Vergely C. Alpha-lipoic acid: molecular mechanisms and therapeutic potential in diabetes. Can J Physiol Pharmacol. 2015 Dec;93(12):1021-7.

[35] Baeeri M, Bahadar H, Rahimifard M, Navaei-Nigjeh M, Khorasani R, Rezvanfar MA, Gholami M, Abdollahi M. a-Lipoic acid prevents senescence, cell cycle arrest, and inflammatory cues in fibroblasts by inhibiting oxidative stress. Pharmacol Res. 2019 Mar;141:214-223.

[36] Smith AR, Shenvi SV, Widlansky M, Suh JH, Hagen TM. Lipoic acid as a potential therapy for chronic diseases associated with oxidative stress. Curr Med Chem. 2004 May;11(9):1135-46.

[37] Patrick L. Mercury toxicity and antioxidants: Part 1: role of glutathione and alpha-lipoic acid in the treatment of mercury toxicity. Altern Med Rev. 2002;7(6):456-71.

[38] Packer L. Alpha lipoic acid: a metabolic antioxidant which regulates NF- kappaB signal transduction and protects against oxidative injury. Drug Metab Rev 1998;30:245–75.

[39] Lee HA, Hughes DA. Alpha-lipoic acid modulates NF-kappaB activity in human monocytic cells by direct interaction with DNA. Exp Gerontol. 2002;37(2-3):401-10.

[40] Costantino D, Guaraldi C, Costantino M, Bounous VE. [Use of alpha-lipoic acid and omega-3 in postpartum pain treatment]. Minerva Ginecol. 2015 Oct;67(5):465-73.

[41] Hiller S, DeKroon R, Hamlett ED, Xu L, Osorio C, Robinette J, Winnik W, Simington S, Maeda N, Alzate O, Yi X. Alpha-lipoic acid supplementation protects enzymes from damage by nitrosative and oxidative stress. Biochim Biophys Acta. 2016 Jan;1860(1 Pt A):36-45.

[42] Faust A, Burkart V, Ulrich H, Weischer CH, Kolb H. Effect of lipoic acid on cyclophosphamide-induced diabetes and insulitis in non-obese diabetic mice. Int J Immunopharmacol. 1994; 16(1):61-6.

[43] Burkart V, Koike T, Brenner HH, Imai Y, Kolb H. Dihydrolipoic acid protects pancreatic islet cells from inflammatory attack. Agents Actions. 1993; 38(1-2):60-5.

[44] Lateef H, Aslam MN, Stevens MJ, Varani J. Pretreatment of diabetic rats with lipoic acid improves healing of subsequently-induced abrasion wounds. Arch Dermatol Res. 2005 Aug;297(2):75-83.

[45] Thirunavukkarasu V, Nandhini AT, Anuradha CV. Fructose diet-induced skin collagen abnormalities are prevented by lipoic acid. Exp Diabesity Res. 2004 Oct-Dec;5(4):237-44.

[46] Wang Y, Li X, Guo Y, Chan L, Guan X. alpha-Lipoic acid increases energy expenditure by enhancing adenosine monophosphate-activated protein kinase-peroxisome proliferator-activated receptor-gamma coactivator-1alpha signaling in the skeletal muscle of aged mice. Metabolism. 2010 Jul;59(7):967-76.

[47] Packer L, Cadenas E. Lipoic acid: energy metabolism and redox regulation of transcription and cell signaling. J Clin Biochem Nutr. 2011 Jan;48(1):26-32.

[48] Huerta AE, Navas-Carretero S, Prieto-Hontoria PL, Martínez JA, Moreno-Aliaga MJ. Effects of a-lipoic acid and eicosapentaenoic acid in overweight and obese women during weight loss.
Obesity (Silver Spring). 2015 Feb;23(2):313-21.

[49] Huerta AE, Prieto-Hontoria PL, Fernández-Galilea M, Escoté X, Martínez JA, Moreno-Aliaga MJ. Effects of dietary supplementation with EPA and/or a-lipoic acid on adipose tissue transcriptomic profile of healthy overweight/obese women following a hypocaloric diet. Biofactors. 2017 Jan 2;43(1):117-131.

[50] Li N, Yan W, Hu X, Huang Y, Wang F, Zhang W, Wang Q, Wang X, Sun K. Effects of oral a-lipoic acid administration on body weight in overweight or obese subjects: a crossover randomized, double-blind, placebo-controlled trial. Clin Endocrinol (Oxf). 2017 May;86(5):680-687.

[51] Madry E, Chudzicka-Strugala I, Grabanska-Martynska K, Malikowska K, Grebowiec P, Lisowska A, Bogdanski P, Walkowiak J. Twelve weeks CLA supplementation decreases the hip circumference in overweight and obese women. A double-blind, randomized, placebo-controlled trial. Acta Sci Pol Technol Aliment. 2016 Jan-Mar;15(1):107-113.

[52] Kucukgoncu S, Zhou E, Lucas KB, Tek C. Alpha-lipoic acid (ALA) as a supplementation for weight loss: results from a meta-analysis of randomized controlled trials. Obes Rev. 2017 May;18(5):594-601.

[53] Namazi N, Larijani B, Azadbakht L. Alpha-lipoic acid supplement in obesity treatment: A systematic review and meta-analysis of clinical trials. Clin Nutr. 2017 Jun 8. pii: S0261-5614(17)30212-1.

[54] Namazi N, Larijani B, Azadbakht L. Alpha-lipoic acid supplement in obesity treatment: A systematic review and meta-analysis of clinical trials. Clin Nutr. 2018 Apr;37(2):419-428.

[55] Haghighatdoost F, Hariri M. The effect of alpha-lipoic acid on inflammatory mediators: a systematic review and meta-analysis on randomized clinical trials. Eur J Pharmacol. 2019 Apr 15;849:115-123.

[56] Tromba L, Perla FM, Carbotta G, Chiesa C, Pacifico L. Effect of Alpha-Lipoic Acid Supplementation on Endothelial Function and Cardiovascular Risk Factors in Overweight/Obese Youths: A Double-Blind, Placebo-Controlled Randomized Trial. Nutrients. 2019 Feb 12;11(2). pii: E375.
[57] Mousavi SM, Shab-Bidar S, Kord-Varkaneh H, Khorshidi M, Djafarian K. Effect of alpha-lipoic acid supplementation on lipid profile: A systematic review and meta-analysis of controlled clinical trials. Nutrition. 2019 Mar;59:121-130.
[58] Arivazhagan P, Ramanathan K, Panneerselvam C. Effect of DL-alpha-lipoic acid on mitochondrial enzymes in aged rats. Chem Biol Interact. 2001 Nov 28;138(2):189-98.
[59] Palaniappan AR, Dai A. Mitochondrial ageing and the beneficial role of alpha-lipoic acid. Neurochem Res. 2007 Sep;32(9):1552-8.
[60] Zhang YH, Wang DW, Xu SF, Zhang S, Fan YG, Yang YY, Guo SQ, Wang S, Guo T, Wang ZY, Guo C. a-Lipoic acid improves abnormal behavior by mitigation of oxidative stress, inflammation, ferroptosis, and tauopathy in P301S Tau transgenic mice. Redox Biol. 2018 Apr;14:535-548.
[61] Yang T, Xu Z, Liu W, Xu B, Deng Y. Protective effects of Alpha-lipoic acid on MeHg-induced oxidative damage and intracellular Ca(2+) dyshomeostasis in primary cultured neurons. Free Radic Res. 2016;50(5):542-56.
[62] Lv C, Maharjan S, Wang Q, Sun Y, Han X, Wang S, Mao Z, Xin Y, Zhang B. Alpha-Lipoic Acid Promotes Neurological Recovery After Ischemic Stroke by Activating the Nrf2/HO-1 Pathway to Attenuate Oxidative Damage. Cell Physiol Biochem. 2017;43(3):1273-1287.
[63] Molinari C, Morsanuto V, Ghirlanda S, Ruga S, Notte F, Gaetano L, Uberti F. Role of Combined Lipoic Acid and Vitamin D3 on Astrocytes as a Way to Prevent Brain Ageing by Induced Oxidative Stress and Iron Accumulation. Oxid Med Cell Longev. 2019 Feb 28;2019:2843121. doi: 10.1155/2019/2843121. eCollection 2019.
[64] Derave W, Eijnde BO, Verbessem P, Ramaekers M, Van Leemputte M, Richter EA, Hespel P. Combined creatine and protein supplementation in conjunction with resistance training promotes muscle GLUT-4 content and glucose tolerance in humans. J Appl Physiol. 2003 May;94(5):1910-6. Epub 2003 Jan 10.
[6565] Laviano A, Molfino A, Lacaria MT, Canelli A, De Leo S, Preziosa I, Rossi Fanelli F. Glutamine supplementation favors weight loss in nondieting obese female patients. A pilot study. Eur J Clin Nutr. 2014 Nov;68(11):1264-6.
[66] Legault Z, Bagnall N, Kimmerly DS. The Influence of Oral L-Glutamine Supplementation on Muscle Strength Recovery and Soreness Following Unilateral Knee Extension Eccentric Exercise. Int J Sport Nutr Exerc Metab. 2015 Oct;25(5):417-26.
[67] Phillips GC. Glutamine: the nonessential amino acid for performance enhancement. Curr Sports Med Rep 2007; 6: 265-8.
[68] Koo GH, Woo J, Kang S, Shin KO. Effects of Supplementation with BCAA and L-glutamine on Blood Fatigue Factors and Cytokines in Juvenile Athletes Submitted to Maximal Intensity Rowing Performance. J Phys Ther Sci. 2014 Aug;26(8):1241-6.
[69] Cruzat VF, Bittencourt A, Scomazzon SP, Leite JS, de Bittencourt PI Jr, Tirapegui J. Oral free and dipeptide forms of glutamine supplementation attenuate oxidative stress and inflammation induced by endotoxemia. Nutrition. 2014 May;30(5):602-11.
[70] Freitas HR. Glutamine in Sport and Exercise. International Journal of Medical and Biological Frontiers Hauppauge 2016; 22.4 :277-291.
[71] Margaritis I, Rousseau AS, Hininger I, Palazzetti S, Arnaud J, Roussel AM. Increase in selenium requirements with physical activity loads in well-trained athletes is not linear. Biofactors. 2005;23(1):45-55. Links

[72] Lukaski HC: Low dietary zinc decreases erythrocyte carbonic anhydrase activities and impairs cardiorespiratory function in men during exercise. Am J Clin Nutr 2005; 81: 1045-1051.
[73] Prasad AS. Zinc deficiency in women, infants and children. Journal of the American College of Nutrition 1996;15(2):113-20.
[74] Cordova A, Alvarez-Mon M. Behaviour of zinc in physical exercise: a special reference to immunity and fatigue. Neuroscience & Biobehavioral Reviews 1995;19(3):439-45.
[75] Kieffer F. (Trace elements: their importance for health and physical performance.) Deutsche Zeitschrift fuer Sportmedizin 1986;37(4):118-123.
[76] Oteiza PI, Olin KL, Fraga CG, Keen CL. Zinc deficiency causes oxidative damage to proteins, lipids and DNA in rat testes. J Nutr 1995;125(4):823-9.
[77] Hsu JM. Zinc deficiency and alterations of free amino acid levels in plasma, urine and skin extract. Progress in Clinical & Biological Research 1977;14:73-86.
[78] Dorup I, Flyvbjerg A, Everts ME, Clausen T. Role of insulin-like growth factor-1 and growth hormone in growth inhibition induced by magnesium and zinc deficiencies. British Journal of Nutrition 1991;66(3):505-21.
[79] Ghavami-Maibodi SZ, Collipp PJ, Castro-Magana M, Stewart C and Chen SY. Effect of oral zinc supplements on growth, hormonal levels and zinc in healthy short children. Ann Nutr Metab 1983;273:214-219.
[80] Hartoma TR, Nahoul K, Netter A. Zinc, plasma androgens and male sterility. Lancet 1977;2:1125-1126.
[81] Hunt CD, Johnson PE, Herbel J, Mullen LK. Effects of dietary zinc depletion on seminal volume of zinc loss, serum testosterone concerntrations and sperm morphology in young men. Am J Clin Nutr 1992;56(1):148-157.
[82] Kara E, Gunay M, Cicioglu I, Ozal M, Kilic M, Mogulkoc R, Baltaci AK. Effect of zinc supplementation on antioxidant activity in young wrestlers. Biol Trace Elem Res. 2010 Apr;134(1):55-63.
[83] Marreiro DN, Geloneze B, Tambascia MA, Lerario AC, Halpern A, Cozzolino SM. [Participation of zinc in insulin resistance] Arq Bras Endocrinol Metabol. 2004;48(2):234-9.
[84] Bhattacharya A, Banu J, Rahman M, Causey J, Fernandes G. Biological effects of conjugated linoleic acids in health and disease. J Nutr Biochem. 2006;17(12):789-810.
[85] Ip C, Singh M, Thompson HJ, Scimeca JA. Conjugated linoleic acid suppresses mammary carcinogenesis and proliferative activity of the mammary gland in the rat. Cancer Research 1994;54(5):1212-5.
[86] Ip C, Scimeca JA, Thompson HJ. Conjugated linoleic acid. A powerful anticarcinogen from animal fat sources. [Review] Cancer 1994;74(3 Suppl):1050-4.
[87] Pariza MW, Ha YL, Benjamin H, et al. Formation and action of anticarcinogenic fatty acids. Advances in Experimental Medicine & Biology 1991;289:269-72.
[88] Luongo D, Bergamo P, Rossi M. Effects of conjugated linoleic acid on growth and cytokine expression in Jurkat T cells. Immunol Lett 2003;90:195– 201.
[89] Eder K, Schleser S, Becker K, Korting R. Conjugated linoleic acids lower the release of eicosanoids and nitric oxide from human aortic endothelial cells. J Nutr 2003;133:4083– 9.
[90] Zulet MA, Marti A, Parra MD, Martinez JA. Inflammation and conjugated linoleic acid: mechanisms of action and implications for human health. J Physiol Biochem. 2005 Sep;61(3):483-94.

[91] Yu Y, Correll PH, Vanden Heuvel JP. Conjugated linoleic acid decreases production of pro-inflammatory products in macrophages: evidence for a PPAR gamma-dependent mechanism. Biochim Biophys Acta. 2002 Apr 15;1581(3):89-99.
[92] Cheng WL, Lii CK, Chen HW, Lin TH, Liu KL. Contribution of conjugated linoleic acid to the suppression of inflammatory responses through the regulation of the NF-kappaB pathway. J Agric Food Chem. 2004 Jan 14;52(1):71-8.
[93] Dowling JK, McCoy CE, Doyle SL, BenLarbi N, Canavan M, O'Neill LA, Loscher CE. Conjugated linoleic acid suppresses IRF3 activation via modulation of CD14. J Nutr Biochem. 2013 May;24(5):920-8.
[94] Yenuganti VR, Ravinder R, Singh D. Conjugated linoleic acids attenuate LPS-induced pro-inflammatory gene expression by inhibiting the NF-kB translocation through PPARy in buffalo granulosa cells. Am J Reprod Immunol. 2014 Sep;72(3):296-304.
[95] Shultz TD, Chew BP, Seaman WR, Luedecke LO. Inhibitory effect of conjugated dienoic derivatives of linoleic acid and beta-carotene on the in vitro growth of human cancer cells. Cancer Letters 1992;63(2):125-33.
[96] Zulet MA, Marti A, Parra MD, Martinez JA. Inflammation and conjugated linoleic acid: mechanisms of action and implications for human health. J Physiol Biochem. 2005;61(3):483-94.
[97] Luongo D, Bergamo P, Rossi M. Effects of conjugated linoleic acid on growth and cytokine expression in Jurkat T cells. Immunol Lett 2003;90:195– 201.
[98] Eder K, Schleser S, Becker K, Korting R. Conjugated linoleic acids lower the release of eicosanoids and nitric oxide from human aortic endothelial cells. J Nutr 2003;133:4083– 9.
[99] Yu Y, Correll PH, Vanden Heuvel JP. Conjugated linoleic acid decreases production of pro-inflammatory products in macrophages: evidence for a PPAR gamma-dependent mechanism. Biochim Biophys Acta. 2002 15;1581(3):89-99.
[100] Cheng WL, Lii CK, Chen HW, Lin TH, Liu KL. Contribution of conjugated linoleic acid to the suppression of inflammatory responses through the regulation of the NF-kappaB pathway. J Agric Food Chem. 2004 14;52(1):71-8.
[101] Ing SW, Belury MA. Impact of conjugated linoleic acid on bone physiology: proposed mechanism involving inhibition of adipogenesis. Nutr Rev. 2011 Mar;69(3):123-31.
[102] DeLany JP, Blohm F, Truett AA, Scimeca JA, West D.B. Conjugated linoleic acid rapidly reduces body fat content in mice without affecting energy intake, Am J. Physiol 1999;276:R1172–R1179.
[103] Belury MA. Dietary conjugated linoleic acid in health: physiological effects and mechanisms of action. Annu Rev Nutr 2002;22:505–531.
[104] Parra P, Serra F, Palou A. Moderate doses of conjugated linoleic acid isomers mix contribute to lowering body fat content maintaining insulin sensitivity and a noninflammatory pattern in adipose tissue in mice. J Nutr Biochem. 2009 Feb 4. [Epub ahead of print]
[105] Gaullier JM, Halse J, Hoye K, Kristiansen K, Fagertun H, Vik H, Gudmundsen O. Conjugated linoleic acid supplementation for 1 y reduces body fat mass in healthy overweight humans. Am J Clin Nutr. 2004;79(6):1118-25.
[106] Eyjolfson V, Spriet LL, Dyck DJ. Conjugated linoleic acid improves insulin sensitivity in young, sedentary humans. Med Sci Sports Exerc. 2004;36(5):814-20.
[107] Steck SE, Chalecki AM, Miller P, et al. Conjugated Linoleic Acid Supplementation for Twelve Weeks Increases Lean Body Mass in Obese Humans. J. Nutr. 2007 137 (5).
[108] Blankson H, Stakkestad JA, Fagertun H, Thom E, Wadstein J, Gudmundsen O. Conjugated linoleic acid reduces body fat mass in overweight and obese humans. J Nutr 2000;130:2943-2948.

[109] Riserus U, Berglund L, Vessby B. Conjugated linoleic acid (CLA) reduced abdominal adipose tissue in obese middle-aged men with signs of the metabolic syndrome: a randomised controlled trial. Int J Obes Relat Metab Disord. 2001;25(8):1129-35.

[110] Gaullier JM, Halse J, Høye K, et al. Conjugated linoleic acid supplementation for 1 y reduces body fat mass in healthy overweight humans. Am J Clin Nutr 2004;79:1118–1125.

[111] Gaullier JM, Halse J, Hoye K, Kristiansen K, Fagertun H, Vik H, Gudmundsen O. Supplementation with conjugated linoleic acid for 24 months is well tolerated by and reduces body fat mass in healthy, overweight humans. J Nutr. 2005;135(4):778-84.

[112] Park Y, Albright KJ, Storkson JM, et al. Changes in body composition in mice during feeding and withdrawal of conjugated linoleic acid, Lipids 1999;34(3):243-248.

[113] Pariza MW, Park Y, Cook ME. The biologically active isomers of conjugated linoleic acid, Prog Lipid Res 2001;40(4):283-298.

[114] Choi Y, Kim YC, Han YB, et al. The trans-10,cis-12 isomer of conjugated linoleic acid downregulates stearoyl-CoA desaturase 1 gene expression in 3T3-L1 adipocytes, J Nutr 2000;130 (8):1920-1924.

[115] Park Y, Albright KJ, Storkson JM, et al. Changes in body composition in mice during feeding and withdrawal of conjugated linoleic acid, Lipids 1999;34(3):243-248.

[116] Pariza MW, Park Y, Cook ME. The biologically active isomers of conjugated linoleic acid, Prog Lipid Res 2001;40(4):283-298.

[117] Choi Y, Kim YC, Han YB, et al. The trans-10,cis-12 isomer of conjugated linoleic acid downregulates stearoyl-CoA desaturase 1 gene expression in 3T3-L1 adipocytes, J Nutr 2000;130 (8):1920-1924.

[118] Tarnopolsky MA, Safdar A. The potential benefits of creatine and conjugated linoleic acid as adjuncts to resistance training in older adults. Appl Physiol Nutr Metab. 2008 Feb;33(1):213-27.

[119] Cook ME, Miller CC, Park Y, Pariza M. Immune modulation by altered nutrient metabolism: nutritional control of immune-induced growth depression. Poultry Science 1993;72(7):1301-5.

[120] Miller CC, Park Y, Pariza MW, Cook ME. Feeding conjugated linoleic acid to animals partially overcomes catabolic responses due to endotoxin injection. Biochem Biophysic Res Comm 1994;198(3):1107-12.

[121] Gaullier JM, Halse J, Hoivik HO, Hoye K, Syvertsen C, Nurminiemi M, Hassfeld C, Einerhand A, O'Shea M, Gudmundsen O. Six months supplementation with conjugated linoleic acid induces regional-specific fat mass decreases in overweight and obese. Br J Nutr. 2007;97(3):550-60.

[122] Close RN, Schoeller DA, Watras AC, Nora EH. Conjugated linoleic acid supplementation alters the 6-mo change in fat oxidation during sleep. Am J Clin Nutr. 2007 Sep;86(3):797-804.

[123] Oyanagi E, Yano H, Kato Y, Fujita H, Utsumi K, Sasaki J. L-Carnitine suppresses oleic acid-induced membrane permeability transition of mitochondria. Cell Biochem Funct. 2008 Oct;26(7):778-86.

[124] Koves TR, Ussher JR, Noland RC, Slentz D, Mosedale M, Ilkayeva O, Bain J, Stevens R, Dyck JR, Newgard CB, Lopaschuk GD, Muoio DM. Mitochondrial overload and incomplete fatty acid oxidation contribute to skeletal muscle insulin resistance. Cell Metab. 2008 Jan;7(1):45-56.

[125] Noland RC, Koves TR, Seiler SE, Lum H, Lust RM, Ilkayeva O, Stevens RD, Hegardt FG, Muoio DM. Carnitine insufficiency caused by aging and overnutrition

compromises mitochondrial performance and metabolic control. J Biol Chem. 2009 Aug 21;284(34):22840-52.
[126] Stephens FB, Marimuthu K, Cheng Y, Patel N, Constantin D, Simpson EJ, Greenhaff PL. Vegetarians have a reduced skeletal muscle carnitine transport capacity. Am J Clin Nutr. 2011 Sep;94(3):938-44.
[127] Ringseis R, Keller J, Eder K. Role of carnitine in the regulation of glucose homeostasis and insulin sensitivity: evidence from in vivo and in vitro studies with carnitine supplementation and carnitine deficiency. Eur J Nutr. 2012 Feb;51(1):1-18.
[128] Molfino A, Cascino A, Conte C, Ramaccini C, Rossi Fanelli F, Laviano A. Caloric restriction and L-carnitine administration improves insulin sensitivity in patients with impaired glucose metabolism. JPEN J Parenter Enteral Nutr. 2010 May-Jun;34(3):295-9.
[129] Jang A, Kim D, Sung KS, Jung S, Kim HJ, Jo C. The effect of dietary a-lipoic acid, betaine, l-carnitine, and swimming on the obesity of mice induced by a high-fat diet. Food Funct. 2014 Jun 27. [Epub ahead of print]
[130] Neumann, G. Effects of L-carnitine on athletic performance. Seim, H. Loster, H. eds. Carnitine: Pathophysiological Basics and Clinical Applications 1996:61-71 Ponte Press Bochum, Germany.
[131] Manoli I, De Martino MU, Kino T, Alesci S. Modulatory effects of L-carnitine on glucocorticoid receptor activity. Ann N Y Acad Sci. 2004 Nov;1033:147-57.
[132] Famularo G, De Simone C, Trinchieri V, Mosca L. Carnitines and its congeners: a metabolic pathway to the regulation of immune response and inflammation. Ann N Y Acad Sci. 2004 Nov;1033:132-8.
[133] Pertosa G, Grandaliano G, Simone S, Soccio M, Schena FP. Inflammation and carnitine in hemodialysis patients. J Ren Nutr. 2005 Jan;15(1):8-12.
[134] McCarty MF, Gustin JC. Pyruvate and hydroxycitrate/carnitine may synergize to promote reverse electron transport in hepatocyte mitochondria, effectively 'uncoupling' the oxidation of fatty acids. Med Hypotheses 1999; 52(5):407-16.
[135] Nagpal S, Na S, Rathnachalam R. Non-Calcemic Actions of Vitamin D Receptor Ligands. Endocr Rev. 2005 Mar 29;
[136] Chiu KC, Chu A, Go VL, Saad MF. Hypovitaminosis D is associated with insulin resistance and ß cell dysfunction. Am J Clin Nutr 2004;79:820–5.
[137] Rutter MK, Meigs JB, Sullivan LM, D'Agostino RB Sr, Wilson PW. C-reactive protein, the metabolic syndrome, and prediction of cardiovascular events in the Framingham Offspring Study. Circulation 2004;110:380–5.
[138] Rutter MK, Meigs JB, Sullivan LM, D'Agostino RB Sr, Wilson PW. C-reactive protein, the metabolic syndrome, and prediction of cardiovascular events in the Framingham Offspring Study. Circulation 2004;110:380–5.
[139] Parikh SJ, Edelman M, Uwaifo GI, Freedman RJ, Semega-Janneh M, Reynolds J, Yanovski J 2004 The relationship between obesity and serum 1,25-dihydroxy vitamin D concentrations in healthy adults. J Clin Endocrinol Metab 89:1196–1199.
[140] Arunabh S, Pollack S, Yeh J, Aloia JF 2003 Body fat content and 25-hydroxyvitamin D levels in healthy women. J Clin Endocrinol Metab 88:157–161.
[141] Pludowski P, Holick MF, Pilz S, Wagner CL, Hollis BW, Grant WB, Shoenfeld Y, Lerchbaum E, Llewellyn DJ, Kienreich K, Soni M. Vitamin D effects on musculoskeletal health, immunity, autoimmunity, cardiovascular disease, cancer, fertility, pregnancy, dementia and mortality-a review of recent evidence. Autoimmun Rev. 2013 Aug;12(10):976-89.

[142] Barnard K, Colón-Emeric C. Extraskeletal effects of vitamin D in older adults: cardiovascular disease, mortality, mood, and cognition. Am J Geriatr Pharmacother. 2010 Feb;8(1):4-33.
[143] Motiwala SR, Wang TJ. Vitamin D and cardiovascular risk. Curr Hypertens Rep. 2012 Jun;14(3):209-18.
[144] Nettore IC, Albano L, Ungaro P, Colao A, Macchia PE. Sunshine vitamin and thyroid. Rev Endocr Metab Disord. 2017 Jan 14.
[145] Mason RS. Vitamin D: a hormone for all seasons. Climacteric. 2011 Apr;14(2):197-203.
[146] Wolff AE, Jones AN, Hansen KE. Vitamin D and musculoskeletal health. Nat Clin Pract Rheumatol. 2008 Nov;4(11):580-8.
[147] Shantavasinkul PC, Phanachet P, Puchaiwattananon O, Chailurkit LO, Lepananon T, Chanprasertyotin S, Ongphiphadhanakul B, Warodomwichit D. Vitamin D status is a determinant of skeletal muscle mass in obesity according to body fat percentage. Nutrition. 2015 Jun;31(6):801-6. doi: 10.1016/j.nut.2014.
[148] Heller JE, Thomas JJ, Hollis BW, Larson-Meyer DE. Relation between vitamin D status and body composition in collegiate athletes. Int J Sport Nutr Exerc Metab. 2015 Apr;25(2):128-35.
[149] Diamond T, Wong YK, Golombick T. Effect of oral cholecalciferol 2,000 versus 5,000 IU on serum vitamin D, PTH, bone and muscle strength in patients with vitamin D deficiency. Osteoporos Int. 2013 Mar;24(3):1101-5.
[150] Tomlinson PB, Joseph C, Angioi M. Effects of vitamin D supplementation on upper and lower body muscle strength levels in healthy individuals. A systematic review with meta-analysis. J Sci Med Sport. 2015 Sep;18(5):575-80.
[151] Cangussu LM, Nahas-Neto J, Orsatti CL, Bueloni-Dias FN, Nahas EA. Effect of vitamin D supplementation alone on muscle function in postmenopausal women: a randomized, double-blind, placebo-controlled clinical trial. Osteoporos Int. 2015 Oct;26(10):2413-21.
[152] Wyon MA, Koutedakis Y, Wolman R, Nevill AM, Allen N. The influence of winter vitamin D supplementation on muscle function and injury occurrence in elite ballet dancers: a controlled study. J Sci Med Sport. 2014 Jan;17(1):8-12.
[153] Chiang CM, Ismaeel A, Griffis RB, Weems S. Effects of Vitamin D Supplementation on Muscle Strength in Athletes: A Systematic Review. J Strength Cond Res. 2017 Feb;31(2):566-574.
[154] Wyon MA, Wolman R, Nevill AM, Cloak R, Metsios GS, Gould D, Ingham A, Koutedakis Y. Acute Effects of Vitamin D3 Supplementation on Muscle Strength in Judoka Athletes: A Randomized Placebo-Controlled, Double-Blind Trial. Clin J Sport Med. 2016 Jul;26(4):279-84.
[155] Barcal JN, Thomas JT, Hollis BW, Austin KJ, Alexander BM, Larson-Meyer DE. Vitamin D and Weight Cycling: Impact on Injury, Illness, and Inflammation in Collegiate Wrestlers. Nutrients. 2016 Nov 30;8(12).
[156] Willis, K.S.; Smith, D.T.; Broughton, K.S.; Larson-Meyer, D.E. Vitamin D status and biomarkers of inflammation in runners. Open Access J. Sports Med. 2012, 3, 35–42.
[157] Glerup H, Mikkelsen K, Poulsen L, et al. Commonly recommended daily intake of vitamin D is not sufficient if sunlight exposure is limited. J Intern Med 2000;247:260–8.
[158] Thomas MK, Lloyd-Jones DM, Thadhani RI, et al. Hypovitaminosis D in medical inpatients. N Engl J Med 1998;338:777–83
[159] Weaver CM, Fleet JC. Vitamin D requirements: current and future. Am J Clin Nutr. 2004 Dec;80(6 Suppl):1735S-9S.

[160] Yuasa M, Matsui T, Ando S, Ishii Y, Sawamura H, Ebara S, Watanabe T. Consumption of a low-carbohydrate and high-fat diet (the ketogenic diet) exaggerates biotin deficiency in mice. Nutrition. 2013 Oct;29(10):1266-70.

[161] Clifton PM, Noakes M, Keogh J, Foster P. How effective are meal replacements for treating obesity? Asia Pac J Clin Nutr. 2003;12 Suppl:S51.

[162] Heymsfield SB, van Mierlo CA, van der Knaap HC, Heo M, Frier HI. Weight management using a meal replacement strategy: meta and pooling analysis from six studies. Int J Obes Relat Metab Disord. 2003 May;27(5):537-49.

[163] Noakes M, Foster PR, Keogh JB, Clifton PM. Meal replacements are as effective as structured weight-loss diets for treating obesity in adults with features of metabolic syndrome. J Nutr. 2004 Aug;134(8):1894-9.

[164] Westerterp-Plantenga MS, Lejeune MP, Nijs I, van Ooijen M, Kovacs EM. High protein intake sustains weight maintenance after body weight loss in humans. Int J Obes Relat Metab Disord. 2004 Jan;28(1):57-64.