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KEY POINTS

- The Ultimate is a handy all-in-one formula, designed to support improvements in lean muscle mass, muscle strength, muscle power, exercise performance and recovery.
- Following periods of high-intensity exercise, individuals often suffer with symptoms of EIMD (e.g. pain /inflammation).
- Protein (whey) and Omega 3 PUFAs can help to develop and repair damaged muscle cells by stimulating muscle protein synthesis (MPS) to create a positive energy balance (hypertrophy). These ingredients have also been reported to improve endurance exercise capacity by delaying the onset of fatigue.
- Creatine, β-Alanine, Taurine and N Acetyl-Cysteine (NAC) supplemented in conjunction with resistance training have shown evidence of increased muscular power in high-intensity exercise.
- L-Leucine, HMB, Glutamine and Vitamin D all contribute to the development / maintenance of skeletal muscle and repair of muscle cells following periods of high-intensity exercise.
- Vitamins C & D, as well as NAC and Selenium have also been shown to support skeletal muscle recovery and immune function, posing positive implications on recovery time and susceptibility to illness and infection (e.g. URTI).

The Ultimate is Nutrition X's bespoke All-In-One supplement, designed specifically for athletes who want to achieve maximum results from their training and nutrition. Containing a number of active ingredients, The Ultimate shake supports the development of lean body mass, muscular power and immune function, without the need to take several different tablets and shakes per day.

KEY INGREDIENTS

A single serving of The Ultimate (60g: 3 Scoops) contains 27g of protein, 26.5g of carbohydrate and 1.8g of fat, providing 227Kcals per serving. The Ultimate also contains:

Protein Blend, Omega 3, Fatty Acids **(Muscle Development)**

L-Leucine, HMB, Glutamine, Vitamin D **(Muscle Maintenance)**

Creatine, Beta Alanine, Taurine, N Acetyl-Cysteine **(Muscle Power)**

Vitamin C / D, N Acetyl-Cysteine, Selenium **(Muscle Recovery/Immune System)**

The key ingredients and nutrients included within The Ultimate are carbohydrate for energy, protein and key amino acids for muscle protein synthesis, 'good' fats (polyunsaturated) for energy and health and a combination of supplements which have been scientifically proven through decades of research to enhance muscle recovery, strength, and power.

MUSCLE DEVELOPMENT

Protein – The main source of protein contained in The Ultimate formula is derived from whey, which serves a purpose to facilitate the muscular adaptive responses to exercise (i.e. muscular hypertrophy) and attenuate symptoms of exercise-induced muscle damage (EIMD) (Howarth et al., 2009; Levenhagen et al., 2001; Tipton et al., 1999).

ULTIMATE
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Whey protein is an important ingredient within this blend as it contributes towards a net positive nitrogen balance, where rates of muscle protein synthesis (MPS) exceed rates of muscle protein degradation (Morton, McGlory and Phillips, 2015). Furthermore, research has consistently shown that whey protein typically contains the highest quantities of essential amino acids (EAA) and branched-chain amino acids (BCAA) (Hulmi, Lockwood and Stout, 2010; van Vliet, Burd and van Loon, 2015) (Figure 1). This research illustrates the potency of whey, in comparison to other well-re-searched types of proteins, such as soy, casein and egg.

Previous research has established that endurance, strength and power-based athletes require a greater dietary protein intake when compared to sedentary populations. A recent study by Jäger et al. (2017) suggested that a protein intake corresponding to between 1.4-2.0g of protein per kilogram of body mass would suffice for most athletes, and varies depending on the athletes' volume, intensity and duration of training and competition. In addition, research has consistently shown the importance of protein timing. Given the likelihood of exercise-induced amino-acid metabolism during exercise, especially endurance-based exercise, amino acids should be provided ideally pre and (or) post-exercise. Moore et al. (2012) illustrated that the rates of MPS and MPD have a tendency to fluctuate throughout the day. Therefore, the consumption of The Ultimate would ensure that a sufficient amount of amino-acids are provided to negate the effects of exercise on muscle development.

Omega-3 Fatty Acids – Omega-3 polyunsaturated fatty acids (PUFAs) consist of α-linolenic acid (ALA), eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). These fatty acids are known for their anti-inflammatory properties, which can help to attenuate the inflammation caused by oxidative stresses as a result of strenuous exercise.

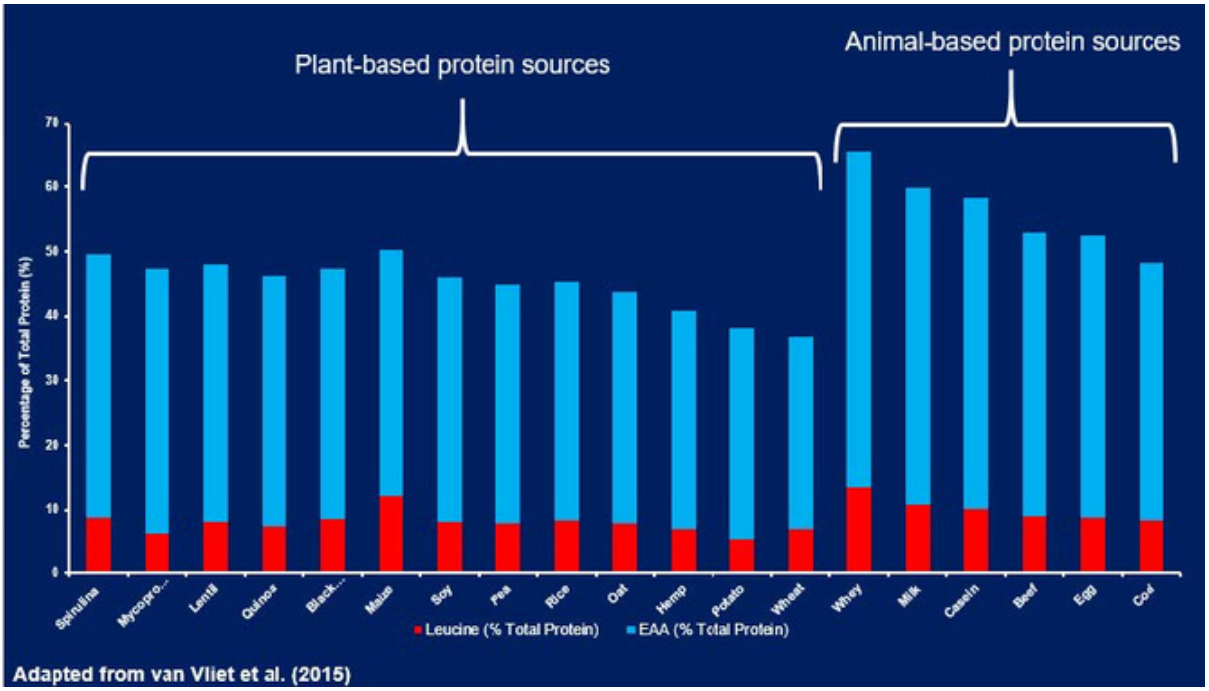

Figure 1: Leucine and EAA content of common plant and animal-based protein sources (van Vliet et al., 2015).

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Research by Gammone et al. (2019) suggested that Omega-3 PUFAs can facilitate the change the state of the muscle cell membrane, including changes in membrane fluidity, receptor function and the production of cytokines, all of which are known to lower the effects of exercise on subsequent muscle damage. In addition to the anti-inflammatory properties of Omega-3 PUFAs, research has found their consumption to be beneficial for cardiovascular health (i.e. reduced LDL cholesterol, reduced risk of atherosclerosis and hypertension). The associated cardiovascular benefits of Omega-3 PUFA consumption have been reported to improve endurance exercise capacity and mitochondrial function (Da Boit et al., 2017; Gravina et al., 2017; Le Guen et al., 2015). There is also some reported improvements in cognitive function, including an improved CNS repair (recovery) and metabolism of neurotransmitters.

SEE 'SCIENCE BEHIND' DAILY OMEGA-3 FISH OILS FOR MORE INFORMATION.

MUSCLE MAINTENANCE

The Ultimate formula combines L-leucine, HMB, Glutamine and Vitamin D, which are all key ingredients to give muscles the maximum chance of staying anabolic throughout the day i.e. MPS greater than MPB. The Ultimate is an important supplement to consider for not only muscle development, but muscle maintenance and protection. Whey protein forms a key component in the Nutrition X Ultimate blend.

In addition, the BCAA's (most specifically, leucine) contained within whey are fundamental for the regulation of several cellular processes, including tissue generation, substrate metabolism and MPS. A standout study by Tang et al. (2009) investigating the effect of isonitrogenous doses of whey, soy and casein on leucine concentrations in the blood observed (a) the potency of whey protein supplementation on leucine concentration, and (b) greater stimulation of MPS. However, it is important to consider that leucine cannot stimulate an increase in MPS in the absence of a full complement of EAA (Churchward-Venne et al., 2012). Nevertheless, the results from Tang et al (2009) were likely attributed to the increased essential amino-acid and BCAA content of whey (Churchward-Venne et al., 2012; van Vliet et al., 2015) (Figure 1). The increased rate of MPS and fractional synthesis rate (rate of muscle protein turnover) helps to maintain an athletes levels of muscle mass by reducing the risk of a negative nitrogen balance and subsequent muscular atrophy.

HMB (Beta-hydroxy-beta-methylbutyrate) is a derivative of the amino acid leucine. When supplemented in conjunction with resistance exercise, research has reported significant increases in muscular strength and lean body mass, as well as reductions in fat mass (Alon et al., 2002). HMB has also been found to reduce MPD (muscle protein breakdown) and support the recovery of damaged muscle cells following bouts of high-intensity training.

Glutamine is a naturally occurring, non-essential amino acid. Despite being categorised as non-essential, it becomes an essential component of the diet when the skeletal muscles come under significant stress or trauma (e.g. strenuous exercise). Research has identified four beneficial effects of glutamine consumption in the diet.

- Prevents exercise induced muscle breakdown.
- Poses positive effects on immune function and can therefore be classified as a nutraceutical(foods claimed to pose a medicinal effect on human health).
- Increases insulin concentrations, which promote anabolic states.
- Essential for gut health, ensuring the optimum absorption of nutrients.

In addition, there is also some evidence of increases in muscle glycogen synthesis and reduced ammonia accumulation induced by exercise (Coqueiro, Rogero and Tirapegui, 2019). Although not conclusive, this review has also suggested the attenuation of parameters associated with EIMD, such as creatine kinase (CK) and lactate dehydrogenase (LDH) following the supplementation of glutamine.

ULTIMATE
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SEE 'SCIENCE BEHIND' GLUTAMINE FOR MORE INFORMATION.

Vitamin D is a fat-soluble vitamin, which can be found in the diet or through exposure to sunlight. Early research illustrated the major role of vitamin D supplementation in skeletal muscle growth and repair (Willis, Peterson and Larson-Meyer, 2008). Since then, research into vitamin D supplementation has developed further, with some studies suggesting that following Vitamin D supplementation, both skeletal muscle and the immune system combine to modulate recovery periods from EIMD (Owens, Allison and Close, 2018). To avoid vitamin D deficiency in winter months, consuming a product such as Nutrition X's 'The Ultimate' can help to reduce the risk of:

- Impaired muscle function and recovery.
- Impaired immune health (Increased susceptibility to URTI).
- Impaired bone health (Increased susceptibility to osteomalacia - softening of the bone).

SEE 'SCIENCE BEHIND' VITAMIN D3 FOR MORE INFORMATION.

MUSCLE POWER

The Ultimate formula combines creatine monohydrate, beta alanine, taurine and N-acetyl cysteine, which form the key ingredients within the formula to optimise muscle power during exercise.

Creatine (Creatine Monohydrate) when ingested using a suitable loading strategy increases muscle creatine concentration (Harris et al., 1992). Sufficient loading strategies can produce ergogenic effects, especially during high intensity exercise performance. Furthermore, the mechanism by which creatine produces an ergogenic effect is thought to be multifaceted. The greatest contribution appears to come from metabolic enhancements, molecular adaptations and reduced muscle damage (Rawson and Persky, 2007). For instance, sufficient creatine loading strategies facilitate the increase in muscle creatine concentrations and subsequent muscle phosphocreatine (PCr) concentrations (del Favero et al., 2012). By having more PCr available, there is more substrate to re-phosphorylate ATP as part of the PCr energy system (Wallimann et al., 2011). Research has also illustrated the capacity for creatine to increase the expression of proteins related to muscle hypertrophy (Branch, 2003). Therefore, creatine can support the optimisation of specific training adaptations for high intensity and high-intensity intermittent sport athletes. Indeed, a study by Kreider (2003) demonstrated that following a sufficient creatine loading strategy, the performance high intensity and (or) repetitive (intermittent) exercise is typically increased by 10–20%, dependent upon the magnitude of increase in muscle PCr.

SEE 'SCIENCE BEHIND' CREATINE MONOHYDRATE FOR MORE INFORMATION.

Beta Alanine (β-alanine) is a non-essential amino-acid and despite being non-essential, it plays a fundamental role as a precursor to carnosine synthesis, binding with the EAA L-histidine to create carnosine (Maté-Muñoz et al., 2018). This increase in muscle carnosine concentration contributes to the regulation of skeletal muscle pH, which suppresses the developments of fatigue through metabolic acidosis (Black et al., 2018; Maté-Muñoz et al., 2018). The improved regulation of muscle pH helps allows athletes to maintain calcium (Ca2+) release from the sarcoplasmic reticulum, troponin C sensitivity to Ca2+ and cross-bridge cycling, which is important for the maintenance of muscular strength and power production during exercise (Guidetti et al., 2002).

SEE 'SCIENCE BEHIND' BETA ALANINE MORE INFORMATION.

Taurine is another non-essential amino acid used in the formula. There is limited understanding of the mechanisms surrounding taurine supplementation, however, existing research has outlined a number of possible mechanisms:

ULTIMATE
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- Assists with sarcoplasmic reticulum calcium handling (Hamilton et al., 2006; Dutka et al., 2014).
- Potential anti-oxidative role, which is thought to improve the efficiency of ATP turnover (Hansen et al., 2006).
- Reduced EIMD (Dawson et al., 2002).

It is thought that these mechanisms either exclusively or combined can enhance endurance performance by increasing the capacity of human muscle over prolonged periods (Waldron et al., 2018). To make the findings more conclusive, there is a need for more research on human samples.

N-acetyl cysteine (NAC) is a derivative of the amino acid L-cysteine. Indeed, cysteine is one of the few amino acids that contains sulphur, which allows it to bond and maintain the structure of proteins in the body. Furthermore, NAC is the rate limiting step for the synthesis of antioxidants and amino acids such as glutathione and taurine (Ferriera and Reid, 2008; Lamprecht, 2015). NAC is thought to support moderate-intensity exercise performance by delaying the onset of fatigue (Ferriera and Reid, 2008). However, the efficacy is reported to be less prominent in high-intensity exercise bouts.

MUSCLE REAPAIR/IMMUNE FUNCTION

To allow athletes to get the most out of their performance, it is vital that they recover efficiently and fully. The Ultimate formula combines vitamins C and D, NAC and selenium. Which are important for muscle repair (recovery) and regulation of immune function to counteract the demands that high-intensity exercise exert on skeletal muscle and the immune system.

Vitamin C and NAC are powerful dietary antioxidants contained within The Ultimate formula, which help to prevent the oxidative damage of free radicals. These ingredients are thought to alleviate EIMD, and in turn, reduce the amount of recovery time required between sessions / competitions.

As discussed, **vitamin D** is an important ingredient to maximise muscle stem cell activation, which allows the muscle to adequately recover post-exercise (Owens et al., 2016). This can often become a challenge when sunlight hours are reduced, with previous research illustrating that many athletes become 'vitamin d deficient' in winter months (Cannell et al., 2006). Therefore, this makes the consumption of a product such as Nutrition X's The Ultimate all the more worthwhile.

Selenium is an important mineral that plays a role in a number of bodily functions, notably immune function. With some studies suggesting that approximately 1 billion people worldwide are considered to be 'selenium deficient', it is important to consume enough of this mineral in the diet to reduce the risk of illness (Gerrad et al., 2017).

CONCLUSION

The Ultimate is an All-In-One nutritional supplement for the busy athlete who at certain times may be unable to consume a variety of essential components to recover from and enhance training. Specifically, this could include periods of recovery from injury or elective surgery, or when there is a busy work and training schedule. Some athletes are unwilling to take time to mix a range of suitable supplements during heavy training periods and would benefit from a product which, in effect, contains all the requirements they need. The balance of nutrients in The Ultimate are such that muscle recovery, muscle maintenance, power, and immune function are not compromised during training periods and even periods of inactivity due to muscle injury.

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ULTIMATE
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ULTIMATE
THE SCIENCE BEHIND

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