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BLUE STAR®
NUTRACEUTICALS

THE SCIENCE BEHIND CREA-TECH™

The New Era of Creatine

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THE SCIENCE BEHIND CREA-TECH™

Creatine is undoubtedly the most widely accepted ergogenic aid in the entire sports supplement industry. Since the first studies in the early 90s, many hundreds of research publications have emerged studying the effects of creatine ingestion in muscle adaptations and exercise performance.

Basics of Creatine

The liver of humans and animals synthesizes a minimal amount of creatine by combining the two amino acids, arginine and glycine. In addition, diets containing meat from animals will also contribute creatine to the body, and collectively the various sources of creatine are transported through the blood to the muscle where it can carry out its purpose. The primary function of creatine within muscle cells is to provide a small reserve of energy for high-intensity exercise. Therefore, by increasing the pool of muscle creatine through supplementation, the reserve of energy can be increased as well. As a result, high intensity exercise can be pushed to greater limits, allowing for greater training benefits. Additional benefits from increasing muscle-creatine levels comes from accumulating water into muscle cells, increasing muscle volume, inducing satellite cell activation / proliferation, and ultimately enhancing muscle hypertrophy. In the long run, creatine supplementation has been shown to improve muscle strength, size and performance. However, for these improvements to occur, supplemental creatine needs to effectively get to the muscle cells.

The vast majority of research focused on the benefits of creatine supplementation comes from a very standardized protocol: 20 grams of creatine monohydrate daily for the first 7 days followed by 5 grams of creatine monohydrate daily thereafter. This is the basis of many of the scientific evidence for the effects of creatine supplementation, and has been the bona fide method for all the improvements creatine has to offer. With its long track record of evidence showing improvements in high-intensity sport performance, muscle power, muscle strength, muscle hypertrophy and many others, what can really be innovative about creatine today? Throughout recent years, many companies have been aiming to improve upon the traditional creatine benefits but with only limited success contributed to the lack of superiority from the original standard. Innovations such as attaching additional molecules to creatine (creatine malate, creatine citrate, creatine-orate...etc.) were popular mostly because consumers didn't understand that once dissolved in solution they dissociate into free creatine making the additional molecule completely unrelated to the effects of creatine. Another innovation combined creatine with esterified alcohol (creatine ethyl ester) that was purported to improve cellular absorption and transport into muscles. However, this too was scientifically proven to not be accurate, and in fact when examined ended up being inferior in increasing muscle creatine when compared to creatine monohydrate.

Issues of Creatine Stability

Even though intramuscular creatine can be reused indefinitely, eventually the creatine molecule transforms into an inactive by-product called creatinine **(Figure 1)**. This cyclized by-product of creatine has no functional benefit and therefore is destined only for excretion by the kidneys. This transformation of creatine in the body occurs at 2 grams a day and is the reason why chronic supplementation is required to keep intramuscular creatine at optimal levels. However, a large amount of a supplemental creatine being consumed will actually become creatinine before your body absorbs it, or worse, before it gets past the stomach or possibly even before it's ingested. This is because creatine has the disadvantage that it does not have pronounced stability in an aqueous solution. Considering that most creatine supplements are ingested as a beverage explains why the most valid focus toward creatine improvements is behind its inherent instability.

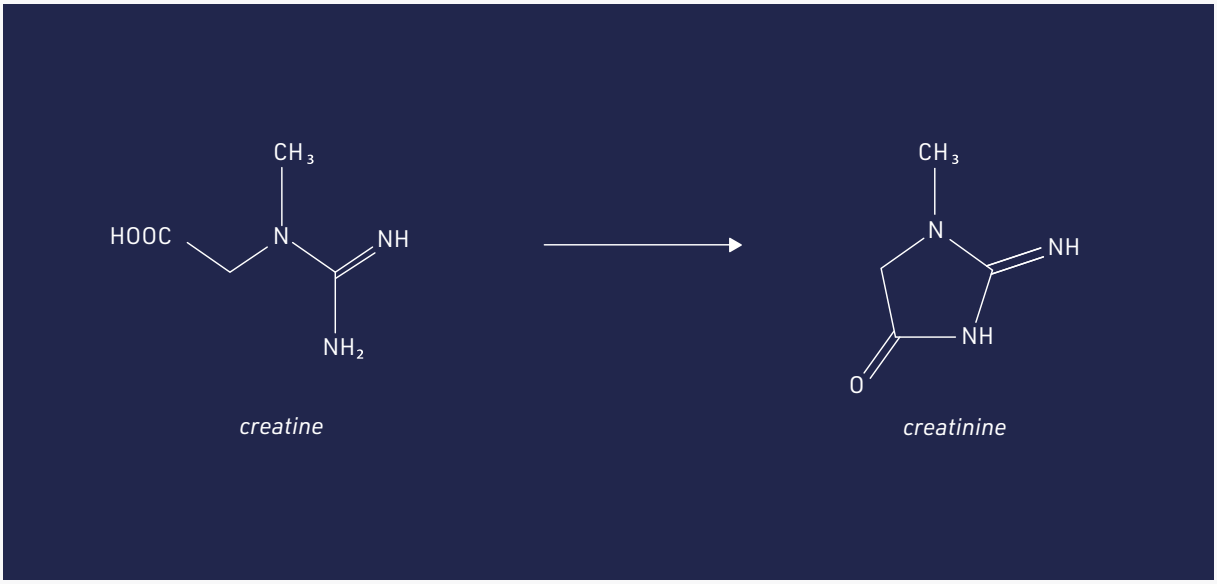

Figure 1. Creatine can be converted to creatinine rendering inactive and is excreted.

The conversion of creatine to its inactive byproduct, creatinine, while in solution, is largely dependent on the pH of the solution **(Figure 2)**. Particularly in the neutral and acidic pH range, the formation of creatinine proceeds very rapidly. Therefore, as soon as the creatine is dissolved in water, the creatine molecule is beginning to be inactivated. Consequently any lag time between when the supplement is prepared to when it is consumed is associated with less active creatine available. However, the inactivation doesn't end there. The pH of the stomach is more acidic than the external environment, which means that as soon as the creatine solution enters the stomach, creatinine formation is accelerated as it passes through the

stomach. Collectively, a large portion of supplemental creatine is not actually reaching the muscle and instead is merely wasted away in the urine.

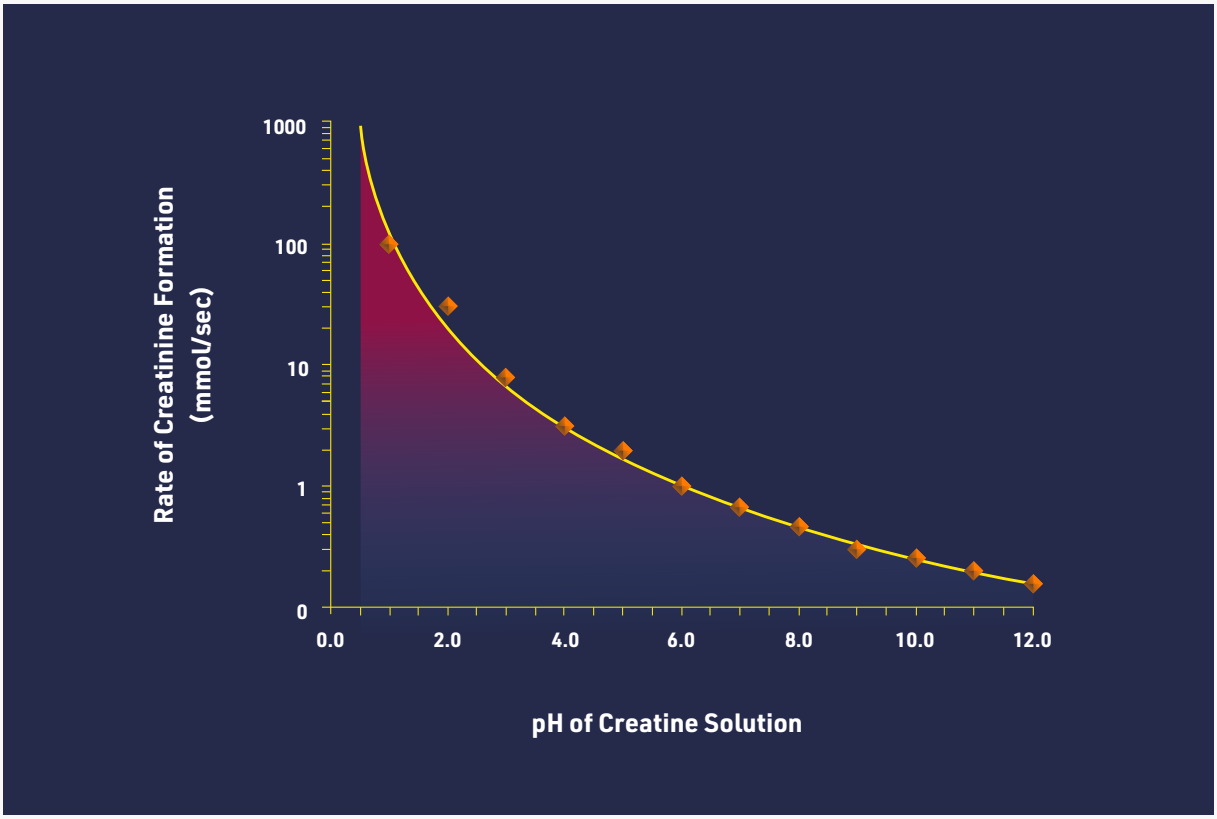

Figure 2. Rate of creatinine formation from creatine as a function of pH.

It is important to understand that stability is in no way related to solubility. A distinction sometimes misunderstood, even by other supplement companies. This became apparent with the creation of Creatine-HCl that claimed to have enhanced stability, as incorrectly evidenced by improved solubility. Creatine-HCl is the creatine molecule attached to a hydrochloric acid molecule. The improved solubility was marketed as having improved absorption. However, understanding the dynamics of creatine in acids, as mentioned above, this combination was a step in the wrong direction. Despite a popular rebuttal, there is no substantiated acidic range where creatine becomes protected from creatinine formation. Instead of improving stability, Creatine-HCl actually accelerates the production of creatinine, and thus yields a far less active product. Coincidentally, the solubility of creatinine is nearly 7 times as high as creatine, which explains the improved solubility of Creatine-HCl in solution.

The instability of creatine initiated the idea of creatine buffering. The concept being, that if creatine existed at an alkaline pH, then the rate of creatinine formation would be minimized. Kre-Alkalyn® is a product that does just that. Kre-Alkalyn® is a patented creatine product that starts at an alkaline pH of 12, and calls it buffered. Simply raising the pH to the alkaline range is not a true buffer, however. When introduced to an acid environment, such as the stomach, the pH of Kre-Alkalyn® will rapidly decline into the acid range in very little time. In contrast, a truly buffered creatine solution functions to resist changes in pH, not just delay it.

The Only Truly Buffered Creatine

Crea-Tech™ contains the multi-patented ingredient, Creapure® pH-10; the world's first and only truly buffered creatine. By combining the world's leading creatine manufacturer, Creapure®, with the ingredients of a true buffer, Creapure® pH-10 is capable of legitimately resisting the alterations in pH in any solution. To create a true buffer, two components are required: a weak acid, and its conjugate base. The combination of these two components does not change the pH of a solution. However, this combination has the ability to react with and neutralize any acids being introduced to the solution.

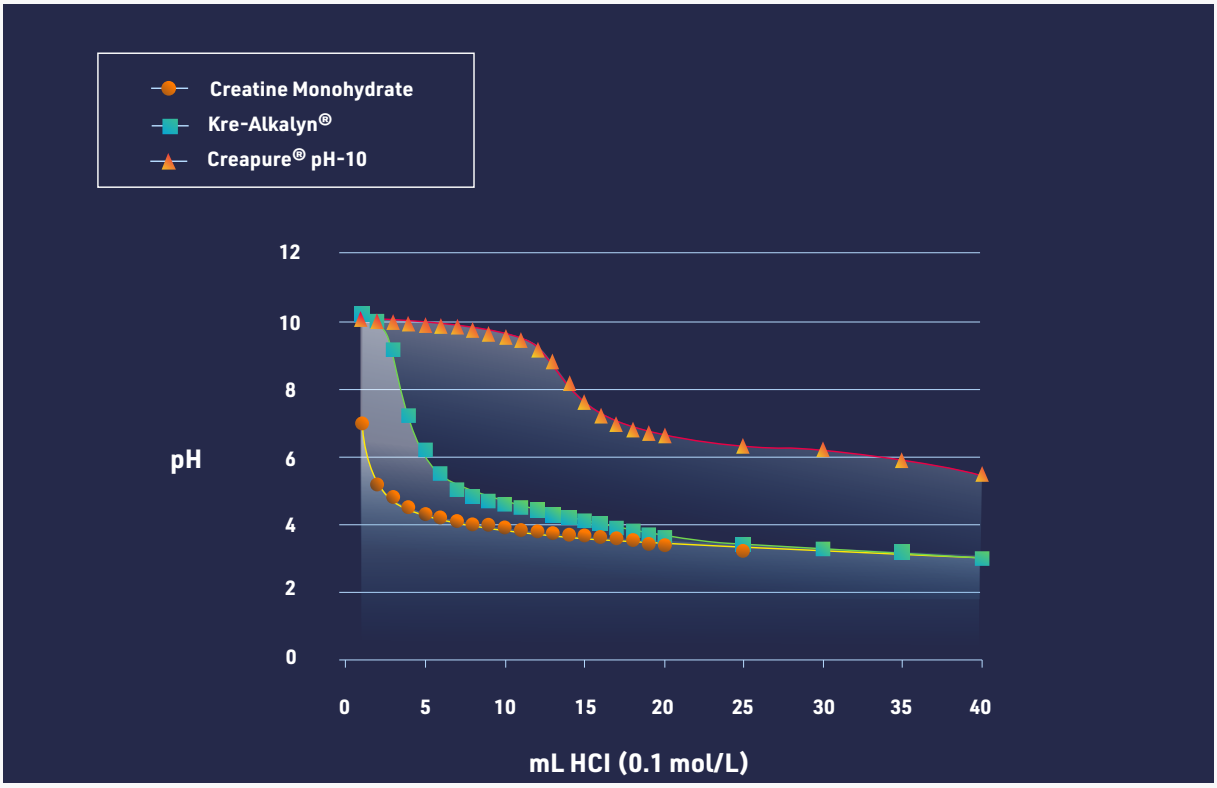

Figure 3. Titration of Creatine Monohydrate, Kre-Alkalyn® and Creapure® pH-10 with 0.1M HCl.

Therefore, in a true buffer, added acid will make only small changes in pH until the buffer capacity has been reached. An otherwise alkalized solution will rapidly fall into the acid range when introduced with acid **(Figure 3)**. The true buffering capability of Creapure® pH-10 is what allows for the improved stability of creatine when dissolved in solution, and while passing through the stomach. This feature guarantees the maximum proportion of active creatine to be intact until it's absorbed into the bloodstream.

Bioavailability

Despite all the empirical evidence behind creatine supplementation, new forms of creatine continue to thrive based on underpowered studies showing a similar benefit to creatine monohydrate. The mechanism of creatine once in the muscle is not questioned. Therefore, the most powerful attribute that should be considered when evaluating the effectiveness of a new creatine is how much of it actually reaches the muscle. Rather than conducting a training study investigating the relative differences in strength, hypertrophy or performance, all of which are heavily influenced by many confounding factors, the creators of Creapure® pH-10 were brave enough to directly measure intramuscular creatine content with muscle biopsy data. Biopsy data is the most conclusive evidence to fully appreciate the relative effectiveness between creatine supplement products. The data above shows that based on the actual intramuscular creatine content, creatine monohydrate and Kre-Alkalyn® both increase creatine content so a similar level. However, the increase in intramuscular creatine is limited to the amount of creatine not transformed into creatinine before it is transported into muscle. Due to the true buffering capacity of Creapure® pH-10, a greater portion of active creatine can successfully reach the muscle **(Figure 4)**. The powerful biopsy data obtained in this study provides a definitive rationale for Creapure® pH-10 being the best choice to maximize the benefits of creatine supplementation.

Industry Leading Purity

Not only does this novel technology stack up to be better than other creatine products, the creatine itself is none other than the industry leader and premium brand of creatine known worldwide; Creapure® by Alzchem. Only Creapure® has the industry leading 99.95% purity.

Hydration

The transport of creatine into muscle cells has an influence of water movement as well. While one of the major benefits of creatine supplementation occurs from the co-transport of fluid into muscle cells, this typically leaves the bloodstream dehydrated unless adequate fluid is also ingested to restore the plasma volume. The inclusion of electrolytes in Crea-Tech™ functions to promote hydration and maintain water balance to keep the body functioning optimally. The additional sodium is particularly advantageous to further improve the uptake of creatine into muscle cells.

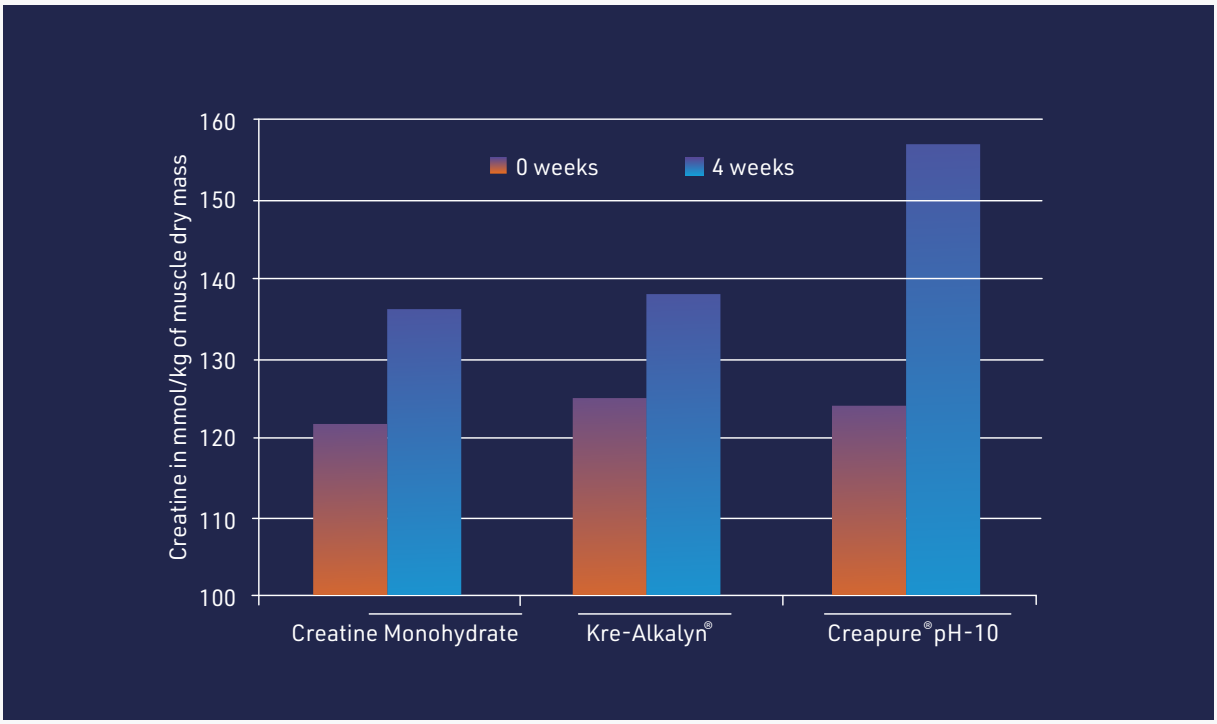

Figure 4. Intramuscular creatine content before and after 4 weeks of supplementing with creatine monohydrate, Kre-Alkalyn® or Creapure® pH-10.

Rob Riches

Blue Star Nutraceuticals® Athlete

CONCLUSION

Crea-Tech™ is the new revolution of creatine with its inclusion of the revolutionary Creapure® pH-10 clinically shown to drastically improve intramuscular creatine levels compared to any other creatine supplement, through enhanced buffering controlled stability. What makes Crea-Tech™ more unique is the inclusion of electrolytes to promote hydration. Altogether, Crea-Tech™ represents the latest and greatest innovation of creatine supplementation.

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About The Author

Dr. David Gundermann is an award winning nutritional product development scientist, clinical researcher, and known expert in muscle health and metabolism. He developed his passion for health & fitness at a very early age growing up in a family of accomplished competitive athletes.

As Director of Research and Development at Blue Star Nutraceuticals®, he leads all efforts concerning product formulation, key ingredient research, flavor science, long-term scientific assessment, and proprietary development.

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