

Is there such a thing as “pH stable creatine” formulas? Here we examine the REAL evidence behind issues causing waves in the sports nutrition industry.

Of late scientific attacks on creatine, its absorption, safety and subsequent uptake into muscle have hit overdrive with the release of so called pH stable and pH correct creatine’s. There comes a point when you have to take a stand and put these pseudo-scientists in their place, if you have wasted you hard earned cash on these overpriced products your going to be really P***ed by the time you finish reading this article. I am going to provide you with the REAL science behind how much creatine really is absorbed when given in the only PROVEN performance enhancing form of creatine. That’s right plain old “creatine monohydrate”. So if you want to know the influence of low pH, stomach acids, and fluids on creatine levels don’t stop reading just yet as this is the article you have all been waiting for...

THE TRUTH ABOUT CREATINE STABILITY!

The facts about creatine monohydrate and pH stable formulations

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The reason these companies have been able to play on your insecurities about the uptake of creatine and its so-called instability is that there have been relatively few studies that assessing the pharmacokinetics of creatine [1,2]. However, there is data to qualify many of these issues including:-

1. How long does it take for a 5 gram dose to get through the gut and how much reaches the muscle transport system?

2. What is the effect of pH on creatine and its subsequent breakdown to creatinine?

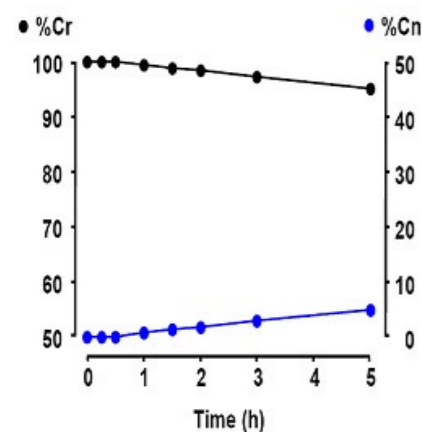


Figure.1
 (Adapted from Harris et al. 1999 [3])

3. What amount of creatine is absorbed into muscle during loading?

4. What is the effect of cooking on creatine and creatinine in meats?

The answer to these questions will provide you with concrete evidence of just how effect and stable creatine really is.

Myth # 1
Creatine breaks down massively in low pH!

Work presented by Professor Roger Harris way back in 1999 at a meeting in Milan[3] gave some great insights into creatine metabolism but more than that unequivocal scientific PROOF that creatine is highly stable in low pH environments. In figure (1) you can see the effect of creatine monohydrate placed into A low pH environment (pH <2) to stimulate gastric juice, the exact environmental conditions

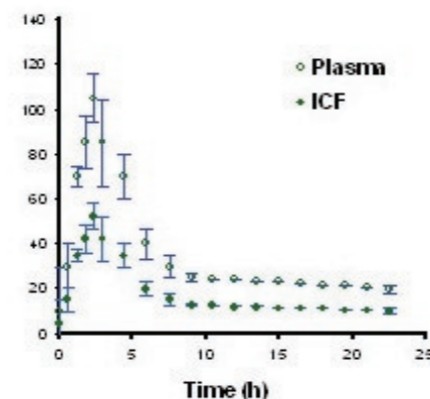


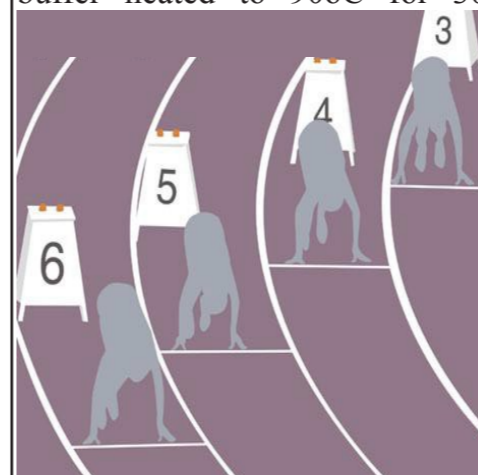
Figure.2
 (Adapted from Persky et al. 2003[2])

experienced by creatine once ingested. This measurement period represents the typically time it would take for a full 5 gram dose to pass from the gut into your plasma (see figure 2). As you can see the actual breakdown and loss of creatine is less than a few % “Hardly the huge loss you have been lead to believe occurs by so called stable creatine manufactures”.

Myth # 2
Creatine is 100% converted into creatinine at low pH in minutes if not seconds!

Well in the last myth we have

looked at the short-term or typical time a 5g dose of creatine would take to pass into the blood stream (<6hours Persky et al. 2003 [2]. see figure 2). But what about at other pH levels not in the gut where claims are being made to show creatine is degraded 100% to creatinine across a whole selection of pH values? Well again guys lets take a look at some real data and not just looking at minutes or hours or even day but what about months? Again here is some further data from the Milan conference [3] also available from Patent data [4]. As you can see in figure (3) we have a description of creatine in a selection of pH fluids ranging from 3 – 7 (2g Cr.H2O in 100ml of 0.1M citrate phosphate buffer heated to 90oC for 30



minutes). Now as you could see in figure (1) creatine is so stable its breakdown was accelerated in this next experiment by heating on day 0 then following the breakdown of creatine in different pH’s (see the effect of heating in figure 4). Even with this extreme method you can clearly see after 120 days of suspension in a range of fluids never is creatine degrade 100% to creatinine. In fact we see equilibrium develops (creatine /creatinine) with at worst a 70% loss of initial values at 35 days. Only a slight change in the citrate buffer content (to 0.2M) can actually cause creatine to increase at pH 5, 6, 7 and at lower pH’s such as in the gut (pH 3) maximum loss by day 100 is only in the order of only 40%.

So what does that mean for you? Well practical application wise you could place 17g of creatine monohydrate in any pH fluid of between 3-7 and even in the worse case scenario (gut pH 3.0)

after 4 months of it just sitting there you still would have enough creatine to maintain your muscle creatine stores with this solution following a loading phase i.e. 5 grams worth. Best-case scenario a pH 7.0 solution such as tap water will leave you with 85% of the original dose at day 120. **So anyone claiming a 100% breakdown of creatine in fluids, juices or similar liquids in minutes or seconds are pulling your chain or more importantly your purse strings...don’t be fooled!**

Myth # 3
Most creatine is broken down to creatinine before it ever reaches your muscles!

If this myth were for real then we would expect no change in muscle of plasma creatine levels during the creatine (monohydrate) loading phase. Its common sense but lets take a look at some evidence just to make sure! The

Article Insights

"The truth about creatine"

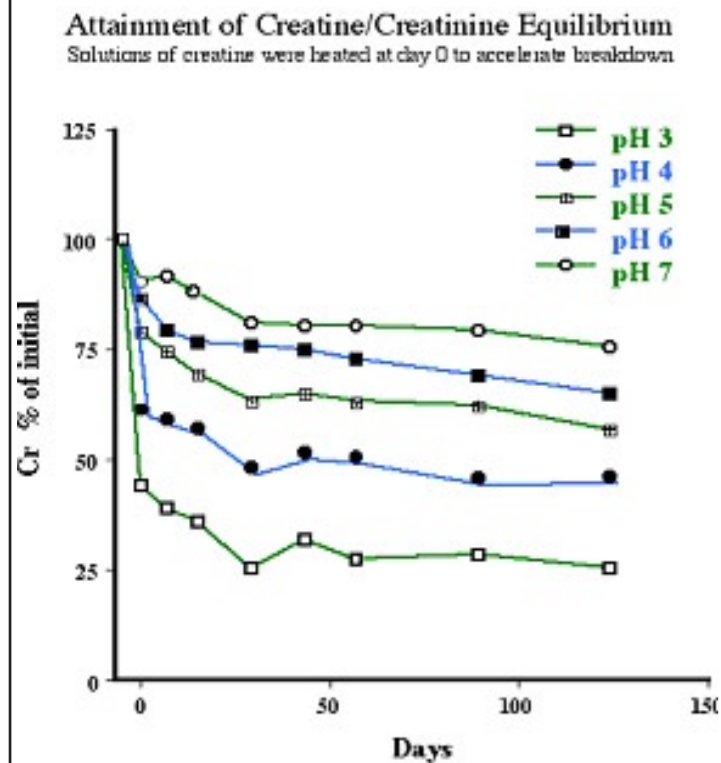


Figure.3
(Adapted from Harris et al. 1999 [4])

first real study to examine this in detail was by Harris et al. (1992) [1] where 5g taken 4-6 times per day for 4 days increased total muscle creatine stores by as much as 50%. What was also demonstrated was that in day 1 of supplementation 60-80% of the administered dose was retained in the body's tissues meaning only 20-40% was lost in urinary output. This loss steadily increased over the subsequent days reflecting the muscle creatine concentrations reaching their upper storage capacity rather than conversion of creatine to creatinine due to the effect of low gut pH on creatine stability. If it was an issue of pH rather than muscle tissue having a finite capacity for retention we would see much less

uptake on day one of supplementation. Again this is real evidence proving "Creatine is not degraded 100% to creatinine in low pH environments such as the gut".

On a secondary note many companies have further exaggerated poor absorption of creatine by calculating creatine taken up into muscle versus the total grams of creatine given as a supplement. However, as the published absorption studies in humans use creatine monohydrate not pure creatine you are only giving 0.88grams of pure creatine per gram of creatine monohydrate. Another way of looking at this is to say for every 20g of creatine monohydrate (a creatine molecule attached to a water molecule) you are in real terms giving 17.5 grams of pure creatine. Therefore, unless actually base you calculation on pure creatine delivered you will underestimate the actual creatine retention levels. Because many of these supplement companies know this they can provide incorrect figures for absorption so be aware.

Myth # 4

Creatinine is a toxic waste product that should only be formed from your muscles!

Bulls**@... this is the worst lie of them all! Creatinine is a natural byproduct of creatine metabolism and any product, I mean any product that

tells you they can increase your creatine levels will also increase your excretion of creatinine. But that said what about the claims creatinine is a toxic waste product? Cause cramps or bloating? AND finally should creatinine only be formed in your muscle cells and not before (as claimed)? That's right guys these factors are all claimed to be a consequence of creatinine formation from supplemental creatine but are they correct?

Again these claims are scientifically incorrect and darn right inflammatory. Creatinine is formed not only from creatine metabolism in muscle tissue but also from other tissues that metabolise creatine such as your brain. So what about the cramps and bloating? Well again no literature to back this up either with regards creatinine being the source of these problems. The likelihood is that creatine is the causative factor especially when it comes to cramps due to associated increases in intracellular fluid levels during loading (0.5 – 2kg). However, this is not a new phenomenon as the same occurs with glycogen loading. Hence, the recommendation during the initial loading phase that extra water should be taken on board maybe beneficial. However, the whole issue of muscle cramping has been covered in the scientific literature with no evidence of cramping presented in a study of US college football players monitored for up to 84 days taking 2-25g Cr.H₂O/ d (Greenwood et al. 2003) [5].

Finally, what of the main claim of creatinine being toxic? Again evidence to the contrary folks. The confusion and misrepresentation of the facts about

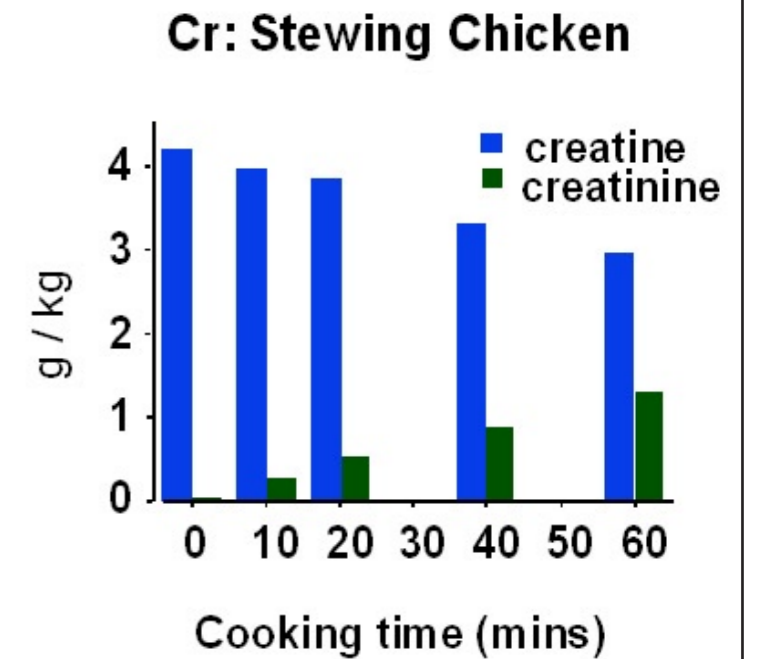


Figure.4
(Adapted from Harris 1999 [3])

Because creatinine is used as a by physicians as a marker of kidney function when elevated levels are found automatically physicians can jump to the conclusion of kidney malfunction. The fact is this could not be further from the truth because as creatine intake is increased (either through meat intake or supplementation) creatinine excretion will also increase concomitantly. In fact numerous papers have been published of which I am sure many of you are well aware of proving the safety of creatine supplementation including: Juhn and Tarnopolsky, 1998 [6], Kamber et al. 1999 [7], Kreider et al. 2003 [8]; Mayhew et al. 2002 [9]; Mihic et al. 2000[10]; and Volek et al. 2000[11] to name a few. These studies up to 10 years in length have assessed kidney function and many other markers of health and no negative impact of supplementation was seen.

The recent suggestions and statement that so-called new data is backing up creatinine toxicity is not backed by any reference material in anyway shape

or form. Even though there is some data within the literature as hypotheses or case studies these so called incidences of toxic creatine supplementation on closer inspection reveal subjects were already on medication that influences creatine metabolism such as cyclosporin and/or had pre-existing kidney malfunction (nephritis syndromes). Therefore, we have no choice based on all the available evidence to conclude creatine is safe and effective when taken in recommended quantities.

NOW FOR SOMETHING NEW...Beyond the so called inert and toxic creatinine is actually beneficial to our bodies in many ways let me shed some light on something you may not of heard of. For some years now the bacteria in our gut and intestinal tract know as intestinal flora has been shown to be vital for optimum immune system function [12] as well as absorption of many important nutrients with respect to bone health and muscle metabolism eg. Calcium [13]. So how is this related to creatinine formation? Well creatinine is simply not just finished regarding its metabolism in our bodies once it is broken down from creatine. It can take many pathways in our bodies, one of which is to chemicals (1-methylhdantoin) that provide a nitrogen source for or gut flora [14 - 17]. So in some ways creatinine is a natural and beneficial resource for our bodies and not a TOXIN some are tying to make us believe. We already know that this beneficial bacterial flora has adapted to exist in an acid environment i.e. Gut. Therefore that constant use of highly alkaline (circa pH 12) may damage the efficiency and or kill many

of these beneficial bacteria leading to decreased absorption of many vital vitamins and minerals. Over time it is even possible the damage to the gut flora by excessive alkaline pH could decrease the uptake of the metabolite they are claiming is absorbed better at alkaline pH "CREATINE".

A Final word

"Fraudulent claims threaten the foundations of our industry!"

With the sports nutrition industry under increasing governmental pressure on the safety and self-regulation of our supplements widely inaccurate claims can add further fuel to the fire. Suggesting a supplement that has been the saving grace of our industry for the past decade is toxin producing threatens the very core of research proven efficacious products out there. The worst part of all is they cite not one specific reference to back their claims on toxicity of creatinine. Now it seems to me if this stuff is so fantastic why has no peer reviewed studies been ran on it? The typical reply from charlatans like this is oh its in press. Well as in what journal then contact the journal guys and you will find that there is no actual submission at all. The fact is if they claim that X product does not convert to creatinine yet elevates creatine stores in muscle it is common sense that whole body creatine turnover will also increase and with it a larger release of creatinine wha ever way you cut it. Remember you need a 20-30% increase in total muscle creatine stores to influence performance. I am all for innovation as long as

compounds are proven safe; but when clinically valid nutrients such as creatine are attached by sudo-scientists with no academic qualifications something has to be done. The future of the industry is in your hands as well as scientists like myself so lets spread the word and protect nutrients that provide the foundations of which our industry and lifestyle are built.

Nb. For your interest other studies on creatine stability confirming the work of Professor Harris are listed in additional materials following the central reference list.

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