

Lack of Knowledge on the Use and Benefits of Creatine

Discovering the price at which the potential risks outweigh the potential benefits of creatine supplementation for the average college student

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Summary

The main issue with creatine supplementation is that creatine supplements are not regulated by the FDA and so there is almost no uniformity among products. In addition, the labels are difficult for most individuals to understand, which makes trying to ascertain what people put into their body even more difficult. There is a strong dissociation between people taking supplements and accepting the risks that come along with them. A sample size of 31 individuals were randomly selected to fill out surveys for a research study that examined the association between the perceived risks and the willingness of people to take creatine as a supplement to aid them in their attempt to increase lean body mass. When it came to the negative side effects such as suffering from severe dehydration, kidney and liver damage, heart problems, or dying at a young age, people were not willing to pay as much money. On average, people did not think charging over \$15 for a 1 pound container was worth the risks.

Video Link

Our informational video will be available at: <http://youtu.be/teXS5wCWpTo>.

Introduction

Creatine is an organic acid that was discovered by Michel Eugène Chevreul as a component of skeletal muscle in 1832. It provides cells of the body, particularly those in muscle, with energy through the formation of adenosine triphosphate (ATP). According to the University of Maryland Medical Center, half of the creatine within our bodies is produced by the body and the other half is obtained from the foods that we eat. It is naturally produced by the body from amino acids within the liver, kidneys, and the pancreas. The body synthesizes creatine in adequate amounts needed by the body. For this reason, it is not an essential nutrient. Nearly all stored creatine within the body is stored in skeletal muscle and it can also be obtained from

certain foods including meat and fish, but mainly meat. Vegetarians do not eat meat and for this reason they tend to have lower levels of creatine within the body when compared to individuals who do eat meat. In addition, Vegetarian diets tend to be low in protein, which the body uses to synthesize creatine.

Creatine Use in High School

(GC) Creatine has become a popular supplement for use as an ergogenic aid to increase lean muscle mass. Creatine supplementation has been shown to increase physical performance during high-intensity performance which lasts thirty seconds or less, such as sprinting and weightlifting. Furthermore, it has been shown to be particularly efficacious during performances that require a number of repetitions. Consequently, creatine has become particularly popular among professional and novice athletes (e.g., high school, college, and recreational football, lacrosse, and hockey players) alike. This is sometimes a concern due to the fact that some athletes, especially younger ones, tend to regulate their intake inadequately and they often take more than the recommended amount. When taken at high doses there increased complications due to side effects such as dehydration and kidney damage, as previously mentioned. Creatine supplements come in a variety of forms including powders, liquids, tablets, capsules, energy bars, and drinks such as carbohydrate solutions, which are easily accessible by any student athlete. Some studies found that carbohydrate solution taken in conjunction with creatine augments creatine levels in muscle more than taking creatine alone, and so creatine drinks have become increasingly more popular.

Purpose of Creatine Supplementation

(PG) Creatine supplementation helps athletes with their performance. Many people are aware of its benefits, but avoid reading over its side effects or simply its uses. Creatine is used to help skeletal muscles use energy for high intensity activities. The phenomenon of using creatine as an aid started in early 1990's. Since creatine is a protein, it could be metabolized first by the body to yield energy during a high intensity workout. The quick yielding energy allows an athlete to make rapid movements during a game, thus yielding a greater performance. Since it helps athletes not use their stored muscle glycogen and cause a rapid depletion, supplement companies feel that they can make a profit off of consumers who believe in muscle building by the means of protein aids such as creatine. Consumers, who are simply ignorant of the fact that creatine supplements are worthless products of moneymaking business and foolish marketing tactics, believe that creatine will help them "grow" muscle, because it is protein for the muscle.

Effectiveness of Creatine Use

(GC) The effectiveness of creatine use to increase performance depends on a variety of factors including fitness level, age, the type of sport or activity, and the dose taken. Individuals who have lower levels of creatine, such as vegetarians, seem to benefit from creatine supplements more than individuals who already have high creatine levels. In addition, creatine

does not seem to improve performance in aerobic activities. Creatine has not been shown to improve performance in older individuals ages seventy and older. The reason for this is not yet known. There is still much uncertainty regarding the type of individual who can most benefit from its use, the optimal dosage for an individual, and the effects of creatine, particularly any long term effects that may stem from its use.

Scientific Basis of Creatine Supplementation

(PG) As mentioned earlier, creatine could be known as a muscle enhancer on the basis of performance. It is quite true as scientific evidence proves; however, as one source mentions, “unfortunately, claims have escalated beyond science, and now athletes from a wide variety of sports have begun taking this substance,” (Jenkins, 1998). The author of this source continues describing that creatine is only beneficial for certain activities, and not all. The creatine that will be used when high intensity work is causes a depletion of ATP is phosphocreatine. Phosphocreatine is what is used in order to convert ADP to ATP, and then ATP is then used for energy. Phosphocreatine (PCr) can only used for about two to three seconds. Looking over this fact, a question arises: then why do people think PCr will help them during their workout session, when in fact it only last the first two to three seconds of a workout? The short-term effects of creatine are only beneficial for performance, not energy usage for an entire workout. Furthermore, this article describes that PCr is used for power athletes and not endurance athletes. This is because power athletes use anaerobic methods more for their fast-twitch (type IIb fibers) rather than aerobic methods that endurance athletes use for their slow-twitch (type I fibers). Looking at the exercises for building muscle, muscle gain or bodybuilding requires endurance. Since endurance is required for resistance training, then why would the muscle fibers used in the exercise require anaerobic methods such as PCr to provide ATP (energy) for their systems? This shows that PCr is not a supplement that could be used to build the kind of muscle bodybuilders would want to.

Additionally, this article also describes that, “creatine that is normally present in human muscle may come from two potential sources, dietary (animal flesh), and/or internally manufactured” (Jenkins, 1998). If the body already makes creatine, why would you need to supplement more to the body? One answer could be that the more exogenous creatine a person takes in, the less the body produces endogenously. However, in either case, creatine is still excreted via the kidneys as creatine (if excess) or creatinine (its side product when creatine is metabolized). This shows that creatine serves no purpose in storage when it comes to muscles. It is a quickly used and then excreted. This is because, there is a significant “ increase, [but it] appears to be [an] upper limit and it has been shown that, even over a few days, a progressively increasing percentage of supplemented creatine ends up in the urine,” (Jenkins, 1998).

Physiological effects of creatine

(GC) Creatinine is produced at a constant rate, dependent on the amount of muscle mass an individual has, and nearly all the creatinine produced is excreted from the body. Although the

normal level of creatinine in the blood is about 0.6 to 1.2 milligrams, this may vary by sex or even by age. Sex is an important factor since creatinine levels in the blood are directly correlated with muscle mass and men typically have more muscle mass. Because nearly all creatinine is removed from the blood and creatinine levels are usually fairly constant, creatinine levels can be used for certain medical examinations. Creatine levels, however, may increase temporarily if an individual is dehydrated or is taking certain medications, including blood pressure drugs as well as non-steroidal anti-inflammatory drugs. High creatinine levels can be associated with impaired kidney function. Kidney damage cannot be undone and individuals who have kidney disease, kidney failure, or a disease that may increase an individual's chance of developing kidney disease such as diabetes should be especially cautious when using creatine. It is recommended that they avoid creatine use, as repeatedly suggested. The kidneys filter creatinine from the blood for excretion, and the more creatine individuals have in their body, the harder the kidneys will have to work.

Prolonged Use of Creatine

(PG) Still the question arises, then why is creatine needed to “build” muscles, especially for non-athlete gym-goers? One important reason why creatine supplements really do not have benefits for bodybuilders is because of the side effects. Prolonged use of creatine supplements cause muscle cramping, especially in heat. This would not be suitable for a body builder or simply someone who wants to build muscle, because the muscle would fatigue quicker. Other complications include nausea, gastrointestinal disturbances, elevates liver transaminases and acute renal injury (due to overload of protein excretion and urine concentrations that are unusually 90 times greater than normal). The renal injuries could become severe overtime and may cause kidney stones, because creatine dehydrates the body.

A reliable source, American Academy of Orthopedic Surgeons (AAOS) supports Jenkins claims. ASOS mentions that creatine is a natural product, but the creatine supplements have synthetic creatine, which is not so natural to the body. That is why there is no guarantee of safety and purity. In fact, creatine is over-the-counter, and not many users know how much to take. In fact, U.S. Food and Drug Administration (FDA) does not even regulate creatine. Although, this could be because it is not toxic like vitamins, it still has side effects that many people are unaware of. Other adverse effects include that creatine causes the muscles to retain water. This would draw water in from other cells into the muscle. This is the reason why many people feel as if they are “building muscle”, because it is just water weight in the muscle. Little do consumers know that they are not building muscle or increasing Lean Body Mass (LBM or muscle mass), they are simply increase Free Fat Mass that consists of mainly water, not muscle. Therefore, water retention means that the body will be dehydrated. This is why when ingesting creatine, it is important that the individual consumes a great amount of water. In fact, if this is not taken with precaution, long-term use of creatine supplements includes risks such as muscle cramps (due to increase body weight due to water), dehydration, diarrhea (because of dehydration), nausea (due to dehydration) and seizures (due to increase protein intake).

Problems with Creatine Supplementation

Another problem that ASOS states is that it is dangerous to take creatine supplements when certain sports require dehydration, for example like wrestling. Furthermore, more ASOS mentions that it is dangerous for someone who is trying to lose weight. This is because, water will be retained, which increases weight, and not decrease it. Plus, an increased water weight will keep the fact in the body, since fat storage requires water. ASOS also mentions some unknown health risks. These are unknown, because the field of medicine does not understand why these risks occur. Some side effects doctors encountered were on important organ systems, which include the heart, brain, liver, kidneys and reproductive organs. In fact, long-term use of creatine could cause muscles to shrink and fail, which could be because of increase water weight that puts pressure on the muscle. Since cardiovascular system consists of muscle, specifically the cardiac muscle, creatine would have adverse effects on the heart. This is why there are cases of heart failure and/or heart disease with excessive creatine use. Adding to the list, stroke would be a risk factor, along with muscular and neuromuscular disease. Furthermore, extensive use of creatine supplements is detrimental for growing children. This would not only include children sports, but also high school sports, and to an extent college sports, dependent on the individual's growth. Risks are greater in children and adolescents younger than 18 years. Also, this would include pregnant women or nursing women, because the fetus and the infant are developing.

Another risk group would include renal patients. This is because, creatine causes a urine overload in the kidneys, as mentioned earlier. ASOS suggests that an individual should only advice a doctor before taking creatine supplements. This is very trivial, because doctors have medical histories of their patients. Since doctors understand the field of medicine, it is important patients and prospect creatine consumers speak to their doctors about creatine supplements. One strong reason why this should be reinforced is because combining creatine supplements might interact with over-the-counter medications, prescription drugs, vitamins and energy drinks. Examples include: Non-steroidal anti-inflammatory drugs (NSAIDs; common forms are ibuprofen and naproxen, commonly known as Motrin/Advil and Aleve, respectively), Caffeine (could cause dehydration and stroke), Diuretics (can lead to dehydration and kidney damage), Cimetidine/Tagamet (can cause kidney damage. This could be quite fatal if precautions are not taken. However, creatine must be regulated, because it is so easy to get and easily used, it is hard to regulate the use of it. It does not have as many short-term effects as it has more long-term effects. Also, creatine is only beneficial if you take it while exercising and training. Creatine will not work without any exercise. It will flush out in the urine if you just take it in as a supplement like Vitamin C. However, there are medical uses of creatine that are important to understand also.

Impact of Creatine Supplementation

According to the research by the University of Maryland School of Medicine, there are some benefits to creatine use. As mentioned earlier, athletes use creatine for training in sports,

but doctors also use creatine to treat patients. Studies show that creatine use could help heart disease. This is because creatine can help lower levels of free triglycerides in the blood plasma in both men and women. However, this is the case if there is no extensive and excessive use of creatine. Minimal use of creatine actually helps increase amount of exercise, and since exercise has medical benefits on the heart, patients with heart disease can benefit from creatine use to increase their exercise levels. In fact, a symptom of heart disease is quick fatigue, and since creatine increases fuel for use, the body has more fuel to use, and thus, the body will have a delayed fatigue. Furthermore, creatine can help lower levels of homocysteine. Since homocysteine is linked to heart disease, heart attack and stroke, the effects of heart disease and risk of heart attack and stroke will be decreased.

Additionally, other medical conditions that could be treated include Chronic Obstructive Pulmonary Disease (COPD), Muscular dystrophy, and Parkinson's disease. COPD could be treated, because creatine helped the muscles involved in COPD. Since the respiratory system consists of smooth muscle, creatine helps by increasing muscle strength. This helps with breathing in COPD. Also, it helped training the smooth muscle deal with exercise in terms of breathing while exercise. However, exercise capacity did not improve; similar training the body was increased. One possible reasoning behind treatment for muscular dystrophy is because of decreased creatine levels in the muscle, which could cause weakness. Studies show that creatine intake increased muscle strength, which thus treated muscular dystrophy. Parkinson's disease is similar to muscle dystrophy in the sense that muscles are weak. In order to increase muscular fitness, creatine intake was necessary. Creatine helped by increasing muscle strength and prolonging strength to avoid fatigue. Studies show that patients with Parkinson's Disease benefitted from creatine, because creatine helped by improving exercise ability and endurance. Studies also show that creatine supplements elevated the moods of Parkinson's Disease patients, which helped decrease the amount of prescribed medication they required. This shows that creatine could be beneficial, but only for short-term uses and only when it is prescribed by doctors. Although supplements are given to compensate or increase levels of creatine in the body, creatine could easily be found in many natural substances.

Creatine, as mentioned earlier, is not just a synthetic product of a moneymaking business like GNC. Creatine, in fact, could be found in many foodstuff. Supplements could be sold as powders, liquids, tablets, capsules, energy bards, fruit-flavored chews, drink. However, dietary sources include lean red meat and fish (specifically herring, salmon and tuna). A question then arises, which is, then why is creatine "needed" for body builders or just individuals who want to gain muscle? Food is sufficient to have creatine, then why have more and then deal with long-term consequences. The problems is people think that if something is good for you, then you could take an overdose, and it will be even more beneficial. This is not the case with excess creatine. In fact, creatine supplements will not do anything if solely creatine is taken. Exercise and creatine must be used together, but creatine levels must be regulated. Thus, it is important for consumers to understand the uses of creatine, the appropriate time to use creatine, the appropriate amount of creatine and the accurate directions of how to use creatine.

Creatine regulation

(GC) Although creatine has become more and more popular over the years, along with many other supplements, creatine is not regulated by the FDA, as stated earlier. Creatine supplements can easily be obtained at vitamin shops, and there are usually other ingredients in them as well. According to the New York Times, many doctors say that there is almost no uniformity among products and the labels are difficult for most people to understand. This makes trying to ascertain what you are putting into your body even more difficult. Furthermore, the doses on the bottle are sometimes much greater than the amounts recommended by physicians. For this reason doctors recommend only adults take fitness supplements since their bodies can handle larger doses. Although this is the case many high school athletes use it as well. Nonetheless, the International Olympic Committee and the National Collegiate Athletic Association (NCAA) have not banned the use of creatine. Although this is the case, the NCAA no longer allows colleges to supply creatine to students. The NCAA banned the distribution of creatine from colleges to athletes due to the insufficient amount of research on the possible side effects of creatine. However, students are allowed to obtain creatine on their own. Although this is the case for collegiate athletes, individuals going through basic training in the military are not allowed to use creatine, however, in subsequent training schools it is allowed only at the discretion of the instructor.

Medical uses for creatine

In addition to its use as an aid in performance, creatine has many medical uses as well, including uses for congestive heart failure, depression, bipolar disorder, Parkinson's disease, diseases of the muscles and nerves, gyrate atrophy, high cholesterol, McArdle's disease, as well as other various diseases. Creatine may slow the progression of symptoms for individuals with early Parkinson's disease. It may increase strength in individuals with muscular dystrophy or improve strength and endurance in individuals with heart failure. One study demonstrated that individuals who were diagnosed with heart failure and took creatine were able to increase the amount of exercise that they could perform before becoming fatigued. In addition, creatine has been shown to lower levels of homocysteine, which is associated with heart disease, heart attack, and strokes. According to the University of Maryland Medical Center, creatine may help to lower triglyceride levels in the blood in individuals with high blood triglyceride levels. Doctors are the only individuals who can regulate creatine uses. However, many student athletes are normal, and do not visit doctors on a regular basis as an adult would. Since creatine is so easily accessible, the problem is that there is not method of regulation. Thus, athletes and consumers misunderstand the uses of creatine and fall into trouble when they abuse creatine supplements.

Long-term consequences of creatine use

Although there is much information on the benefits of creatine on performance, there is much less information available on the possible health risks that creatine poses. According to Schröder and colleagues, the only documented side effects resulting from the supplemental use

of creatine have been weight gain which may be partially attributed to water retention, and increase in pressure in the anterior compartment of the lower leg. They performed a longitudinal study to investigate the effects of creatine on hepatic, renal, and muscular function. Their study proved inconclusive in finding any detrimental effects of creatine as some markers of kidney damage could be attributed to other factors such as increased muscle mass, as repeatedly emphasized. Unfortunately, there is limited information if any regarding the long-term effects regarding the use of creatine.

The Hype About Creatine Supplementation

Many adolescent individuals use creatine. Some use it to alter their muscular physique or appearance. Others use it to improve performance in a sport, the most popular of which are wrestling, sprinting, bodybuilding, football, and hockey. People often use supplements for “instant gratification”, they want to see results as quickly as possible. Many young individuals use advice from the Internet or their peers when seeking information regarding creatine. However, many of these individuals may take it in greater doses than is recommended. Creatine by itself will not enhance performance. An individual using it still needs to exercise to benefit from using it, unless it is taken for a pathophysiological reason. Another danger that creatine possess is that individuals who use it do not understand the mechanism by which it works, or they do not want to put in the time and effort of exercising and instead just believe that somehow it is doing something for them. For this reason there seems to be a disconnection between why individuals take creatine without fully realizing its effects of the body.

What Needs to be Understood of Creatine Supplementation

(RS) Despite the potential side effects of creatine, people are still willing to take this supplement because they feel that it will help them build muscle. The vitamins and minerals in supplements are good for the body when taken in small dosages, but when they are taken in large quantities such as in supplements, it is unknown whether there are dangerous side effects. There is concern as to whether or not creatine can be harmful to the liver or kidneys, yet regular people who are not professional athletes take this unnecessary risk because they want to look a particular way or increase their muscle strength. For professional athletes and people who plan on participating in the Olympics creatine can give an athlete the edge they need to win or at least be competitive. The average person is not trying to subtract a few milliseconds off their 100 meter dash or gain an extra inch on their vertical jump to get above the competition. So the question then becomes why the average person takes creatine along with the potential side effects when they can achieve the results that they want simply by going to the gym regularly and eating healthy. Creatine is too readily available and it is very cheap to obtain. It is no wonder that people are willing to buy this supplement. If for a few dollars a person can take something that has the possibility of making them look better, it is almost dumb not to at least try it. What will it take for people not to creatine as a supplement? At what point does the price or the risk of

taking creatine outweigh the potential benefits?

Reasons why individuals take supplements

There are many high school students who take supplements such as energy drinks, protein drinks, vitamins, herbal supplements and creatine for various reasons. Jennifer A. O’Dea (2003) describes in “Consumption of nutritional supplements among adolescents: usage and perceived benefits” some of the reasons for taking these supplements. O’Dea (2003) found out that some of the reasons high school kids take supplements includes health, prevention of illness, sports performance, energy, and muscle gain. It seems like many high school students learn about the benefits of the supplements from other people such as friends and family without doing much of the research themselves. Kids are only becoming aware of the benefits of supplements and are not particularly exposed to the potential side effects. Without knowledge of both the benefits and side effects of taking supplements, kids cannot appropriately weigh the risks against the benefits and make a decision whether or not to take them. O’Dea (2003) that students who take energy drinks claim that it gives them a boost of energy. She goes on to discuss how students are confused about what is really giving them the boost of energy. Caffeine, which is a stimulant, is what is making these kids feel like they have more energy. This shows that some kids feel like the drink is creating energy in their body, and they do not realize what exactly is going into their body to create this energy.

A lack of knowledge is a big problem when kids are taking these supplements. O’Dea (2003) explains that many kids are not aware of the potential risks involved with taking supplements or they simply ignore the risks because of the potential benefits. This shows that in high school students’ minds the potential gains are worth the risk they have to take to take the supplements. They do not feel that the risks are severe enough. Some of the reasons that high school students may take supplements are that they tend to be involved in experimentation with new behaviors and increased conformity to peers and peer influences (O’Dea 2003). It is also important for boys to be good at sports, therefore, it is no surprise that high school boys take supplements to enhance their performance (O’Dea 2003). The way to help high school students make the appropriate decision of whether they should or should not take supplements, they should be better informed of what goes into their body and how they can get the vitamins and minerals supplements are supplementing. With all of these reasons for high school students to take supplements such as creatine and the lack of knowledge of why it may be harmful to take these supplements, it is an easy decision for students to take the risks that come along with supplementation. It is now somewhat understood why younger people take supplements, but why do college students and adults take these supplements when they know the potential side effects and when, for the majority of people, are done with athletics?

Sources of Creatine

Dietary supplements are becoming more and more popular among adults. The European Union (EU) Directive on Food Supplements defines dietary supplements as food stuffs the

purpose of which is to supplement the normal diet and which are concentrated sources of nutrients or other substances with a nutritional or physiological effect, alone or in combination, marketed in dose form, namely forms such as capsules, pastilles, tablets, pills and other similar forms, sachets of powder, ampoules of liquids, drop dispensing bottles, and other similar forms of liquids and powders designed to be taken in measured small quantities (Egan, Hodgkins, Shepherd, Timotijevic and Raats 2011). This means that supplements are meant to be taken in conjunction with a healthy diet. They are not meant to be taken as an alternative to eating healthy. Furthermore, it is made clear that supplements are meant to be taken in small quantities to be effective. Too often, people take large quantities of supplements thinking that more has to be better and will have a stronger effect. This is a common misconception. It is often that large quantities of supplements such as creatine are helpful at small doses and potentially very harmful at large dosages. There are many reasons for adults to take supplements. They are taken for both physical and psychological reasons. Egan (2011) describes that adults take dietary supplements to cure ailments, prevent disease, gaining “peace of mind”, supplementing a poor diet, and saving money on medical care. Adults have different reasons for taking supplements than young adults, but, regardless of the supplements being taken, they all have their own risks when taken in large dosages. A survey regarding the safety and testing of herbal products and dietary supplements revealed a number of misperceptions among the survey respondents and that two thirds of all respondents falsely believed that such products pose no risk to the general population and the majority incorrectly thought that the Food and Drug Administration test and regulate these products Egan (2011). This shows that even adults are misinformed or ignorant about the use of dietary supplements. This can be helped by educating the population. Many people are taking supplements without realizing what the harmful effects are. Adults hear that certain supplements have health benefits and without much research they believe what they hear and they feel that they are healthier when they take these supplements.

Dissociation Between Risks and Benefits

There is a strong dissociation between people taking supplements and accepting the risks that come along with them. Anytime a person puts anything into their body there is at least a small risk. The individual does not know what else was added to the supplement or how exactly the supplement was made. There are risks such as potentially harming the liver or kidneys. There are also well known risks such as dehydration. It is known that when an individual takes creatine, they have to consume much more water than they normally would. Anything that asks you to change your lifestyle, such as the amount of water you intake, should be taken with caution. Young adults are taking supplements like creatine to enhance their performance in sports and to put on muscle mass. This is all because they have an image in their head of what they feel like they need to look like, and instead of working hard by going to the gym there is this illusion that there is a magic substance that can do the work for them. Until the prices of these substances become more expensive, people will continue to buy supplements like creatine and protein powder in hopes that they will not have to work as hard to achieve the desired results. If the price

of creatine was 50 dollars would the general public be as willing to purchase it? What if the price of creatine was 100 dollars? What if the risk of taking creatine was known to cause liver and kidney damage or if it increased the mortality rate in people? Would people still be so inclined to taking these supplements?

Supplements can be useful when used correctly, but a large number of people are misusing these supplements. Supplements can easily be replaced with the right diet. The main purpose of a supplement is to get vitamins and minerals that you do not normally get. People over use these supplements and get too much of the vitamin or mineral which can be just as dangerous as not getting enough of the vitamin or mineral. The goal should be to have people get away from using supplements by getting the necessary nutrients a more natural way through a healthy diet. Even creatine is found in certain food. It is just too easy for people to take a magic pill or drink that claims it can do the work for them when there is such a small cost in terms of price and accessibility. People are always looking for an easy way out and the objective is to figure out at what point people will realize that there is no easy way to achieve their goal.

Survey to Determine the Price Point for Purchasing and Consuming Creatine

For our service project, we intend to find out what it will take for college students to stop taking unnecessary supplements, mainly creatine. We want to know at what point the students realizes that the risks of taking these substances outweigh any gains they can achieve. We want to find out exactly what price will be considered by most to be too much to pay for creatine, and will it prevent them from taking it. At what point does this supplement become not worth while? We also want to see when the perceived risk will be too much for the people taking creatine. It is assumed that creatine can harm the liver and kidneys but there is still much unknown about it. What if there was more known? Would people stop taking creatine if there was a direct relationship between liver and kidney damage or cancer with people taking creatine. We want to know would college students still consider the alleged benefits of putting on muscle mass is worth the chance of developing these diseases.

People are ready to take anything they hear will help them look better or get healthier if it is at a reasonable price. They are also willing to take this information and trust it completely without considering how these supplements are meant to be used or how much is unknown about them. We hypothesize that there are many people using creatine improperly because they have been misinformed or they have not done the necessary background check on how the substance aides the body. We would like to find out if people know that there are potential side effects that come along with using substances such as creatine and protein. We would also like to find out if people are aware that the FDA does not regulate these substances and if they know that the army has banned its use. If people find out that creatine is not as well regulated as they thought, there is a chance that they might stop using or at least give it more consideration into taking creatine. It is unsure whether people are aware that creatine is available in a healthy diet, and they can get creatine just by eating healthier. People know that any supplement can help you otherwise it would not be on the market. Do people realize that any supplement can be dangerous and

potentially lethal at very high dosages? Would learning more about the substance they are putting into their body prevent them from doing it or is it just much easier to take something and hope it will work better than hard work?

The reason behind anyone taking any supplement is that people feel that it will help them either be healthier or improve a certain type of performance. It is necessary to find out why people take creatine and other muscle building supplements. Did they hear from a friend or a coach that this will help them gain muscle? Did they hear that it will help them train at a higher intensity allowing them to work out harder? Are they taking creatine because they are in some type of high level athletic competition where they would not be competitive if they did not put on a little extra muscle? We feel that there are a large number of people taking creatine for the sole fact of putting on some extra muscle. They are not trying to get better at any type of sport. They just want to have a bulkier look to their physique. People taking creatine might not be working out enough to make creatine effective. If they just take it by themself and do not go to the gym nearly every day then the extra weight they are putting on is just water weight. People today are too impatient, and they want to see results immediately. They can obtain a stronger looking body without taking creatine. They just need to put in hard work, go to the gym regularly, and eat healthy. We want to know when people will stop taking unnecessary supplements. Will the price of creatine affect people's attitudes towards taking it, will the potential dangers that come along with taking creatine stop them, or will simply learning more about the supplement stop them from taking it? We want to get people to move to a more natural way of exercising.

Factors to Take Into Consideration

(PG) From our previous research, we understood the background regarding creatine. By understanding the background, the group was able to put together the service project that was based on creatine supplementation. With the research information and results from the service project, we are able to conclude the effects of price on consumption of creatine supplementation. However, while doing research, we forgot many aspects of creatine supplementation that were important to the project. Therefore, we must cover those parts of research, before we can analyze the results from the service project.

Different Types of Creatine

Since there are different types of creatine supplements, it is necessary to understand the types and their effects. There are three main types: creatine monohydrate, creatine citrate, and creatine phosphate. There are other less common types: creatine malate, creatine ester (ethyl ester), creatine hydrochloride, micronized creatine, Kre-Alkalyn, creatine magnesium chelate, creatine alpha-amino-n-butyrate (creatine AAB), creatine anhydrous, creatine tartrate, creatine glutamine-aurine. Each of these types has its advantages and disadvantages. The most common types are stable, which could be used by athletes or regular gym-goers.

Creatine Monohydrate

(PG)

Creatine monohydrate is the acid form of creatine. Monohydrate is the hydroxyl group that is attached to the end of creatine. This is easily to obtain in powder form as an acid. In water, it is converted to its ionized form. This ionized form could be used to make ATP, which is used for energy in the body. The reason why this works is because the ionized form of creatine can receive a phosphate, which can then convert to creatine phosphate, which is another form of creatine.

Creatine Phosphate

One important and common type is creatine phosphate (PCr) is the type of phosphate that is used in the body to form ATP directly. The phosphate is lost to ADP to make ATP. The reason why this is popular is because it could be used quickly, since it breaks down so easily in the body. It is important in sports and exercise, because it can quickly provide for ATP by donating its phosphate to ADP without the help of any other molecule like as in glycolysis or oxidative phosphorylation. In my opinion, I feel the most convenient form is creatine phosphate, but there is also one other type that is as common as the other two previously mentioned.

Creatine Citrate

Another common type is creatine citrate. In this form, creatine is bound to citrate. Citrate is an intermediate of the Krebs cycle, which is the second step in oxidative phosphorylation of metabolism. This is the process by which ATP is synthesized in greater amounts compared to glycolysis. The advantage of having creatine citrate is the fact that citrate could be used to produce ATP aerobically, and creatine could be used anaerobically to produce ATP. The advantage of creatine is quick ATP, whereas with the citrate, it is a longer process. Creatine in creatine citrate is similar to creatine in creatine monohydrate, because creatine is in its ionic form, so that it can accept a phosphate and work as creatine phosphate indirectly. The reason why creatine citrate is used is, because in muscle building, endurance is required. Endurance requires oxidative phosphorylation, which could provided by citrate. However, in training, creatine helps with quick supply of PCr. PCr is quicker than glycolysis to provide ATP, and thus faster than citrate (oxidative phosphorylation). Another reason creatine citrate is used commonly is because in athletes, it is a convenient method to receive PCr for quick movement as so in sports such as soccer, football, basketball and many others. For sports, which require endurance and power, creatine citrate is ideal. However, there are still less common forms that people use.

Creatine Malate

A type of creatine that is less common is creatine malate. It is similar to creatine citrate, as it is creatine bound to malate. Malate is similar to citrate, because it is also an intermediate in the Krebs Cycle. As mentioned earlier, it would work similar to creatine citrate. The Krebs Cycle will serve to start oxidative phosphorylation, and then continue to the Electron Transport Chain (ETC) to make the majority of ATP. The Krebs Cycle and ETC can only occur in the presence of oxygen. Thus, this would be acceptable in an oxidative environment as in endurance sports. For power sports, creatine is mandatory for energy, because PCr anaerobically (without oxygen) can provide for ATP. Since sports and activities require ATP for energy, it is important to have oxidative and substrate-level phosphorylation (substrate-level as with creatine and glucose). As mentioned previously, creatine will provide for quick energy, and malate will provide for energy in the later stages of exercise. However, there are other types of creatine that are easier for the

body to absorb or even harder to absorb.

Creatine Ethyl Ester

Creatine ester is usually in the form of creatine ethyl ester. This form is its storage form. However it is more easily absorbed compared to creatine monohydrate. It is believed that the ester form is stored in the body to improve cellular function; however, not many studies have been done to prove this claim. Even other forms of creatine supplements that are easily absorbed are used, but that are still less common compared to creatine monohydrate.

Creatine HCl

One type that is more absorbable than creatine monohydrate is creatine HCl. It is 59 times more absorbable than creatine monohydrate. It is because it functions as an acid chloride in the body, and it is highly reactive compared to the acid form. That is why this form is the most effective creatine form. Although, this is the case, it is fairly new, and there are downsides to the fact it is new. But, we will discuss the advantages and disadvantages in detail later. (PG)

Micronized Creatine

Micronized creatine are smaller parts of creatine monohydrate. This form is easily absorbed, because creatine monohydrate particles are smaller. Since it is smaller, it has greater surface area, which allows it to be absorbed quicker. It functions in the same method as creatine monohydrate does, but it works faster, as its absorption time is shorter. This is fairly new like others that were mentioned earlier. However, the other newer ones work a little differently than micronized creatine works.

Kre-Alkalyn

Kre-Alkalyn is a form of creatine that is in the pill form. The reason why it is believed to be more effective is because it is stable until it reaches the stomach. The pH of the stomach breaks down the pill covering, releasing its contents. The creatine can be absorbed by the body and provide function in its targeted tissues. However, this seems very practical in theory; however, it is less common, because it seems to have no function on muscles. This could be understood by its disadvantages, which will be discussed later.

Creatine Magnesium Chelate

Creatine magnesium chelate is a form of creatine that chelates magnesium (hence the name). Chelation means that it irreversibly binds magnesium. Magnesium is in its ionic form: Mg^{2+} . Since creatine is negatively charged in its ionic form, it could bind to positively charged ions. Therefore, creatine in its anionic form can bind to magnesium in its cationic form. The reason why magnesium is thought to have function in the body is because this mineral is involved in muscle contraction with calcium (in its ionic form as Ca^{2+}). Since exercise requires for muscle contraction, Mg^{2+} is thought to help with contraction, while the creatine will provide for energy, as previously mentioned. However, this form of creatine is less common, since it serves as no real function in the body. Since Mg^{2+} is chelated to creatine, it cannot reversibly unbind from creatine. This would make this form of creatine highly useless. However, since it is acceptable in theory, it is still sold, but uncommonly used. In this form, a mineral is attached to

creatine, but there are other forms in which creatine is attached to a protein.

Creatine alpha-amino-N-butyrate

In creatine alpha-amino-n-butyrate (creatine AAB), creatine is covalently bound to an alpha amino butyrate (which is an amino group bound to a hydrocarbon chain). Since this is very uncommon, not much is said about it; however, it is theorized that it functions as an amino acid, since the alpha amino butyrate could be broken down as ammonia and hydrocarbon chain in the urine. The ammonia could be excreted as ammonium (or urea, which is created in the liver) in urine in the kidneys. The reason why this could be beneficial is because when the body can filter out hydrogen ions (since the ammonia could accept hydrogen ions and become ammonium). The hydrogen ions is created when exercise (especially high intensity workouts). Exercise creates carbon dioxide (which lowers pH, since carbon dioxide circulates the body as bicarbonate ions). Also, exercise decreases pH, because lactic acid is produced. Lactic acid is the true product of glycolysis. Glycolysis takes place in the muscle when PCr is not around to provide for ATP. Glycolysis breaks down glucose providing ATP and producing pyruvate. Since levels of CO₂ increase, hydrogen ions are produced. Pyruvate accepts the hydrogen ions and then produces lactic acid. This acid gives the burning feeling in the muscles, but also could be converted back to glucose in the liver via gluconeogenesis to provide for ATP. Since creatine is bound indirectly bound to a hydrocarbon chain, the hydrocarbon chain can provide for energy, as it could be broken down via glycolysis. Since each part of creatine AAB is involved in providing ATP for exercise, this form would be highly accepted; however, this is only a myth. Creatine AAB is absorbed slower, because it is such a large molecule. For it to work, it must be metabolized, which takes a longer process.

Creatine Anhydrous

Creatine anhydrous is a chemical form of creatine that is produced by two molecules of creatine (in its acid form). This is theoretically ideal, because it would give two molecules of creatine compared to one molecule of creatine in all the other forms of creatine supplements. However, creatine anhydrous is the most stable form of creatine, and it is not broken down as quickly. Since it is not as reactive, it will not be broken down in the body as fast, and since it will not be metabolized as fast, it will not be quickly and easily absorbed either. This is why creatine anhydrous is not commonly used.

Creatine Tartrate

Creatine tartrate is a form of creatine supplement that is bound to an amino acid. This form is useful, because the creatine could be used in anaerobic exercise (usually high intensity workouts) and the amino acid could be metabolized in aerobic intervals of exercise (when intensity is lowered or when endurance activities are required). Both parts of the molecule will serve to give ATP. This is also similar to another creatine supplement, which is creatine glutamine-taurine.

Creatine Glutamine-Taurine

Creatine glutamine-taurine is a creatine supplement that is bound to 2 amino acids. Those

amino acids are glutamine and taurine. As mentioned earlier, the amino acids will be required in oxidative phosphorylation and the creatine will be involved with quick anaerobic metabolism. There are many other forms of creatine, which are currently in the market; however, the forms mentioned above are common forms, either frequently used or not as frequently used. There are other forms that are found, but those are not as important to understand, as the ones mentioned earlier. These forms could be found in the powder form or the pill form. (PG)

Forms of Creatine Supplementation

There are two forms that creatine supplements could be found powder or pill. In its powder form, it could be added to a liquid substance and ingested. In the pill form, it would be ingested as the pill, and the pill will be broken down in the stomach, because of the low pH in the stomach. Both forms are readily available over the counter in any local supplement store such as GNC. There are many advantages and disadvantages to the forms of creatine mentioned above.

Advantages of Creatine

Advantages of creatine supplementation are common for all of the types mentioned above. Coming across all the types, the reason why creatine supplements are used is because they are cheap. The fast absorbing ones are the cheapest. Also, a reason why a person can have creatine loading is because overload of creatine will simply be excreted. Excess creatine is excreted in the urine as a waste product known as creatinine. However, excess creatine overtime can cause problems also; thus creatine supplementation has its side effects.

Disadvantages of Creatine

Disadvantages of creatine are that high levels of creatine are highly toxic to the body if left in the urine. This is because creatine could be built up in kidneys, and thus creatine is not recycled in the body. One effective method of creatine supplementation would be in minute quantities. Other side effects were mentioned earlier, but creatine draws in water into the muscle from other parts of the body, dehydrating the body, which can impair functions of other organs. And since it is not regulated by the FDA, side effects are not as frequently documented. It is sad to hear the side effects such as heart problems and dehydration, and therefore, there must be something done about this situation. We would not want students and other young adults misusing creatine supplements and dealing with risks later in life. Our service project helped us understand what it will take to lower these risks and the consumption of creatine supplements.

Results of Survey

After giving the surveys and collecting the data, we gathered information from 10 people who are currently use creatine and 20 people who are not currently using creatine, all which resistance train regularly. Based on the surveys, most of the people who were coming out of the gym that we asked to take the survey resistance train between 3 to 5 days a week. We surveyed 25 males and 5 females. The participants were mostly college students and between the ages of 18 and 29.

Misconceptions Individuals Have About Creatine Supplementation

(GC) Some people who are taking creatine are unaware of exactly how much they are consuming each day, but for the majority they were taking about 5 grams per day. Most of the people who are taking creatine also participate in at least one endurance workout a week. Everyone who is taking creatine did say that they consumed more water while taking it. When it came to listing the pros and cons of taking creatine, many people did not know much more than creatine makes your muscles hypertrophy and you need to drink more water while taking it. Among some of the answers for pros were “get big”, “muscle”, “increased strength”, and “more energy”. Some of the answers for cons was “water weight”, “kidney failure”, “loss of water”, “kidney stones”, and “need water”. Most of the people were not sure of any specific pros or cons. Most people feel that creatine helps with endurance exercises such as running and swimming and they believe that creatine aids the body by making you stronger and/or giving you more energy. Many people are not sure of any other ways of getting creatine into the body. When it comes to the different types of creatine, most people are not sure what the difference is between the different types and do not really prefer one over the other, or they are not sure why they prefer one over the other.

Analysis of Results

(RS) Many people did either did not want to fill in the short answer questions or open ended questions possibly because it would take up too much of their time. For future surveys, we suggest the use multiple choice questions only. People who answered “no” to whether or not they use creatine. This project provided answers to questions regarding how individuals going to the gym perceived the use of creatine, more specifically about its risks and benefits. As this was a random assessment, we can assume this information to reflect that of the Rutgers community. We found that on average most people going to the gym did not use creatine, but that about thirty three percent did use it. This seems somewhat high, but it should be noted that these results reflect the Rutgers community population.

Table 1

	\$1	\$10	\$25	\$50	\$75	\$100	\$150	\$200	Average
If the benefit was increasing your strength?	0	4	9	9	3	4	0	2	\$56.13
If the benefit was increasing muscle mass?	0	4	9	10	4	2	1	1	\$52.10
If it will improve your athletic ability?	0	2	7	12	6	3	0	1	\$56.29
The only benefit was adding water weight?	8	5	6	6	4	2	0	0	\$32.52
It was unknown if creatine can help increase muscle mass?	6	7	6	7	5	0	0	0	\$30.68
If it potentially	13	6	6	6	0	0	0	0	\$16.87

caused kidney and liver damage?									
If it caused severe dehydration?	11	7	9	3	1	0	0	0	\$17.13
If it caused irregular heart problems?	14	6	5	5	1	0	0	0	\$16.90
If you already had a health risk such as diabetes, hypertension, or renal failure?	15	6	6	3	1	0	0	0	\$14.52
If there was a chance of dying in 10 years?	19	6	2	2	2	0	0	0	\$12.23
If there was a chance of dying in 50 years?	15	6	6	3	0	1	0	0	\$15.32
If there was a chance of dying in 100 years?	13	6	6	5	0	1	0	0	\$18.48

Risks/Benefits vs. Price of Creatine



Figure 1

Overall Results of the Survey

(GC) The questions in the survey that asks at what point would the price of creatine outweigh the risk of using creatine. When it comes to benefits such as increasing strength, increasing muscle mass and improving athletic ability people are willing to pay more money to achieve these outcomes. On average people were willing to pay \$50 for a 1 pound container of

creatine. Some people were willing to pay more, and some people were not willing to pay as much as 50 but it was an average. When it came to the negative side effects such as suffering from severe dehydration, causing kidney and liver damage, causing an irregular heart problem, or dying at a young age, people were not willing to pay as much money. On average, people did not think charging over \$10 for a 1 pound container was worth the risks.

Effects of Price on Creatine Consumption

(RS) People were willing to pay more for the supplement when there were positive benefits such as increasing your strength, increasing muscle mass, or improving your athletic ability. However, they were not willing to pay as much when the consequences were negative which included: potentially causing kidney and liver damage, causing severe dehydration, causing irregular heart problems, and if there chance of dying in 10 years, 50 years, or 100 years. Although this was expected it was interesting to see how much people were willing to spend on the supplement if the only benefit was adding water weight to muscle. It seemed that people were willing to spend more on the supplement in this case than if the supplement caused potential health risks. They were almost just willing to pay for a supplement that added weight to muscle as they were if the supplement caused an increase in strength, athletic ability, or muscle mass. The reason for this may be the fact that there were no potential risks attached to this.

Overall, the greater the risk that was associated with using creatine, the less people were willing to pay for it. It seems like if the container was cheap enough, regardless of the risks, people deemed it worthy of taking the risk to look better and increase their strength. Having creatine at a cheap price makes it very accessible to the general public. Having it so cheap makes people overlook the potential side effects. If creatine was more expensive, it would make people really weigh the potential risks with the benefits before they make the decision to buy or consume it. Another main problem is that people do not know how creatine is suppose to help the body or how it can harm the body. This lack of knowledge can help them to make the wrong decision when it comes to buying creatine while it is at such a cheap price. The best way to keep creatine use limited to the population that it is useful for would be to increase the price of creatine. If it was more expensive, people would put more research into what they are putting into their body, and they would really give consideration if taking creatine is right for them or not.

Research Limitations

(GC) Some limitation associated with this study include the fact that the study only involved Rutgers affiliated students, faculty, staff, or other individuals who regularly use Rutgers facilities. For this reason, results from this study may not be generalizable to the sample size of our study was somewhat low which may influence the results. Also, most of the surveys were distributed on only one day, which may influence the outcome of our results. Another important aspect that should not be overlooked is that individuals who do not take creatine may not necessarily understand how much one pound of creatine actually is.

This study looked at individual's thoughts on perceived risk and price of creatine use, which allowed us to establish a relationship between the two variables. However, we feel that it may be more influential to divide the study population into two groups. One group would include the population that regularly uses creatine and the other group would be comprised of individuals do not use creatine. Ideas for future service projects related to the topic or supplements and creatine use could further the communities understanding about the effects of

creatine through seminars or presentations while referencing the information from this service project.

Conclusion

(RS) In conclusion, in order to have college students give more thoughtful consideration to whether or not creatine is the right choice for them, the price of creatine should be increased. In addition, knowledge about the potential risks should be more readily available. Since creatine is so cheap and easily accessible to students, there is no risk associated with spending a few dollars for the potential of a “better body”. With this increase in information and the cost being much higher than it already is, college students will hopefully put in more research to see if creatine going to help them reach their goals or not.

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Letters to the Editor

Geoffrey Casimir

April 4, 2012

Dear editor,

I am currently a senior at Rutgers University New Brunswick. My colleagues and I are performing a community service project for our Ethics in Science and Society class taught by Professor Fagan. We chose to perform our service project on creatine by compiling data taken from surveys that we have given out.

Although creatine has become more and more popular over the years, along with many other supplements, creatine is not regulated by the FDA. Creatine supplements can easily be obtained at vitamin shops, and there are usually other ingredients in them as well. According to the New York Times, many doctors say that there is almost no uniformity among products and

the labels are difficult for most people to understand. This makes trying to ascertain what you are putting into your body even more difficult. Furthermore, the doses on the bottle are sometimes much greater than the amounts recommended by physicians. For this reason, doctors recommend only adults take fitness supplements since their bodies can handle larger doses. The International Olympic Committee and the National Collegiate Athletic Association (NCAA) have not banned the use of creatine. Although, the NCAA banned the distribution of creatine from colleges to athletes due to the insufficient amount of research on the possible side effects of creatine, students are allowed to obtain creatine on their own.

We intend to find out what it will take for college students to stop taking unnecessary supplements, mainly creatine. We want to know at what point students believe that the risks of taking these substances may outweigh any gains they can achieve. More specifically, we want to find out exactly what price they consider it to be too expensive to purchase creatine, and prevent them from taking it. At what point does this supplement become not worthwhile? We also want to see when the perceived risk will be too much for the people taking creatine. Some studies have shown that creatine can harm the liver and kidneys but there is still much unknown about creatine use, especially long term effects

Sincerely,
Geoffrey Casimir

Priyanka Gianchandani

April 2, 2012

To Whom It May Concern:

I am Priyanka Gianchandani, a senior at Rutgers, The State University of New Jersey (New Brunswick campus), anticipating graduation in May. Thus, I am currently enrolled in Ethics In Science and Society, a colloquium class, which fulfills a requirement for School of Environmental and Biological Sciences (SEBS). I am a double major in Exercise Science and Sport Studies, as well as, Nutritional Science, while a minor in Biological Sciences and certified in Women's Studies, as I am enrolled in Douglass Residential College (DRC). I have graduated high school from South Brunswick High School, and thus, as a South Brunswick permanent resident, I felt that it would be acceptable if I wrote to the editor of South Brunswick post to publish my information. I would like the support of my fellow residents to help me speak up about what I feel is ethically right in the community. I feel this is the opportunity I should take, and with having my work be published, I can make a difference in community, specifically to our town. Before I begin detailing our work, I would like to introduce about my topic. My colleagues, Geoffrey Casimir, Robert Stasiak and I are performing a community service project on creatine supplementation that is conducted by our professor. Overall, our service project consists of handing out surveys and have participants fill out surveys. By doing so, we will be obtaining data that we could write our paper on. We believe that although people know (or may not know) the pros and cons of creatine, they are willing to invest in it, because it is cheap. We want to study the effects of costs (of buying the supplements) on the consumption of creatine supplements. If you are not aware of the pros and cons of creatine, I would like to detail them for you.

Creatine supplements are for those who want to gain muscle, as many believe. Little do people know (or chose to ignore this part) is that it is not an increase in muscle that these supplements function to do, but in fact, they cause an increase of water into the muscle, which makes the muscle look bigger. Also, creatine has become popular over the years, yet is not regulated by the FDA. Creatine supplements can easily be obtained at vitamin shops such as GNC, but the FDA is not considering it legal or illegal. However, this could be a threat to many consumers, because any substance that is passed by the FDA has proper screening done. Thus, because it is not regulated, we do not know what the source of the distribution of this supplement can be. Even though, it might seem like the biological creatine the body makes, according to the New York Times, many doctors say that there is almost no uniformity among products and the labels are difficult for most people to understand. Therefore, a person is ascertain of what they are ingesting. Furthermore, the doses on the bottle are sometimes much greater than the amounts recommended by physicians. For this reason, doctors recommend only adults take fitness supplements since their bodies can handle larger doses. In fact, it is highly dangerous for younger children, because it accompanies high levels of homocysteine that lead to increased risk of Cardiovascular Disease and many other medical risks. Consequently, the International Olympic Committee and the National Collegiate Athletic Association (NCAA) have not banned the use of creatine. Although, the NCAA banned the distribution of creatine from colleges to athletes due to the insufficient amount of research on the possible side effects of creatine, students are allowed to obtain creatine on their own.). Adding to the list, some studies have shown that creatine can harm the liver and kidneys but there is still much unknown about creatine use, especially long term effects. This is why we feel that we should reach our to the community, especially to the sport teams in South Brunswick, as we are concerned of the consequences of creatine supplementation. We want the South Brunswick Township to be aware of this topic.

All in all, we are requesting South Brunswick post to take our topic seriously. We intend to find out what it will take for college students (as well as high school students) to stop taking unnecessary supplements, mainly creatine. We also want to understand what is the limit at which students believe that the risks of taking these substances may outweigh any gains they can achieve. More specifically, we want to discover out exactly what price they consider it to be too expensive to purchase creatine, and thus, prevent them from taking it. Overall, it would answer the question: at what point does this supplement become not worthwhile? This would help us formulate a conclusion for when the perceived risk will be too much for the people taking creatine in the mindset of student athletes (or just student gym-goers). Thank you for taking the time to take our topic into consideration. I hope that we can make a difference in the community.

Sincerely,
Priyanka Gianchandani

Rob Stasiak

My name is Rob Stasiak, I am a SEBS senior and I am a student in professor Fagan's Ethics in Science and Society class. We are conducting a research study on the disconnection between the use of creatine as a supplement and the risks associated with using it. For those who are unaware, creatine is a supplement that is taken along with resistance training to increase muscle size and performance. There are many perceived risks when taking creatine such as increased strain on

kidneys and potential heart problems. Also, it can be rather expensive to buy creatine constantly. There are many people who claim that they know what they are putting into their body and why they are doing it, but in reality they are misinformed. Our experiment consists of taking surveys from a variety of college students, some which use creatine as a supplement and some that do not use it as a supplement. Regardless, we are looking to survey college students who resistance train regularly, and we want to see what they know about creatine and how they would react to certain situations. The survey will take approximately five minutes. We will be outside the Busch, Cook, College ave, and Livingston gyms at various times. Thank you.