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*Case Report*

# Creating Creatinine: How to Pass a Urine Drug Test

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**ABSTRACT**

Here we report on a patient that consumed recreational drugs, successfully passing a urine drug screen (UDS) by consuming a marketed detoxification product. After some exploration of the product consumed, there proved to be a viable mechanism by which the UDS outcome can be manipulated. The UDS relies on urine meeting specific concentration criteria to validate the sample. Dilute samples may mask the tested drugs as they fall below a concentration threshold for detection. Common UDS require a specific gravity with a reference range of 1.003-1.035 and a urine creatinine concentration above 20 mg/dL. Participants are told not to drink fluid for 4-5-hours pre-test to allow urine to concentrate above these thresholds. The 21-year-old female we describe along with each UDS had lab drawings on two separate occasions in which both measurements revealed elevated serum creatinines of 1.8 mg/dL. She had ingested QCarbo Maximum Strength Same-Day Cleansing Formula™, a marketed detoxification product, the day prior to the lab draws. The product recommended that the consumer ingest a large volume of water to "flush" the drugs from the body. This resulted in dilution of her urine to cause the drug levels to fall below the detectable range, while still exceeding the urine creatinine concentration to provide a valid test. Although she was unaware that this product increased both serum and urine creatinine, this proved successful. She passed the test and was awarded the position.

**Keywords**
Urine drug screen; Urine drug test; Creatine; Creatinine; Detoxification.

## INTRODUCTION

Here we present a novel case. Interestingly, it is a method currently being used by recreational drug users to pass a urine drug screen, however, the exact scientific methodology is not apparent to this community. Here we describe the technique used to successfully pass the screen despite active drug use. It arose when a patient presented to the Nephrology clinic with apparent renal dysfunction. After some discussion, she admitted to consuming an acidic beverage high in creatine monohydrate and hydrating excessively. This diluted her urine to allow the detected drugs to dilute below a threshold for detection, whilst providing high enough filtered creatinine to pass a valid threshold. The case is backed up by clinical research but to my surprise, it has not been reported on patients in the past. As drug use and marijuana legalization increase in the USA, we would anticipate this method to be used with increased frequency.

## CASE PRESENTATION

A 21-year-old female presented to our nephrology clinic with two separate laboratory tests that indicated elevated serum creatinine. Her clinical history was remarkable only for attention deficit hyperactivity disorder, for which she was previously prescribed amphetamine/dextroamphetamine (Adderall™), and reported no other prescribed medications. She denied any potentially nephrotoxic exposures, and had an unremarkable renal history, with normal creatinine of 0.9 mg/dL reported in May 2018. In August 2020, her serum creatinine was measured at 1.8 mg/dL. Upon re-evaluation in February 2021, her creatinine was again elevated to 1.8 mg/dL. The equated MDRD eGFR for both elevated results was measured at 36 mL/min/1.73 $m^2$ (Table 1).

**Table 1.** *Date of Specimen, Serum Creatinine, Serum BUN and eGFR*

| Date of Specimen | Serum Creatinine (mg/dL) | Serum BUN (mg/dL) | eGFR (mL/min/1.73 $m^2$) |
|---|---|---|---|
| 5/2018 | 0.9 | 13 | >60 |
| 8/2020 | 1.8 | 14 | 36 |
| 2/2021 | 1.8 | 11 | 36 |
| 3/2021 | 0.69 | 13 | >60 |

During the evaluation of the subject's apparently worsened kidney function, her blood urea nitrogen (BUN) level was within

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normal limits, (i.e., BUN 11 mg/dL in February 2021 and BUN 14 mg/dL in August 2020 as represented in Table 1).

On review of her urine drug screens from August 2020 and February 2021, all drug detection was negative. The August 2020 report revealed a urine creatinine concentration of 39.1 mg/dL with a urine specific gravity of less than 1.003. The urine creatinine concentration was not recorded with the February 2021 results, but the specific gravity was 1.008 (Table 2). The requirement for a valid drug test is a urine creatinine above 20 mg/dL or urine specific gravity within the reference range of 1.003-1.035. As her urine creatinine exceeded the 20 mg/dL cut-off in August 2020, despite her low urine specific gravity, she was successful in passing the screening. Her next urine specimen in February 2021 revealed a specific gravity within the normal range. Her urine creatinine was not recorded with that specimen.

**Table 2.** *Date of Specimen, Specific Gravity, Urine Creatinine, and Substances Detected*

| Date of Specimen | Serum Gravity | Urine Creatinine (mg/dL) | Substances Detected |
|---|---|---|---|
| 8/2019 | 1.003 | 33.3 | THC |
| 8/2020 | <1.003 | 39.1 | None |
| 2/2021 | 1.008 | Not Recorded | None |

*THC=Tetrahydrocannabinol ("Marijuana")

An in-depth review of the subject's medical history revealed no other contributing/causative factors that may have led to acute renal insufficiency. She initially denied recreational drug use or alcohol intake; however, after further discussion, she admitted to consuming a cleansing "detoxification" health drink the day prior to blood draws in August 2020 and February 2021 to mask her use of marijuana. The product she consumed is the Herbal Clean QCarbo™ Maximum Strength Same-Day Cleansing Formula™. It is a proprietary blend that contains numerous herbal extracts as well as creatine monohydrate. The total weight of the blend is 17.44 g per 32 fluid-ounce bottle. The instructions for ingestion are to drink the 32-ounce bottle over the course of 30-60-minutes. It is recommended that when using the cleansing product QCarbo™, the individual should drink 48 ounces of water per day and avoid any toxins.[1] Upon follow-up evaluation in March 2021, a repeat serum creatinine resulted at 0.69 mg/dL, equating to a GFR of >60 mL/min, indicating a complete resolution of her presumed kidney dysfunction (Figure 1).

**Figure 1.** *QCarbo Maximum Strength Same-Day Cleansing Formula™ (Manufacturer Herbal Clean®, AZ, USA)*


*Source: Herbal Clean®*[1]

## DISCUSSION

We describe a subject that presented to the nephrology clinic with elevated serum creatinine, and who passed the urine drug screen (UDS) despite admittedly smoking marijuana regularly. After some exploration of the detoxification compound consumed, there proved to be a viable mechanism by which the UDS outcome can be manipulated.

Urine drug screening relies on urine meeting certain concentration criteria to validate the sample. If a sample is dilute, the substance being tested may fall below a concentration threshold for detection. Commonly used urine drug screens require specific gravity within a reference range of 1.003-1.035 and a urine creatinine concentration above 20 mg/dL, to ensure the sample is concentrated enough to be valid.[2] It has been proposed and studied that ingesting creatine, or its metabolite creatinine, would increase creatinine elimination and allow individuals to dilute their urine with increased fluid intake while masking the ingested toxin.[3] There is, however, a paucity in the literature of individuals successfully utilizing this method to mask drug screening. This is the first case report of a patient successfully passing a UDS with a description of the methodology used.

Creatinine is the metabolic waste product of phosphocreatine, the main energy phosphate storage molecule in muscle. It is used by the body to provide phosphorylation of adenosine di-phosphate (ADP) to adenosine tri-phosphate (ATP). Energy is released when the phosphate group is removed from phosphocreatine to become creatine and from ATP to become ADP. Therefore, there is a constant cycle of energy formation that is utilized by the body for physical and biological activity.[4] Most individuals get creatine through the ingestion of normal food sources, such as red meats and fish. Supplementation with exogenous creatine has also been studied in athletes to determine the effects on performance and renal function. The findings have indicated that there is increased urinary excretion of creatinine in individuals who ingest supplemental creatine/creatinine, although this is not a ubiquitous finding.[3] Serum creatinine is used to monitor renal function.[5] A normal serum creatinine level typically ranges from 0.5-1.2 mg/dL. The Kidney Disease Improving Global Outcomes (KDIGO) has defined acute kidney injury as either an increase in serum creatinine by 0.3 mg/dL within 48-hours, an increase in serum creatinine to greater than 1.5 times baseline within the last 7-days, or a urine volume less than 0.5 ml/kg/h in 6-hours.[5]

Urine drug screen testing requires participants to refrain from overhydration for 4 to 5-hours prior to testing. This ensures the urine sample is concentrated and therefore able to detect the presence of drugs in the urine. Standard urine drug screening

for marijuana usage typically uses immunoassays to detect the tetrahydrocannabinol (THC) metabolite, THC-COOH, range 20-100 ng/mL. Overhydration decreases the THC level found in the urine.[2,6] It is anticipated that the ingested creatine metabolizes into additional creatinine.[7] This additional creatinine is filtered through urination, allowing the participant to increase the water content of the urine thus decreasing drug concentrations below the detectable threshold while maintaining a valid creatinine level. This exact technique was applied by this patient through increasing creatine supplementation *via* ingestion of QCarbo™ which led to higher urinary levels of creatinine. This case demonstrates how ingestion of creatine is metabolized to creatinine leading to elevated serum creatinine levels in the blood, therefore interpreted as pseudo-renal dysfunction.

There are conflicting reports in the literature as to the efficacy of creatine metabolization to creatinine. In a study performed for the Forensic Toxicological Center in Munich Germany, by Franz et al[7] an increased conversion rate of creatine to creatinine was reported when creatine was added to orange juice (pH of 3.5) for four-days. In this study, participants demonstrated elevated urine creatinine two hours after ingestion. We measured the pH of QCarbo™ to be 5.5-6.0 and would allow for the creatine to convert to creatinine. Although QCarbo™ was used by this subject, one could speculate that using creatine monohydrate in acidic juice would have caused a similar effect.

The long-term effects of creatine supplementation do not, so far, appear to yield significant consequences to overall kidney function. In a study performed to determine the effects of long-term creatine supplementation in previously healthy athletes by Poortmans et al[8] creatine supplementation for greater than 10-months to 5-years had no deleterious effects on kidney function. They had previously studied short- and mid-term effects without any significant risk noted. In a separate randomized, double-blind, placebo-controlled trial performed by Lugaresi et al[9] that evaluated the effects of creatine supplementation in athletes, there were no observed significant differences between those individuals receiving creatine supplements *versus* the placebo group after 12-weeks. Similarly, in the presented above case, this patient's serum creatinine normalized in the subsequent months after ingestion of exogenous creatine. These results may not be generalized to include patients with preexisting chronic kidney disease and may be an avenue for further research.

## CONCLUSION

This is the first case report of a patient successfully passing a UDS with a description of the methodology used. In this case report, elevated serum creatinine levels from ingestion of QCarbo™ leads to an increase in urinary excretion of creatinine greater than 20 mg/dL, and therefore, renders a false negative report. However, it is important to note that the subject's urine was diluted below the valid threshold measurement for specific gravity. The subject reported that she smokes marijuana frequently, as recently as 24-hours prior to the administration of the urine drug test. Despite this, she was successful in passing the urine drug screening and secured employment. When there is suspicion of drug use, other methods of detection should be considered, (i.e., surprise testing or a blood drug screen).

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

## CONSENT

The authors have received written informed consent from the patient.

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