ORIGINAL STUDY ©

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Zeolite: Investigation of the Effectiveness and Safety as an Oral Chelating Agent for Heavy Metals. A comparison between different commercially available preparations

ABSTRACT

Background

This case study was performed to evaluate the effectiveness of clinoptilolite zeolite ("zeolite" herein) as an oral chelating agent for heavy metals. Zeolite is a hydrated aluminosilicate with symmetrically stacked alumina and silica tetrahedra which result in an open and stable three dimensional honey comb structure with a negative charge. The negative charge within the pores is neutralized by positively charged ions (cations) such as calcium. Historically, zeolite has been used as a commercial absorbent, and more recently in the dietary supplement industry as a detoxifier.

Methods

Three different commercially available zeolite preparations for oral consumption were used: an oral spray, oral drops, and a powdered preparation. The chelating capabilities of the different zeolite preparations on 20 different heavy, and potentially toxic, metals were measured in urinary excretion in 20 human subjects. The excretion rates were compared to baseline (non-consumption) measurements to ensure consistency. The safety was evaluated with pre and post testing of blood counts and chemistry, as well as liver and kidney function.

Results

It was possible to observe the capability of different zeolite preparations to increase the excretion of heavy metals from the human body in a safe manner. The effectiveness of three different zeolite preparations was observed.

Conclusions

When properly prepared as an oral supplement, zeolite can provide detoxification support to the human body to rid itself of heavy and toxic metals with minimal or no side effects. This can include applications to address lead, mercury or radiation poisoning.

KEYWORDS

Zeolite; oral chelation; heavy metal removal; clinoptilolite.

BACKGROUND

There are several commercially available preparations of zeolite in capsule, drop, powdered, and spray forms. They all claim the capacity of zeolite to work as a chelating agent on different heavy metals. Zeolite has been rated Generally Regarded As Safe (GRAS) for human consumption by the Federal Drug Administration (FDA) and it has been used commercially for water filtration for years. Most studies published show the effectiveness of zeolite to clean up contaminated water from heavy metals and other toxins. The lack of human studies proving the effectiveness of zeolite as an oral chelating agent was the reason to perform this trial.

The three zeolite preparations that were tested were the following: oral drops (Waiora, Natural Cellular Defense, Boca Raton, Florida, USA), powdered zeolite (ZEO Health, Zeolite Pure, Valley Cottage, New York, USA), and an oral spray (Results RNA, ACZ Nano Extra Strength, Salt Lake City, Utah, USA). The trial compared the higher doses recommended by each of the liquid (oral drops and oral spray) preparations' respective companies, to the minimum dose recommended by the powdered zeolite preparation's company.

Our testing hypothesis is that zeolite, being an effective chelating agent of heavy metals in the body, should increase the excretion of those metals that it binds with, in urine. The anticipated outcome of our hypothesis is that the use of zeolite should increase the excretion of heavy metals in urine in comparison to non-use of zeolite. Provided that other parameters are fairly constant, such as the introduction of new heavy metals in the body (e.g. from consumption of contaminated seafood), we should be able to measure the difference of the heavy metal excretion in urine following consumption of zeolite.

METHODS

The trial was organized in accordance with the Declaration of Helsinki, was registered with Current Controlled Trials Ltd (Registration Number ISRCTN12861674) and was performed from January through March 2012.

To be eligible for the trial, participants needed to be above eighteen years of age, not pregnant or breastfeeding, and not currently taking heavy metal based medications. Participants were informed of the trial protocol, laboratory testing requirements, and their performance expectations prior to enrollment. Each participant needed to provide oral consent and meet the eligibility requirements in order to be enrolled in the trial. Recruitment started the week prior to

onset of study, January 18th 2012. Twenty participants were randomly assigned to alternating groups (Group A or Group B) based on the order in which they arrived to obtain the testing materials. The trial took place and data collection was performed in one location, Lipogenex Anti-Aging Center in Scottsdale, Arizona, with the laboratory testing outsourced to Genova Diagnostics in Asheville, North Carolina. Analysis was performed according to Genova Diagnostics' standard procedures. The laboratory (Genova Diagnostics) was blind as to if any and which chelating agent was present in the testing process, both at baseline and during zeolite intake.

The primary measure to assess the effectiveness of each zeolite preparation was a urinalysis test to record the excretion levels of each participant for twenty different heavy metals. The secondary measure to assess the safety of the powdered zeolite preparation was a blood test to evaluate any changes in the blood count and chemistry, liver and/or kidney function.

All participants were placed on an all-seafood restricted diet for a week prior to the trial and during the time of the trial, until they completed all urine measurements for heavy metals. This measure was taken as a control in order to prevent any new contamination that might alter the excretion rates between participants. All participants received a complete blood count and comprehensive metabolic panel as a baseline assessment prior to onset of the trial. This measure was taken to compare results after the consumption of zeolite to assess safety. Each participant received a six hour timed urine collection and analysis for heavy metals as a baseline to assess the levels of metals their body is able to excrete without the help of any chelating agent.

For the primary outcome, Group A (10 participants) was tested only on the powdered zeolite preparation (Zeolite Pure by ZEO Health), and Group B (10 participants) was tested first on a liquid preparation, either oral drops (Natural Cellular Defense by Waiora) or oral spray (ACZ Nano Extra Strength by Results RNA), and then on the powdered zeolite preparation (Zeolite Pure by ZEO Health). Both groups were compared to each other when tested on the powdered preparation for the same amount of time, making Group A the control for this portion of the trial. Since all participants took some form of zeolite, the only true control was the individual measurements before and after consumption of any of the zeolite preparations.

Group A consumed one scoop (5 grams) of the powdered zeolite preparation (Zeolite Pure by ZEO Health) for 5 days, totaling 5 grams of pure zeolite per day. One scoop was the lowest recommended dose from the supplement company (ZEO Health). On the morning of the 6th day participants consumed one scoop (5 grams) of the powdered zeolite preparation and collected all urine for 6 hours. First morning urine was discarded by all participants. All participants received 2 liters of bottled water and were asked to consume it within five hours during the urine collection time. A sample of the collected urine was sent for analysis for heavy metal excretion to Genova Diagnostics.

Group B was assigned randomly either the zeolite oral spay (ACZ Nano Extra Strength by Results RNA) or the zeolite oral drops (Natural Cellular Defense by Waiora). Participants consumed the higher recommended dose by the supplement companies (Results RNA and Waiora, respectively) for 5 days. Five participants consumed 8 sprays three times per day of the oral spray preparation, totaling 28.32 milligrams (0.02832 grams) of zeolite per day. The other five participants consumed 10 drops three times per day of the oral drops preparation, totaling 240 milligrams (0.24 grams) per day. On the 6th day, they consumed the same higher recommended dose of their respective zeolite preparation and collected all urine for 6 hours (excluding first moring urine as above). Participants were given two liters of bottled water and asked to consume it within five hours during the urine collection time. A sample of the collected urine was sent to Genova Diagnostics for analysis for heavy metal excretion.

After the collection of the urine, Group B received another blood test (complete blood count and comprehensive metabolic panel) to evaluate any impact of the consumed zeolite on the liver, kidney function, and blood chemistry (electrolytes). After the blood test was performed, participants were placed on a seven day break from all zeolite preparations to allow the body to return to the baseline state of excretion. All participants in Group B continued avoiding all seafood to prevent any potential contamination during the trial.

Group B, after the seven day break from all zeolite preparations, consumed one scoop (5 grams) of the powdered zeolite preparation (Zeolite Pure by ZEO Health) for 5 days. This was done in order to compare effectiveness of the two different types of zeolite preparations (liquid and powdered) on the same participants, since the powdered zeolite preparation contained a much larger amount of zeolite per dose than either of the liquid preparations. We wanted to observe if the powdered zeolite preparation (Zeolite Pure by ZEO Health) had stronger chelating results on the same participants compared to the other two liquid preparations. On the 6th day, participants consumed one scoop (5 grams) of powdered zeolite and a urine collection test was performed as before (six hours timed, excluding first morning urine and while drinking two litters of water).

For the secondary outcome, after the primary outcome observation period ended, all participants (Group A and Group B) were given the maximum recommended dose of the powdered zeolite preparation (Zeolite Pure by ZEO Health) of three scoops per day (15 grams) for total of four weeks to evaluate the safety of the product at the highest recommended dose. All participants were told to report any adverse events or symptoms during the trial. Participants received a blood test at the end of the four weeks to evaluate any potential impact of zeolite on blood chemistry, liver and/or kidney function values. Participants were not tested for excretion of heavy metals during the higher consumption of 15 grams of powdered zeolite.

RESULTS

Efficacy

We tested the excretion in urine of the following twenty toxic elements: Arsenic, Lead, Mercury, Aluminum, Antimony, Barium, Bismuth, Cadmium, Cesium, Gadolinium, Gallium, Nickel, Niobium, Platinum, Rubidium, Thallium, Thorium, Tin, Tungsten and Uranium. We compared the levels of excretion at baseline (without the use of any zeolite preparations), to the excretion during the use of the zeolite preparations. We also observed the differences in excretion, between the participants who received the liquid preparations [either the oral drops (Natural Cellular Defense by Waiora) or the oral spray (ACZ Nano Extra Strength by Results RNA)], and when the same participants received the zeolite powdered preparation (Zeolite Pure by ZEO Health).

We grouped the results of the oral spray and oral drops together in the same data set, since we did not observe any significant differences between the performances of either of the liquid preparations.

For each participant, heavy metal, and different zeolite preparation, we calculated the percent difference (increase or decrease) in excretion by comparing the measured levels of the toxic metal in urine without any treatment (baseline) and during treatment with each zeolite preparation (chelating agent), i.e. we calculated the ratio of the difference in excretion divided by the levels of excretion before treatment. However, we note here that the closer the measured levels are to the detection limit, the less reliable the measurement because of different possible sources of variance. For example, a new small contamination from daily consumption of different vegetables can produce a slight increase, or even the standard deviation of the detection of the test can produce a small variance. This may lead to artificially high values of the aforementioned ratio due to low values in the denominator. Therefore, we apply a “cutoff” value on all measurements, such that after the application of the cutoff, no value can be below the cutoff. More formally, if x and y are the measured levels before and after treatment (respectively), and the cutoff is c, then we compute the following regularized ratio r: $r = (\max(y,c)-\max(x,c))/\max(x,c)$.

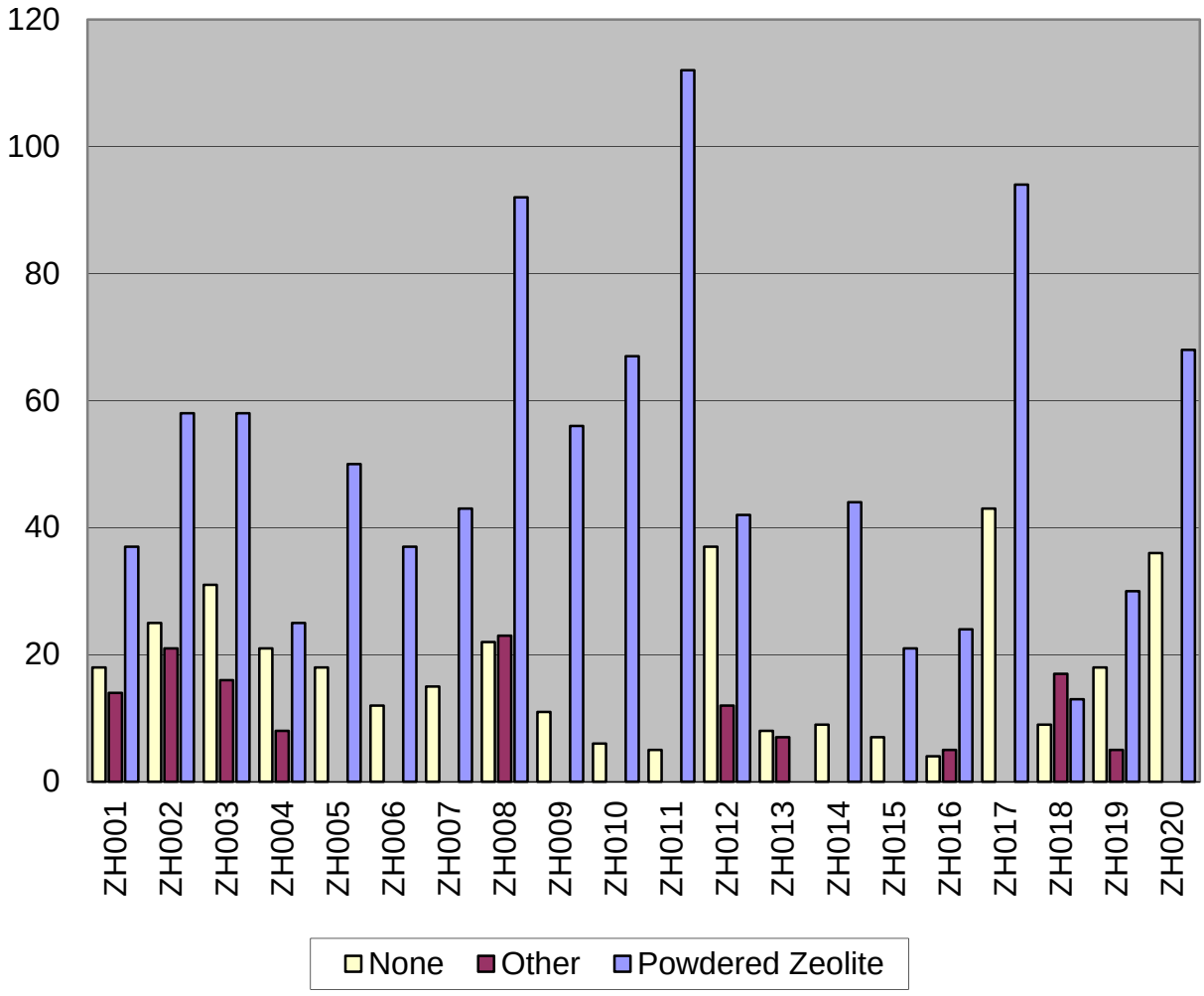
For this trial, we chose the cutoff value to be the median excretion before treatment, across participants. The overall performance of each zeolite preparation per heavy metal across participants was measured in two ways: (a) median percent difference in excretion, and (b) percentage of participants that demonstrated a percent increase in excretion of at least 50% (the % significant in results).

In Arsenic we observed a median increase in excretion of 119% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 73.7% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of -8% in the group that received the

oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion. See Figure 1.

Figure 1 - Arsenic Excretion at Baseline and During Consumption of Different Zeolite Preparations

The graph below shows the results in urinary excretion of Arsenic. The yellow bar that is marked as “none” represents the excretion without any zeolite, at baseline. The maroon bar shows the excretion during the consumption of either the oral drops (Natural Cellular Defense by Waiora) or oral spray (ACZ Nano extra strength by Results RNA) zeolite preparation and marked as “other”; and the purple bar shows the urinary excretion of zeolite during the consumption of the powdered zeolite (Zeolite Pure by ZEO Health) preparation.



In Aluminum we observed a median increase in excretion of 43% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 57.4% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion.

In Antimony, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 5.3% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 10% of participants showing at least 50% increase in excretion.

In Barium, we observed a median increase in excretion of 37% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 47.4% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 10% of participants showing at least 50% increase in excretion.

In Bismuth, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 0% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion

In Cadmium, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 10.5% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion.

In Cesium, we observed a median increase in excretion of 41% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 31.6% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion.

In Gadolinium, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 0% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion.

In Gallium, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 15.8% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion.

In Lead, we observed a median increase in excretion of 43% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 47.4% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion.

In Mercury, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 5.3% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion.

In Nickel, we observed a median increase in excretion of 23% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 26.3% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 10% of participants showing at least 50% increase in excretion.

In Niobium, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 0% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 10% of participants showing at least 50% increase in excretion.

In Platinum, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 5.3% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 10% of participants showing at least 50% increase in excretion.

In Rubidium, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 0% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 10% of participants showing at least 50% increase in excretion.

In Thallium, we observed a median increase in excretion of 119% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 73.7% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion.

In Thorium, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 0% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion.

In Tin, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 5.3% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 10% of participants showing at least 50% increase in excretion.

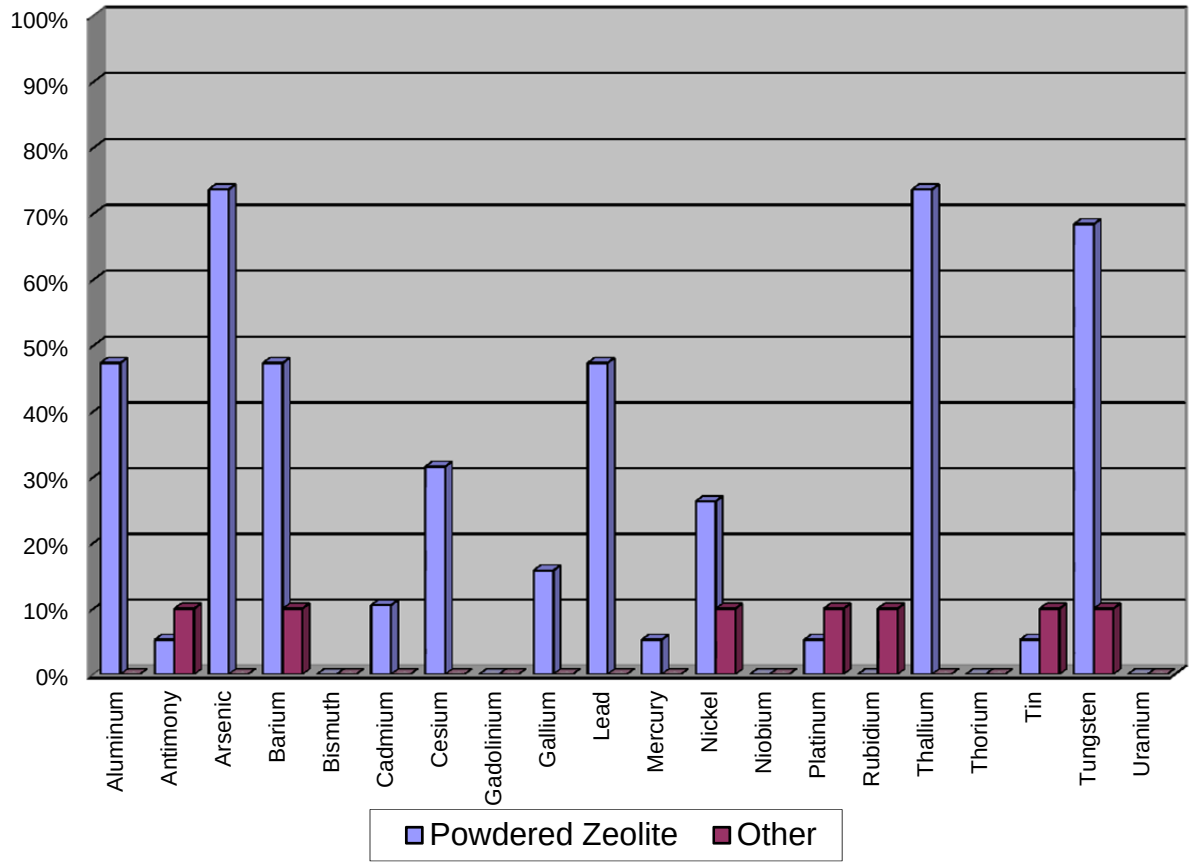
In Tungsten, we observed a median increase in excretion of 99% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 68.4% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 10% of participants showing at least 50% increase in excretion.

In Uranium, we observed a median increase in excretion of 0% in the powdered zeolite (Zeolite Pure by ZEO Health) group with 0% of participants showing at least 50% increase in excretion. We observed a median increase in excretion of 0% in the group that received the oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora) with 0% of participants showing at least 50% increase in excretion.

A graph showing the percentage of participants that showed at least a 50% increase in excretion in the different metals, comparing the powdered to the liquid preparations performance can be seen in Figure 2. Of the twenty metals analyzed, fifteen have data represented on the graph. The powdered preparation is represented in fourteen of the fifteen metals present on the graph, whereas the liquid preparations are only represented in seven metals. This graph also demonstrates that the powdered preparation outperformed the liquid preparations by a ratio of 11:4.

Figure 2 - Percentage of Participants with at Least 50% Increase in Excretion

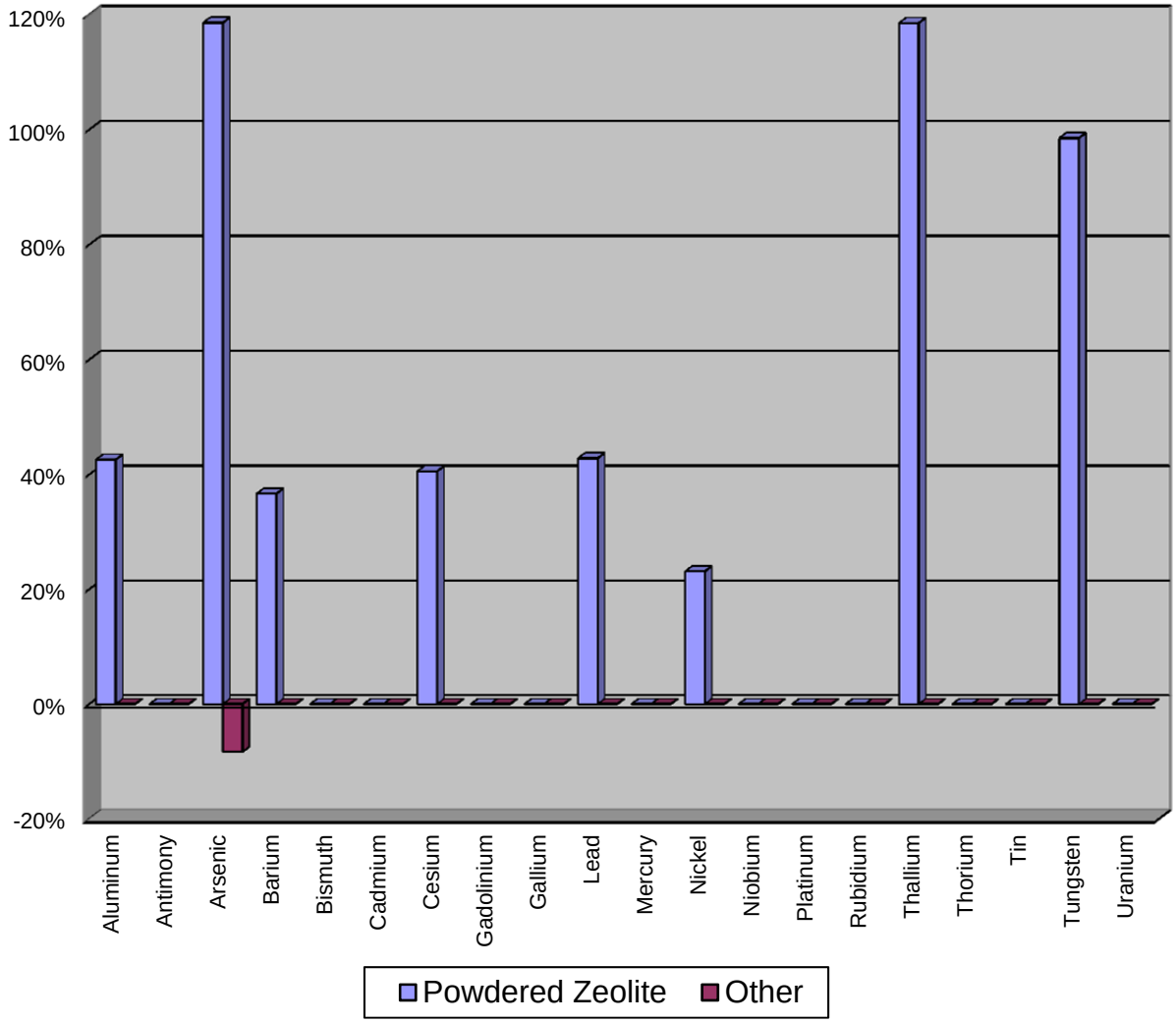
The comparison of the percent of participants that showed at least a 50% increase in excretion of different heavy metals during consumption of the powdered zeolite preparation (Zeolite Pure by ZEO Health) or the liquid zeolite preparation [oral drops (Natural Cellular Defense by Waiora) or oral spray (ACZ Nano extra strength by Results RNA)] (marked as “other”).



The comparison of the median excretion of different metals across participants during the consumption of the zeolite preparations can be seen in Figure 3. The powdered preparation (Zeolite Pure by ZEO Health) shows positive results for eight of the twenty metals. The liquid preparations [ACZ (Advanced Cellular Zeolite) Nano Extra Strength by Results RNA or Natural Cellular Defense by Waiora] are represented on the graph for only one metal, in the negative region. This graph demonstrates that the median excretion was higher for the powdered preparation in all nine of the metals that evidence appears for on the graph.

Figure 3 - Median Increase in Excretion Across Participants per Heavy Metal

The comparison of the median excretion of different metals across participants during consumption of the powdered zeolite preparation (Zeolite Pure by ZEO Health) or the liquid zeolite preparation [oral drops (Natural Cellular Defense by Waiora) or oral spray (ACZ Nano extra strength by Results RNA)] (marked as “other”).



Safety

All participants tolerated the zeolite preparations very well. One participant reported flatulence with the consumption of three scoops (15 grams) of the powdered zeolite preparation (Zeolite Pure by ZEO Health) which was relieved immediately when dose was lowered to two scoops (10 grams) per day. No other participants reported any adverse reactions or symptoms. Comparison of the blood tests pre-consumption of zeolite and post-consumption of zeolite showed no difference in any of the measured values. No negative effects on the blood work were seen. No significant changes were observed in kidney function [BUN (blood urea

nitrogen), Creatinine, GFR (Glomerular Filtration Rate) calculated], liver function [AST (aspartate transaminase) and ALT (alanine transaminase)] or electrolyte levels (sodium, potassium, chloride) immediately after the consumption of each of the zeolite preparations. This proves our hypothesis that zeolite is a safe product for oral consumption.

DISCUSSION

We observed the most urinary excretion with the use of the powdered zeolite preparation (Zeolite Pure by ZEO Health) as an oral chelating agent in the following heavy metals (mean percent increase in excretion): Arsenic 119%, Thallium 119%, Tungsten 99%, Lead 43%, Aluminum 43%, Cesium 41%, Barium 37% and Nickel 23%. The percent of significance in results, people that showed at least a 50% increase in excretion of the heavy metal during the consumption of the powdered zeolite preparation, in comparison to baseline, were as follows: Arsenic 73.7%, Thallium 73.7%, Aluminum 57.4%, Tungsten 68.4%, Lead 47.4%, Barium 47.4%, Cesium 31.6%, and Nickel 26.3%.

We believe that these results are statistically significant to show that the powdered zeolite preparation (Zeolite Pure by ZEO Health) works as an oral chelating agent at least for those metals that showed an increase in urinary excretion by more than 50%. In those heavy metals that we did not observe any excretion, either at baseline (without the use of any zeolite preparation) or during the ingestion of zeolite, it is worth mentioning that 0% excretion does not necessarily mean that the zeolite has no affinity for those metals. Due to the small number of participants, these results probably indicate the absence of those metals in the body of the participants.

We also observed, in some metals, higher excretion numbers at baseline in comparison to the excretion during consumption of zeolite. This created negative values that resulted in the mean percent of excretion to be zero, even though some participants did have higher excretion rates of that metal during the consumption of zeolite. Without being able to analyze any further, we can look for probable causes or variables that might have played a role in this situation. One simple explanation is a possible recent exposure to the metal during the measurement at baseline. Since we controlled for all seafood consumption, the exposure could be from a different food or water source. Since the participants were placed on zeolite oral treatment for five days prior to a second measurement, it is possible for the zeolite to clear the metal from the body that was recently exposed; therefore, the second test could show a lower value. We observed that this happened with metals with low excretion at baseline, close to the detection limit.

In our trial we used, for those participants that consumed the oral drops (Natural Cellular Defense by Waiora) or oral spray (ACZ Nano Extra Strength by Results RNA), the higher daily dose recommended by the company and listed on their respective websites. For the powdered

zeolite preparation (Zeolite Pure by ZEO Health), we used the minimum recommended dose from the company of one scoop (5 grams) per day. Since the maximum recommended daily dose of the powdered zeolite preparation is three scoops per day (15 grams), it is possible that for those toxic metals that we did not observe any significant excretion with the use of this product could also be dose dependent. A higher dose of two or three scoops per day could have shown an increase in urinary excretion of those metals. Nevertheless, the obtained results showed the superiority of the powdered zeolite preparation, even at the lowest dose, in comparison to the other preparations taken at their higher doses.

All twenty participants, at the second part of the trial, (after all urine measurements for the excretion of heavy metals, with the use of any zeolite preparation, were competed), consumed the maximum recommended dose (15 grams per day) of the powdered zeolite preparation (Zeolite Pure by ZEO Health), for four weeks. No major symptoms were reported with the higher dose and no negative changes were recorded in their blood tests. It was during this portion of the trial that the one participant reported flatulence. No other participants reported any other adverse side effects. This shows that this specific zeolite preparation (Zeolite Pure by ZEO Health) is also safe to be consumed for four weeks at the maximum dose of three scoops per day, which is equal to 15 grams.

One of the major concerns with most chelating agents, such as DMPS (2,3-dimercapto-1-propanesulfonic acid) and DMSA (dimercaptosuccinic acid), is their effects on kidney function as the toxic elements exit the body during urination. In our participants, we observed no differences in the blood measurements of BUN and Creatinine, as well as the calculated values of GFR at baseline and immediately after the consumption of zeolite at the end of the trial. Group B was followed with a blood test immediately after the completion of the six days on either of the liquid preparations [oral spray (ACZ Nano Extra Strength by Results RNA) or oral drops (Natural Cellular Defense by Waiora)] to check for any kidney function abnormalities. No differences were found between baseline and post-consumption of the products. Thus, we can conclude that the specific liquid preparations tested are safe at the higher recommended doses, and do not cause any additional burden on kidney function.

We have examined the toxicology study performed with the Zeolite Pure powdered preparation (by ZEO Health) by MB Research Laboratories on Sprague Dawley rats prior to this trial. According to their results, the LD_{50} (lethal dose) of Zeolite Pure powdered preparation (by ZEO Health) is greater than 5000mg/kg of body weight in male rats, which makes it a non-toxic substance as defined in 16 CFR (Code of Federal Regulations) 1500.3(c)(2)(1) of the Federal Hazardous Substances Act.

It is important to report the safety of these products as it showed from our findings in all of our twenty human participants in this trial. No changes in the complete blood count were observed that could signify any negative results imposed from the consumption of the product to the participants. No changes in liver enzymes AST and ALT were observed to signify any negative

or toxic effects in the liver. No changes were observed in the electrolytes at the comprehensive metabolic profile analysis to signify any negative effects of the product on the blood chemistry of the participants. Those results prove our hypothesis that at least the tested zeolite preparations are safe for human consumption at the recommended doses. These results also add to the general body of knowledge that zeolite can be safely consumed as an oral supplement for detoxification and chelation purposes. Since the excretion of the toxic metals during the consumption of the three zeolite preparations tested was so different, we propose that the effectiveness of the zeolite as an oral chelating agent is product and/or dose specific.

It is also important to mention that of all three zeolite preparations tested, the powdered zeolite preparation (Zeolite Pure by ZEO Health), at its minimum dose, was the one preparation that provided the largest amount of zeolite per serving. It is possible to extrapolate or at least raise the question, that the effectiveness of zeolite as an oral chelating agent is dose dependent, and further studies are needed to evaluate dosing and effectiveness among other types of zeolite preparations on the market, such as drops, sprays, capsules and powders.

One of the limitations of the trial is the small number of participants. With a greater number of participants, the group might have been a better representation of the general population. We anticipate that the results might have been slightly different, since a larger group would increase the probability of having a number of participants with elevated levels of those toxic metals that we were not able to observe any excretion in our smaller trial group.

A second limitation identified was the selection of the participants. We selected our participants randomly, instead of pre-screening them for the presence of heavy metal toxicity, with the use of another already widely approved chelating agent, such as DMSA. This would have served as a control in that the participants would have had an existing burden of toxic metals present in their body prior to the trial. Moreover it would have provided a comparison of the effectiveness of zeolite versus another widely used chelating agent.

Our hypothesis has been confirmed. We observed the fact that results were dependent on the preparation and that they were not equal among all of the zeolite preparations tested. The question that arises, which requires follow up research, is to compare the effectiveness of zeolite as an oral chelating agent with another oral chelating agent that has been used for years, such as DMSA. Further studies need be performed to compare zeolite with other known chelating agents and to compare different doses as to establish data for the most effective dose of this substance. This follow up comparison would show the strengths as to which specific heavy and potentially toxic metals the zeolite has more affinity for in comparison to the other chelating agent. This comparison would also provide more clinical guidance as to the use of the most effective chelating agent for the removal of specific toxic metals present in the human body.

CONCLUSIONS

This study was able to provide data that zeolite in all three different preparations tested proved to be a safe substance for human consumption. The powdered zeolite preparation (Zeolite Pure by ZEO Health) has shown to be an effective oral chelation agent for detoxification of several toxic metals. When properly prepared as an oral supplement, zeolite can provide support to the human body to rid itself of heavy and toxic metals with minimal or no side effects. The use of zeolite can be used in cases of lead, mercury or radiation poisoning to remove the harmful metals without further taxing the body.

List of Abbreviations

ACZ - Advanced Cellular Zeolite; ALT - Alanine transaminase; AST - Aspartate transaminase; BUN - Blood urea nitrogen; CFR - Code of Federal Regulations; DMPS - 2,3-Dimercapto-1-propanesulfonic acid; DMSA - Dimercaptosuccinic acid; FDA - Federal Drug Administration; GFR - Glomerular Filtration Rate; GRAS - Generally Recognized As Safe; LD - Lethal Dose; NMD - Doctor of Naturopathic Medicine.

Authors' Information

Dr. Emmanouil Karampahtsis is Board Certified in Antiaging Medicine and an active member of the American Academy of Antiaging Medicine. He graduated with honors from the Honors College at Adelphi University in Garden City, NY, in 1998 with a bachelor’s degree in Psychology. Immediately following, he was accepted at the Southwest College of Naturopathic Medicine in Tempe, AZ, where he graduated with the degree of Doctor of Naturopathic Medicine in 2003. After passing his national board exams and receiving his license in 2004, he started his private practice in Scottsdale Arizona, and has maintained it ever since. Dr. Karampahtsis has treated many patients with different ailments, and has experience utilizing many different naturopathic and pharmaceutical approaches in healing. He has seen success treating people with many chronic diseases when the toxic metals were addressed. The results made him interested in searching for the most effective and the least invasive chelating and detoxification methods to rid the body of toxic, heavy metals.

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