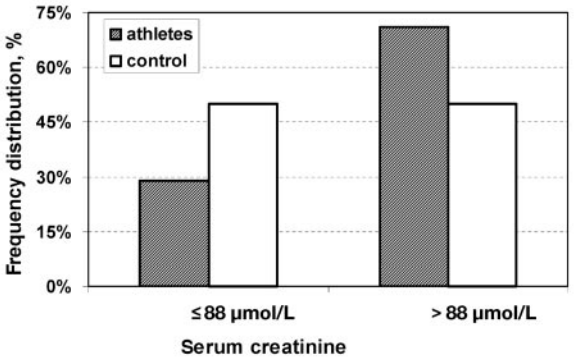

Fig. 1. Frequency distribution of serum creatinine concentrations in the 2 groups.

Data are divided considering as threshold the median value of the control group [88 μmol/L (1.0 mg/dL)].

(Abbott) by an alkaline picrate reaction method. Blood samples were obtained before the start of training for the competitive season, when athletes were not undergoing specific training loads or psycho-physical stresses. We selected age-matched sedentary, nonobese, apparently healthy males, without biochemical and hematologic signs of diseases, as controls (n = 100).

We found mean (SD) creatinine values of 97 (18) μmol/L [1.1 (0.2) mg/dL] in the athletes and 88 (9) μmol/L [1.0 (0.1) mg/dL] in controls. The frequency distributions of serum creatinine in the 2 groups are shown in Fig. 1. The mean (SD) values in the different sports groups were as follows: 88 (9) μmol/L [1.0 (0.1) mg/dL] in triathletes, 97 (9) μmol/L [1.1 (0.1) mg/dL] in basketball players, 80 (9) μmol/L [0.9 (0.1) mg/dL] in cyclists, 80 (9) μmol/L [0.9 (0.1) mg/dL] in motorcyclists, 115 (9) μmol/L [1.3 (0.1) mg/dL] in soccer players, 97 (9) μmol/L [1.1 (0.1) mg/dL] in sailors, 106 (9) μmol/L [1.2 (0.1) mg/dL] in skiers, and 115 (9) μmol/L [1.3 (0.1) mg/dL] in rugby players. There were significant differences (Student *t*-test, $P < 0.01$) between each group of athletes in the different sports and the control group.

Our data seem to be discordant with those reported for endurance athletes (Nordic skiers and cyclists), who showed creatinine values lower than controls: 71–88 μmol/L [0.8–1.0 mg/dL] for skiers and 62–80 μmol/L [0.7–0.9 mg/dL] for cyclists. However, these values were measured during periods of competition *(2)*. To our knowledge, no other study has been published describing creatinine values in elite athletes at rest. In general, creatinine is not influenced by training and competition *(3)*, even during extreme effort *(4)*. We found that the creatinine values in elite athletes were generally higher than in controls, as expected in part because of their higher muscle mass. The athletes competed in 8 different sports with different characteristics of aerobic/anaerobic metabolism, different training loads and frequency of competitions, different lengths of competitions, and different periods of training and competitions. The athletes' diets were monitored and controlled by team physicians; no creatinine supplementation was administered to the athletes.

The use of reference intervals based on general populations is not recommended in sports medicine, to avoid misinterpretation of data and additional, unnecessary investigations. This does not necessarily imply that specific reference intervals should be calculated for the creatinine concentrations of athletes. The individuality index (ratio between intra- and interindividual variability) of creatinine is 0.33, lower than the value of 0.60, which is universally considered the threshold for classifying a reference interval as useful in a population. We recommend that for each athlete, consecutive creatinine assessments be monitored, with one of the values determined before the start of training and competitions used as the basal value.

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Giuseppe Banfi[1,2*]
Massimo Del Fabbro[1,3]

[1] *Istituto Ortopedico Galeazzi*
[2] *Facoltà di Scienze Motorie*
[3] *Dipartimento di Scienze Cliniche "L. Sacco" Università di Milano Milan, Italy*

* Address correspondence to this author at: Istituto Ortopedico Galeazzi, Via R. Galeazzi 4, 20161 Milan, Italy. Fax 39-02-6621-4806; e-mail giuseppebanfi@supereva.it.

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Nanotechnologic Nutraceuticals: Nurturing or Nefarious?

To the Editor:

The use of nutraceuticals (herbal medicines, minerals, and vitamins) has increased dramatically, and it is estimated that approximately one third of Americans consume some form of dietary supplementation *(1)*. Adverse clinical side effects of nutraceutical ingestion have been well documented *(2)*, as have interferences from these agents in laboratory tests *(3)*.

Colloidal suspensions of metal particles (e.g., copper, gold, platinum, silver, molybdenum, palladium, titanium, and zinc) have been marketed as oral health supplements *(2, 4)*. Metal colloids are reactive and can act as reducing agents, bind to proteins, and denature enzymes, and they are efficacious as bactericides in topical formulations *(2)*; however,

the oral administration of metallic colloids, in particular colloidal silver protein, has been reported to have toxic effects *(2)*. Despite this, dozens of companies sell metal colloids as nutritional supplements.

Many metal colloids have been rebranded as "nano" compounds to further intensify the public's interest in their utility. Although clinical concern about the use of colloidal metallic compounds is longstanding, their effects on laboratory tests have not been investigated. These particles are of particular concern because their small size allows high oral bioavailability, accumulation within the blood, and excretion through the kidneys *(5)*. We were interested to know whether metal colloids might cause interference in clinical chemistry tests of blood and urine.

We tested 4 nutraceutical products: Mesogold, Mesosilver, Mesocopper, and Mesoplatinum [Purest Colloids, Inc.; daily recommended doses ranged from 50 to 150 μg *(4)*]. These were colloidal suspensions of nonionic metal with 1- to 10-nm diameter particles. The concentrations of copper, silver, platinum, and gold measured by National Medical Services, Inc. were 0.9, 21, 13, and 18 mg/L of each metal, respectively, whereas the manufacturer's stated concentrations were 10, 20, 10, and 10 mg/L, respectively.

We tested the mesometals (undiluted and as 1:1 mixtures with saline or pooled serum) for interference in a range of automated assays on a Vitros® Model 950 AT: glucose, blood urea nitrogen, creatinine, ammonia, sodium, potassium, chloride, total CO_2, amylase, lipase, calcium, magnesium, phosphate, cholesterol, triglycerides, uric acid, albumin, aspartate aminotransferase, alanine aminotransferase (ALT), lactate dehydrogenase (LD), creatine kinase, alkaline phosphatase, γ-glutamyl transpeptidase, conjugated bilirubin, and unconjugated bilirubin. We also tested various point-of-care methods: Quickvue® One Step hCG Urine (Quidel Corp.); Acceava® hCG Combo (ThermoBiostar); and Chemstrip® 10 S-UA (Roche Diagnostics). The concentrations tested were likely much higher than might be found clinically, and they were chosen to reveal any possible effects.

We found no interferences (1:1 sera:saline vs sera:mesometals) with the exception of LD (10%–20% lower) and ALT (13%–50% higher). Of note, assaying the mesometals directly showed consistently detectable LD (range, 129–182 U/L) and low ALT activities (17–21 U/L) for all metals tested.

We also tested mesometals [undiluted and as 1:1 mixtures in control serum with added drugs (Lyphochek® Immunoassay Positive Control, Ethanol/Ammonia Control; Bio-Rad)] in Emit assays for lidocaine and amikacin, and for ethanol on the Hitachi 911, but we found no interference.

In addition, the Quickvue and Acceava hCG tests demonstrated no interference. The Chemstrip 10 S-UA had 1 aberrant result: mesoplatinum demonstrated a positive hemoglobin of "250 erythrocytes per μL" with a parallel "negative blood". The Mesogold, Mesocopper, and Mesosilver were negative in the test for hemoglobin. No other analytes were affected by any of the mesometal solutions.

Another nanostructure with potential for drug delivery or as an imaging agent is the carbon nanotube. We tested a suspension of 60- to 100-nm diameter surface-charged carbon nanotubes (Nanotech Port Co.) in pooled sera and found no apparent interference with the panel of Vitros chemistry tests examined.

In summary, nanoparticle nutraceuticals exhibited no major interference with the tests examined. Minor interferences were noted in the LD assay on the Vitros as well as a reagent strip assay for hemoglobin. The mechanism of these aberrations is not clear. Clinical laboratories should remain vigilant for possible nanoparticle interferences, as these structures, with their diverse physical and chemical properties, are being used or advocated for use in a broad range of drug delivery applications and as imaging agents.

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Jason Y. Park[1]
Sam F.Y. Li[2]
Larry J. Kricka[1*]

[1] Center for Biomedical Micro & Nanotechnology Department of Pathology & Laboratory Medicine University of Pennsylvania School of Medicine Philadelphia, PA

[2] Department of Chemistry National University of Singapore Republic of Singapore

* Address correspondence to this author at: Department of Pathology & Laboratory Medicine, University of Pennsylvania School of Medicine, 7.103 Founders Pavilion, 3400 Spruce St., Philadelphia, PA 19104. Fax 215-662-7529; e-mail kricka@mail.med.upenn.edu.

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Effect of Sample Collection Tubes on Cerebrospinal Fluid Concentrations of Tau Proteins and Amyloid β Peptides

To the Editor:

Tau protein and its phosphorylated forms, and amyloid β peptides ending at amino acid 42 (Aβ42) are used as cerebrospinal fluid (CSF) biomarkers of Alzheimer disease (AD) *(1–8)*. Because preanalytical factors may affect results *(4, 9, 10)*, we measured these biomarkers in CSF samples in collection tubes made of different materials.

After approval by the Ethics Com-