Appendix S1

Exposure by workout exercise

Before each workout session, the participants washed their hands with soap and water and dried with paper towels. Following that, the operator carefully cleaned their hands with wipes (injection swabs, Attends Healthcare AB, SE-57833 Aneby, Sweden) soaked with 1% nitric acid. The hands were then rinsed with deionised water and dried with precision wipes (Kimberly-Clark Professional, Surrey, United Kingdom) to remove all nickel on the skin surface prior to the experiment. Reference surfaces on the little fingers were covered with Opsite post-op (Smith&Nephew, Hull, England) waterproof film dressing, to serve as quality control areas.

Three gyms with DMG test positive weight machines and dumbbells according to the initial screening, respectively, were chosen for the workout. The participants chose weights according to their own individual preferences among the DMG test positive ones. They exercised for 30 min in each station, one hour in total. All equipment was DMG-tested again at the day of the exercise.

Skin exposure assessment by DMG test and acid wipe sampling

After one hour workout the left hand of each participant was assessed for nickel contamination using DMG test. DMG tests were prepared in advance at the laboratory by pipetting 50 µl of test solution into acid washed Eppendorf® tubes (1.5 ml, polypropylene, Sarstedt, Nümbrecht, Germany). At the gym, a cotton-wool tipped stick was used to absorb the DMG test solution in the tube and then rubbed gently over the test area for 30 s. Each area was tested with a new stick. The result of the test was read against a white background. The test was categorised as positive, doubtful or negative. A pink colour on the cotton indicated a positive result, any colour other than pink was interpreted as a doubtful result, and no colour change was interpreted as a negative result.

The acid wipe sampling was performed on the right hand of the participants on 3 different areas. Two exposed areas on the volar aspect of each hand were chosen: the middle phalanx of middle finger (called middle finger), an area on the distal part of the hypothenar region of the palm (called palm), and one non-exposed reference area on the little finger (Fig. S1[1]). Each area was 2 cm^2. The areas on the right hand were indicated by marking the corners of a plastic foil template. A red ink marking pen (Lumocolor permanent universal pen, Mars GmbH and Co KG, Nürnberg, Germany) was used, which has been shown not to interfere with the chemical analysis of nickel. The operator used vinyl gloves (Papyrus supplies, Mölndal, Sweden) during sampling. The method has been described in detail elsewhere (7). In short, sampling was conducted with 0.5 ml of 1% nitric acid on each wipe. Each demarcated area (2 cm^2) was wiped with 3 consecutive wipes, and gentle pressure was applied during wiping (Fig. S1[1]). Wipes from the same area were put into one bottle (acid washed, 60 ml PP-flasks with lids, Nalgene® Labware, Ohio, USA). After all samples had been taken the subjects washed their hands with soap and water.

The samples taken at the gym were brought to the laboratory where 23.5 ml of 1% nitric acid was added to each bottle. The bottles were shaken for 30 min to extract nickel from the wipes. The extracts were poured into 30 ml test tubes (PP plastic, Sarstedt, Nümbrecht, Germany), and stored up to 4 weeks in a refrigerator at +4°C prior to chemical analysis.

Chemical analysis

The chemical analysis was performed by the Division of Surface and Corrosion Science, at the School of Chemical Science and Engineering, KTH Royal Institute of Technology, Stockholm, Sweden. The acid wipe samples were analysed using graphite furnace – atomic absorption spectrometry (GF-AAS, PerkinElmer AAnalyst 800, Waltham, MA, USA) for analysis at ppb level. Calibration was performed using 0, 30, 100 and 300 ppb Ni standards (Inorganic Ventures, Inc. Madrid, Spain, Lot: T-NI02024). Each sample was analysed in triplicate and the relative standard deviation was below 5% for all samples. Quality control standard solutions were run for every 8 samples to check the performance of the instrument. The limit of detection (LOD) for nickel was 0.3 µg/l based on standard blanks (3xSTDEV) for the instrument. The LOD for the sample matrix was 0.4 µg/l. The limit of quantification (LOQ) was 1.0 µg/l based on standard blanks (10xSTDEV) for the instrument.