GSF – National Research Center for Environment and Health
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Institute of Radiation Protection

PRELIMINARY STUDY OF ENVIRONMENTAL AND CLIMATIC FACTORS ON URINARY EXCRETION IN THE TROPICAL REGION

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INTRODUCTION:

- Urinary analysis is an important method in bioassay measurements involving the determination of radionuclides injected, ingested, or inhaled into the body.
- The total daily urine volume excreted is very important for the accurate determination of the excretion rate of the substance and in the interpretation of the bioassay measurements.
- The daily urine volume excreted depends on the rate at which foodstuffs are metabolised, individual habits such as diet and exercise, and on environmental factors like air temperature and humidity [1,2].
- The ICRP [1] sets a reference daily urinary volume of 1600 ml d^{-1} for adult male using data from the temperate environment.
- However, in order to gain global acceptance, it is necessary to incorporate data from all parts of the world. The ICRP did not consider data from the tropical environment, and no data is available for comparison from the region.

MATERIALS AND METHODS :

- Twenty-four hour urine samples were collected after an initial voiding of bladder from four different groups of male subjects working under different conditions.
  - ➢ the sedentary group A (N=6, Age 24 - 36y) in Jos Plateau (altitude 1300 m)
  - ➢ the public group B (N=4, Age 34 - 44y) working and living in Jos city (altitude 1300 m)
  - ➢ the public group C (N=4, Age 37 - 52y) in Akure about 900 km away from the Jos Plateau (altitude 300 m)
  - ➢ the heavy exercise group D (N=5, Age 26 - 35y) working and living in a mining site in Jos Plateau
- The weight (using analytical balance) and the total volume of the 24-h urine collected from each subject were recorded.
- The urine creatinine was measured using an alkaline picrate procedure.

RESULTS :

- The sedentary group has the highest arithmetic mean value of the daily urinary volume (1416 ± 596 ml d^{-1}).
- The arithmetic mean value for the four groups is about 20% lower than the ICRP reference value [1].
- The relative frequency of the 24 hr urine volume shown in figure 2 indicated that at least 70% of the total urine volume fall below the predicted ICRP value (1600 ml d^{-1}) [1].
- The mean urine creatinine value per day (fig 3) is lower than the ICRP value by 44%.
- The mean urine creatinine per body mass value (fig 4) is 41% lower contrary to literature report that black subjects has 5% higher urine creatinine value per body mass than their white counterpart [3].
- The mean daily creatinine per urine volume (fig 5) is within 1σ of the reference value.

CONCLUSIONS :

- The daily urinary volume for the adult male subjects in Nigeria seems to have values lower than the ICRP reference value.
- The daily urinary creatinine for adult male subjects in Nigeria shows values lower than the reference value predicted by the ICRP.
- The above results seem to suggest the influence of environmental and climatic factors such as the prevailing weather conditions and altitude in Nigeria.

PROSPECTS FOR FURTHER STUDIES :

- Though the low number of subjects prevents statistically validated conclusions, the results obtained indicated a clear trend.
- In view of the aforementioned, there is the need for a more extensive and comprehensive data acquisition in order to be able to validate statistically the present hypothesis.

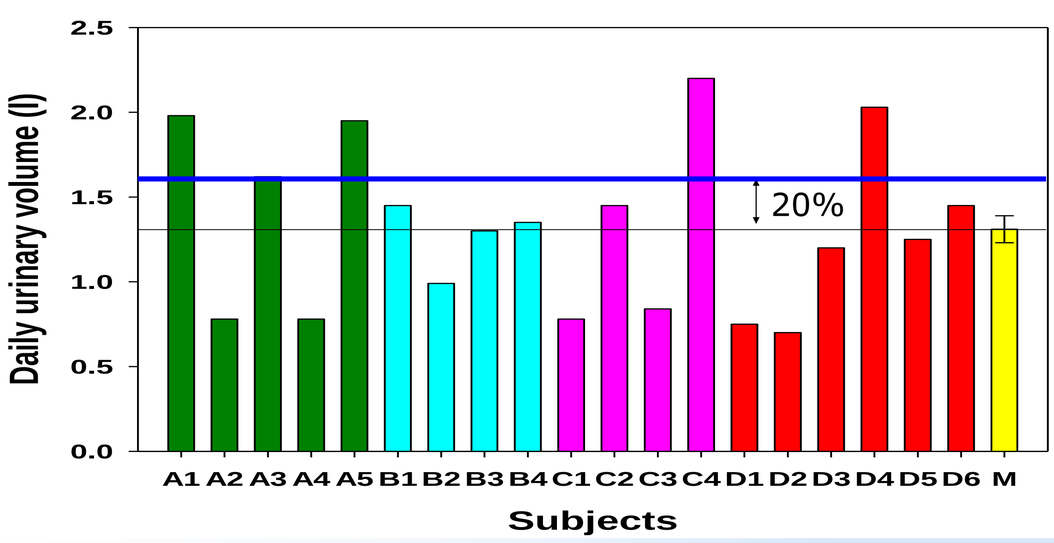

Fig 1: Variation of 24-h urine volume among the four groups

The two solid lines represent the difference between the ICRP value (dark blue lines) and the present mean value (M), error bars are ± SD. Groups (A-D) represent the sedentary workers, public Jos, public Akure and heavy workers, respectively.

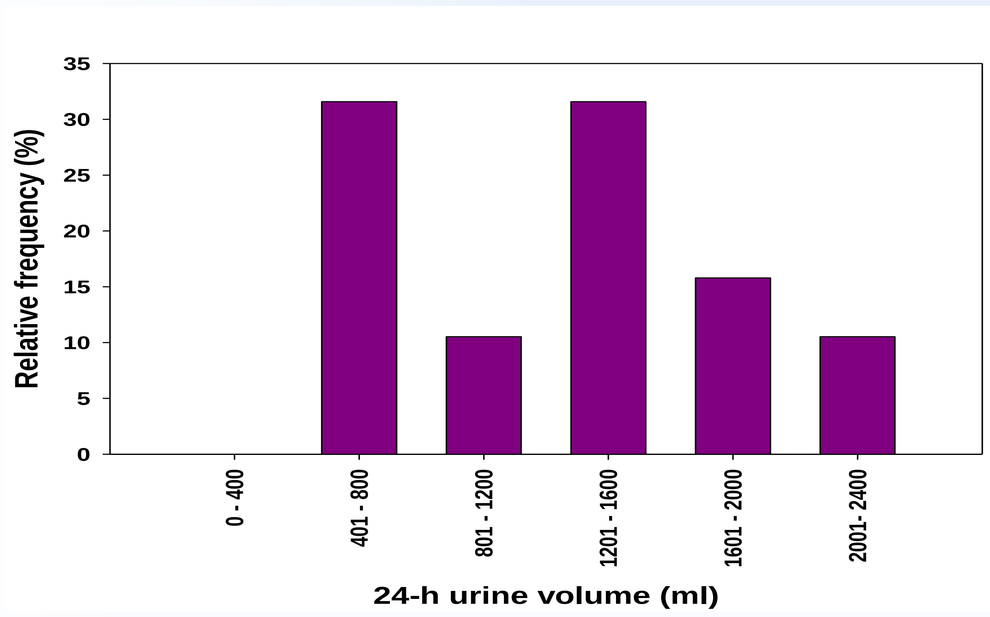

Fig 2: Relative frequency distribution of the measured volume

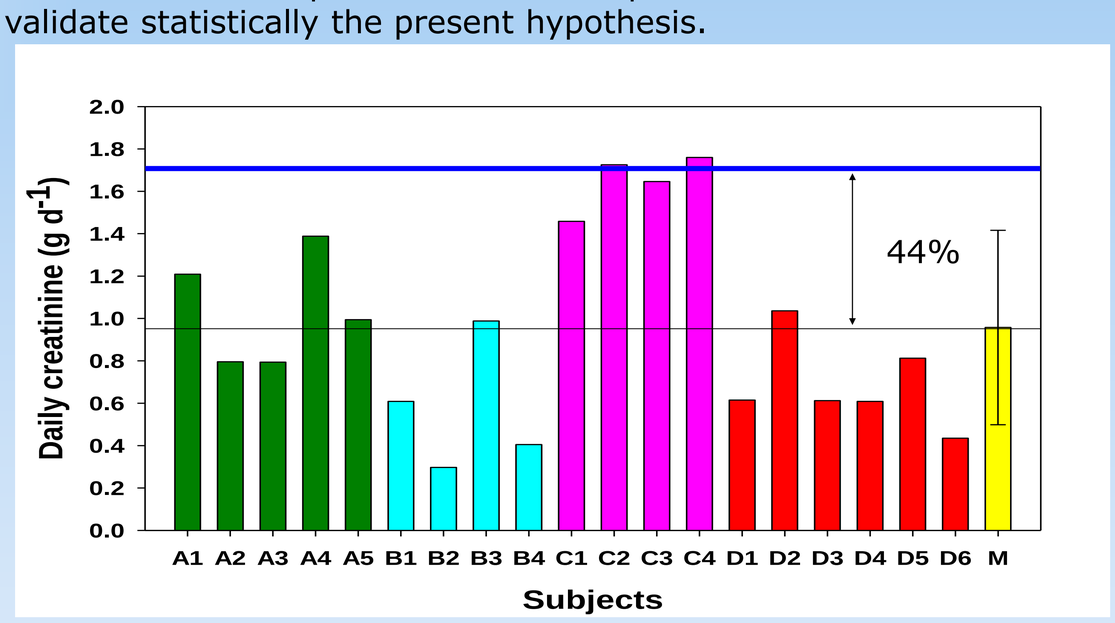

Fig 3: Variation of daily creatinine among subjects

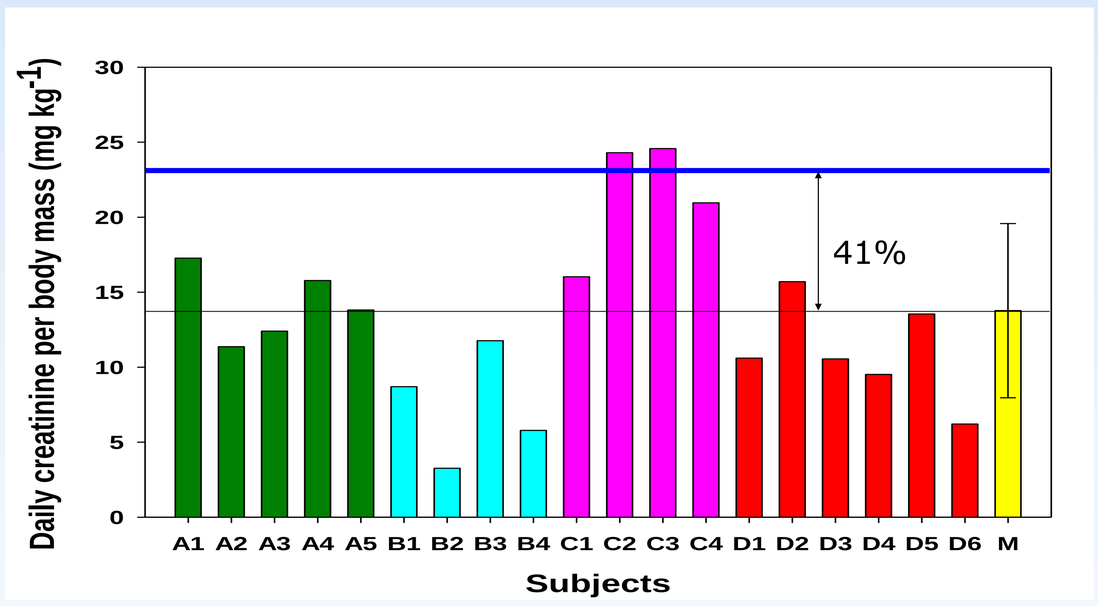

Fig 4: Variation of daily creatinine per body mass among subjects

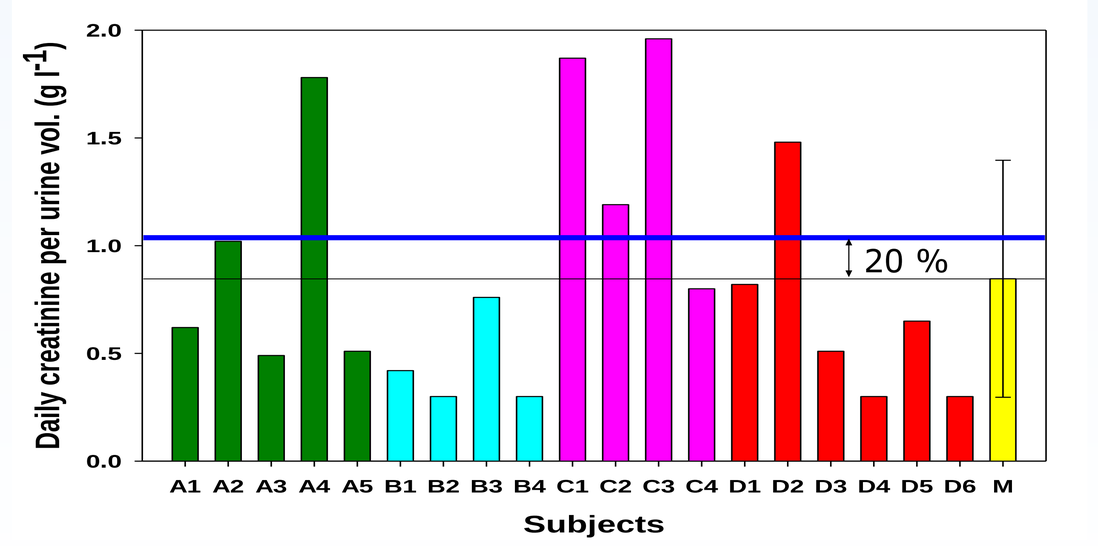

Fig 5: Daily creatinine per urine volume among subjects

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3. James, G. D., Sealey, J. E., Aldermann, M., (1988). An. J. Hypertens. 1, 124-131.