

# Before-after urinary arsenic comparison in a human biomonitoring in the polluted site of Gela, Italy

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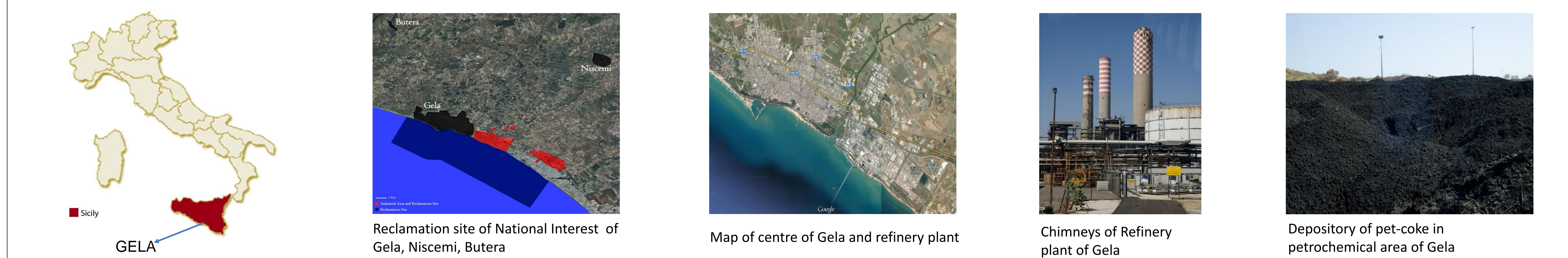
## INTRODUCTION

Gela is a coastal town located in the South of Sicily (Italy) with a population of 76,826 in 2013. Bordering in south-east direction the city of Gela, the industrial area, active since 1962, includes chemical production plants, a power station and an oil refinery plant, one of the larger in Europe, refining 5 million tons of crude per year. (figure 1).

Since 2000 the Area including the Municipalities of Gela, Niscemi and Butera was declared as Reclamation Site of National Interest on the basis of documented soil contaminations or presence of hazardous waste. (figure 1)

Extremely high levels of toxic, persistent and bio-accumulating chemical pollutants have been detected in soil, surface and groundwater as well as in marine water and sediments (Musmeci et al. 2009). Numerous epidemiological studies have reported evidences of health risk (Cernigliaro et al. 2009, Pasetto et al. 2009; Pasetto et al. 2012; Bianchi et al. 2006). This epidemiological knowledge represent a priority set to be considered in environment and health surveillance and to plan a series Human BioMonitoring (HBM) Surveys.

Figure 1. Reclamation Site of National Interest of Gela, Niscemi, Butera



The study is aimed at:

- performing a before-after comparison of urinary total As (tAs);
- improving the assessment of exposure to arsenic in population samples.

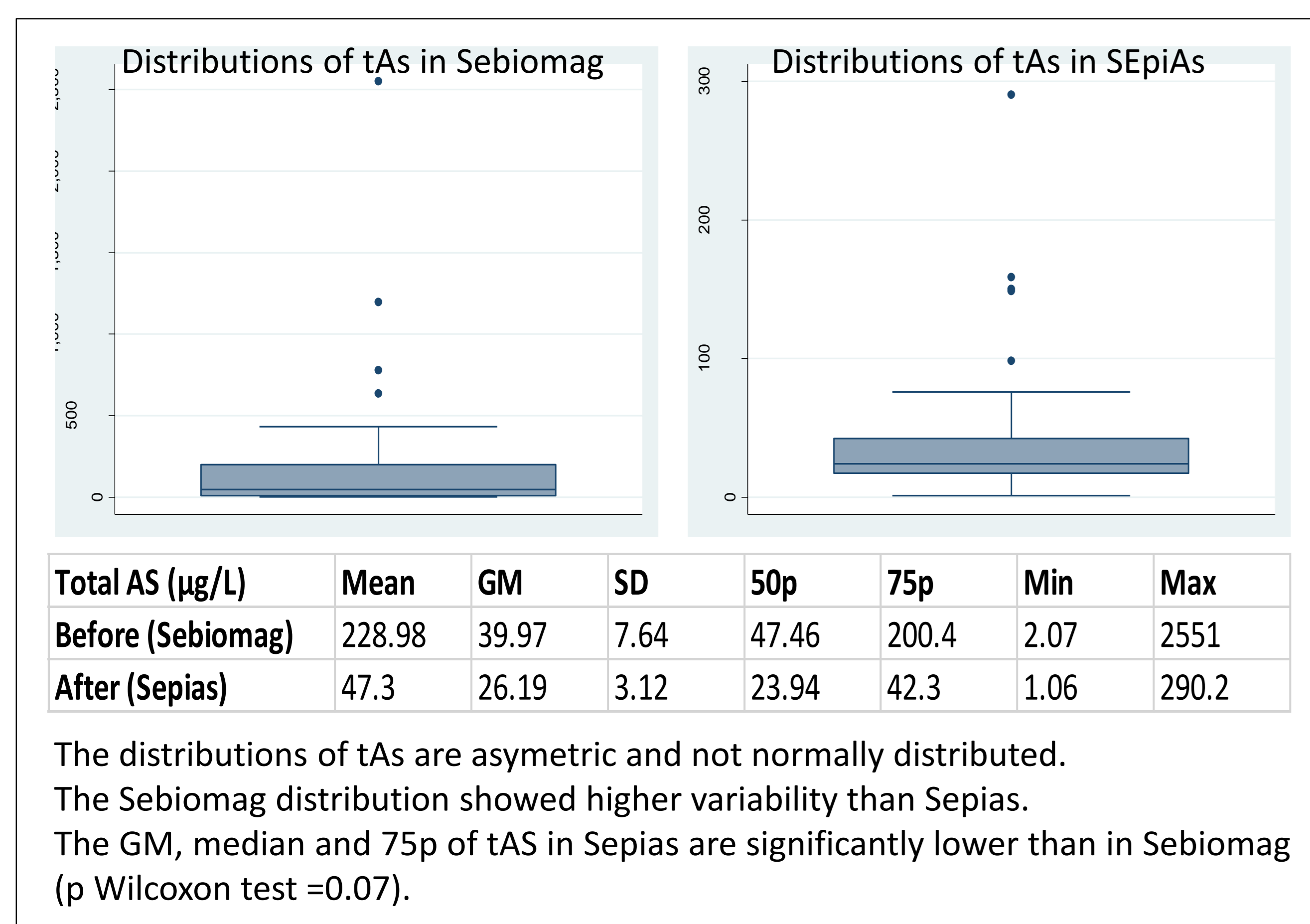
## AIMS

## METHODS

To improve the knowledge on human exposure to arsenic, a HBM survey (Sebiomag) in the area of Gela, Niscemi and Butera was carried out in 2009. The results showed a critical issue for tAs in urine (n=262; GM=16.4 µg/L; 75<sup>th</sup> percentile (75p)=48 µg/L; 95<sup>th</sup> percentile (95p)=352 µg/L). Considering the 75p as cutoff of tAs distribution, 65 subjects (outliers) had high values of tAs. 33 of the 65 outliers were recruited in new HBM survey carried out in 2012 (Sepias); tAs were re-measured in urine sample, As speciation was implemented: inorganic As (iAs), organic MMA and DMA were measured and individual interviews were repeated using the same questionnaire administered in 2009. Before-after comparison of tAs was evaluated by arithmetic and geometric mean (GM), median, 75p and the differences were tested by Wilcoxon signed rank test.

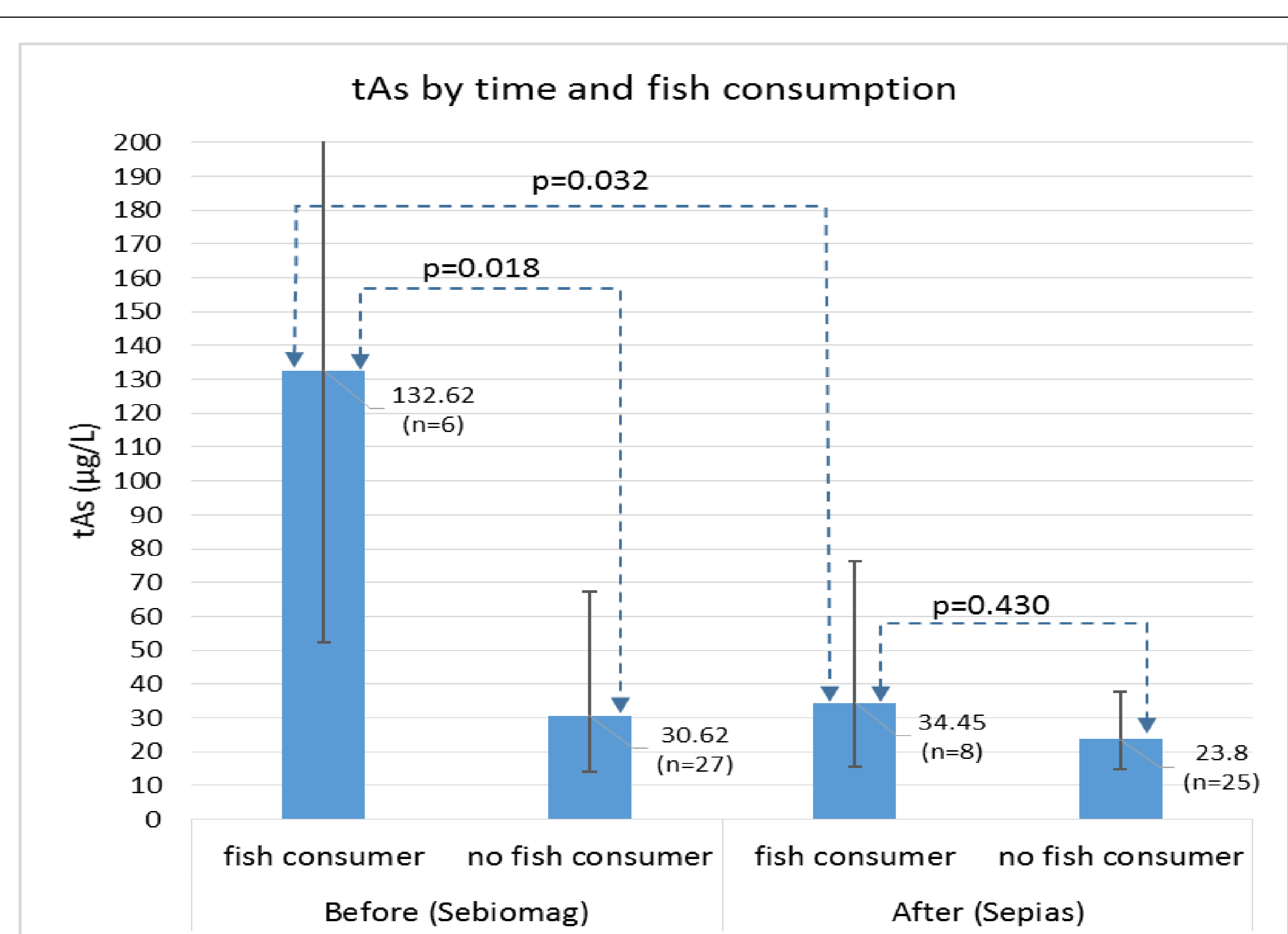
The evaluation of factors that influence the variation of tAs was checked using a GEE regression model for repeated measures. The considered covariates are the consumption of tap water, fish, shellfish, fruit, vegetables, milk, occupational exposure, sex and age.

## RESULTS

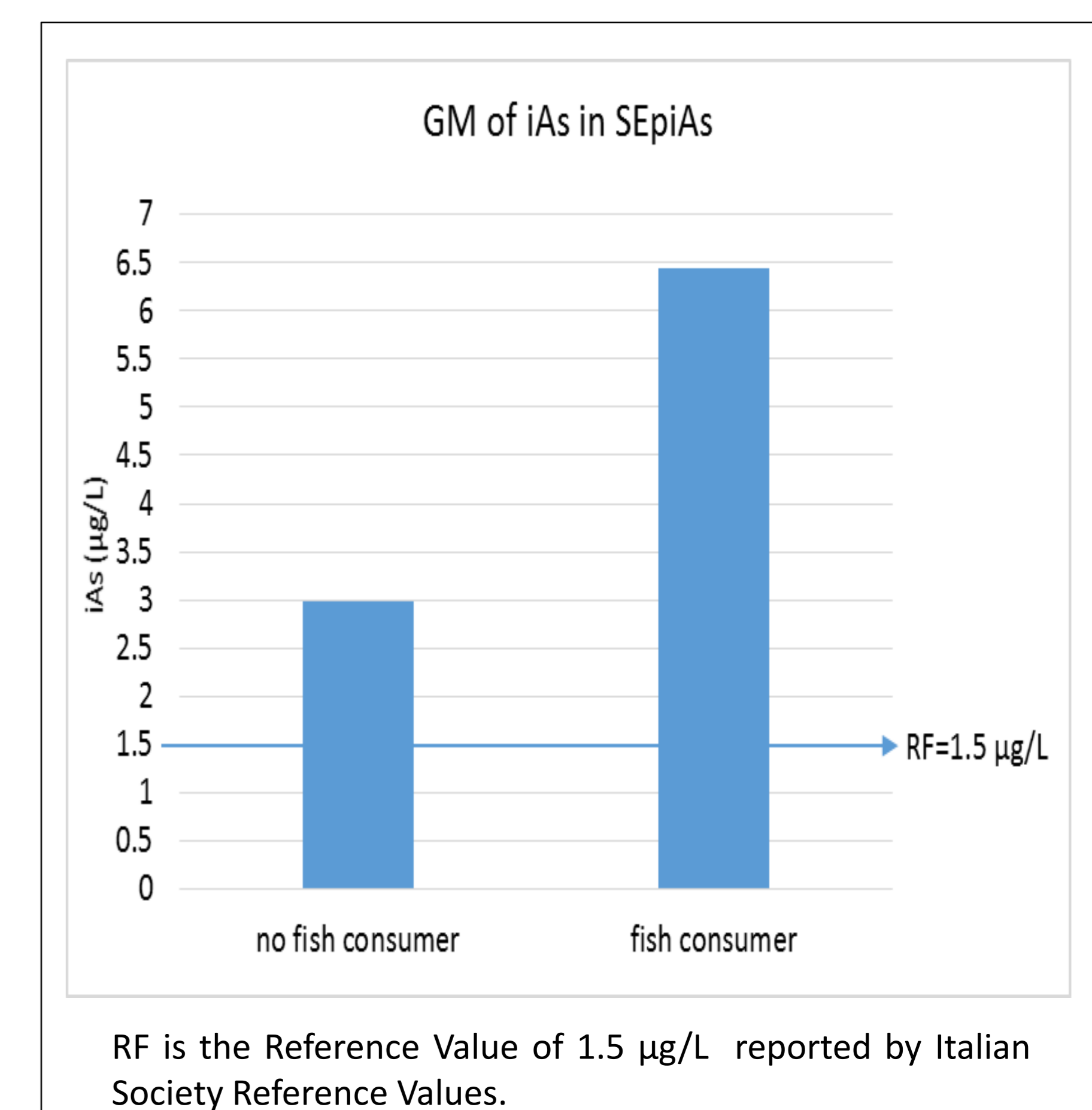


| Before – After Contingency table | tAs after > 50 µg/L |     |       |
|----------------------------------|---------------------|-----|-------|
| tAs before > 50 µg/L             | No                  | Yes | Total |
| No                               | 14                  | 3   | 17    |
| Yes                              | 11                  | 5   | 16    |
| Total                            | 25                  | 8   | 33    |

Using a cut-off of 50 µg/L, 11 values decreased from the high to the low class, while 3 values crossed from the low to the high. (p McNemar test =0.03). This result showed a decrease of subject with high values of tAs (17 vs 8).



The GEE model with interaction between fish-consumption and time (Before-After) was the most informative (the other variables don't significantly affect the tAs concentration), showing a remarkable before-after decrease of tAs among fish consumers (p=0.032). The results showed that in Sepias the fish consumption hasn't significantly increased the concentration of tAs (p=0.430) despite in Sebiomag (p=0.018).



RF is the Reference Value of 1.5 µg/L reported by Italian Society Reference Values.

iAs at the 2nd survey confirmed appreciable levels for fish consumers and not consumers (GM in fish consumer=6.44 µg/L; GM in no fish consumer=2.98 µg/L). MMA-DMA plus iAs gave similar results.

## CONCLUSIONS

The results showed a before-after decrease of tAs. From results we can suppose that the tAs in fish has declined but iAs is higher than reference value in particular in fish consumers. Total As is inadequate for exposure assessment and the importance of As speciation is confirmed and strengthened.