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### ► To cite this version:

Luana Batista Goulart, Stefan Tzortzis, Isabelle Séguy, Gérald Quatrehomme. Intrapopulation growth variation analysis using femur length: the case of Martigues plague victims (south of France – 1720-1721). 19th Annual Conference of the British Association for Biological Anthropology and Osteoarchaeology (BABAO), Sep 2017, Liverpool, United Kingdom. hal-02025667

**HAL Id: hal-02025667**

**<https://hal.univ-cotedazur.fr/hal-02025667>**

Submitted on 19 Feb 2019

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# INTRAPOPULATION GROWTH VARIATION ANALYSIS USING FEMUR LENGTH: THE CASE OF MARTIGUES PLAGUE VICTIMS (SOUTH OF FRANCE – 1720-1721)

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- Individual's living conditions influence his/her stature by 20% (Koepke, 2016).
- Bioarchaeological context: stature analysis has been used to evaluate past populations' living conditions.

## Aims:

- (1) evaluate whether all groups, divided according to age, gender and location at the archaeological site, were equally affected by these famines;
- (2) investigate how differently men and women suffered from them;
- (3) link age classes with starvation episodes in that region.

## Material

- In this work we analyse the skeletons of **95 adults**:
  - victims of the *Great Plague of Marseilles* (1720-1722);
  - exhumed from mass graves located at the city of Martigues (Provence - France) (Tzortzis, 2009);
  - suffered several starvation episodes before the epidemic (Séguy, 2017).

## Methods

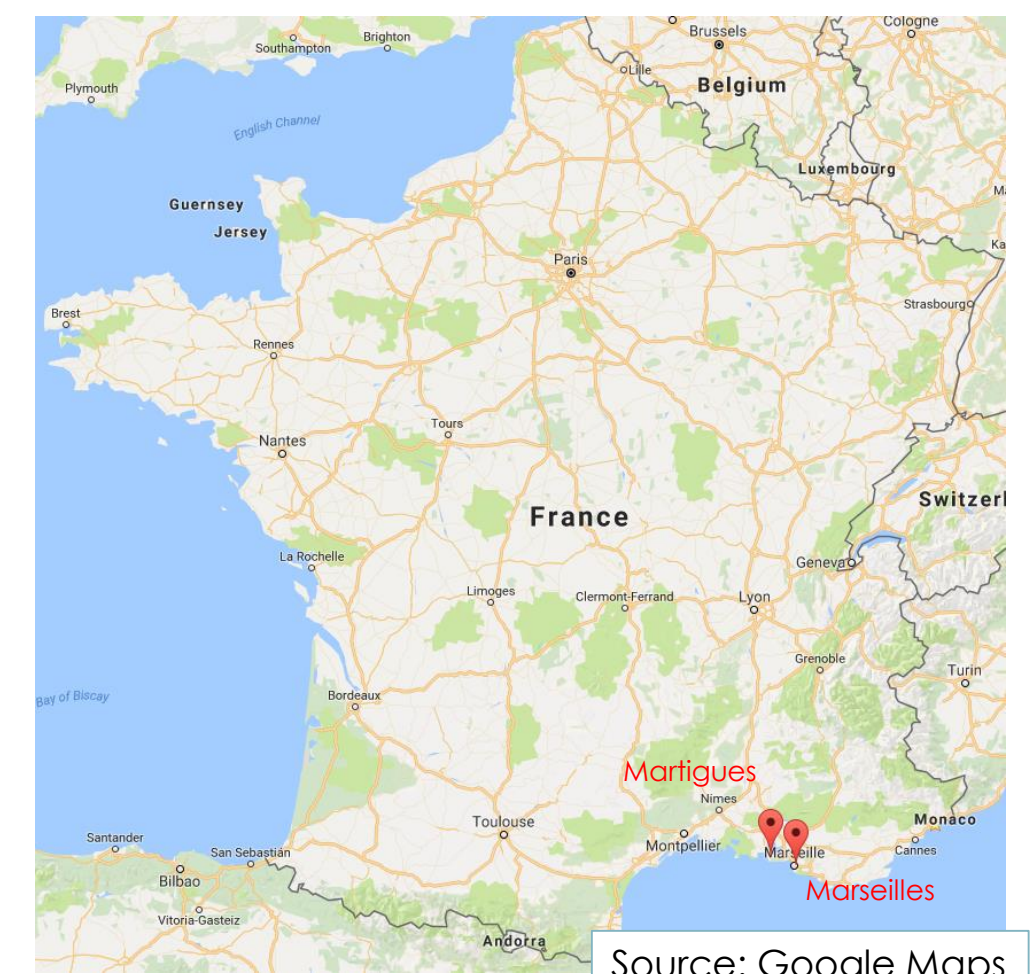
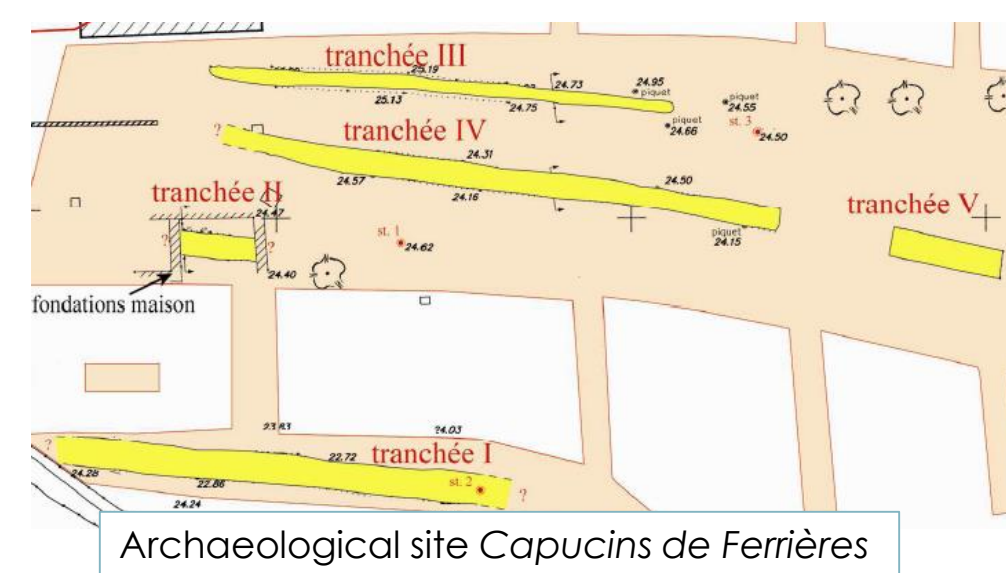
- **Femur length analysis**

We directly examine femur length, instead of predicted statures, to avoid modelling errors.

- **Factorial Analysis of Mixed Data (FAMD)**

Variables: sex, age class, inhumation place and femur length.

- **Investigation of historical sources.**



Source: Google Maps

## Results

- (1) Variables: **sex, inhumation place and femur length (FAMD)**

No pattern of stature variation linked to the inhumation place was observed.

- (2) Variables: **sex, age class and femur length (FAMD)**

- Significant difference between the mean of groups 1 and 3 (*Student's t-test*)
  - Group 1: women (almost only) from age classes young-mature, mature and mature-old.
  - Group 3: women from age classes young and old.
- **Variation in women stature:** the youngest and the oldest are taller than the others.
- Variation of mean among male groups (2 and 4) is not statistically significant.
- Considering both genders, the average statures of different age groups do not differ in a statistically significant manner (*ANOVA test*).

- (3) **Famines**

Victims of 1720-22 plague were born between **1702 and 1625** (90% between 1702 and 1655)

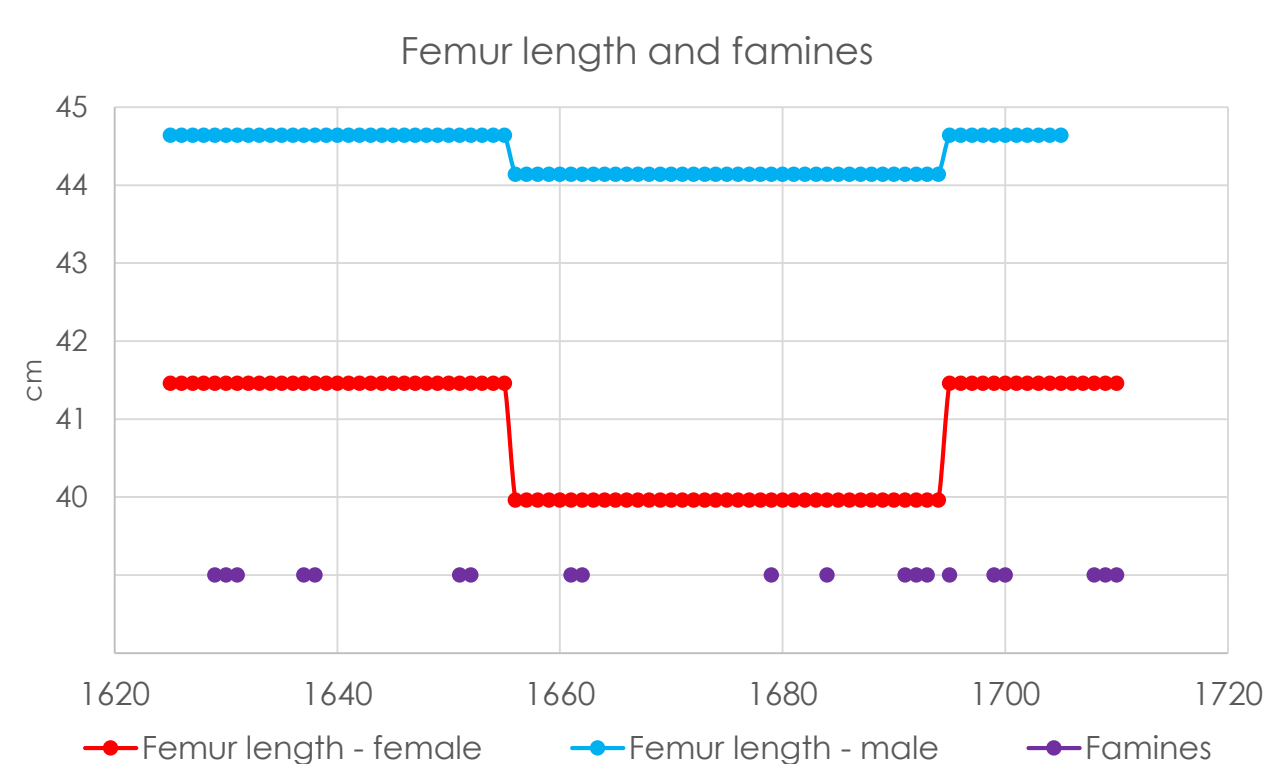
**1695 – 1702** – born period of individuals classed as “young”;

**1684 – 1710** – several episodes of starvation;

Uterine life and development period during the penury;

**1625 – 1655** – born period of individuals classed as “old”;

Both classified in the groups with higher statures (3 and 4).



	Groupe 1					Mean: 39,96cm
	Young	Young-mature	Mature	Mature-old	Old	Total
Women	0	5	8	11	0	24
Men	0	0	0	1	0	1
Total	0	5	8	12	0	25
	Groupe 2					Mean: 44,14 cm
	Young	Young-mature	Mature	Mature-old	Old	Total
Women	0	0	1	1	0	2
Men	0	5	10	14	0	29
Total	0	5	11	15	0	31
	Groupe 3					Mean: 41,46 cm
	Young	Young-mature	Mature	Mature-old	Old	Total
Women	9	0	0	0	12	21
Men	0	0	0	0	0	0
Total	9	0	0	0	12	21
	Groupe 4					Mean: 44,64 cm
	Young	Young-mature	Mature	Mature-old	Old	Total
Women	0	0	0	0	0	0
Men	4	0	0	0	10	14
Total	4	0	0	0	10	14

Results of the FAMD considering sex, age class and femur length.

## Discussion

**Gender inequality hypothesis:** women's stature correlated with age, while male's stature are homogeneous.

- Our analysis suggests that women were the most affected by changes in life conditions.

**“Osteological paradox”** (Wood, 1992):

- The youngest and the oldest were the most vulnerable during the penury period:

- Younger: growing and development period;
- Older: vulnerable because of advanced age.

- Event though, **they had higher stature than the other age group and survived the famines.**

- We hypothesize that:

- they survived because they had better life conditions than their contemporaries;
- differential life conditions made them taller than the other age group.

## Future perspectives:

- Examine the occurrence of **physiological stress markers** in the bones and teeth and also the variation in **dental microwear** to verify the consistency of these results.
- Comparison with other populations from the same region and/or period.

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