Intrapopulation growth variation analysis using femur length: the case of Martigues plague victims (south of France – 1720-1721)

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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);
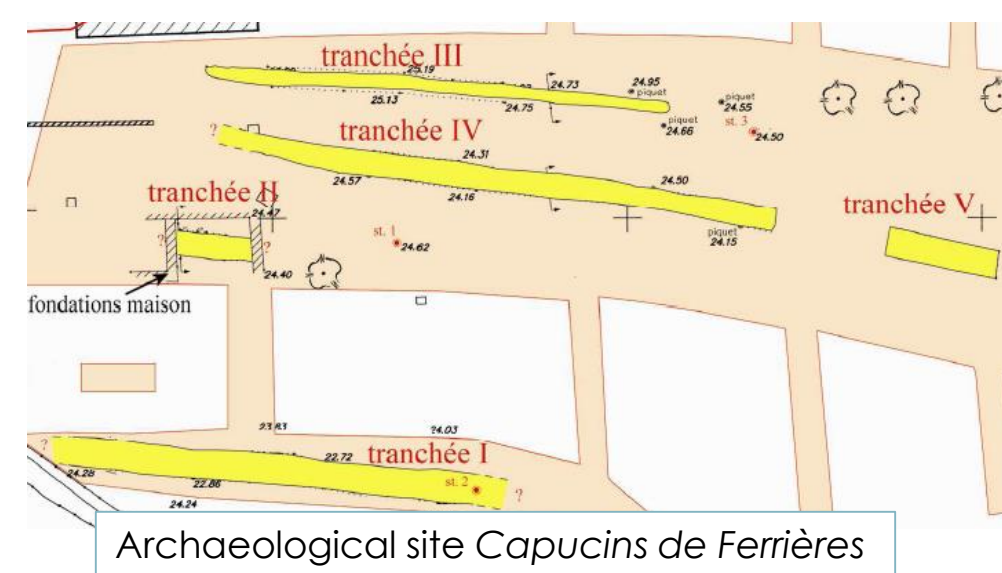   - suffered several starvation episodes before the epidemic (Séguy, 2017).

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.**

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).

Femur length and famines

Archaeological site *Capucins de Ferrières*

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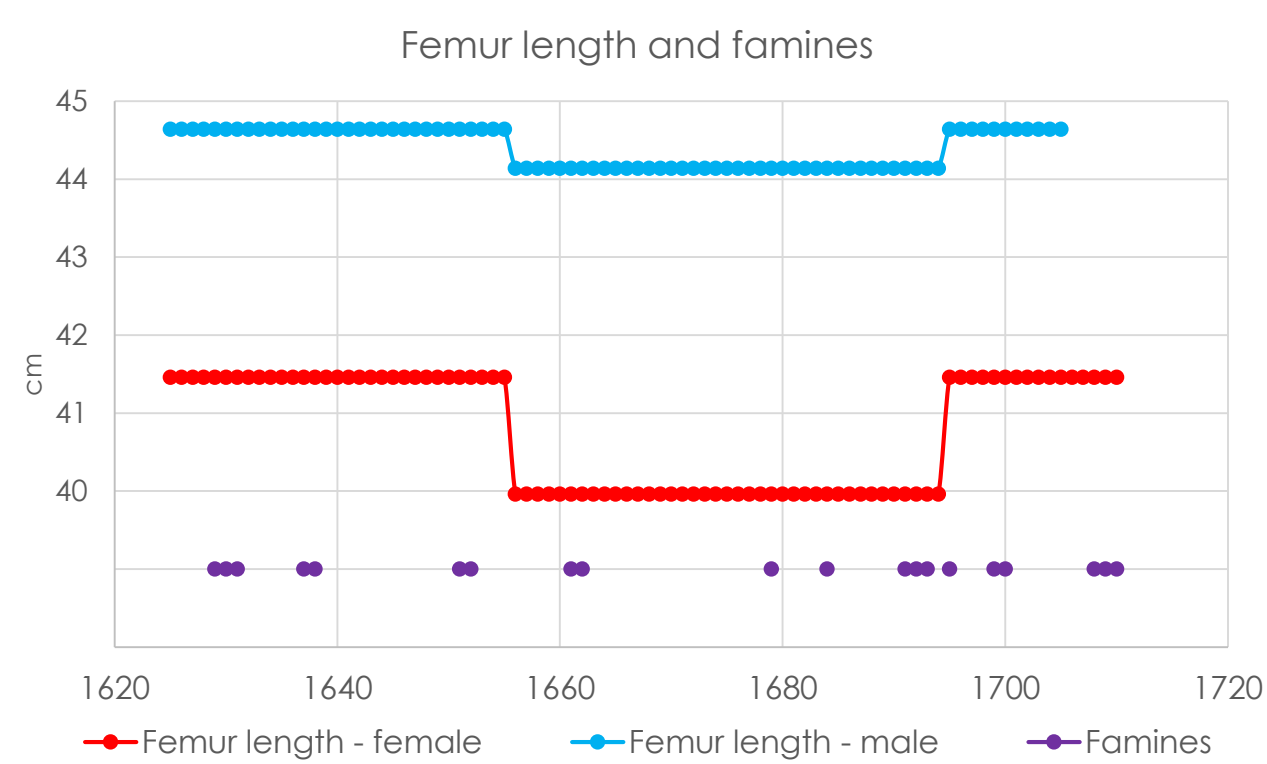
Groupe 1					Mean: 39,96cm
	Young	Young-mature	Mature	Mature-old	Old	Total
Women	0	5	8	11	0	24
Men	0	0	0	1	0	1
Total	0	5	8	12	0	25
Groupe 2					Mean: 44,14 cm
	Young	Young-mature	Mature	Mature-old	Old	Total
Women	0	0	1	1	0	2
Men	0	5	10	14	0	29
Total	0	5	11	15	0	31
Groupe 3					Mean: 41,46 cm
	Young	Young-mature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