Influence of occupational activity on the rate of degenerative change of the pubic symphysis in a sample of 19th-20th century Portuguese males

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INTRODUCTION

Age-at-death in adult skeletal remains is usually estimated from degenerative changes in limited movement joints, like the pubic symphysis (PS).

The first method for age estimation based on PS joint dates back to 1920[1]. Since then, new methods arise, however, the existing methods do not yield satisfactory results, possibly due to the influence of environmental factors, such as occupational activity, on the rate of bone senescence[2].

The purpose of this study was to determine whether the occupational activity influences the senescence of PS.

MATERIAL AND METHODS

• Identified Skeletal Collections curated at the National Museum of Natural History, University of Lisbon and at the Department of Life Sciences, University of Coimbra, were utilized;

• 160 male individuals were selected with ages-at-death ranging from 18 to 96 years;

• The sample was selected according to the recorded occupations: 68 individuals in the non-manual group (e.g. priest, professor and student) and 93 in the manual group (e.g. workers, carpenters and farmer);

• Subsequently, the sample was subdivided, according to the mean of femoral robusticity index (FRI)[3] into: robust (n = 64; FRI ≥ 20.47) and gracile (n = 73; FRI < 20.47) individuals;

• The non-manual and gracile groups represent less physically demanding occupations;

• The manual and robust groups represent more physically demanding occupational activities;

• Degenerative changes in the PS (Table 1 and Figure 1) were recorded as present/absent (Todd[1] and Brooks and Suchey[4]). Except for the public tubercle, recorded attached or separate from the face;

• Intra-observer error was assessed by repeating observations in a sub-sample of 20 PS using Cohen's Kappa;

• Influence of occupation on the age of transition (from absent to present) of each trait was inferred from logistic regression. Billowing was analysed from present to absent, as this reflects the ageing process.

RESULTS

• Scoring of the traits granularity and dorsal plateau lipping showed high intra-observer error (Table 1)

Table 1. Determination of intra-observer error (Kappa) and discordant observations number (n) for each of the characteristics found in 20 pubic symphysis.

Characteristic	n	Kappa
Dorsal plateau lipping	7	0.13
Granulosity	5	0.50
Ligamentous outgrowths on the ventral bevelling	2	0.62
Rim erosion	1	0.63
Face erosion	3	0.66
Billowing	3	0.71
Pubic tubercle	1	0.77
Face depression	1	0.77
Rim	1	0.89
Upper extremity	0	1.00
Lower extreity	0	1.00
Dorsal plateau	0	1.00
Ventral rampart	0	1.00
Ventral bevelling	0	1.00

• Logistic regression results are not statistically significant for most traits, except for ligamentous outgrowths on the ventral bevelling according to individual robustcity (Tables 2 and 3);

• The age of transition for ligamentous outgrowths on the ventral bevelling is younger in robust individuals than in the gracile group (Table 3).

Figure 1. Some of the pubic symphysis characteristics analysed.

Table 2. Median age (transition), lower quartile (LQ) and upper quartile (UQ) in years for traits in the PS which show valid logistic regression models. Wald statistic and p of Wald for significance of differences between the median age in the manual and non-manual group.

Characteristic	Manual group			Non-manual group			Wald	p
	LQ	Median	UQ	LQ	Median	UQ		
Lower extremity	20.18	21.44	22.69	19.97	20.06	20.14	0.735	0.391
Ventral rampart	20.40	21.66	22.92	21.60	23.37	25.14	0.853	0.356

Table 3. Median age (transition), lower quartile (LQ) and upper quartile (UQ) in years for traits in the PS which show valid logistic regression models. Wald statistic and p of Wald for significance of differences between the median age in the robust and gracile group.

Characteristic	Robust			Gracile			Wald	p
	LQ	Median	UQ	LQ	Median	UQ		
Lower extremity	20.3	22.1	23.8	20.0	20.1	20.2	0.540	0.462
Ventral rampart	19.7	21.6	23.4	21.2	22.8	24.4	0.324	0.569
Face erosion	21.9	48.1	74.2	19.1	47.2	75.4	0.001	0.981
Ligamentous outgrowths on the ventral bevelling	47.3	66.6	85.9	70.3	83.4	96.5	6.45	0.011

DISCUSSION AND CONCLUSION

The occupational activity appears to influence the rate of senescence of PS in this sample, with quicker senescence in individuals with physically demanding occupations. Perhaps physically demanding activity leads to more strain and stress in the cartilage and bone in the joint.

The fact that occupational activity may influence the rate of degenerative change in the PS suggests that the reliability of age estimation methods is affected by this environmental factor.

It is suggested that the establishment of future methods of age-at-death estimation using degenerative changes in the pubic symphysis can be improved if they account for occupational activity differences, according to the femoral robusticity index.

LITERATURE CITED

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