EXERCISE INDUCED PULMONARY VASCULAR DISTENSIBILITY IN HEALTHY VS. ATHLETIC SUBJECTS

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INTRODUCTION

Exercise is associated with a decreased pulmonary vascular resistance (PVR), due to a better cardiac output (Q).

PVR can be calculated as :

$$\frac{\text{mPAP} - \text{LAP}}{\text{Q}}$$

mPAP: mean pulmonary arterial pressure

LAP: left atrial pressure

Because of the distensibility of the pulmonary vasculature, the mPAP-Q relationship is not strictly linear. A curvilinear model accounts for the distensibility of the vessels[1] :

the coefficient α : the percentage change of vessel diameter per mmHg of pressure.

$$\text{PVR} = [(1 + \alpha \text{Ppa})^5 - (1 + \alpha \text{Pla})^5] / 5\ \alpha.\text{Q}$$

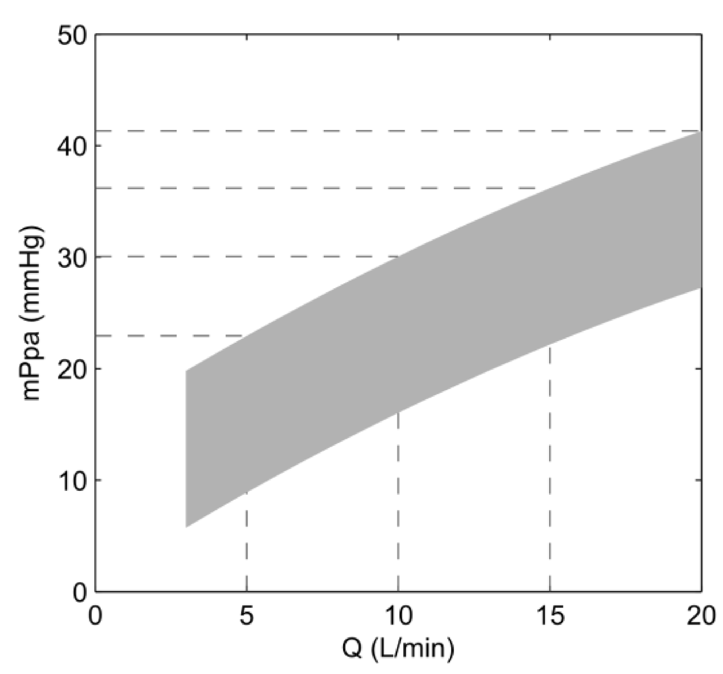


Fig 1 : Evolution of mPAP with Q [2]

Our hypothesis is that distensibility α allows for a higher Q and thus a higher aerobic exercise capacity.

Therefore, highly trained athletes should present with a higher α compared to sedentary controls.

METHODS

34 male volunteers, nonsmokers and free of any disease, participated in our study : 17 professional football players matched with 17 sedentary people.

	age (years)	BMI	weight (kgs)	height (cm)
players	24±3	24±2	82±6	187±7
controls	24±3	23±3	75±10	179±7

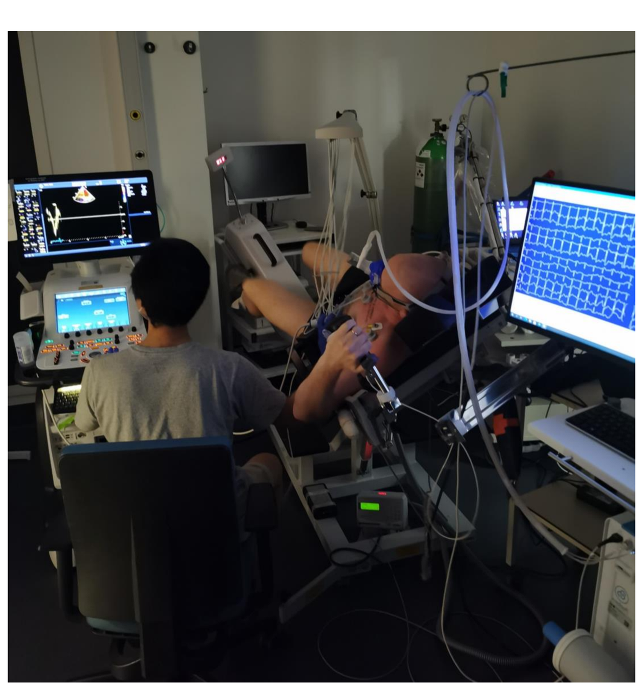


Fig 2 : Subject in experiment conditions

They underwent a cardiopulmonary exercise stress test (CPET) with echocardiography, during which the systemic pressure was recorded continuously.

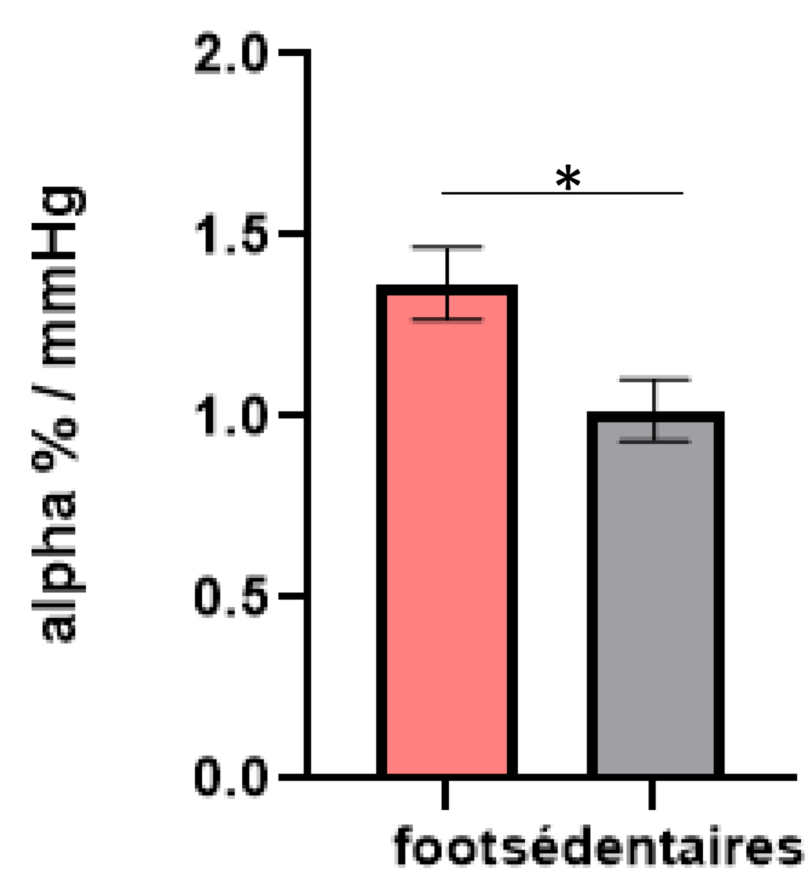
Parameters were measured at progressively increased workload until maximum oxygen uptake (VO_2max).

Measured **mPAP** was estimated from the maximal tricuspid regurgitation jet velocity (TRPG) and Q was estimated from the left ventricular outflow velocity-time integral (LVOT-VTI).

Pulmonary distensibility α index was calculated from multipoint **mPAP-Q plots**, based on the measured and theoretical mPAP:

$$\text{mPAP} = \frac{\left[(1 + \alpha\text{LAP})^5 + 5\alpha R_0\ (\text{Q})\right]^{1/5} - 1}{\alpha}$$

RESULTS



The present results confirmed our initial hypothesis. Athletes exhibited a significative higher α distensibility coefficient compared to sedentary controls.

players	controls	P-value
1,37±.041 % / mmHg	1,02±0,31 % / mmHg	P=0,017

DISCUSSION – CONCLUSION

Invasive and non-invasive studies have shown that α is normally between 1 and 2 %/mmHg, higher in young healthy women, and lower with aging or chronic hypoxic exposure[3,4]. Our results show that endurance athletes have a greater distensibility of the pulmonary arteriolar vessels as compared to sedentary people, which might contribute to develop higher Qmax and enhance VO_2max. Athletes are indeed regularly and chronically exposed to high cardiac output states.

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