Higher Cardiac Workload in the Upright Posture in Male versus Female Subjects

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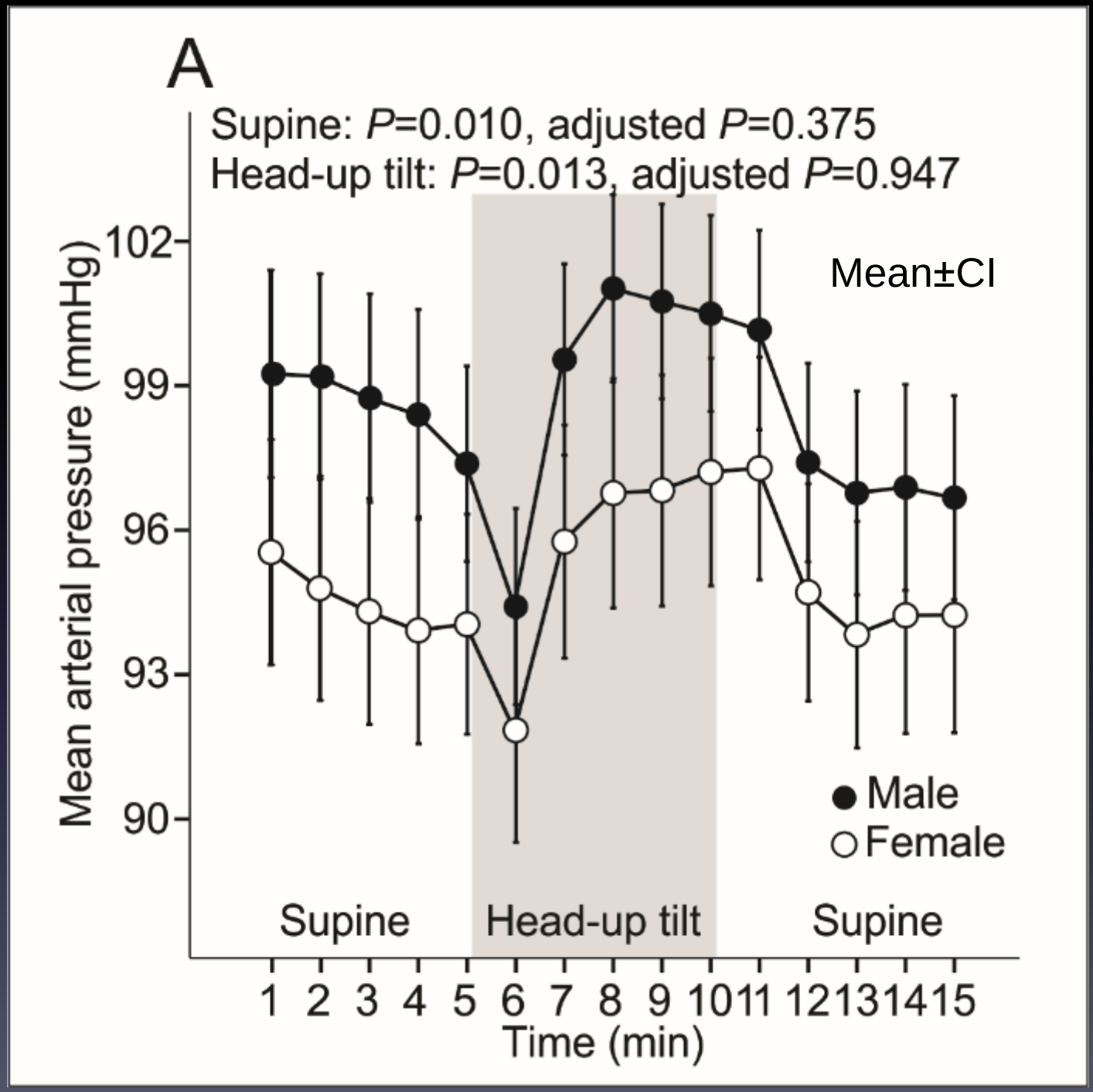
- DYNAMIC
  - Study of hemodynamics
  - Supervised by professor Ilkka Pörsti
- No conflicts of interests

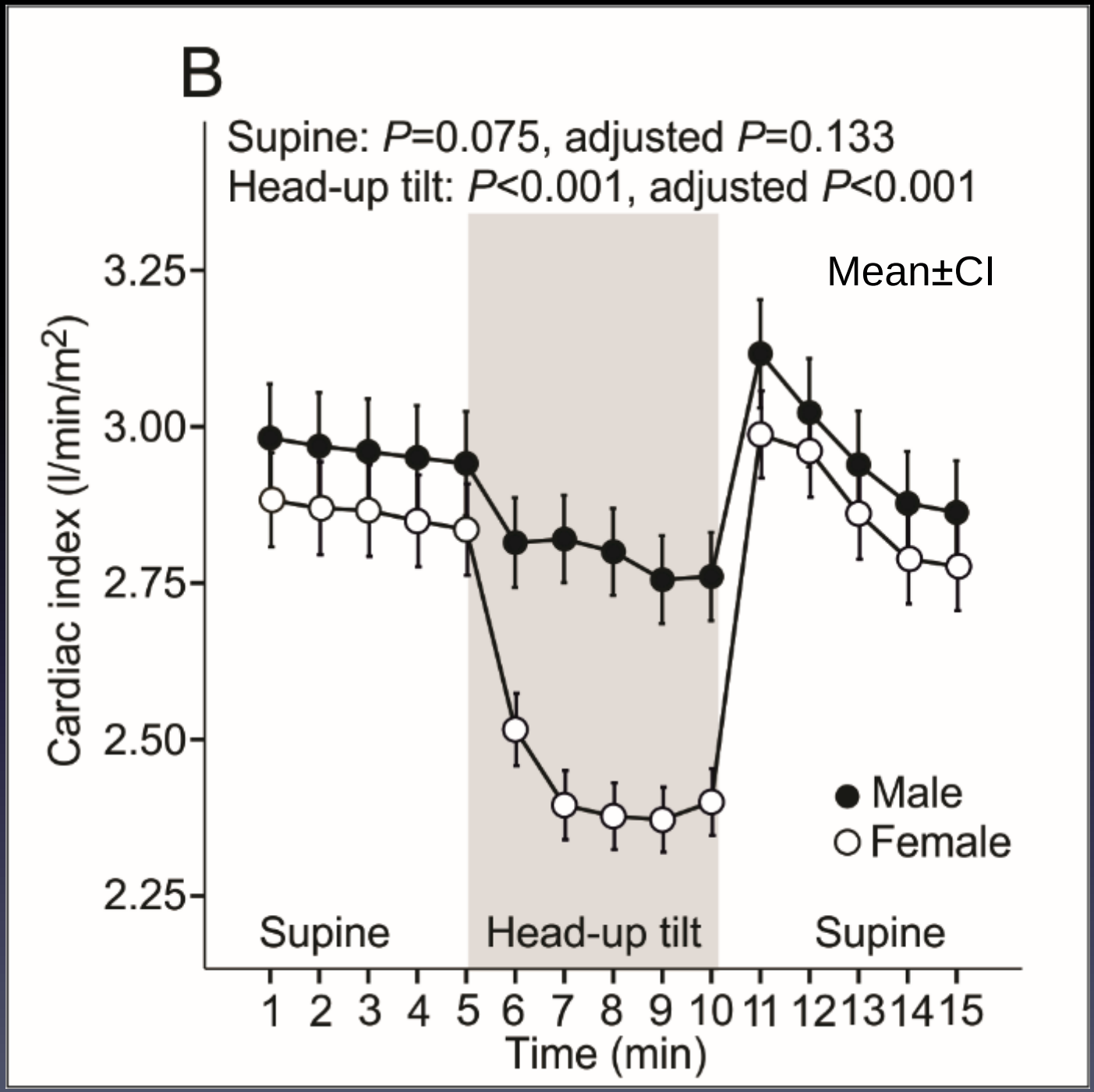
MEN AND WOMEN ARE DIFFERENT!

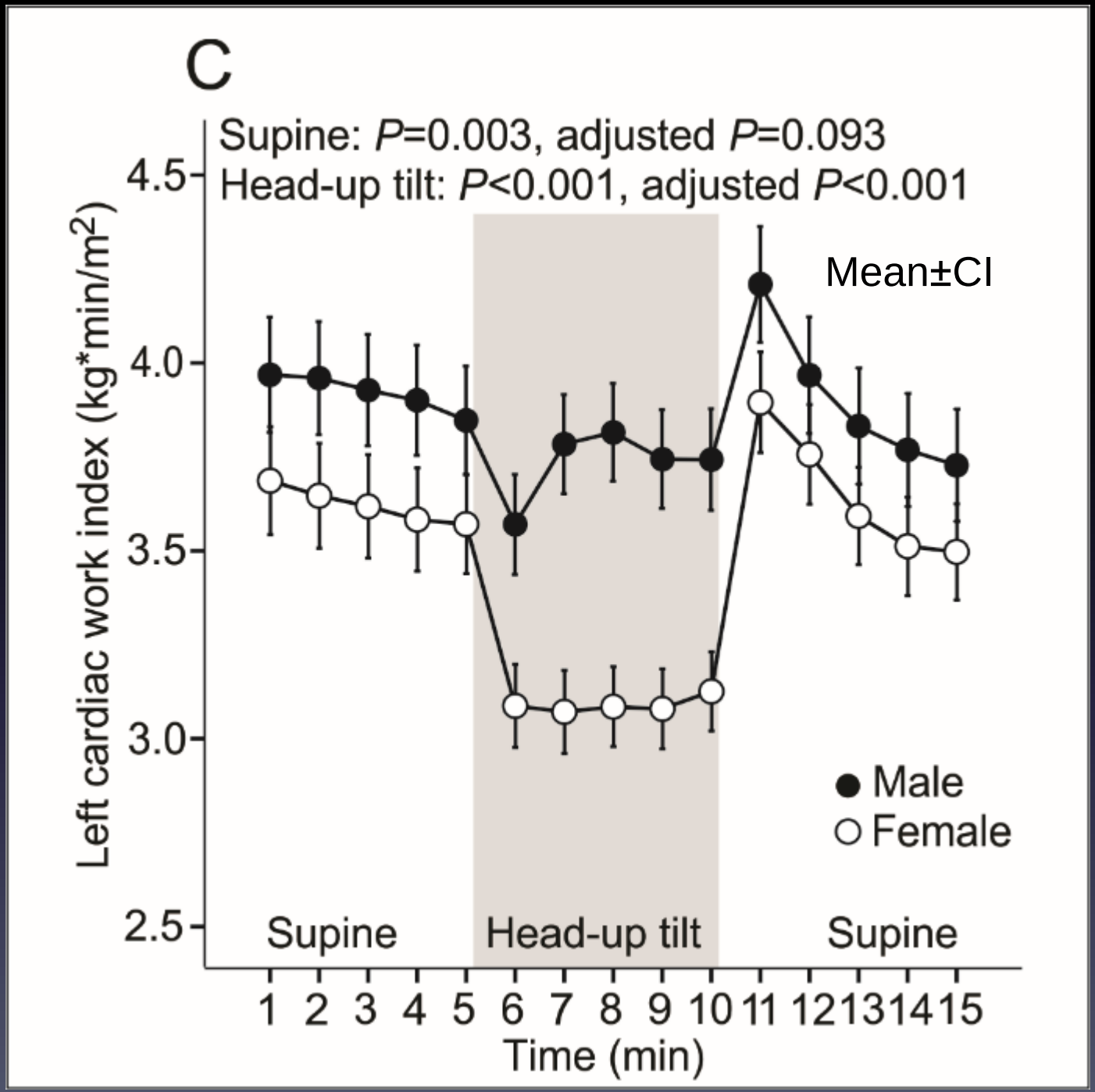
- Men and women differ
  - In the incidence and prevalence of cardiovascular diseases
  - In the mortality of cardiovascular diseases
- However, the treatment for hypertension, hyperlipidemias, diabetes, etc. is the same for both sexes (excluding the time of pregnancy).

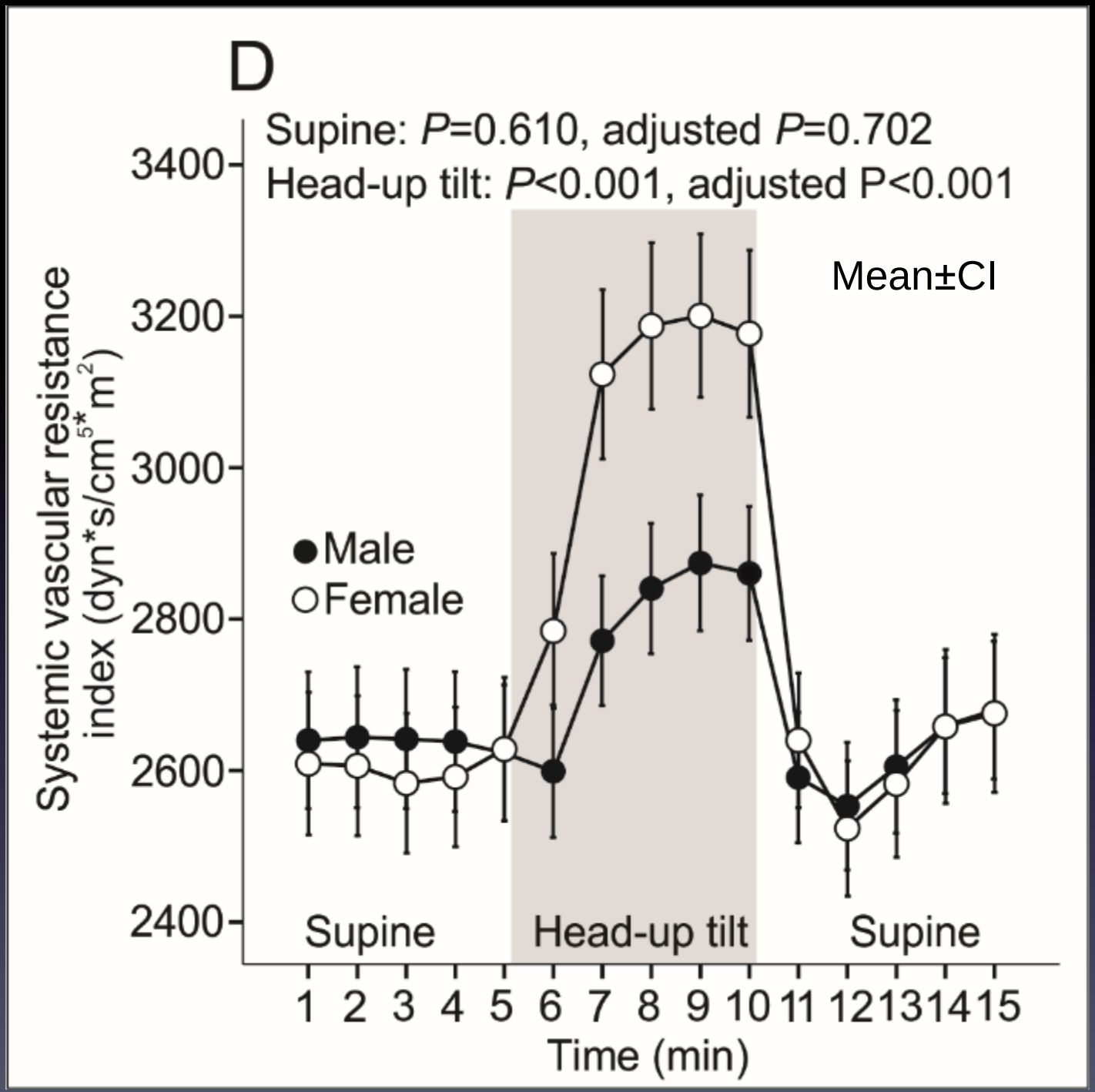
- The aim of our study was to evaluate the sex-related differences in hemodynamics, both in the supine and the upright positions.
- In the evaluation of cardiovascular risk, the significance of upright hemodynamics may have been neglected, although the standing position is characteristic for the human race.

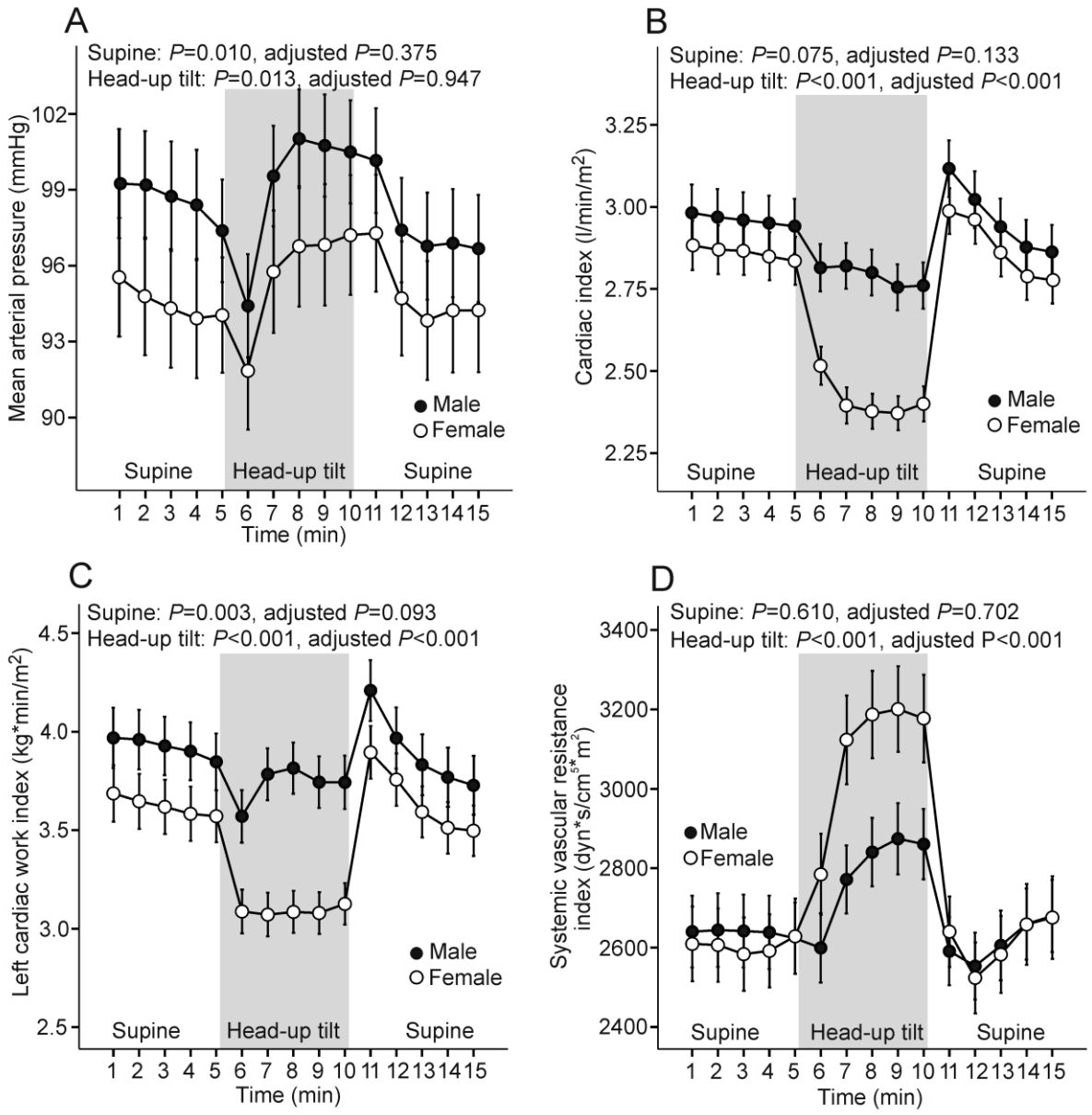
- 5 min in the supine position, 5 min in the upright position (passive head-up tilt).
- Impedance cardiography, tonometric blood pressure recordings (radial artery).
- The study population consisted of 167 men and 167 women matched in age and body mass index.
  - No medications with cardiovacular actions
  - No diabetes, arterosclerosis, heart disease


A
Supine: P=0.010, adjusted P=0.375
Head-up tilt: P=0.013, adjusted P=0.947
Mean±CI
Mean arterial pressure (mmHg)
102
99
96
93
90
Male
Female
Supine
Head-up tilt
Supine
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Time (min)


B
Supine: P=0.075, adjusted P=0.133
Head-up tilt: P<0.001, adjusted P<0.001
Mean±CI
Cardiac index (l/min/m2)
3.25
3.00
2.75
2.50
2.25
Male
Female
Supine
Head-up tilt
Supine
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Time (min)


C
Supine: P=0.003, adjusted P=0.093
Head-up tilt: P<0.001, adjusted P<0.001
Mean±CI
Left cardiac work index (kg*min/m2)
4.5
4.0
3.5
3.0
2.5
Male
Female
Supine
Head-up tilt
Supine
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Time (min)


D
Supine: P=0.610, adjusted P=0.702
Head-up tilt: P<0.001, adjusted P<0.001
Mean±CI
Systemic vascular resistance index (dyn*s/cm5*m2)
3400
3200
3000
2800
2600
2400
Male
Female
Supine
Head-up tilt
Supine
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Time (min)



Analyses were adjusted for LDL and HDL cholesterol, triglycerides, glucose, mean arterial pressure, smoking habits, alcohol intake, and height.

Conclusion

- Men and women have differences in hemodynamics, especially in the upright position.
- In men, the upright position seems to stress the heart, while in women the hemodynamic balance is maintained more by changes in peripheral arterial resistance.
  - *Could this difference be one explanation for the unequal incidence of cardiovascular diseases in men and women?*

- These hemodynamic differences are not explained by the generally known cardiovascular risk factors like smoking, lipid or glucose disorders or hypertension.

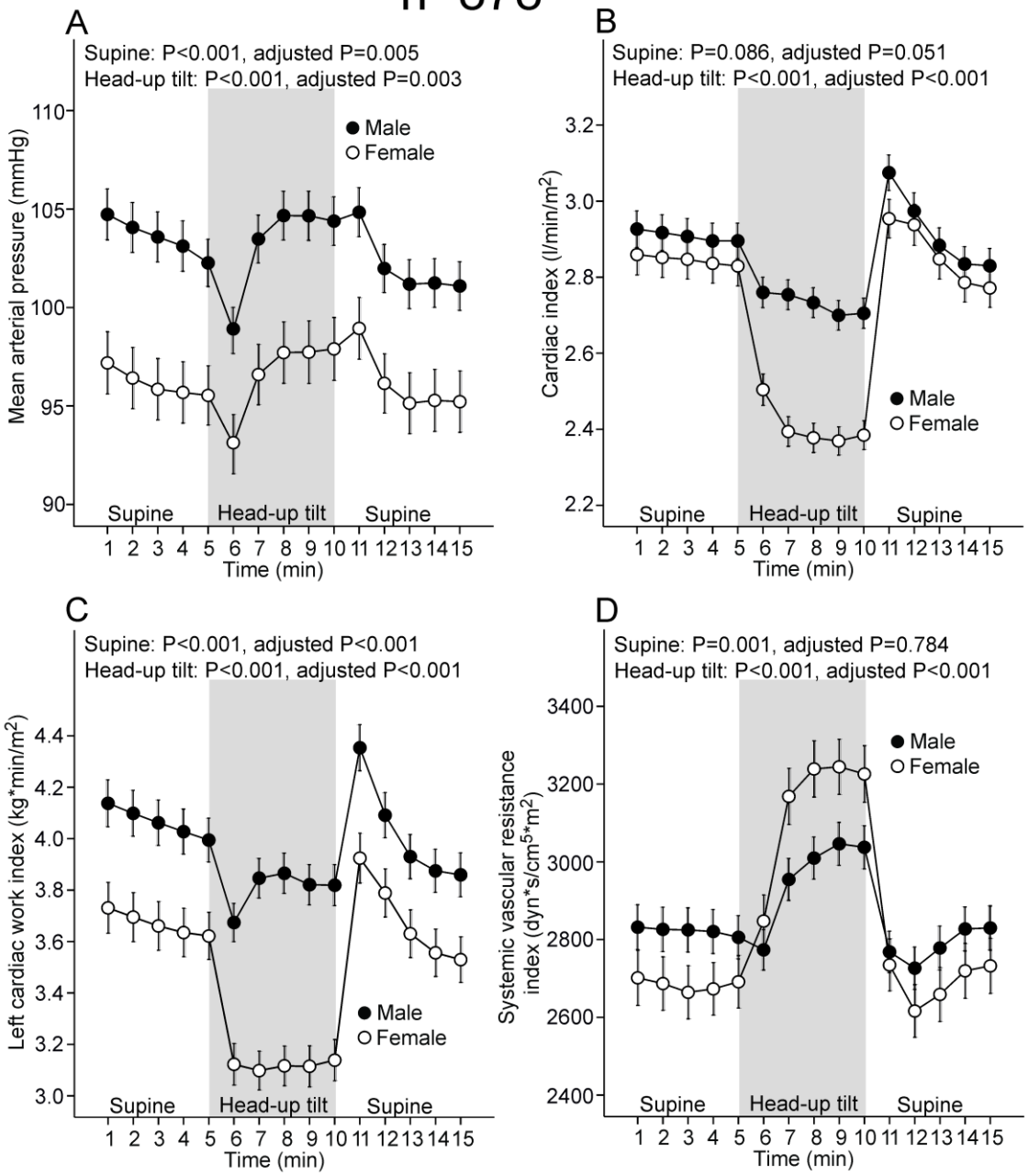
- Blood pressure level is determined by just two variables:

BP=PERIPHERAL VASCULAR RESISTANCE x CARDIAC OUTPUT

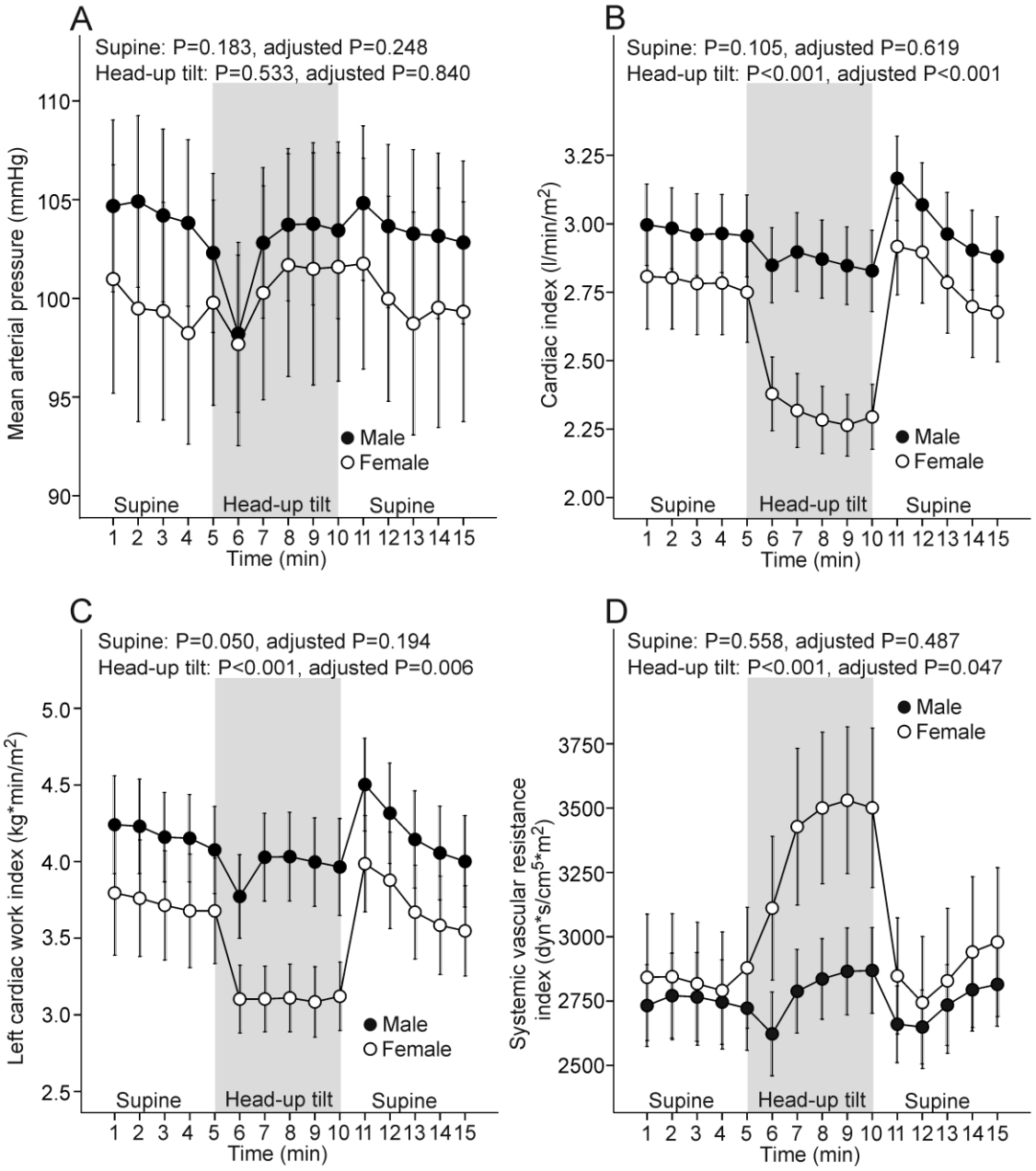
- The original study was published in *Journal of the American Heart Association* in June 2016.

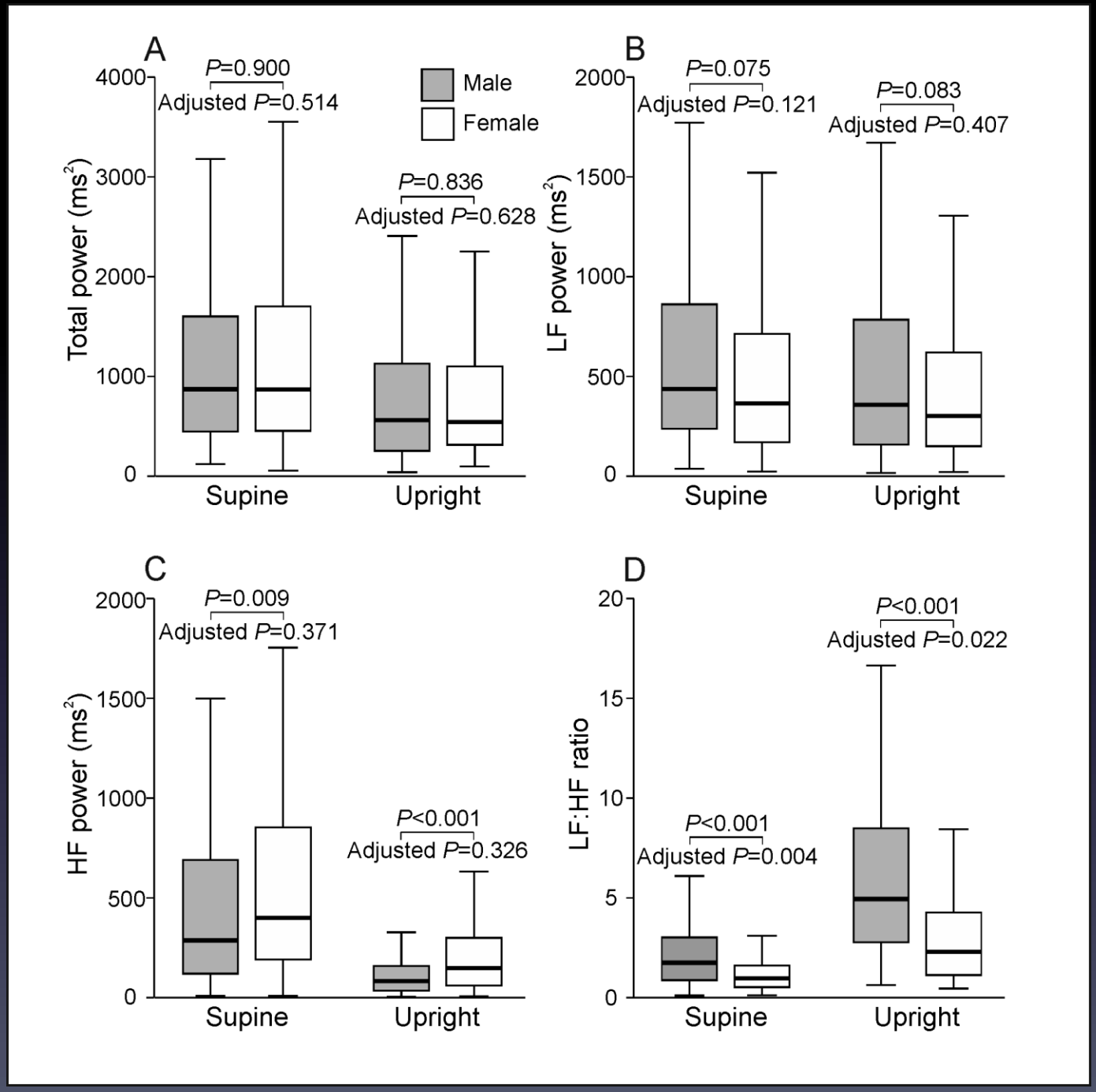

Thank you
for your
attention!

n=878


A
Supine: P<0.001, adjusted P=0.005
Head-up tilt: P<0.001, adjusted P=0.003
Mean arterial pressure (mmHg)
Male
Female
Supine
Head-up tilt
Supine
Time (min)
B
Supine: P=0.086, adjusted P=0.051
Head-up tilt: P<0.001, adjusted P<0.001
Cardiac index (l/min/m2)
C
Supine: P<0.001, adjusted P<0.001
Head-up tilt: P<0.001, adjusted P<0.001
Left cardiac work index (kg*min/m2)
D
Supine: P=0.001, adjusted P=0.784
Head-up tilt: P<0.001, adjusted P<0.001
Systemic vascular resistance index (dyn*s/cm5*m2)

Age≥ 55, without HRT




A
P=0.900
Adjusted P=0.514
P=0.836
Adjusted P=0.628
Male
Female
Total power (ms²)
4000
3000
2000
1000
0
Supine
Upright
B
P=0.075
Adjusted P=0.121
P=0.083
Adjusted P=0.407
LF power (ms²)
2000
1500
1000
500
0
Supine
Upright
C
P=0.009
Adjusted P=0.371
P<0.001
Adjusted P=0.326
HF power (ms²)
2000
1500
1000
500
0
Supine
Upright
D
P<0.001
Adjusted P=0.022
P<0.001
Adjusted P=0.004
LF:HF ratio
20
15
10
5
0
Supine
Upright