Biomonitoring air pollution

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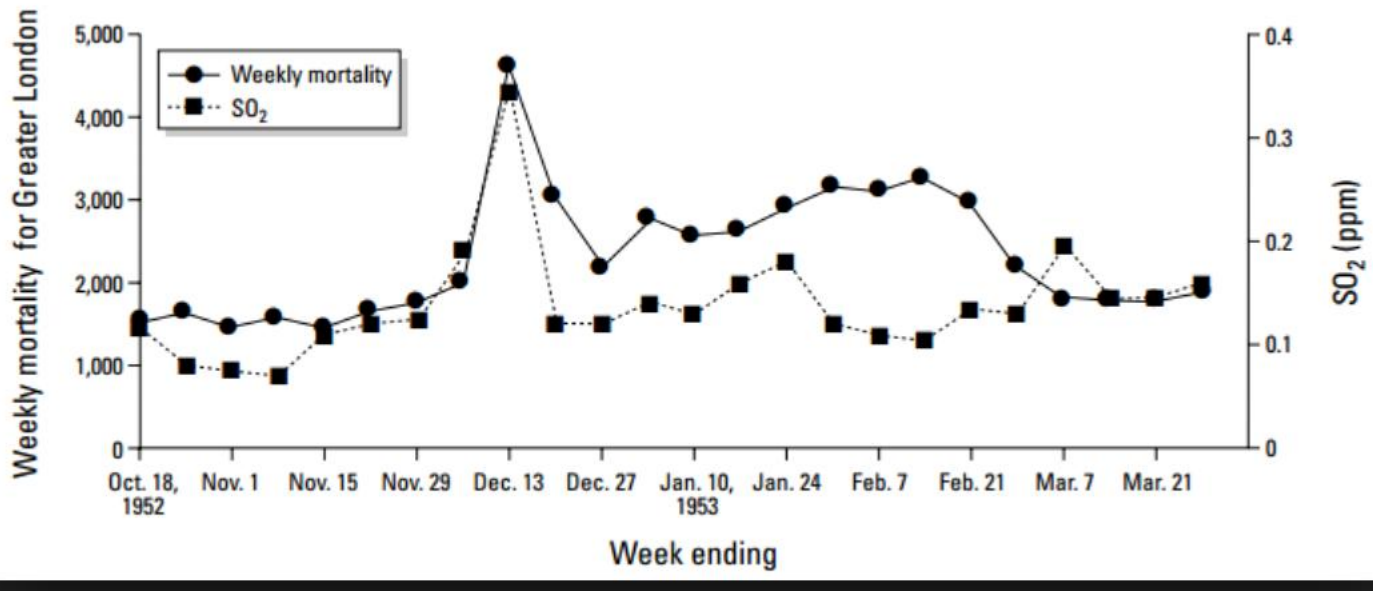

Weekly mortality for Greater London
5,000
4,000
3,000
2,000
1,000
0
Weekly mortality
SO_2
0.4
0.3
0.2
0.1
0
SO_2 (ppm)
Oct. 18, 1952
Nov. 1
Nov. 15
Nov. 29
Dec. 13
Dec. 27
Jan. 10, 1953
Jan. 24
Feb. 7
Feb. 21
Mar. 7
Mar. 21
Week ending

Church of Our Lady of the Rosary of Black Men

Wilfredo Rodríguez

OCT 2016

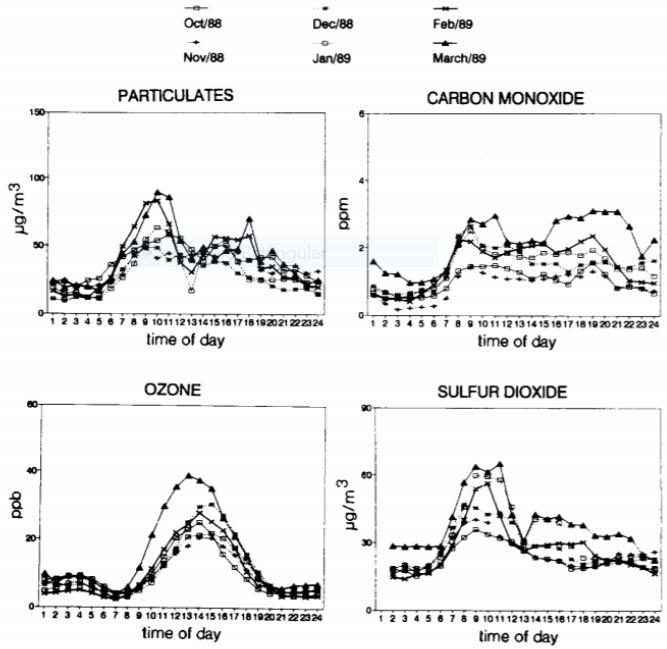


FIG. 1. Mean hourly variation of air pollution levels during the 6 months of exposure in S. Paulo downtown (CETESB, unpublished data). EPA ambient air quality standards: particulates (annual mean) = 75 μg/m³; carbon monoxide (8-hr mean) = 9 ppm; ozone (1-hr mean) = 120 ppb; sulfur dioxide (annual mean) = 80 μg/m³.

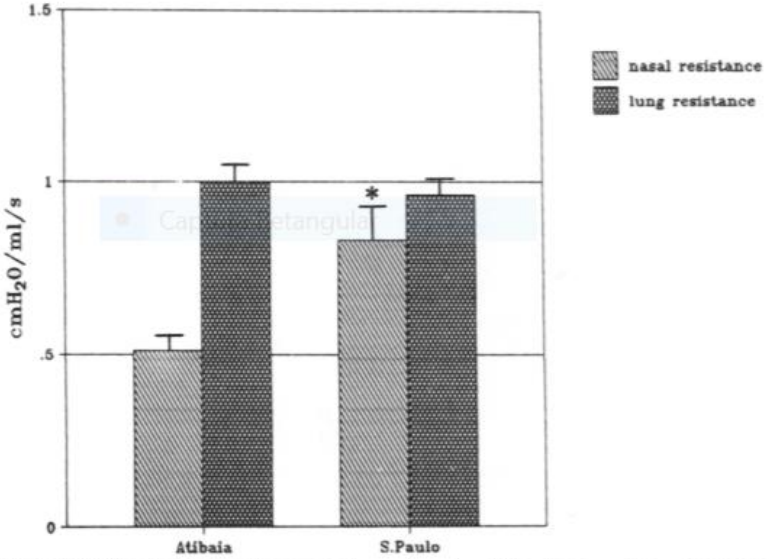


FIG. 2. Mean (±SE) of nasal and lung resistances in rats of S.Paulo (n = 24) and Atibaia (n = 30). *, statistically significant difference between the means (P = 0.003)

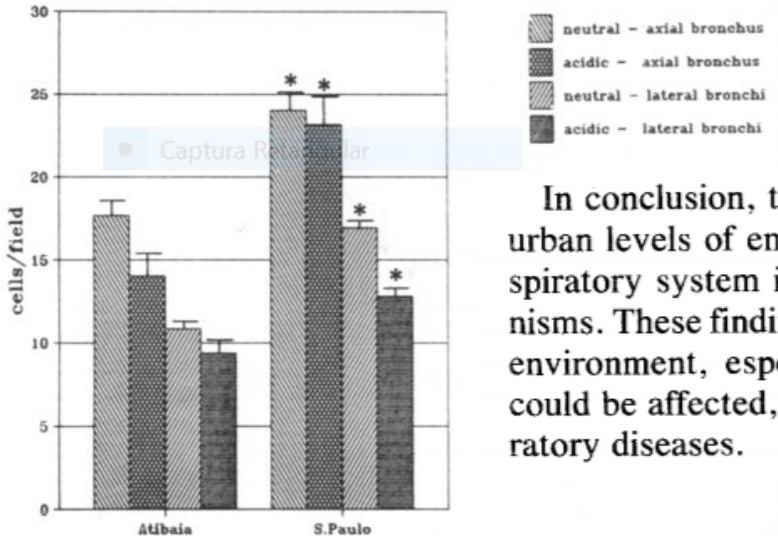
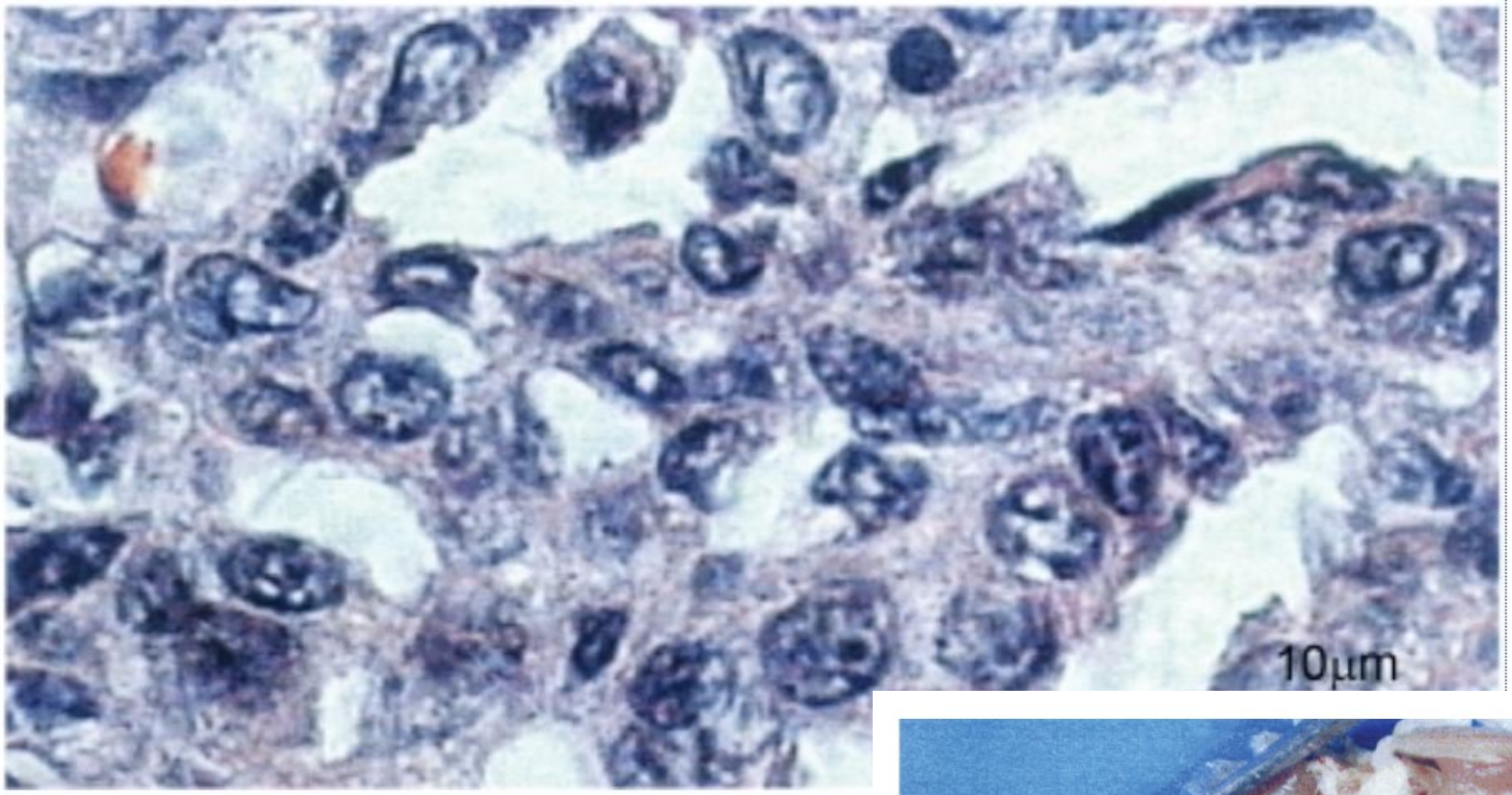
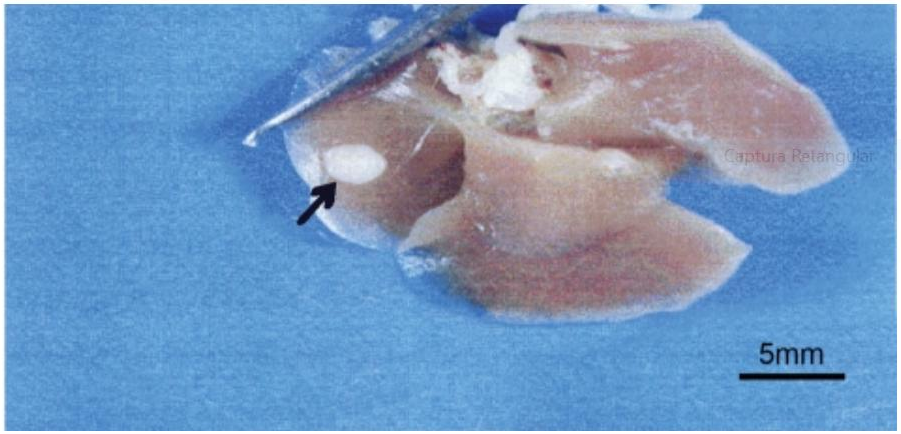
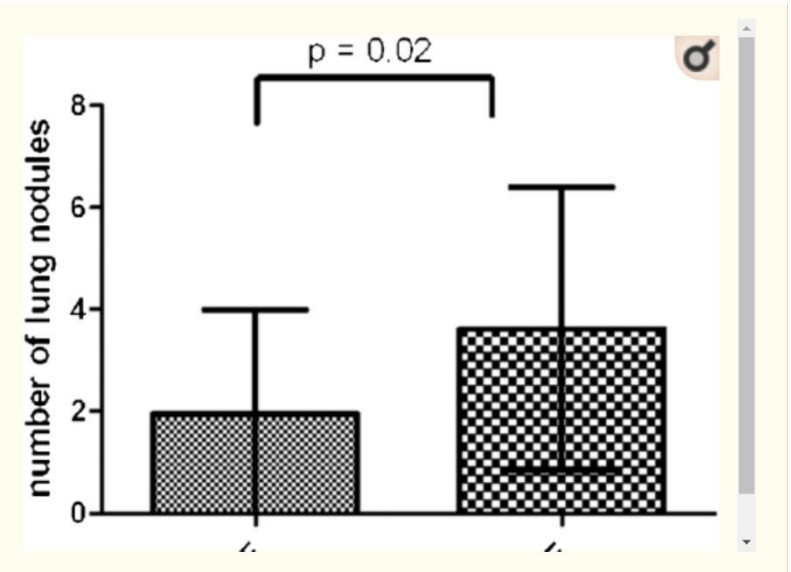


FIG. 5. Mean (±SE) of the counting of secretory cells (400× microscopic field) in axial and lateral bronchi in animals of S.Paulo (n = 30) and Atibaia (n = 30). Statistical significance between the two groups of animals; *, $P < 0.001$.

In conclusion, this paper demonstrates that the prolonged exposure of rats to urban levels of environmental air pollution causes marked alterations of the respiratory system in rats, which leads to an impairment of lung defense mechanisms. These findings suggest that health conditions of the population living in this environment, especially those in disfavored social and nutritional conditions, could be affected, increasing the morbidity and, perhaps, mortality due to respiratory diseases.

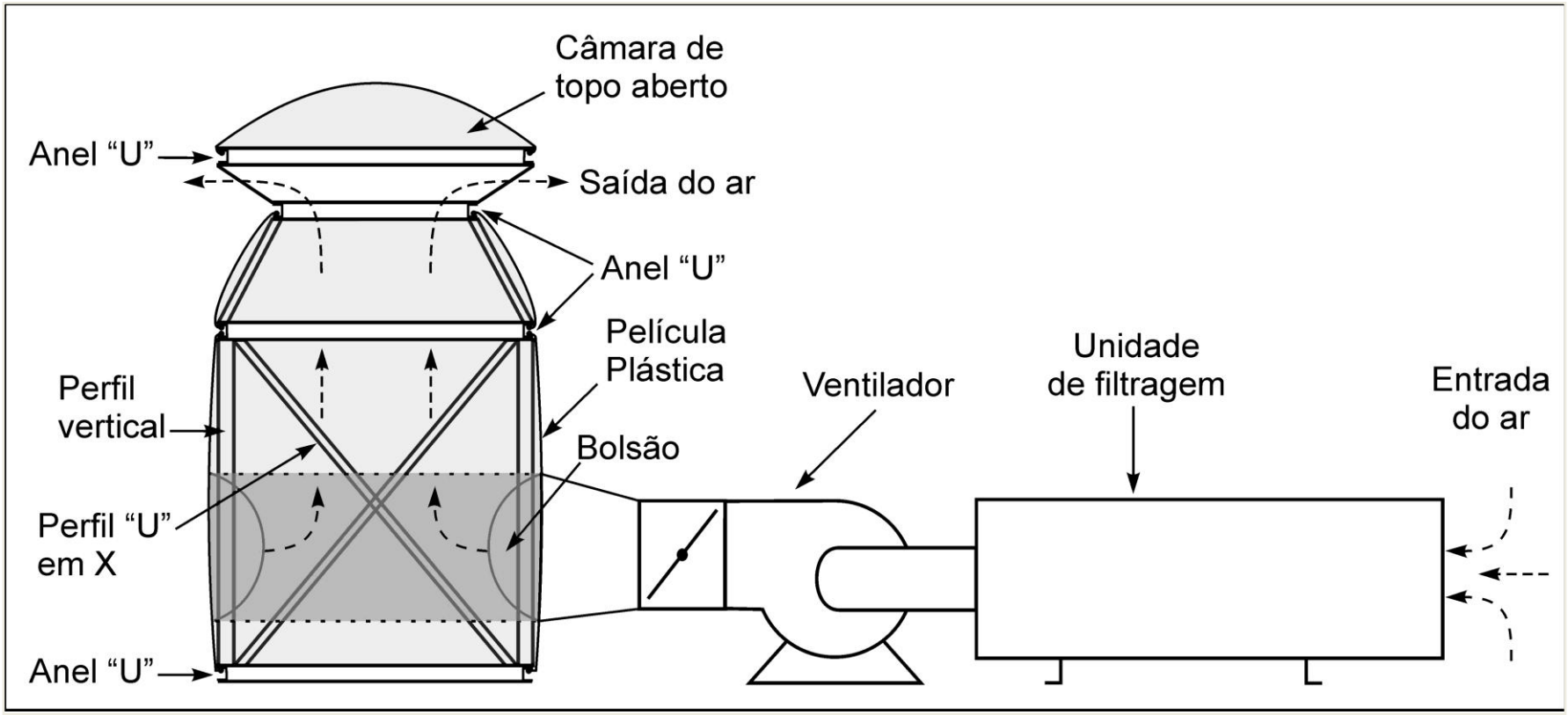


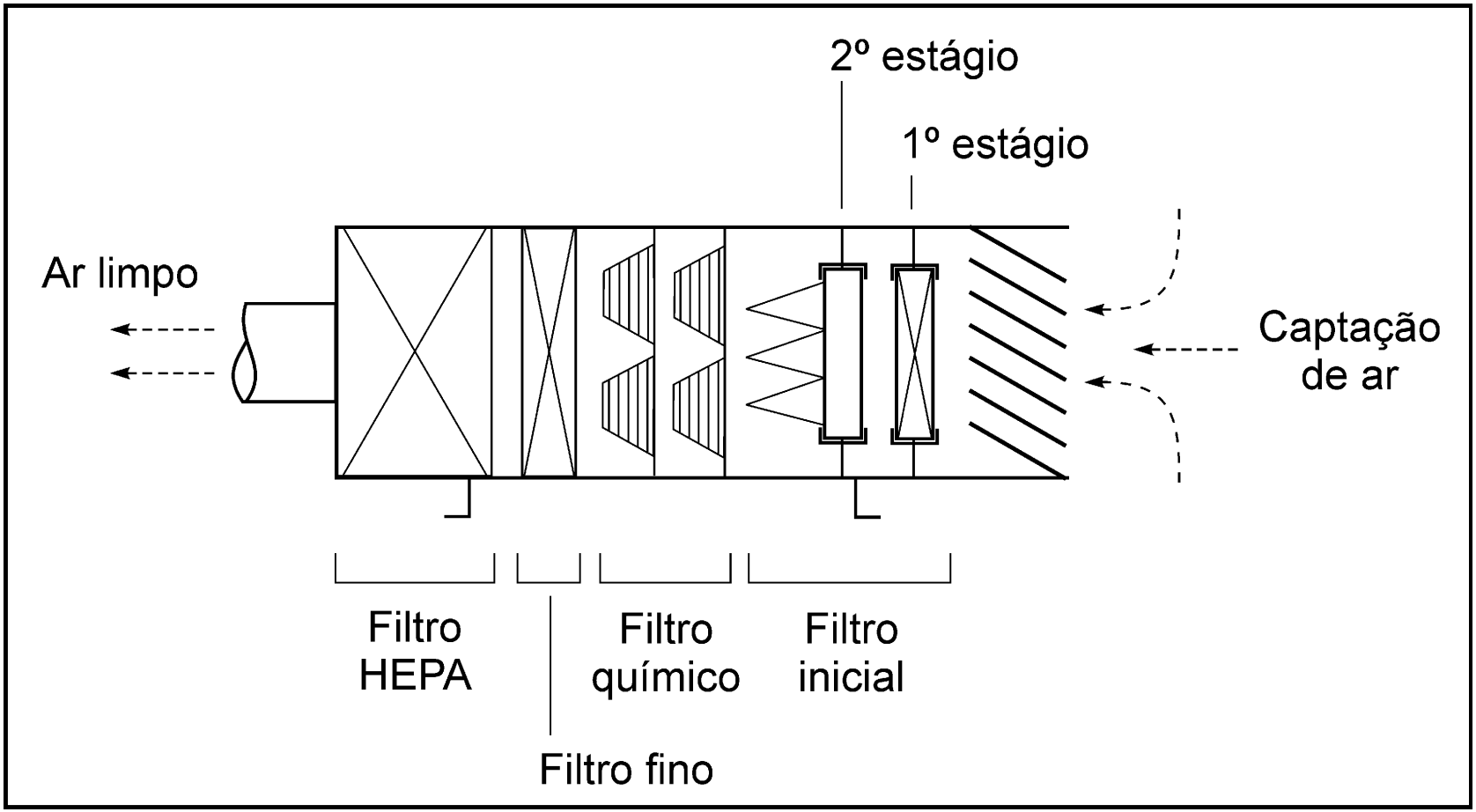


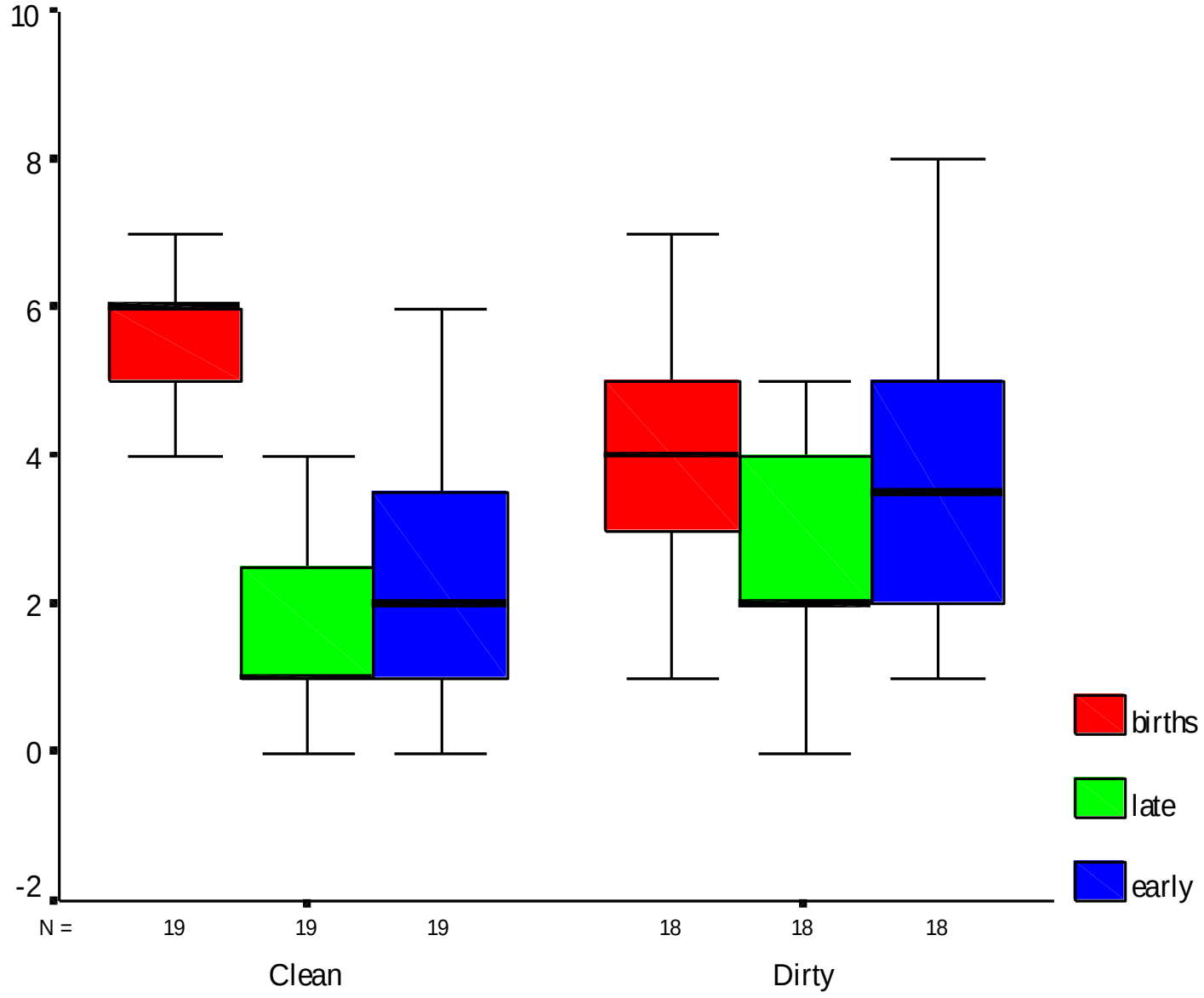


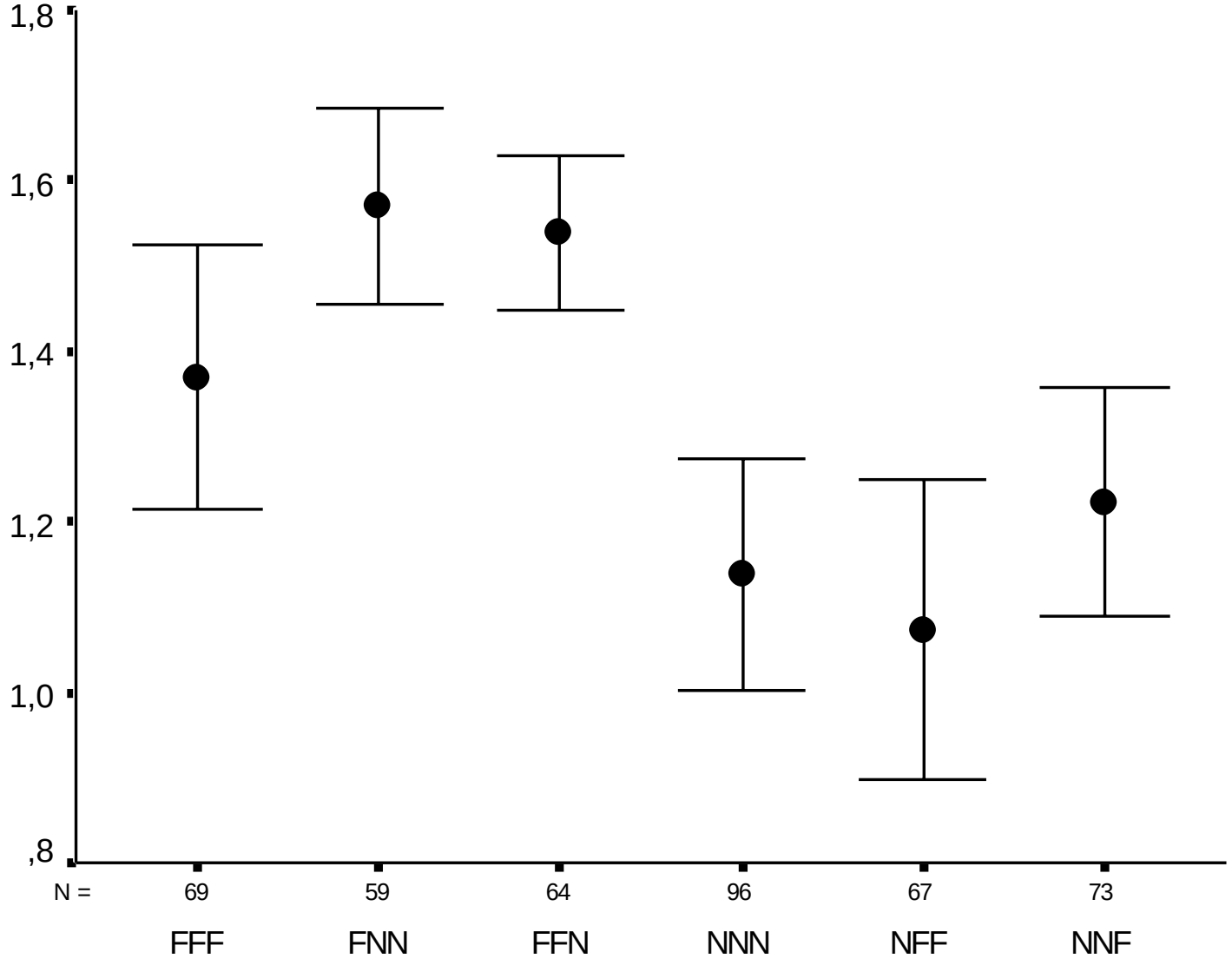
Clinics (Sao Paulo) v.66(6); 2011 Jun
PMC3129956

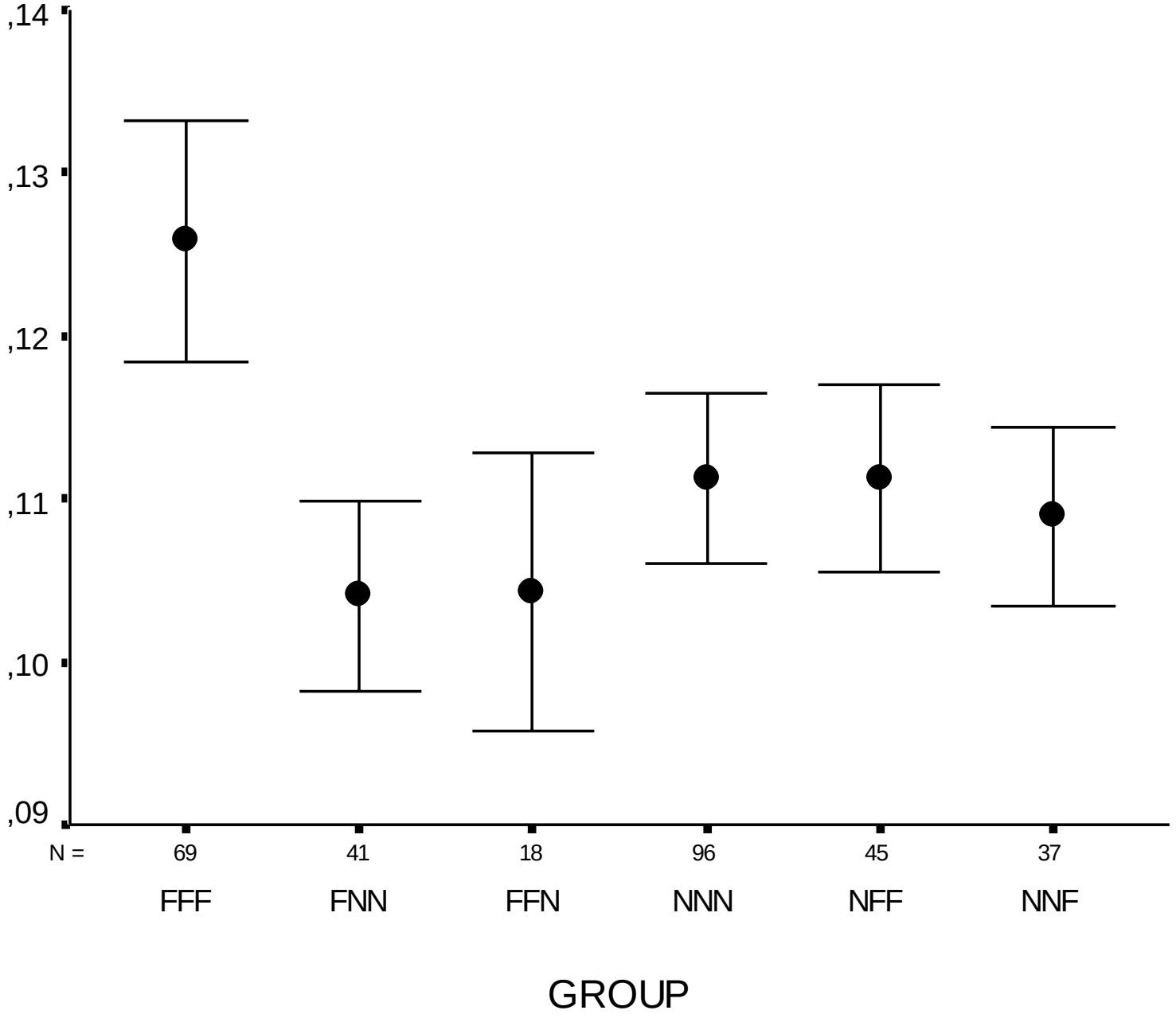
Image © 2005 DigitalGlobe
© 2005 Google
3°33'18.82" S 46°40'15.23" W elev 2697 ft
Streaming 100%
Eye alt 4184 ft

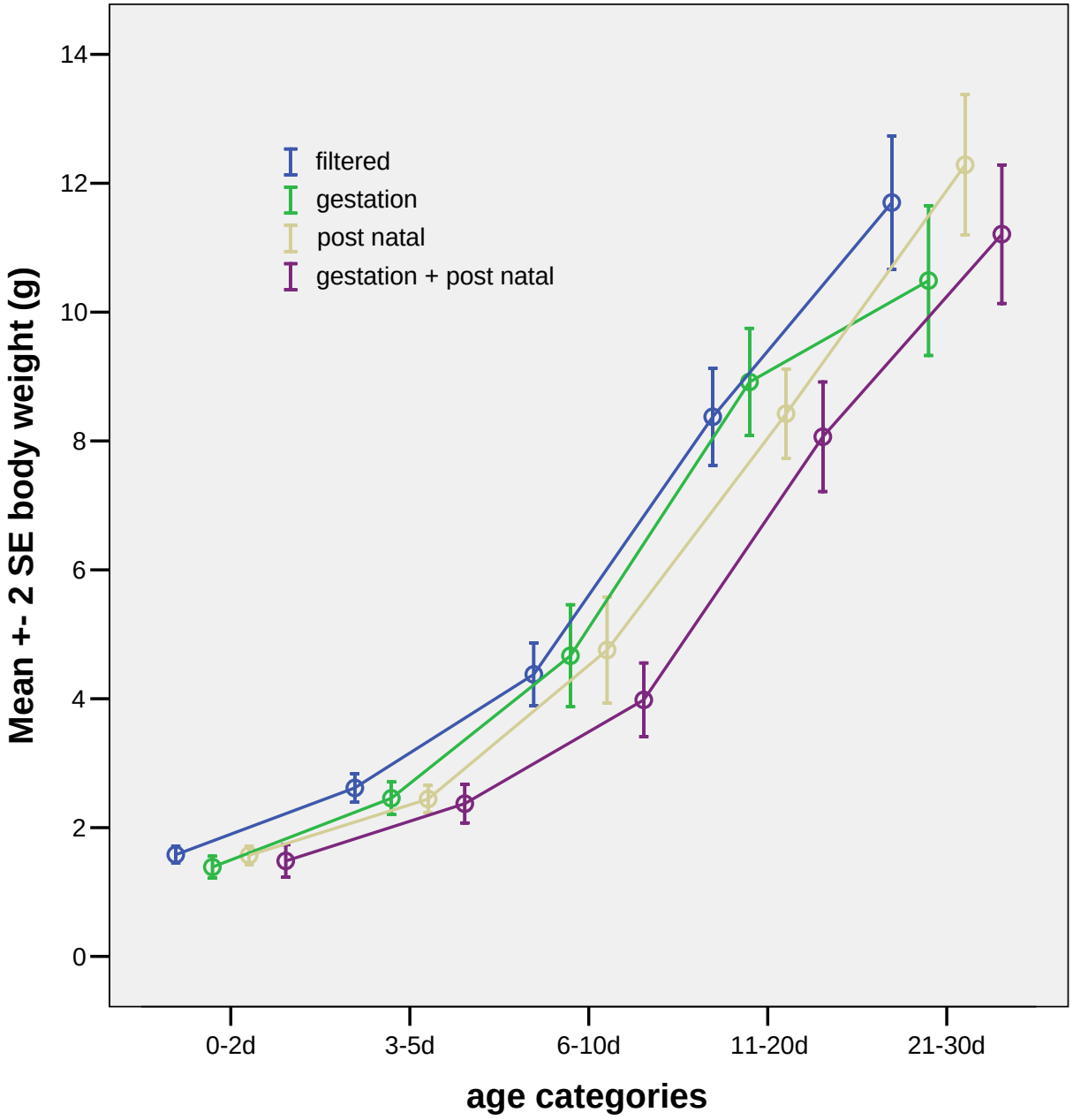

Câmara de
topo aberto
Anel “U”
Saída do ar
Anel “U”
Película
Plástica
Perfil
vertical
Bolsão
Perfil “U”
em X
Anel “U”
Ventilador
Unidade
de filtragem
Entrada
do ar

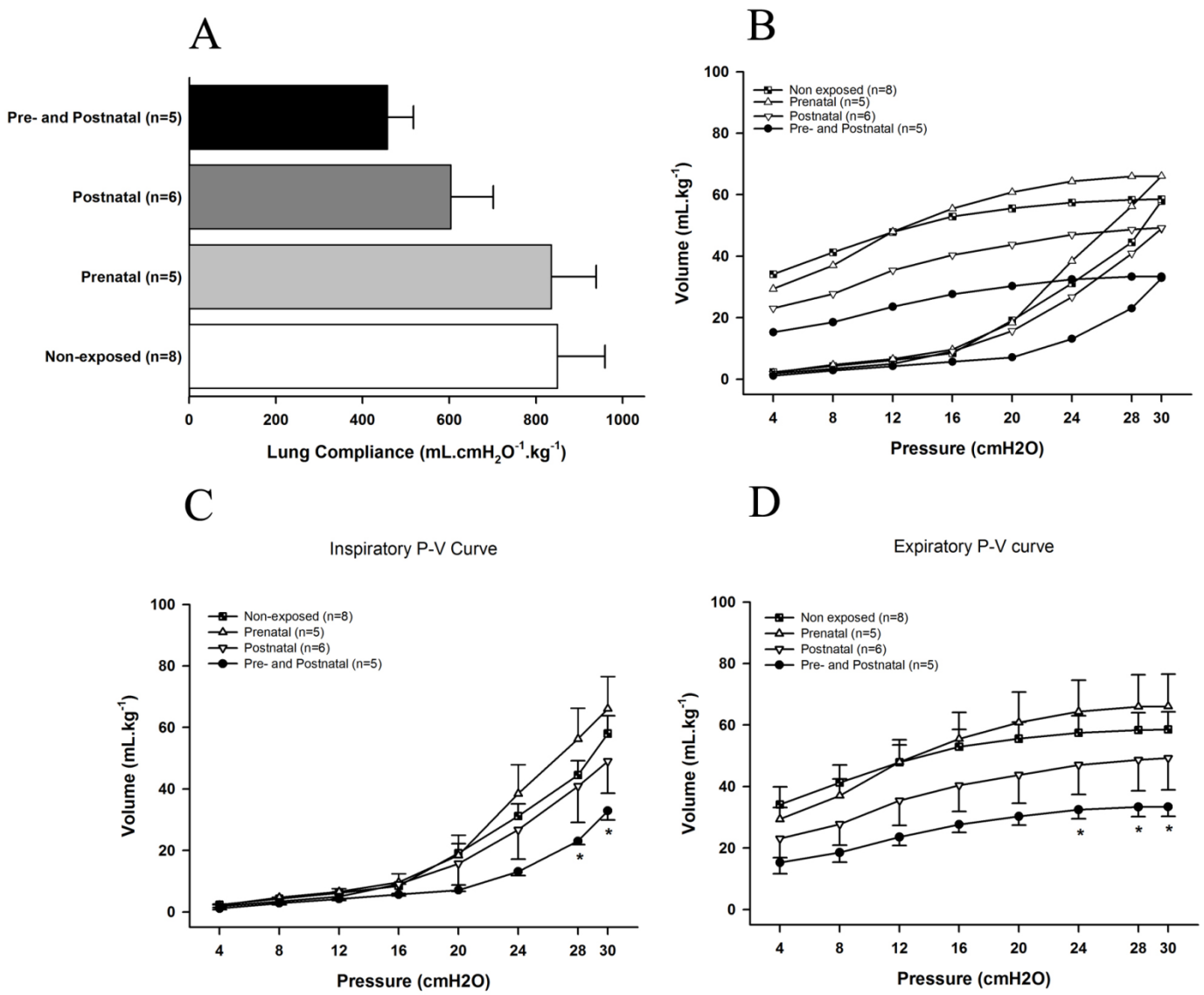

2º estágio
1º estágio
Ar limpo
Captação
de ar
Filtro
HEPA
Filtro fino
Filtro
químico
Filtro
inicial

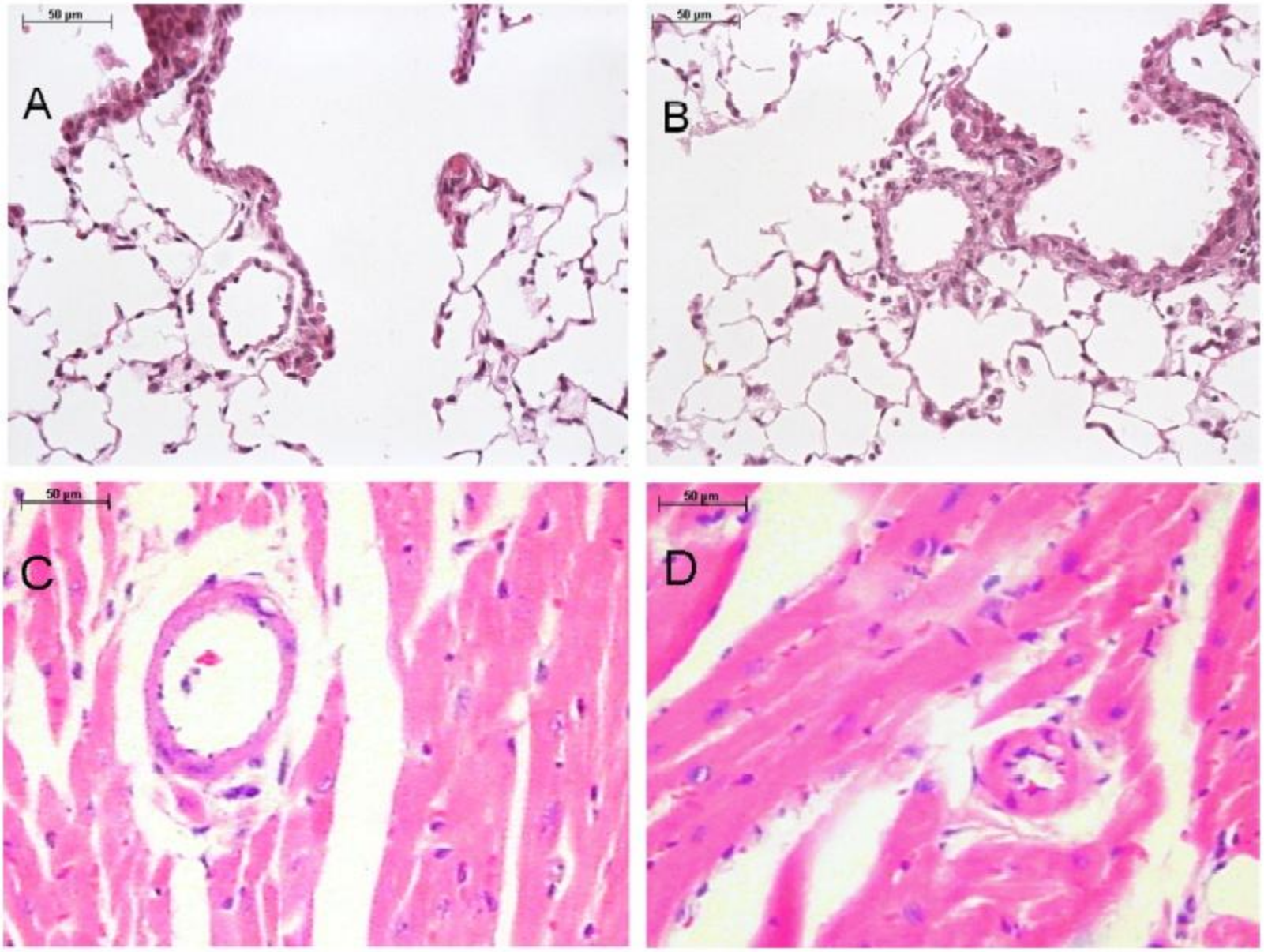

10
8
6
4
2
0
-2
N =
19
19
19
18
18
18
Clean
Dirty
births
late
early

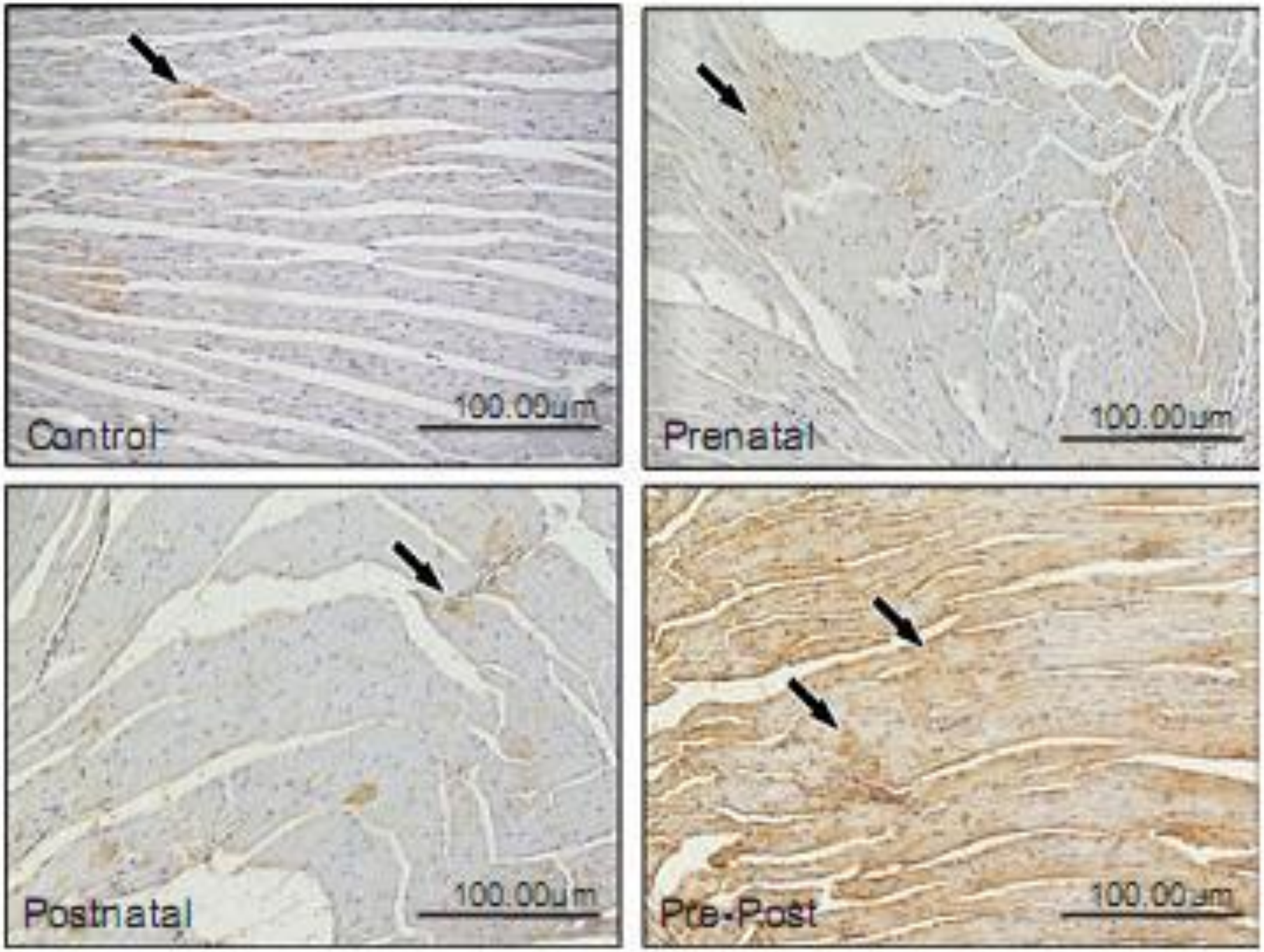

1,8
1,6
1,4
1,2
1,0
,8
N =
69
59
64
96
67
73
FFF
FNN
FFN
NNN
NFF
NNF
GROUP

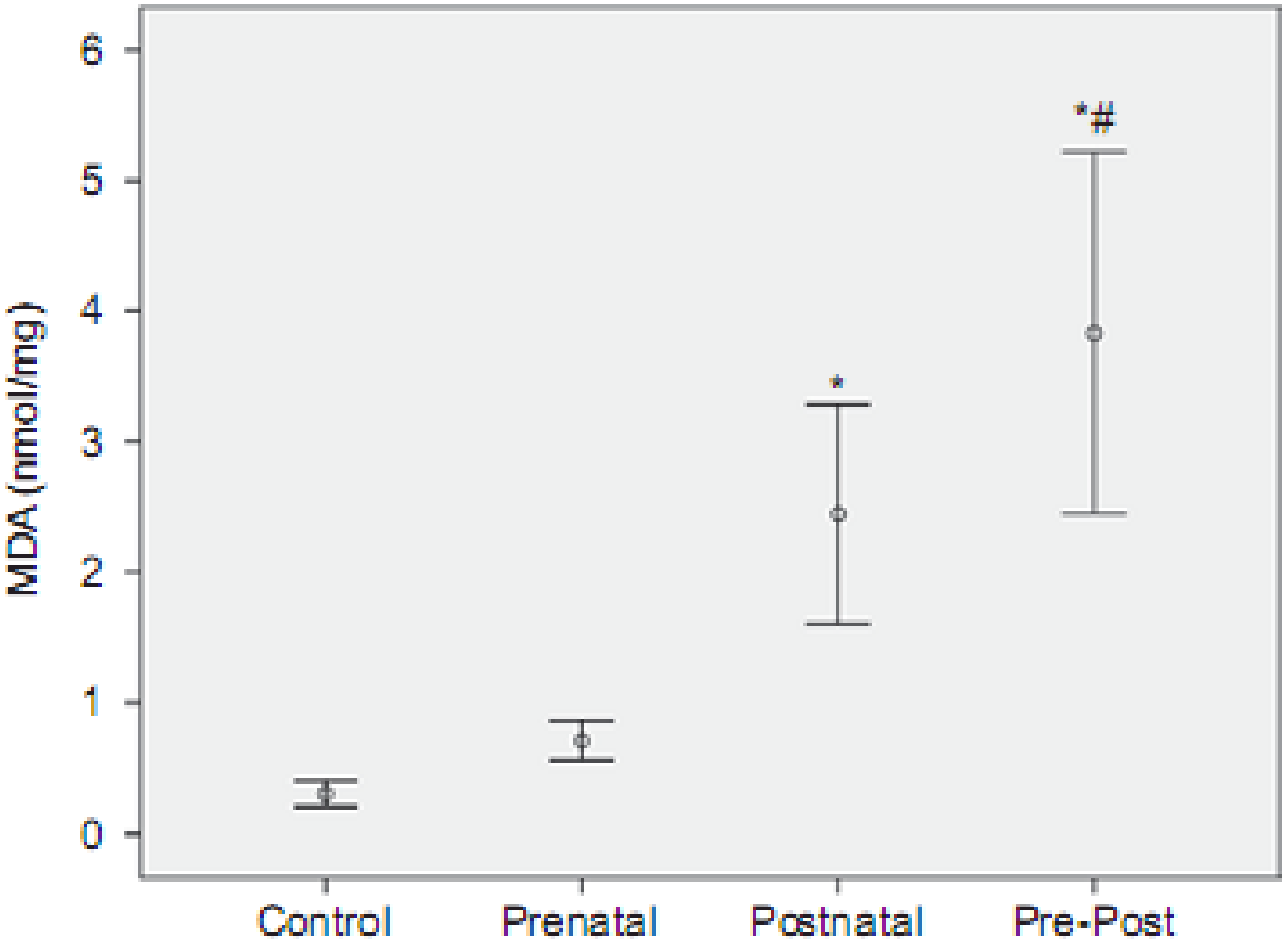

,14
,13
,12
,11
,10
,09
N =
69
41
18
96
45
37
FFF
FNN
FFN
NNN
NFF
NNF
GROUP

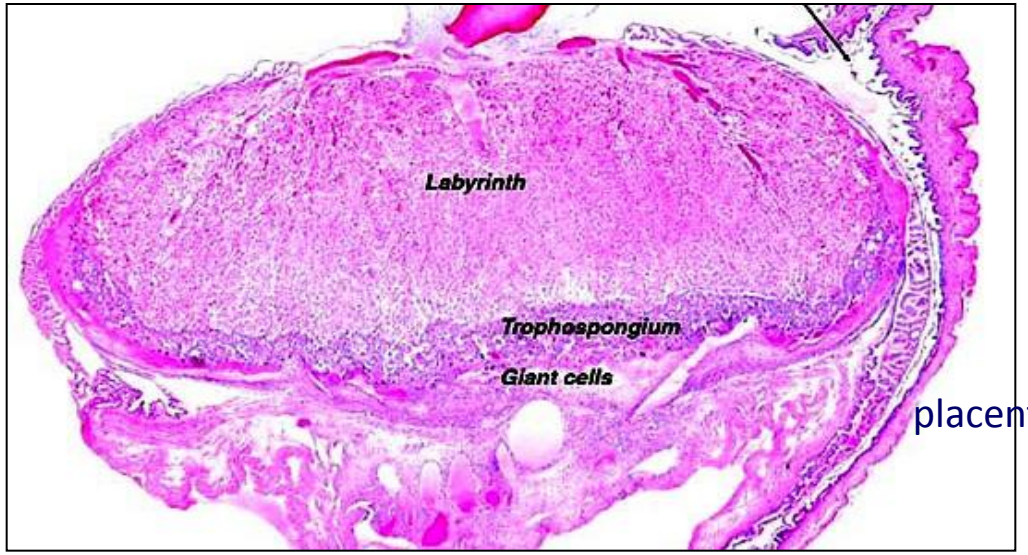

Mean +- 2 SE body weight (g)
14
12
10
8
6
4
2
0
filtered
gestation
post natal
gestation + post natal
0-2d
3-5d
6-10d
11-20d
21-30d
age categories


A
Pre- and Postnatal (n=5)
Postnatal (n=6)
Prenatal (n=5)
Non-exposed (n=8)
0
200
400
600
800
1000
Lung Compliance (mL.cmH2O-1.kg-1)
B
Non exposed (n=8)
Prenatal (n=5)
Postnatal (n=6)
Pre- and Postnatal (n=5)
Volume (mL.kg-1)
Pressure (cmH2O)
C
Inspiratory P-V Curve
Non-exposed (n=8)
Prenatal (n=5)
Postnatal (n=6)
Pre- and Postnatal (n=5)
Volume (mL.kg-1)
Pressure (cmH2O)
D
Expiratory P-V curve
Non exposed (n=8)
Prenatal (n=5)
Postnatal (n=6)
Pre- and Postnatal (n=5)
Volume (mL.kg-1)
Pressure (cmH2O)

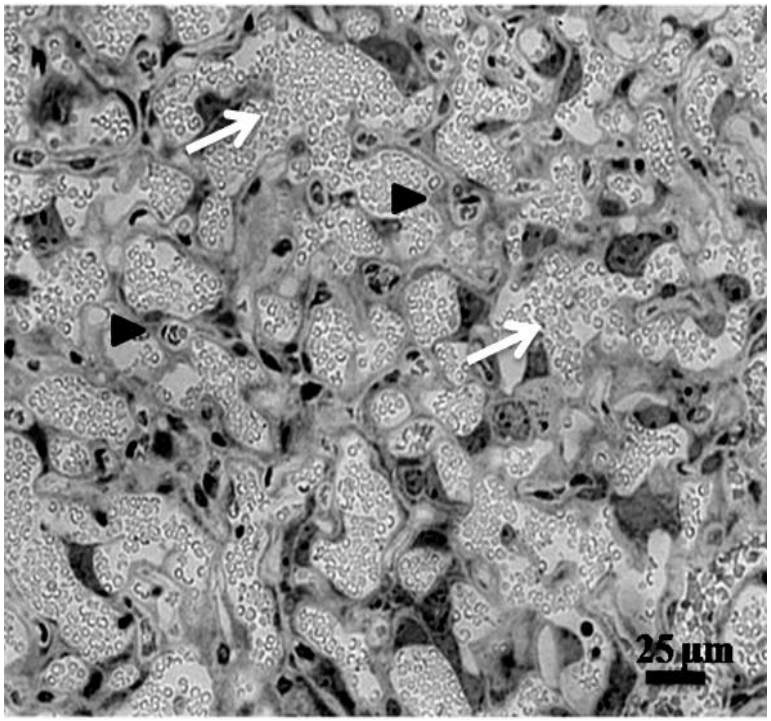

50 µm
A
50 µm
B
50 µm
C
50 µm
D


Control
100.00µm
Prenatal
100.00µm
Postnatal
100.00µm
Pre-Post
100.00µm

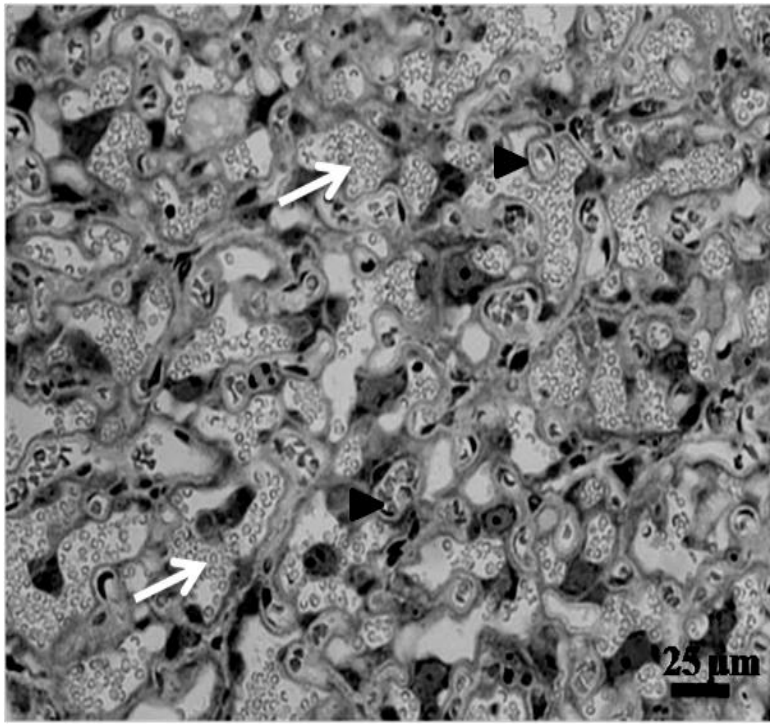

MDA (nmol/mg)
0
1
2
3
4
5
6
*
*#
Control
Prenatal
Postnatal
Pre-Post



placenta

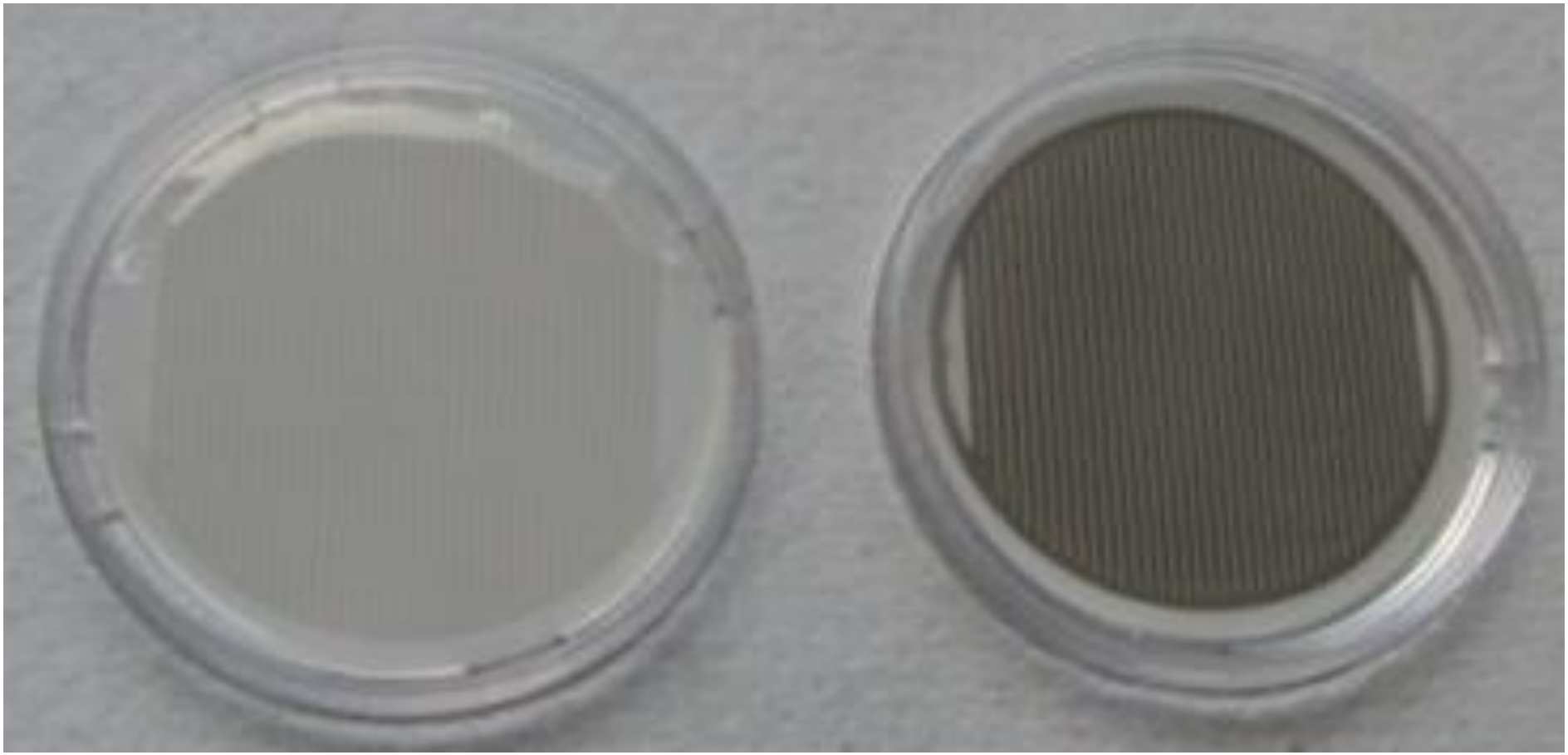


Filtered

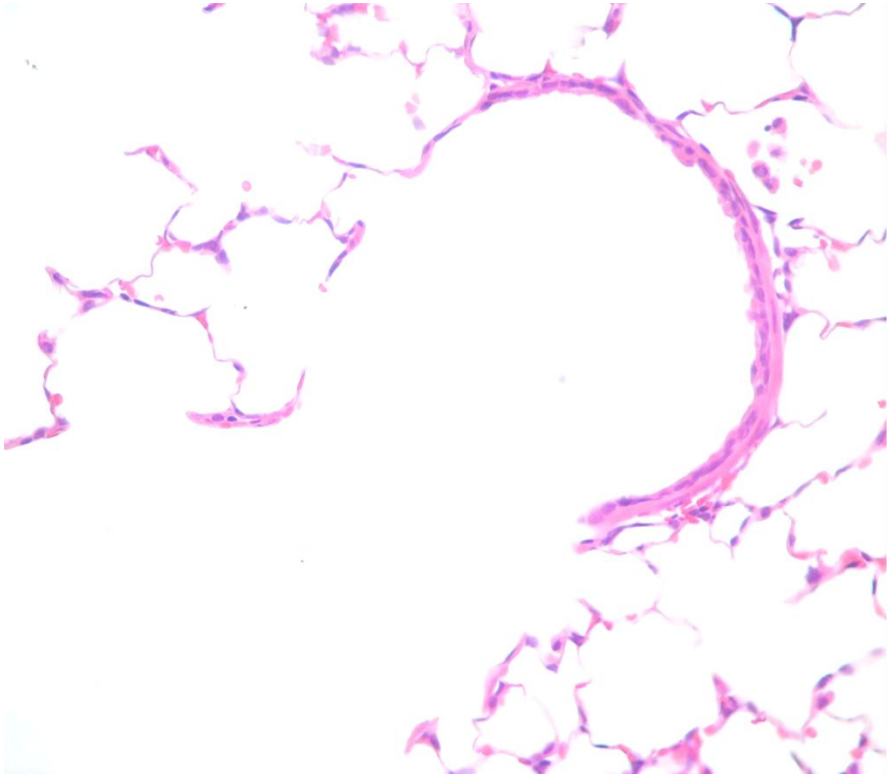


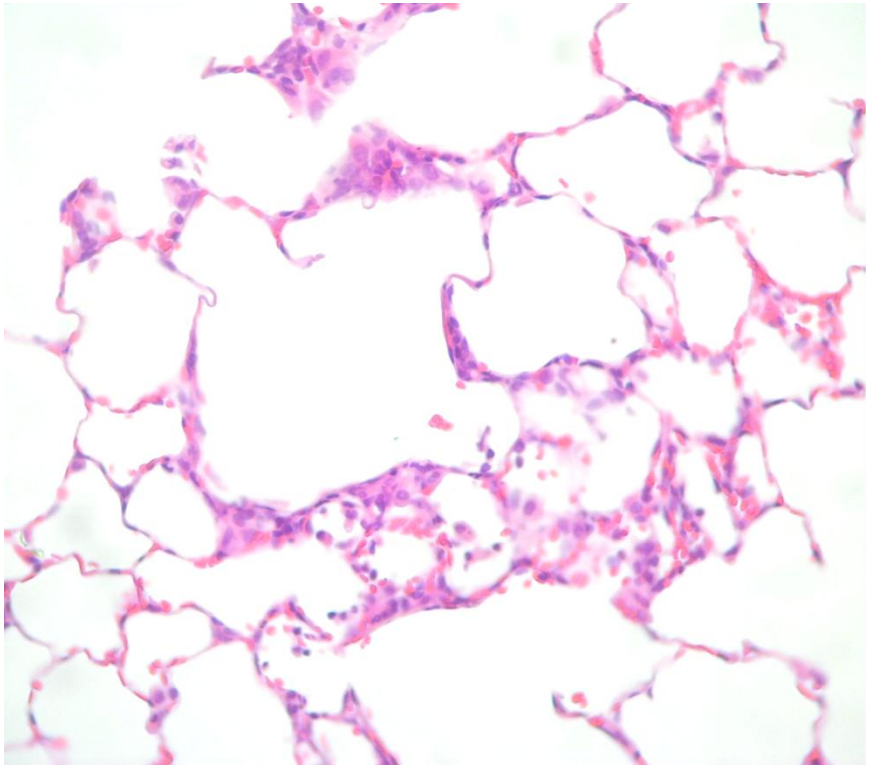
Ambient

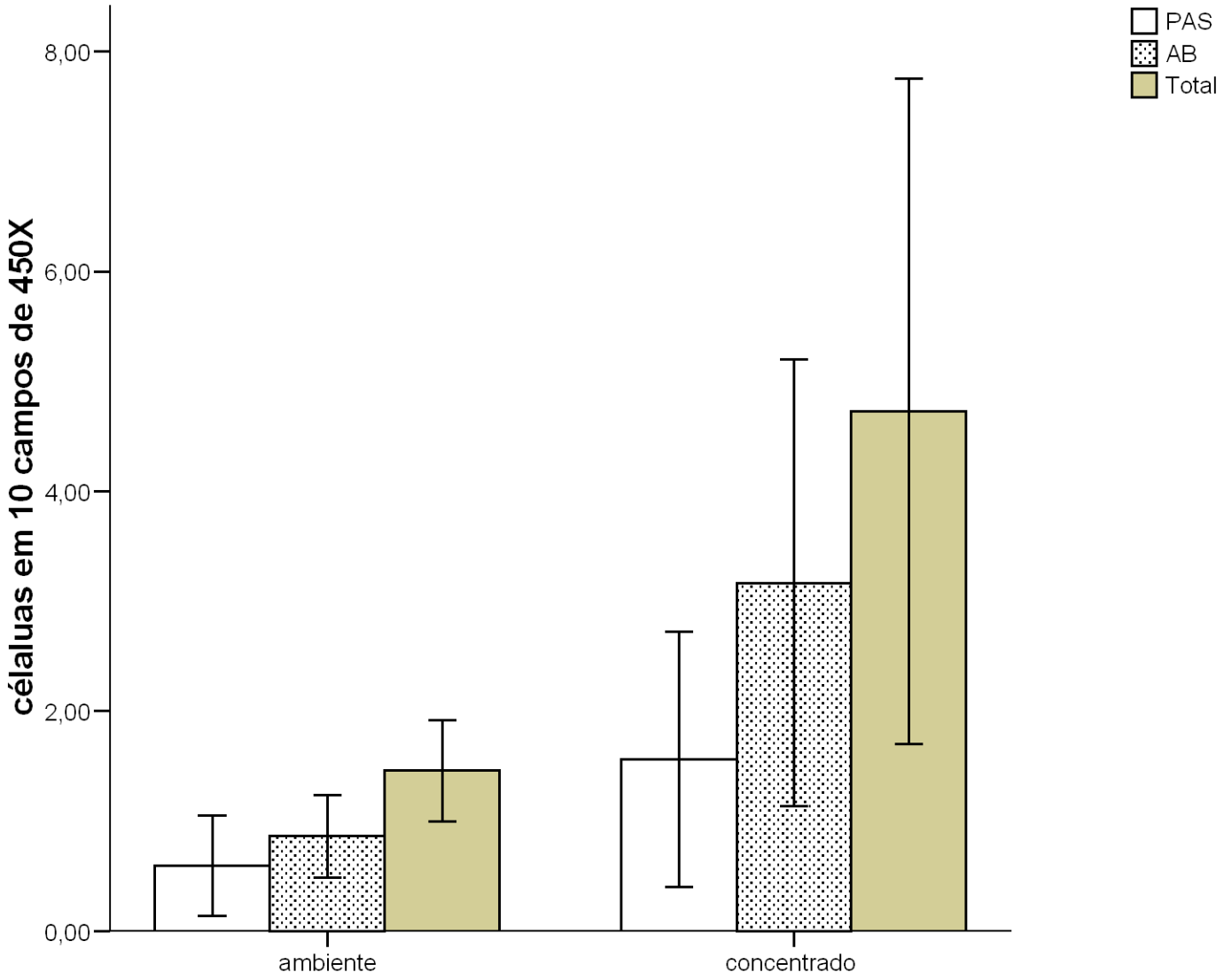

SUTA

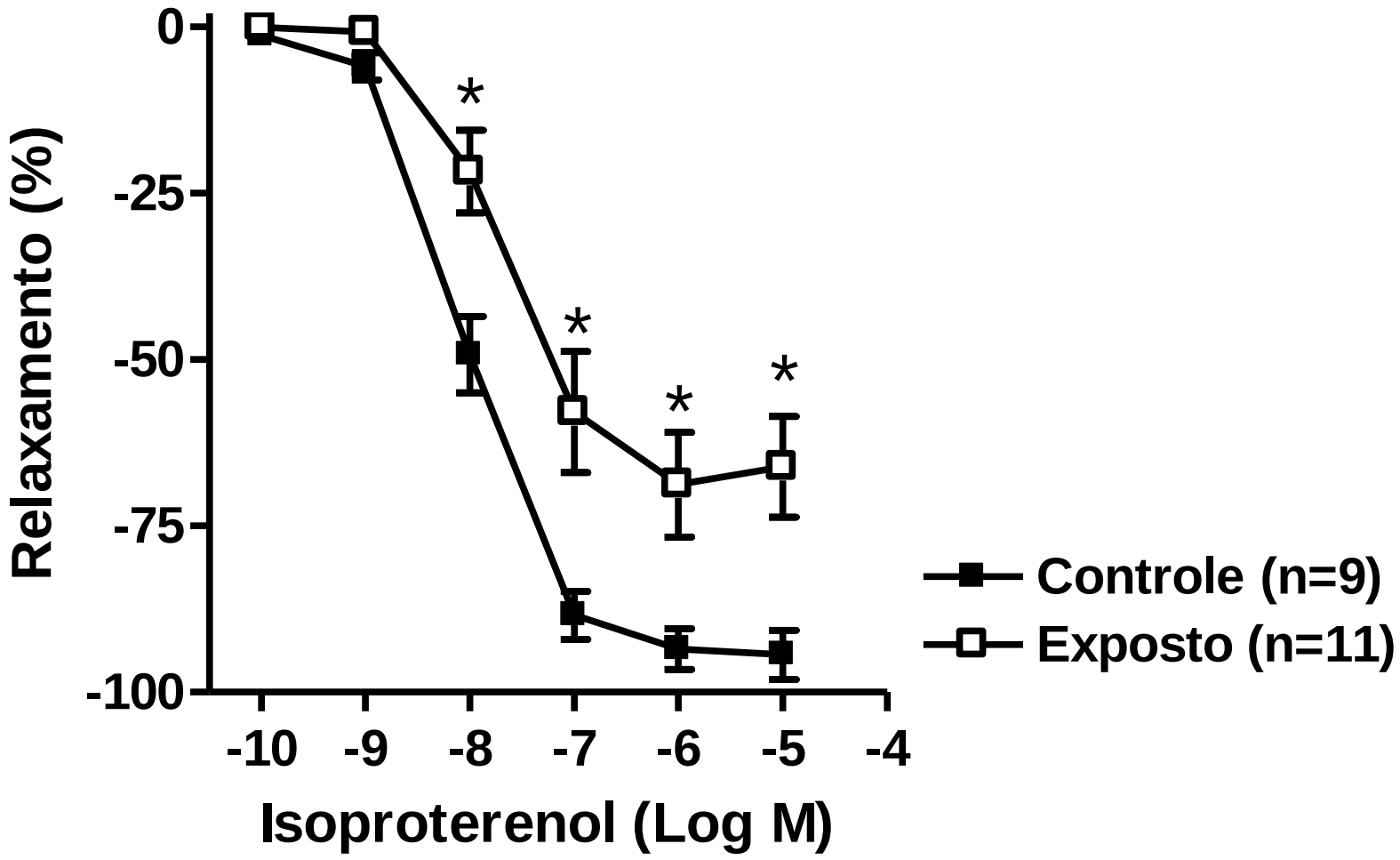


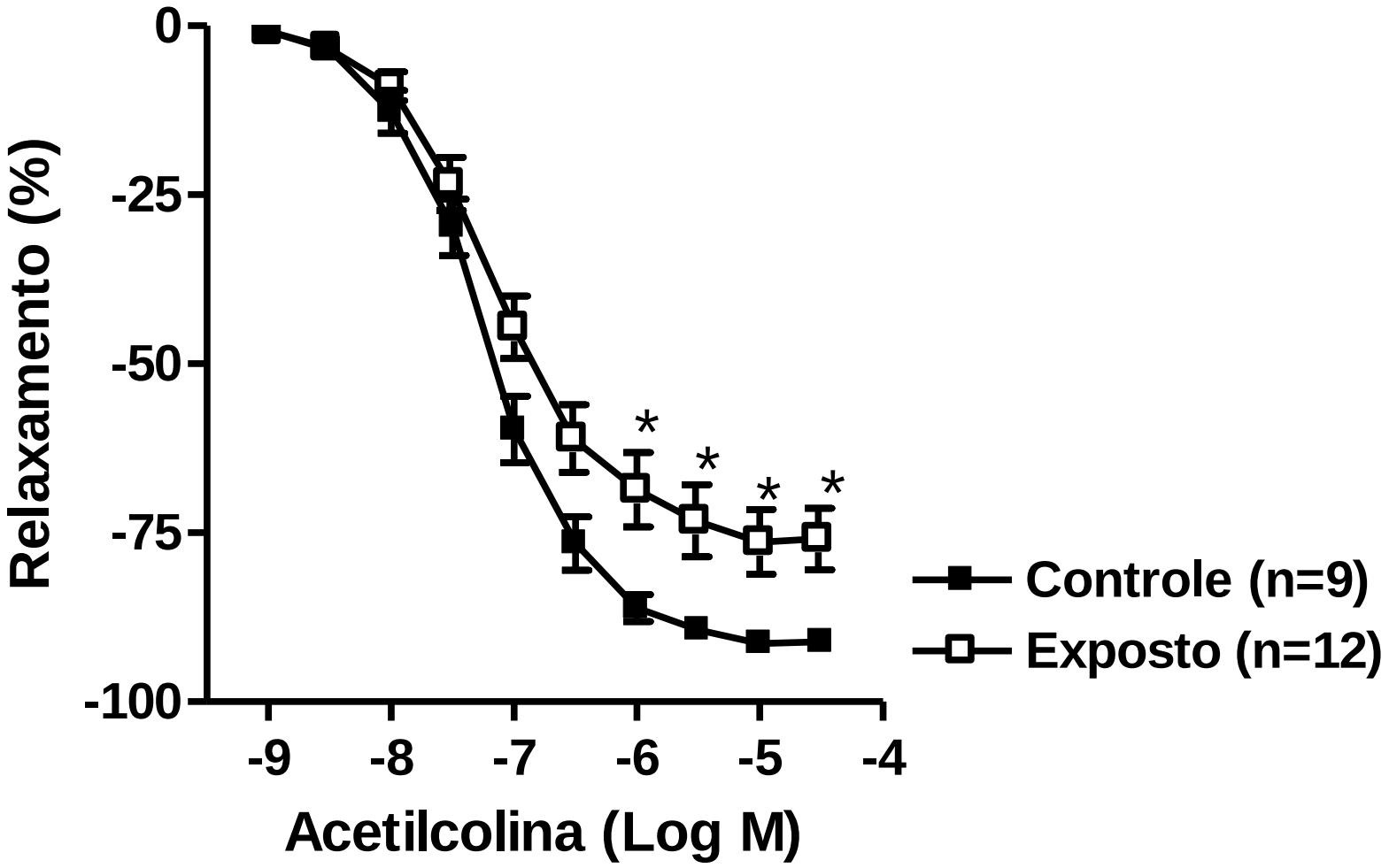

SMAFLEX





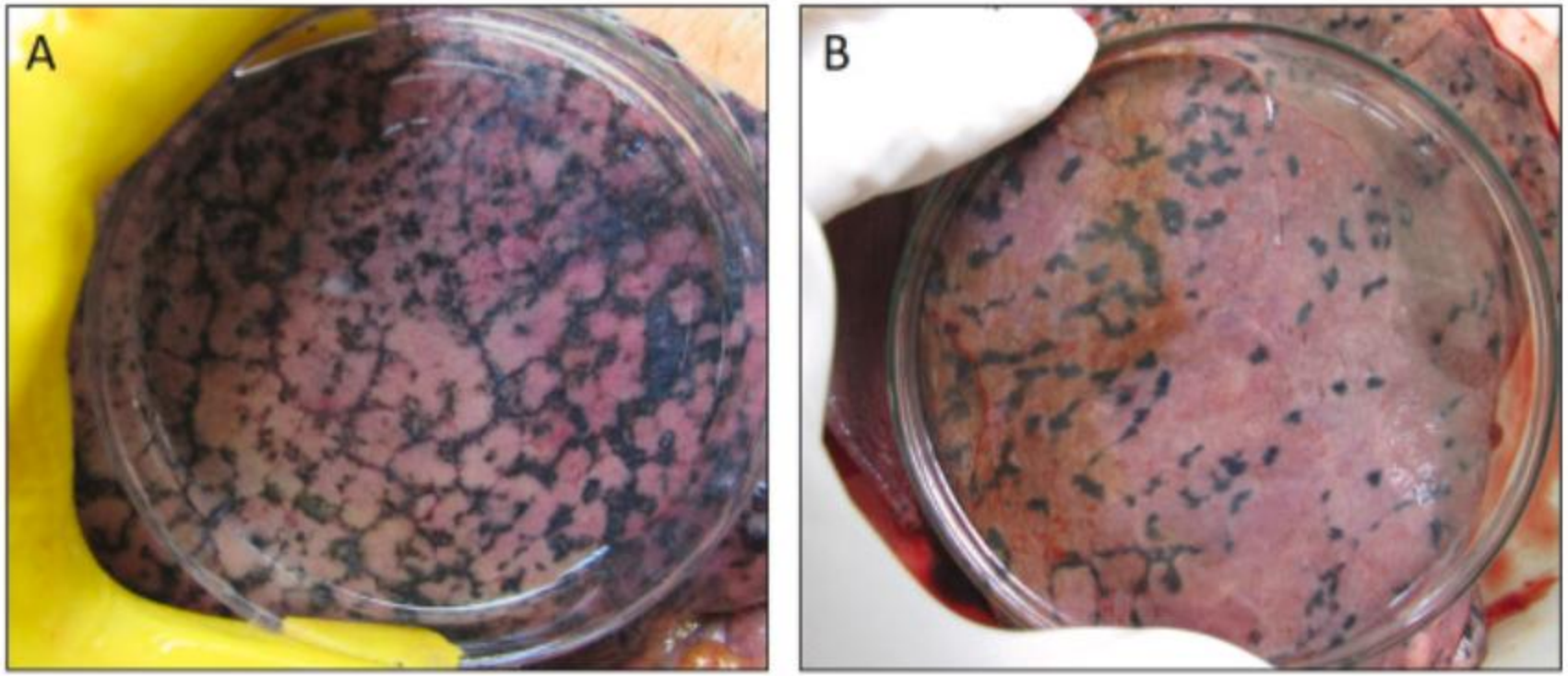

PAS
AB
Total
célaluas em 10 campos de 450X
8,00
6,00
4,00
2,00
0,00
ambiente
concentrado


0
-25
-50
-75
-100
Relaxamento (%)
*
*
*
*
-10
-9
-8
-7
-6
-5
-4
Isoproterenol (Log M)
Controle (n=9)
Exposto (n=11)


0
-25
-50
-75
-100
Relaxamento (%)
-9
-8
-7
-6
-5
-4
Acetilcolina (Log M)
*
*
*
*
Controle (n=9)
Exposto (n=12)

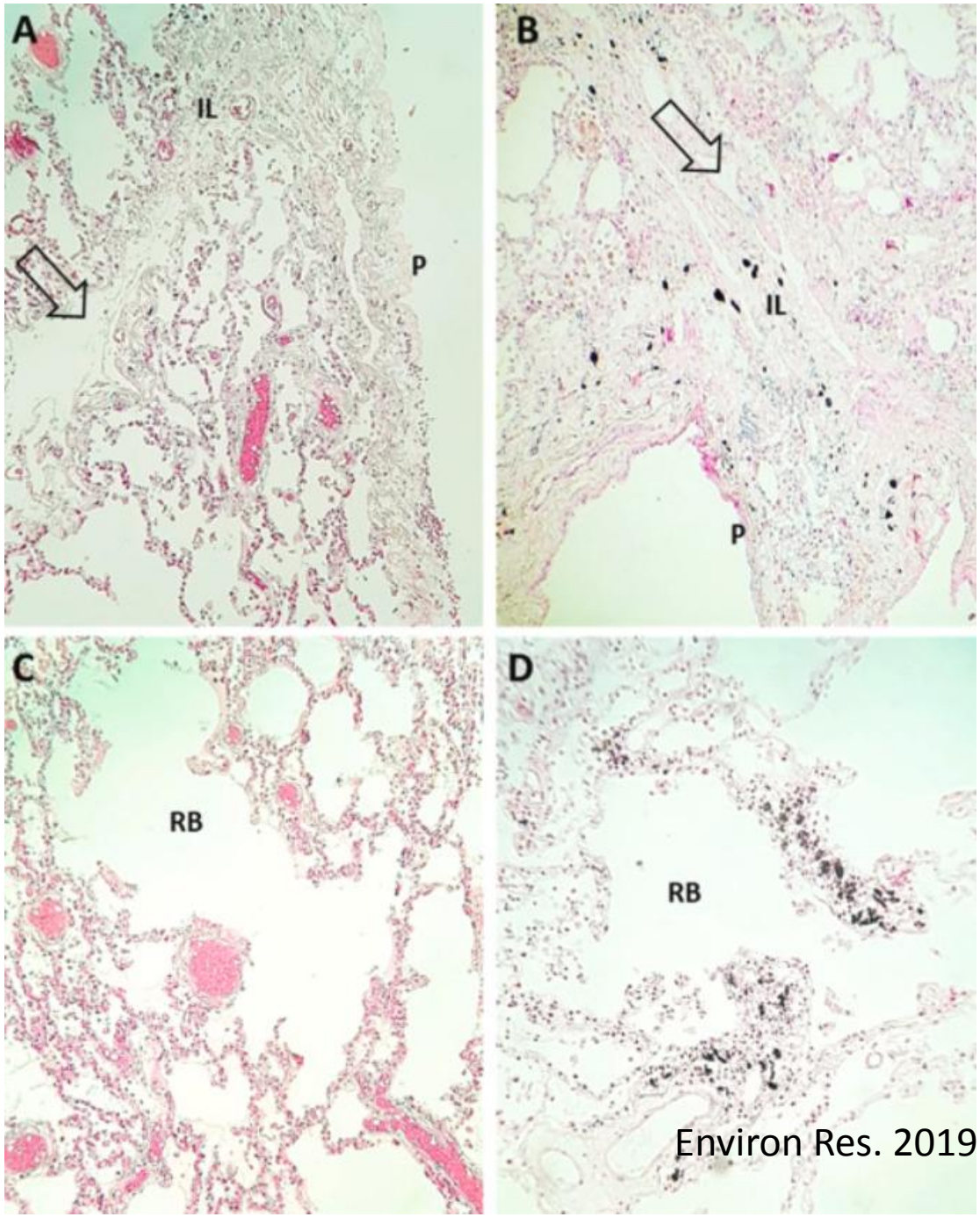
Smoker

Non-smoker



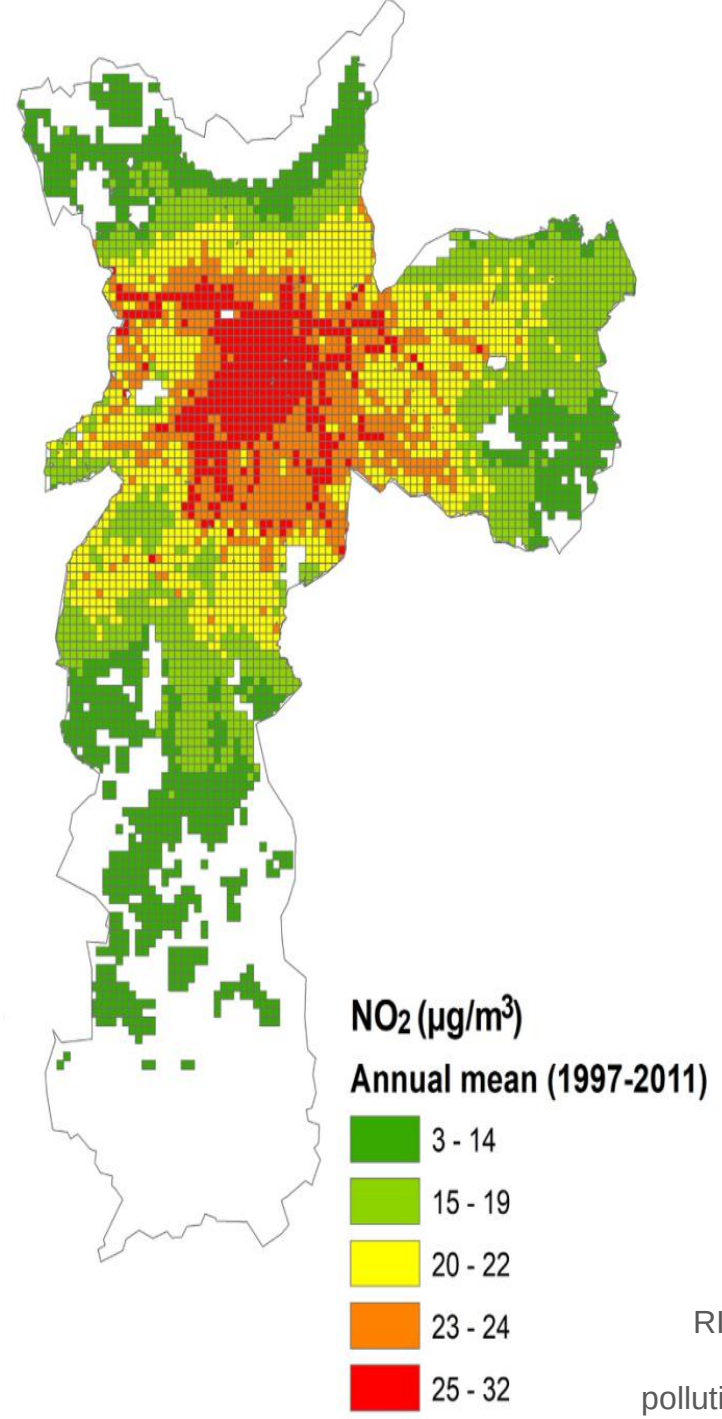
FA = 0.48

FA = 0.19

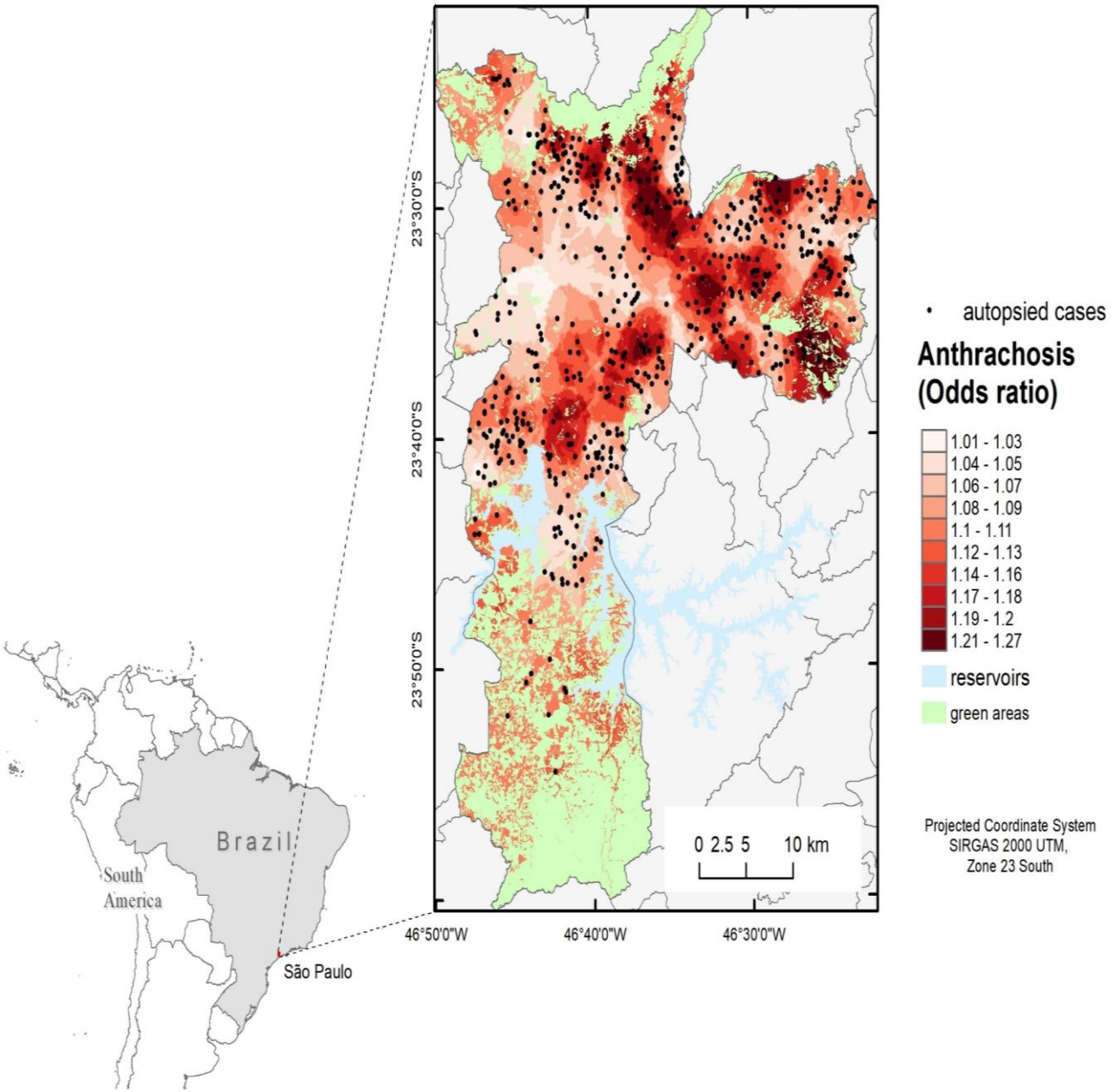


Environ Res. 2019 Jun;173:23-32.

Spatial distribution of nitrogen dioxide in São Paulo (according to Ribeiro et al., 2019)



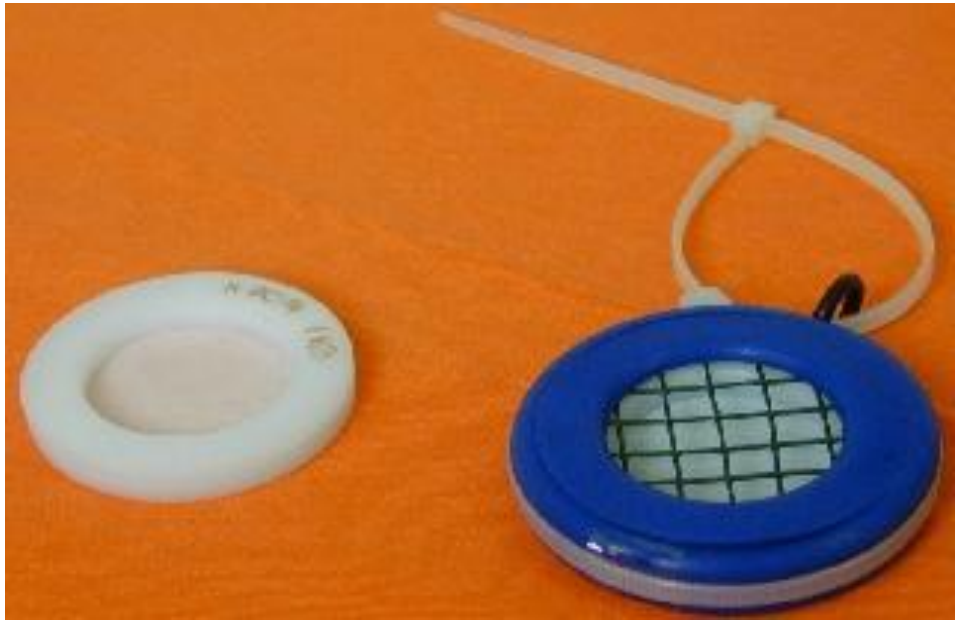
RIBEIRO et al. Incidence and mortality for respiratory cancer and traffic-related air pollution in São Paulo, Brazil. **Environmental Research** 170:243-251, 2019

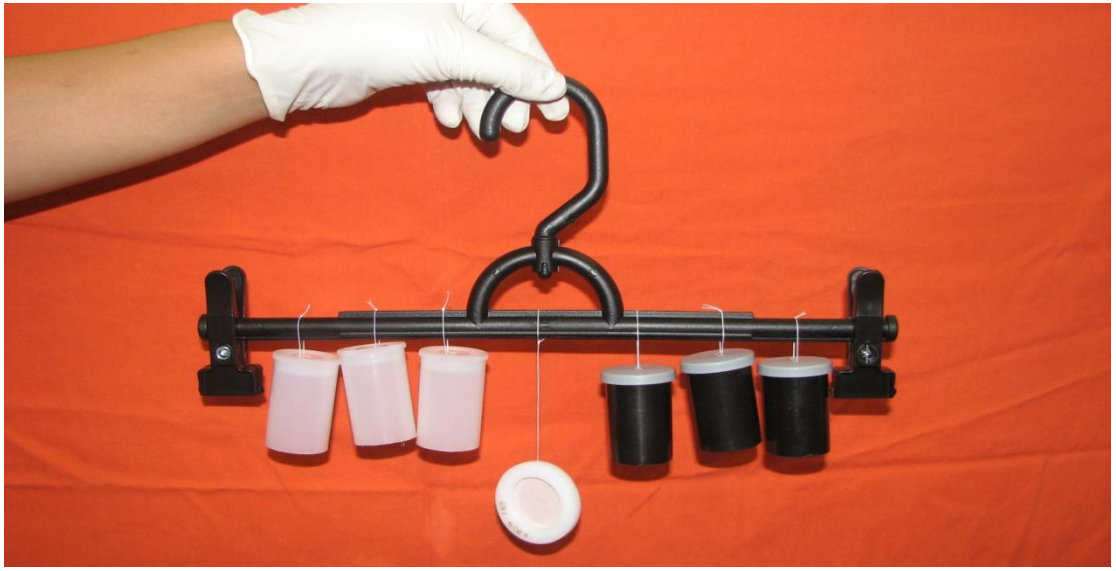


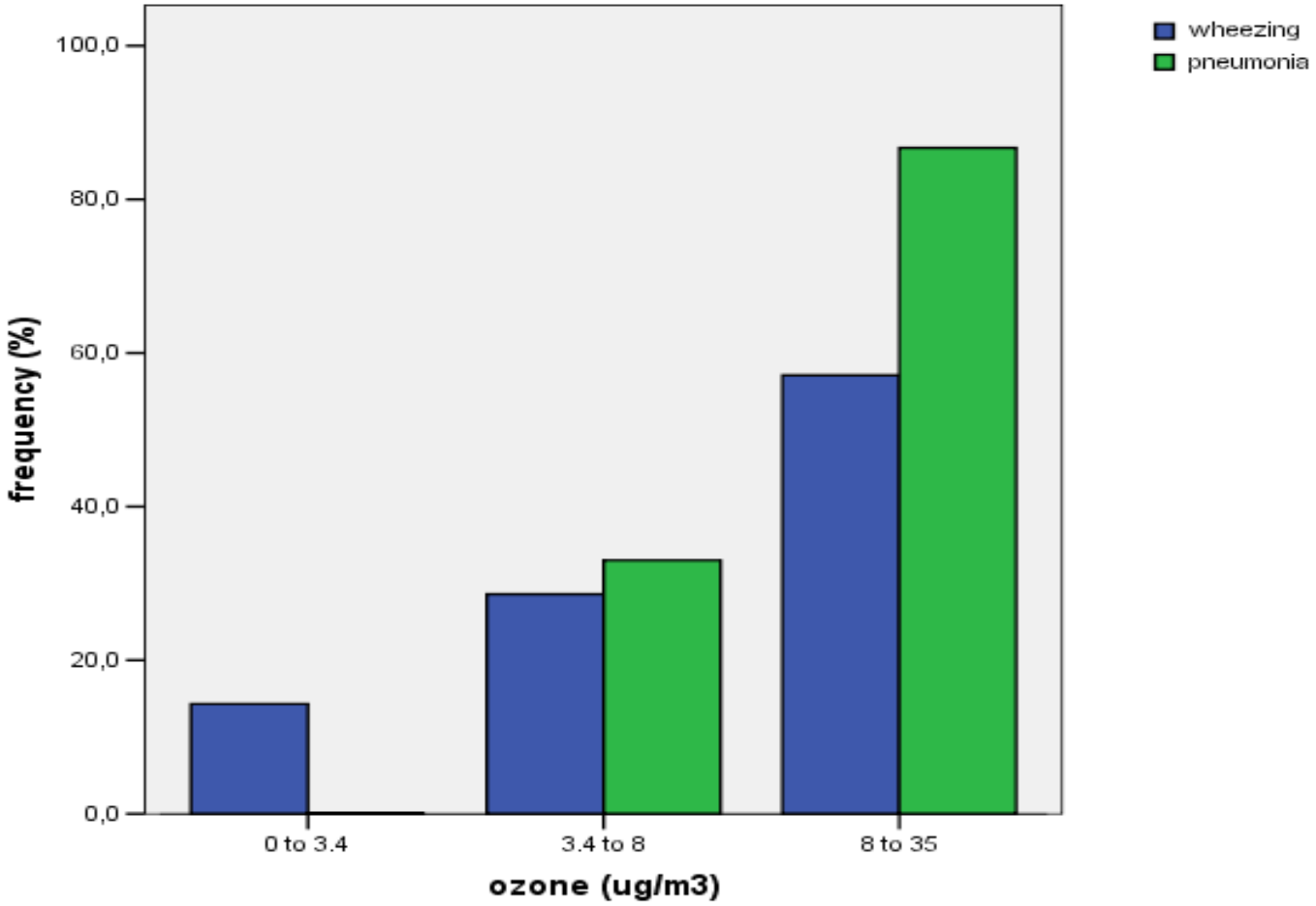
Odds ratio for anthracosis, controlling for:

- Age,
- Time living in SP,
- Tobacco load,
- Passive smoking,
- Road density,
- Distance to the large roads,
- Socioeconomic index

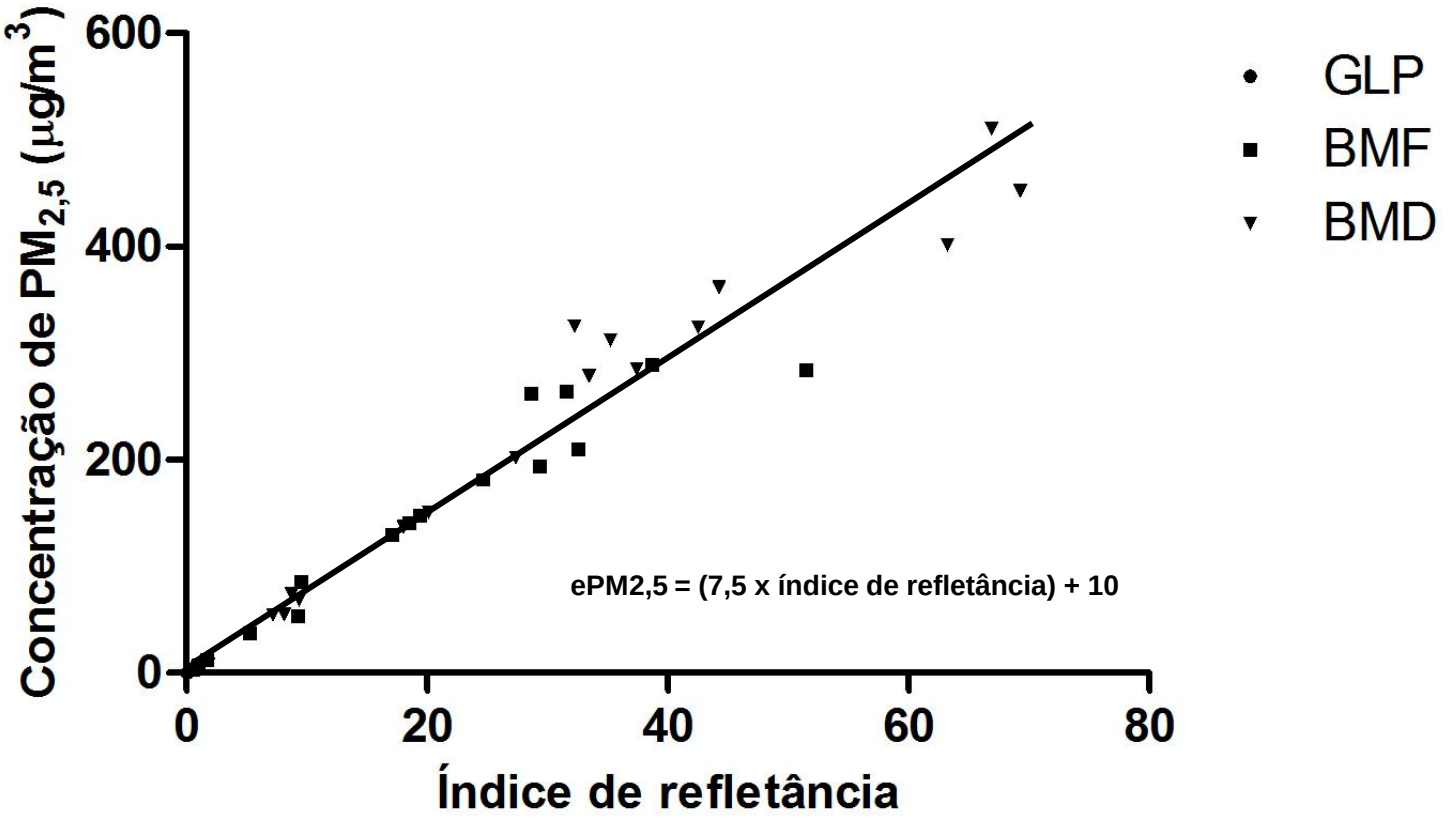
MODAU Team (unpublished)

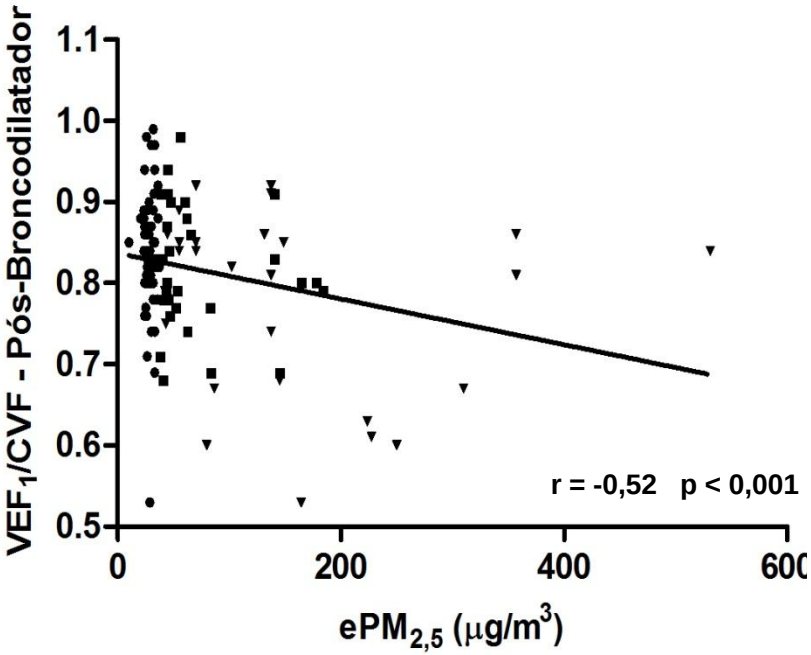





wheezing
pneumonia
100,0
80,0
60,0
40,0
20,0
0,0
frequency (%)
0 to 3.4
3.4 to 8
8 to 35
ozone (ug/m3)


48
86
247
340


Concentração de PM2,5 (µg/m3)
600
400
200
0
0
20
40
60
80
Índice de refletância
ePM2,5 = (7,5 x índice de refletância) + 10
GLP
BMF
BMD



$CE = ePM_{2,5} \times \Delta t(a)$

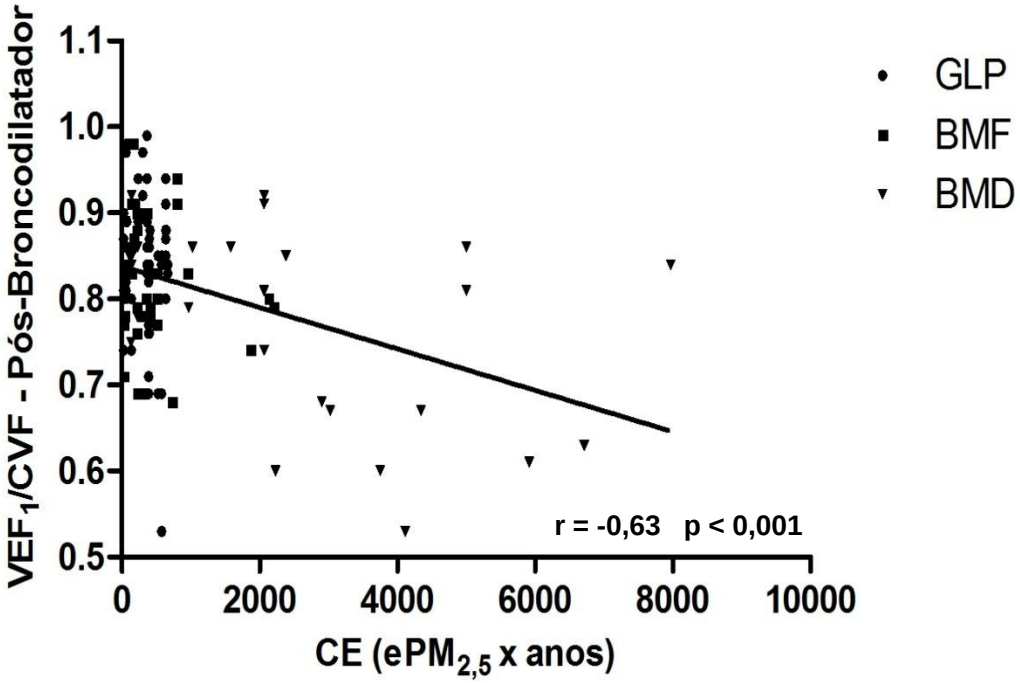
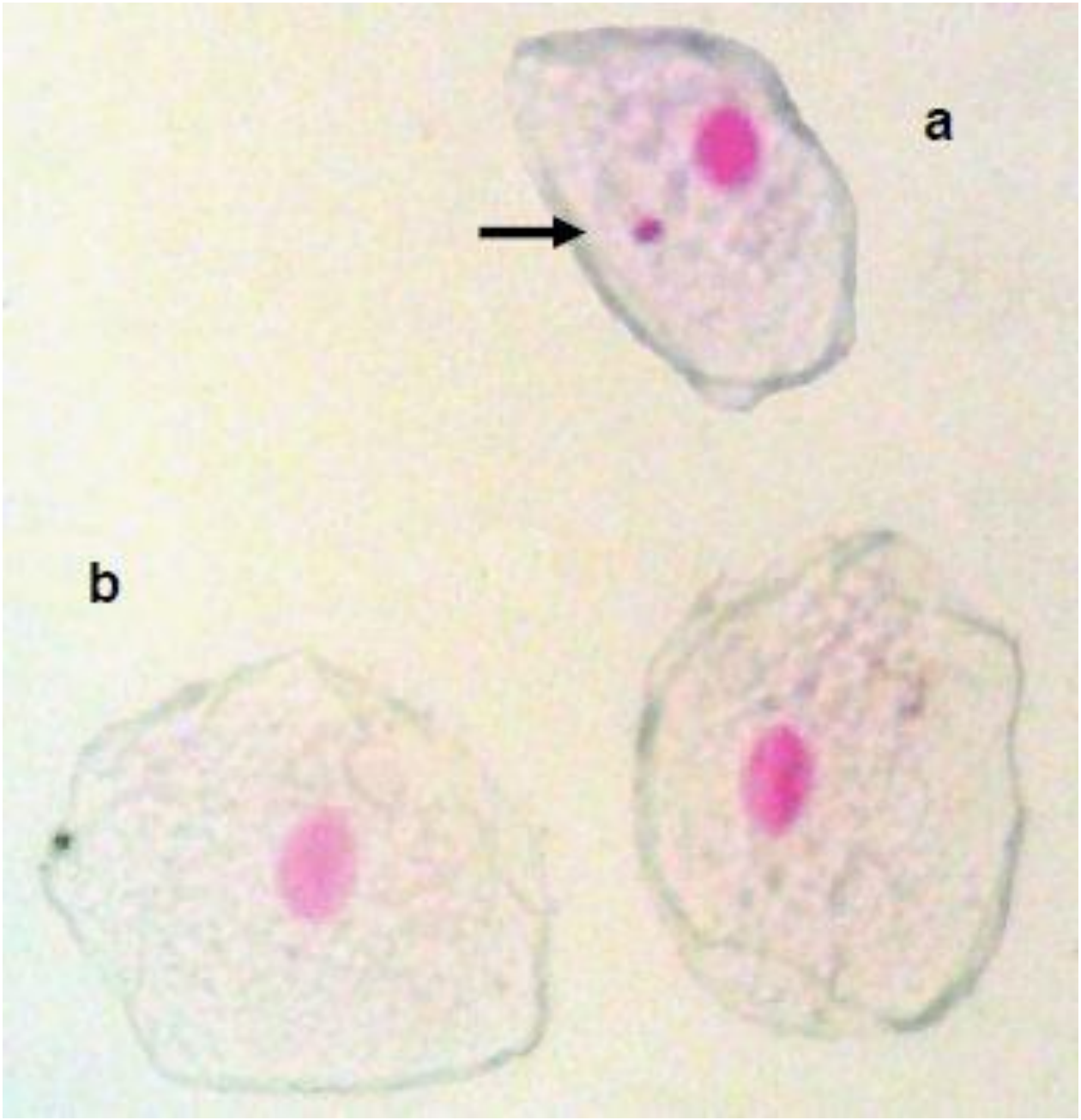


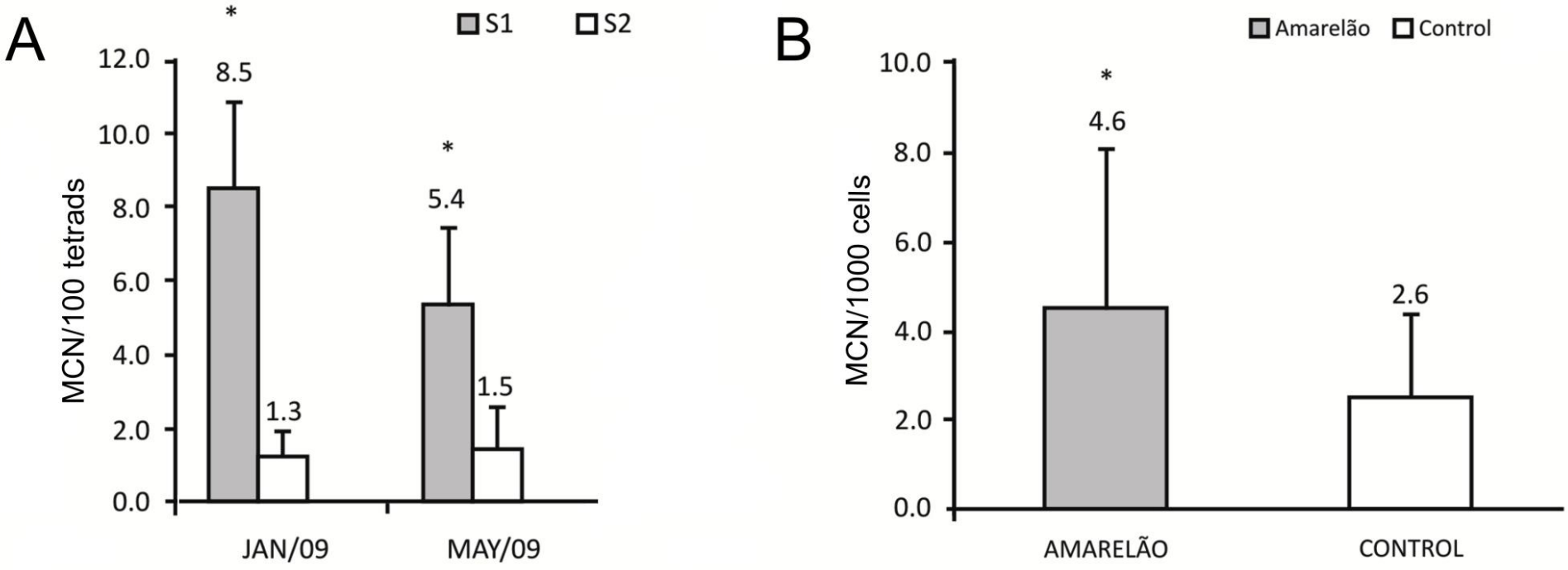

Foto: Marcos Felipe

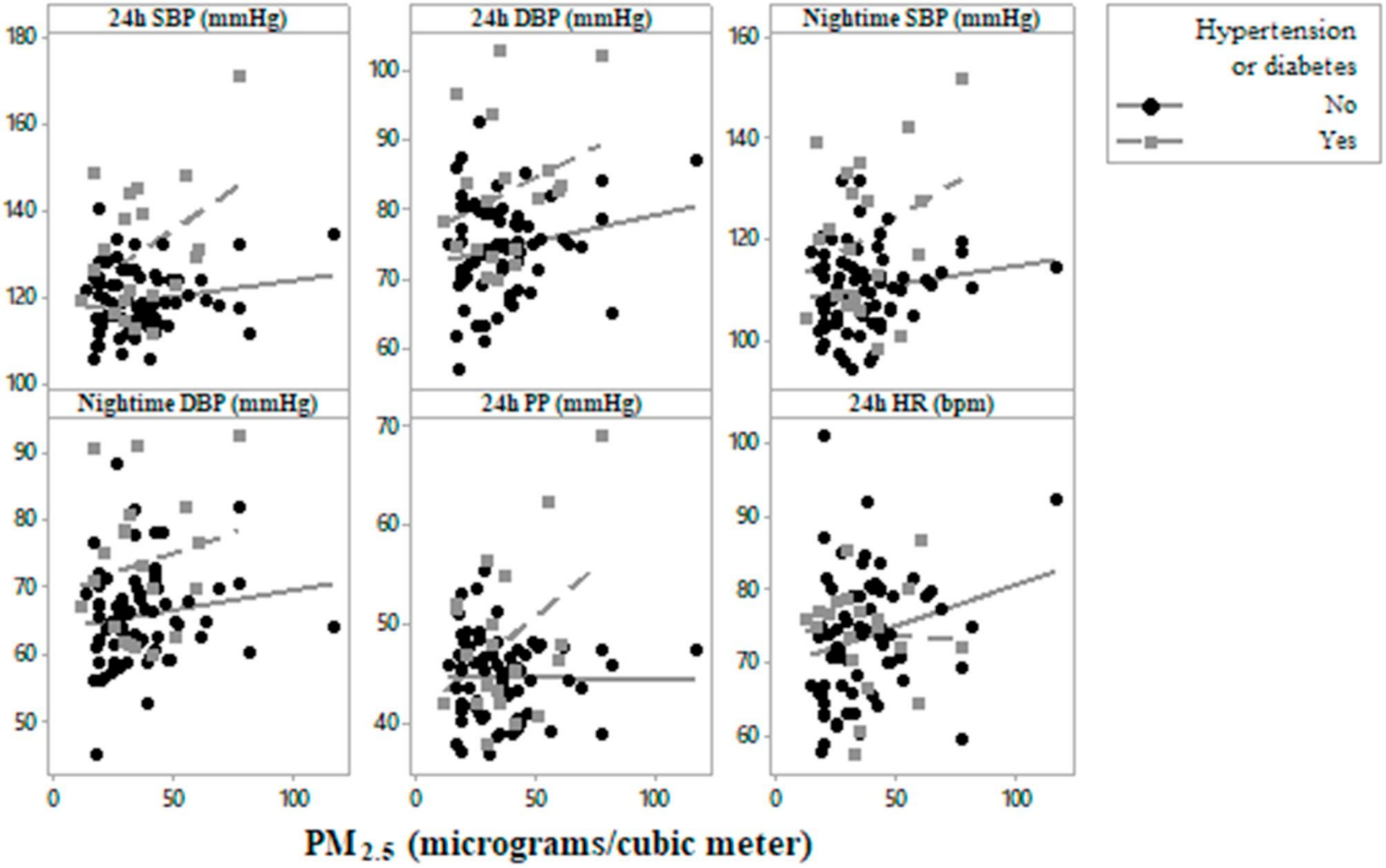

Foto: Marcos Felipe


Foto: Marcos Felipe


AMERICA
99
Foto: Marcos Felipe


a
b


A
S1
S2
MCN/100 tetrads
12.0
10.0
8.0
6.0
4.0
2.0
0.0
*
8.5
1.3
*
5.4
1.5
JAN/09
MAY/09
B
Amarelão
Control
MCN/1000 cells
10.0
8.0
6.0
4.0
2.0
0.0
*
4.6
2.6
AMARELÃO
CONTROL



Environ Res. 2019 Jul;174:88-94. doi: 10.1016/j.envres.2019.04.021. Epub 2019 Apr 25.

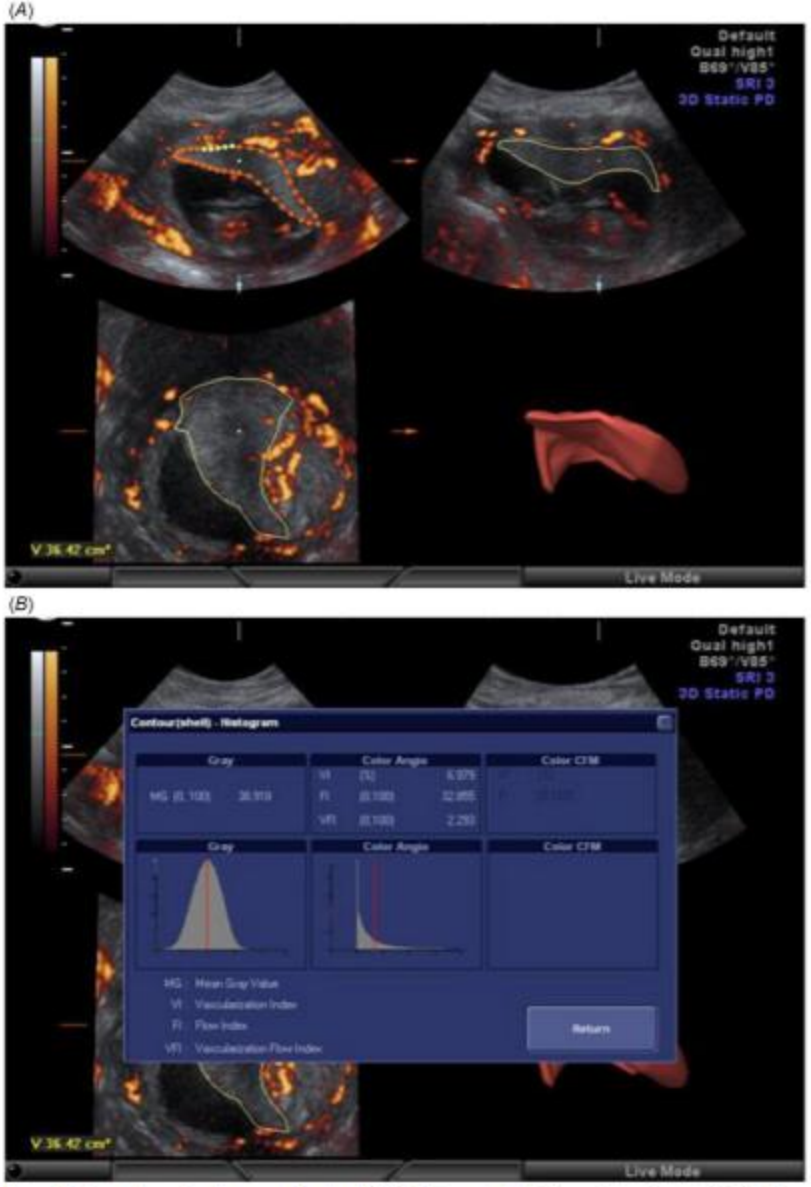


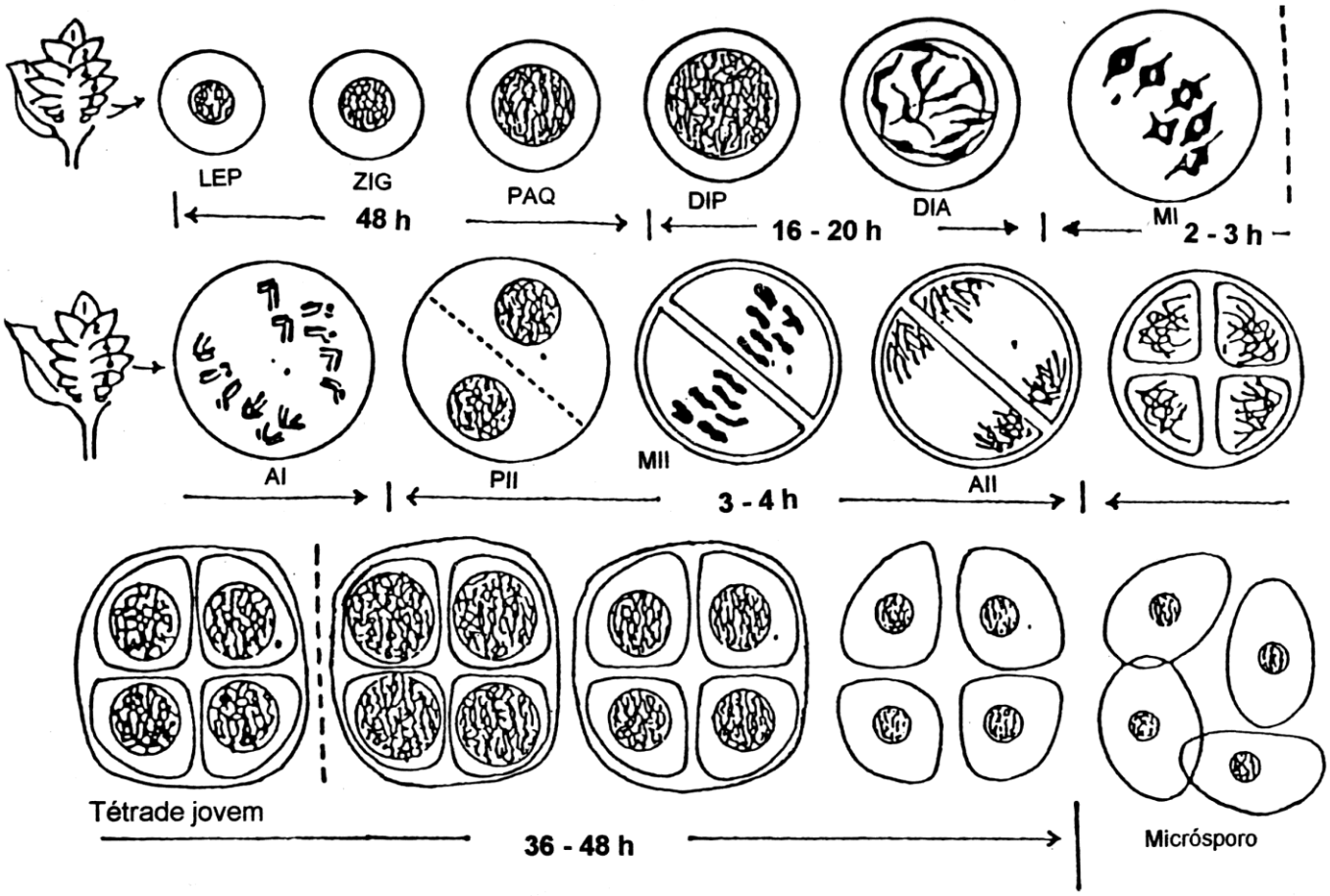
Figure 1. Three-dimensional power Doppler (3DPD) ultrasound. (*A*) Placental capture by 3DPD ultrasonography with the virtual organ computer-aided analysis (VOCAL) method. (*B*) Assessment of placental volume using the rotational technique (VOCAL) and a 3DPD histogram showing the vascular indexes.

Table 4. Estimates of the effects of the NO_2 and O_3 and significant control variables on placental vascularization index ($n = 229$).

Placental variable/ pollutant and SV	Log VI			
	SB	*p*-Value	SB	95% CI
Model 1[a] ($n = 228$)				
NO_2	−0.168	0.013	−0.008	−0.014, −0.002
O_3	0.025	0.708	0.017	−0.073, 0.108
Model 2[b] ($n = 228$)				
NO_2	−0.153	0.020	−0.007	−0.013, −0.001
O_3	0.013	0.842	0.009	−0.079, 0.096
BMI	0.268	< 0.001	0.038	0.020, 0.056
Model 3[c] ($n = 222$)				
NO_2	−0.137	0.042	−0.006	−0.012, −0.0002
O_3	0.012	0.851	0.009	−0.082, 0.099
BMI	0.280	< 0.001	0.040	0.021, 0.059
Model 4[d] ($n = 187$)				
NO_2	−0.213	0.004	−0.009	−0.015, −0.003
O_3	0.056	0.430	0.036	−0.054, 0.126
BMI	0.239	0.001	0.034	0.014, 0.055

Note: BMI, body mass index; CI, confidence interval; Log, logarithm; NO_2, nitrogen dioxide; O_3, ozone; SB, standardized beta; SV, significant variable; VI, vascularization index.
[a]Model 1: Exposure to both pollutants, controlling for gestational age of fetus.
[b]Model 2: Exposure to both pollutants, controlling for gestational age of fetus, body mass index (BMI), parity, smoking, and placental location.
[c]Model 3: Exposure to both pollutants, controlling for gestational age of fetus, BMI, parity, smoking, placental location, maternal alcohol consumption, maternal age, maternal ethnicity, and maternal education level.
[d]Model 4: Exposure to both pollutants, controlling for gestational age of fetus, BMI, parity, placental location, maternal alcohol consumption, maternal age, maternal ethnicity, and maternal education level.

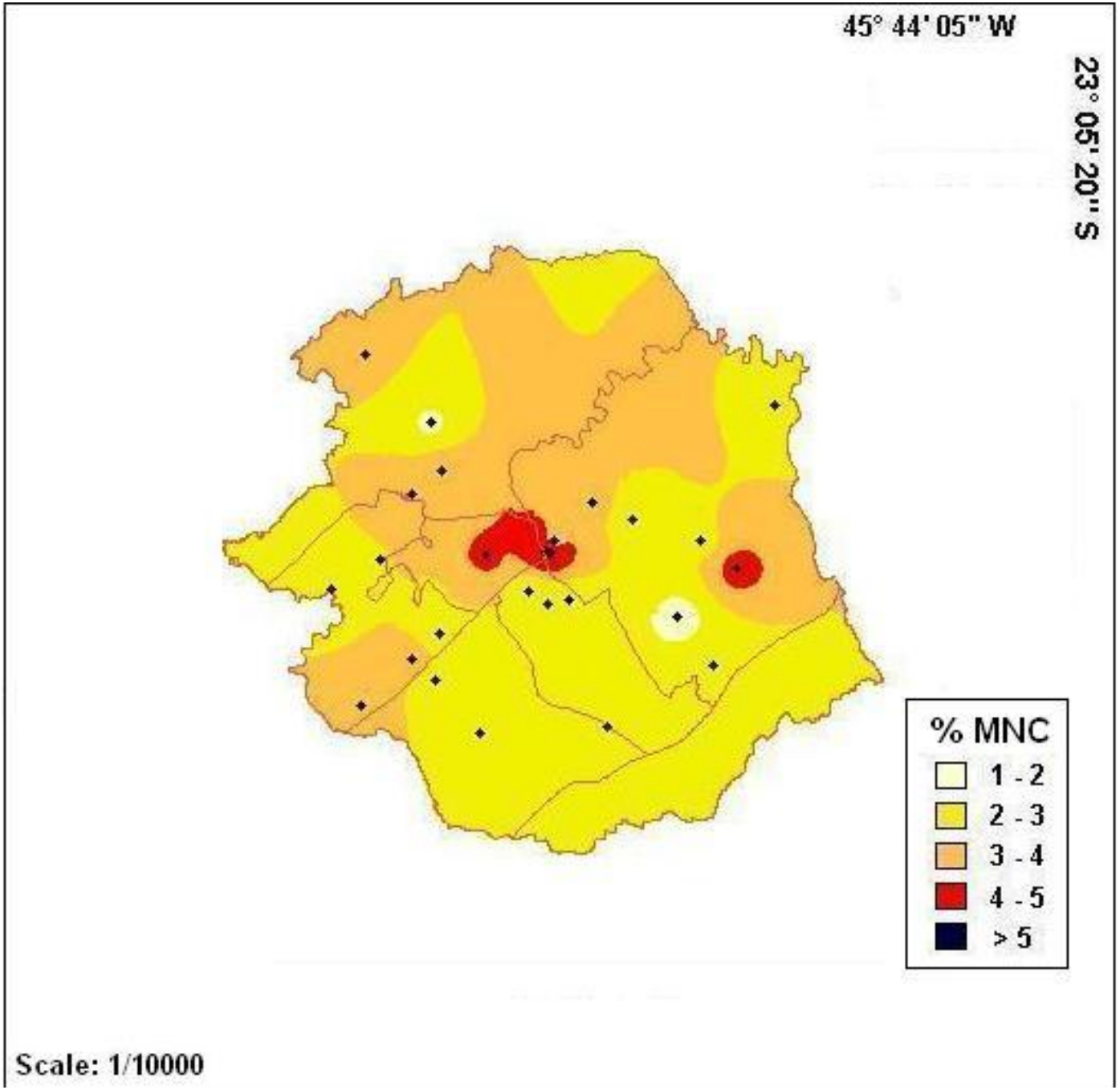
Environ Health Perspect. 2017 Apr;125(4):753-759.

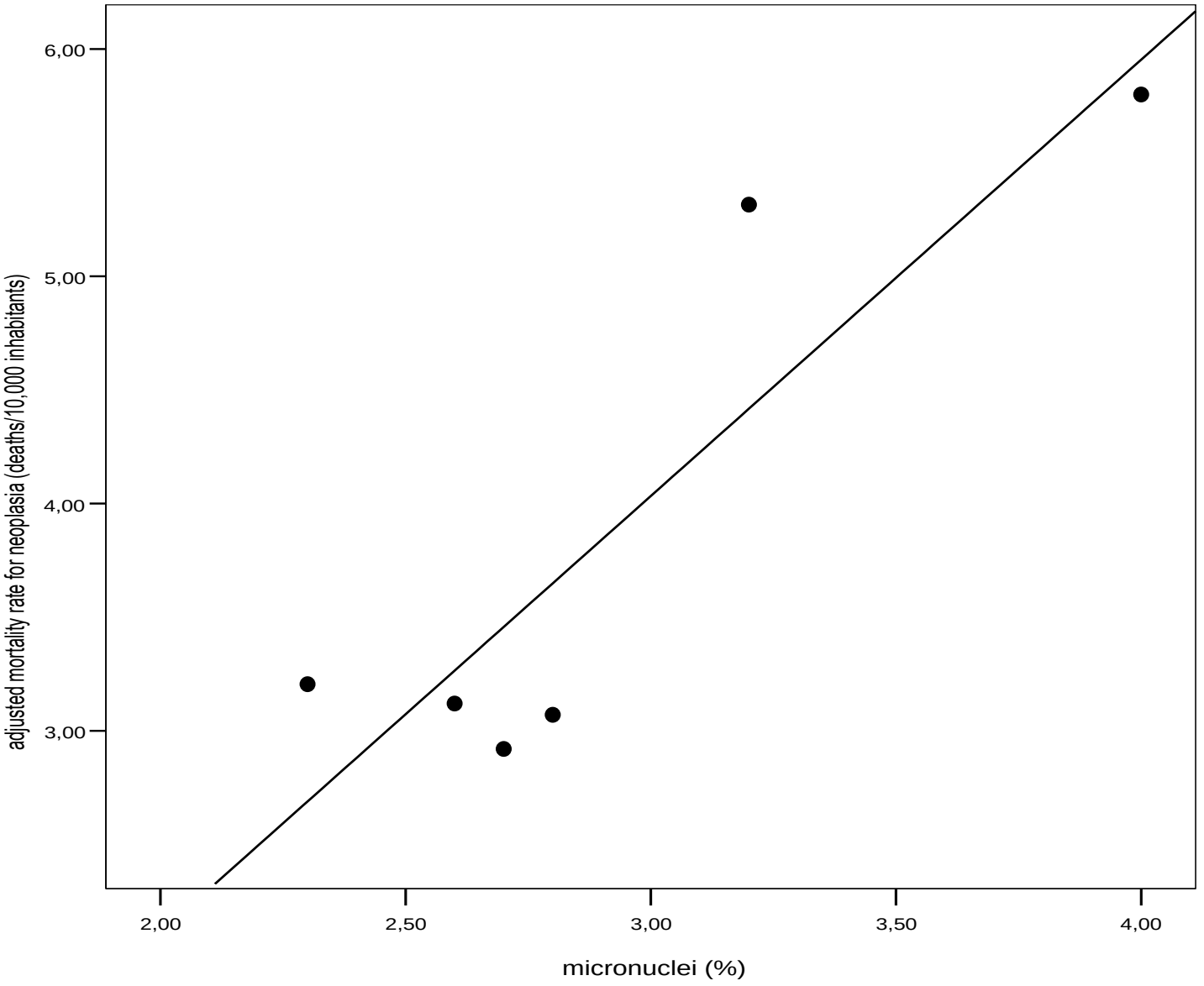

LEP
ZIG
PAQ
DIP
DIA
MI
48 h
16 - 20 h
2 - 3 h
AI
PII
MII
AII
3 - 4 h
Tétrade jovem
36 - 48 h
Micrósporo

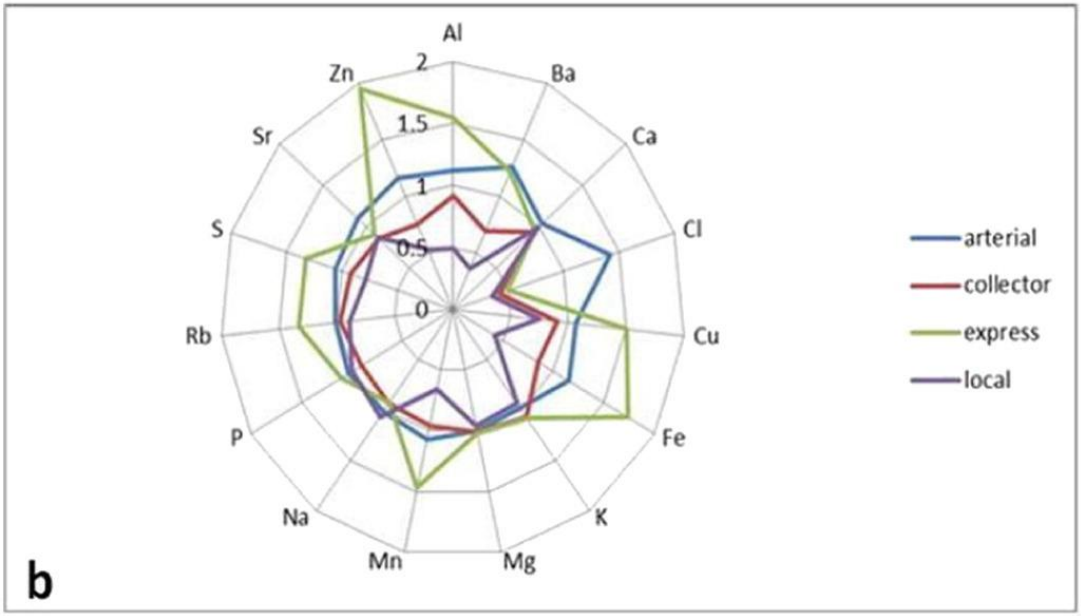
New initiative

Association between micronuclei frequency in pollen mother cells of *Tradescantia* and mortality due to cancer and cardiovascular diseases: A preliminary study in Sao José dos Campos, Brazil

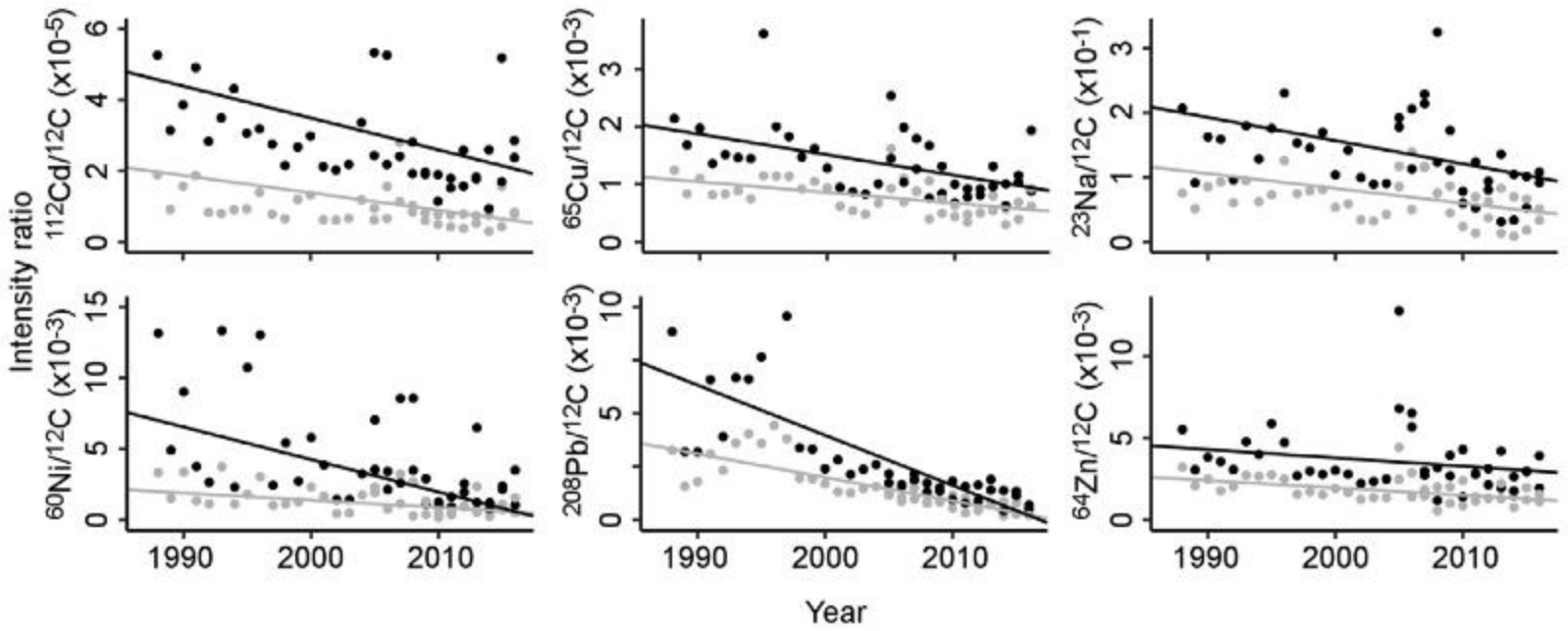
[a]Department of Geochemistry, Fluminense Federal University (UFF), Niteroi, RJ, Brazil
[b]National Institute for Space Research, Sao José dos Campos, SP, Brazil
[c]Experimental Air Pollution Laboratory, Department of Pathology, Sao Paulo University Medical School, Sao Paulo, Brazil
[d]Department of Biological Sciences, Western Illinois University, Macomb, IL 61455, USA
Environ Pollut. 2009 Jun;157(6):1767-70.

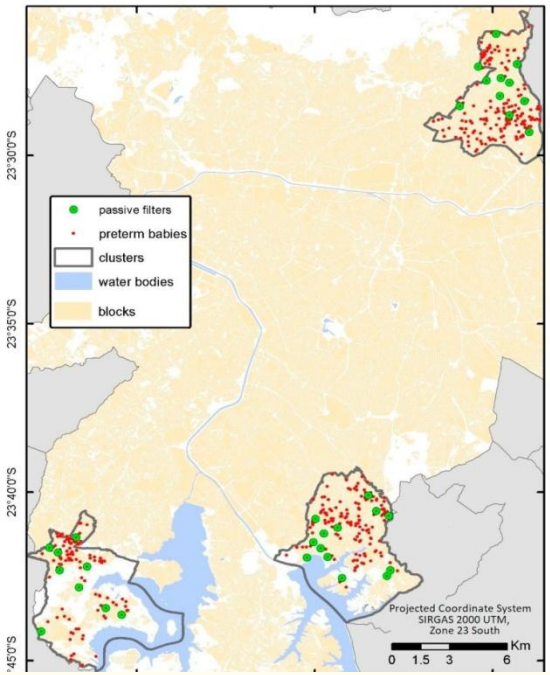

45° 44' 05" W
23° 05' 20" S
% MNC
1 - 2
2 - 3
3 - 4
4 - 5
> 5
Scale: 1/10000


6,00
5,00
4,00
3,00
adjusted mortality rate for neoplasia (deaths/10,000 inhabitants)
2,00
2,50
3,00
3,50
4,00
micronuclei (%)



Environ Int. 2016 May;91:271-5


Intensity ratio
$^{112}Cd/^{12}C$ (x10^{-5})
$^{65}Cu/^{12}C$ (x10^{-3})
$^{23}Na/^{12}C$ (x10^{-1})
$^{60}Ni/^{12}C$ (x10^{-3})
$^{208}Pb/^{12}C$ (x10^{-3})
$^{64}Zn/^{12}C$ (x10^{-3})
1990
2000
2010
Year



COMPONENT MATRIX

ELEMENTS	Factor 1	Factor 2	Factor 3	Factor 4
CU	0.686	0.140	0.485	−0.167
CA	−0.362	−0.621	0.339	0.485
K	0.773	0.039	0.542	−0.045
CL	0.426	0.240	0.290	−0.462
S	0.298	0.582	0.459	0.442
P	0.760	0.071	0.482	0.080
AL	0.786	−0.074	−0.552	0.184
MG	−0.224	0.794	−0.014	−0.324
NA	−0.568	−0.674	0.336	−0.131
BA	0.844	0.083	−0.437	0.206
SR	−0.275	0.412	0.425	0.711

Multivariate logistic model with preterm and variables related to air pollution, the characteristics of mothers, and the onset of prenatal assistance.

Models	Variables	Exp (B)	*p*	Lower CI 95%	Upper CI 95%
Model 1—Pollutants	Low NO_2	1.03	0.98	0.76	1.33
	Low O_3	0.50	0.001	0.36	0.69
	Factor 1 (level 2)	0.91	0.60	0.65	1.28
	Factor 1 (level 3)	1.51	0.02	1.08	2.12
	Factor 1 (level 4)	1.73	0.004	1.19	2.50
Model 2—Pollutants and mothers' characteristics	Low NO_2	0.99	0.96	0.75	1.32
	Low O_3	0.51	0.001	0.37	0.70
	Factor 1 (level 2)	0.89	0.53	0.64	1.26
	Factor 1 (level 3)	1.52	0.02	1.08	2.13
	Factor 1 (level 4)	1.72	0.004	1.18	2.49
	Mother's age (<19 y)	1.50	0.14	0.87	2.58
	Mother's age (>34 y)	1.10	0.47	0.85	1.43
	High school level	1.20	0.21	0.90	1.60
	University level	1.32	0.14	0.91	1.90
Model 3—Pollutants, mothers' characteristics, smoking, use of drugs, and prenatal disease	Low NO_2	0.86	0.33	0.63	1.16
	Low O_3	0.46	0.001	0.33	0.65
	Factor 1 (level 2)	0.87	0.43	0.60	1.24
	Factor 1 (level 3)	1.60	0.01	1.12	2.29
	Factor 1 (level 4)	1.65	0.01	1.11	2.45
	Mother's age (<19 y)	1.41	0.45	0.79	2.51
	Mother's age (>34 y)	1.11	0.62	0.84	1.47
	High school level	1.25	0.16	0.92	1.70
	University level	1.52	0.05	0.99	2.31
	Public assistance	1.34	0.05	1.00	1.80
	Use of drugs	1.13	0.80	0.43	2.98
	Smoking	0.79	0.28	0.51	1.22
	Alcohol consumption	0.91	0.70	0.55	1.50
	Urinary infection	1.69	0.001	1.31	2.19
	Hypertension	1.71	0.001	1.23	2.38
	Syphilis	5.02	0.001	1.93	13.05
	2nd trimester onset of prenatal care	1.74	0.001	1.26	2.39
	3rd trimester onset of prenatal care	1.18	0.72	0.47	2.98

Low O_3 is the first quartile and comprises values ≤ 14.2 $\mu g/m^3$ and high $NO_2 \geq 16.4$ $\mu g/m^3$.