Portuguese Primary Schools: Dust filter samples, a simple tool for assessing bacterial contamination indoors?

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Improving **indoor air quality**
to bring about a **healthier future**
for our children

IAQ IN SCHOOLS AND HEALTH RISKS[1,2]

- Microbial contamination risks health in indoor environments.
- Schools: high risk for respiratory/infectious diseases.
- Children in schools are especially vulnerable.
- They spend long hours in these settings.
- Indoor air quality (IAQ) management is critical.

ADRESSING AIR QUALITY INDOORS

- Assessing airborne bacteria remains crucial for the prevention of respiratory health problems[3]
- Active air sampling remains the gold standard for compliance with legal frameworks on indoor air quality[4]
- Passive sampling methods, such as filtration, are simple and cost-effective[5]
- Allow longer sampling periods, providing insights into prolonged exposure[3]

MAS-100

VS.

UV-sterilized filters

Objective: assess bacterial contamination seasonal variations across school settings with dust filter samples, to identify high-risk areas

SAMPLING CAMPAIGN

- Conducted in **10 schools** within the Metropolitan Lisbon Area.
- Samples collected during **warm season (N=33)** and **cold season (N=34)**.
- Locations sampled: **canteens (N=14)**, **classrooms (N=33)**, **gymnasium (N=9)**, **library (N=9)**, and **toilets (N=2).**
- **Sampling Method:** Settled dust collected using UV-sterilized coffee filters placed inside disinfected vacuum tubes.
- **Surfaces Sampled:** Shelves, plinths, and floors around students' desks and near the door in all sampled rooms.

FILTERS EXTRACTION AND INOCULATION

Extraction Method: Samples extracted using a **NaCl + Tween 80 solution**.

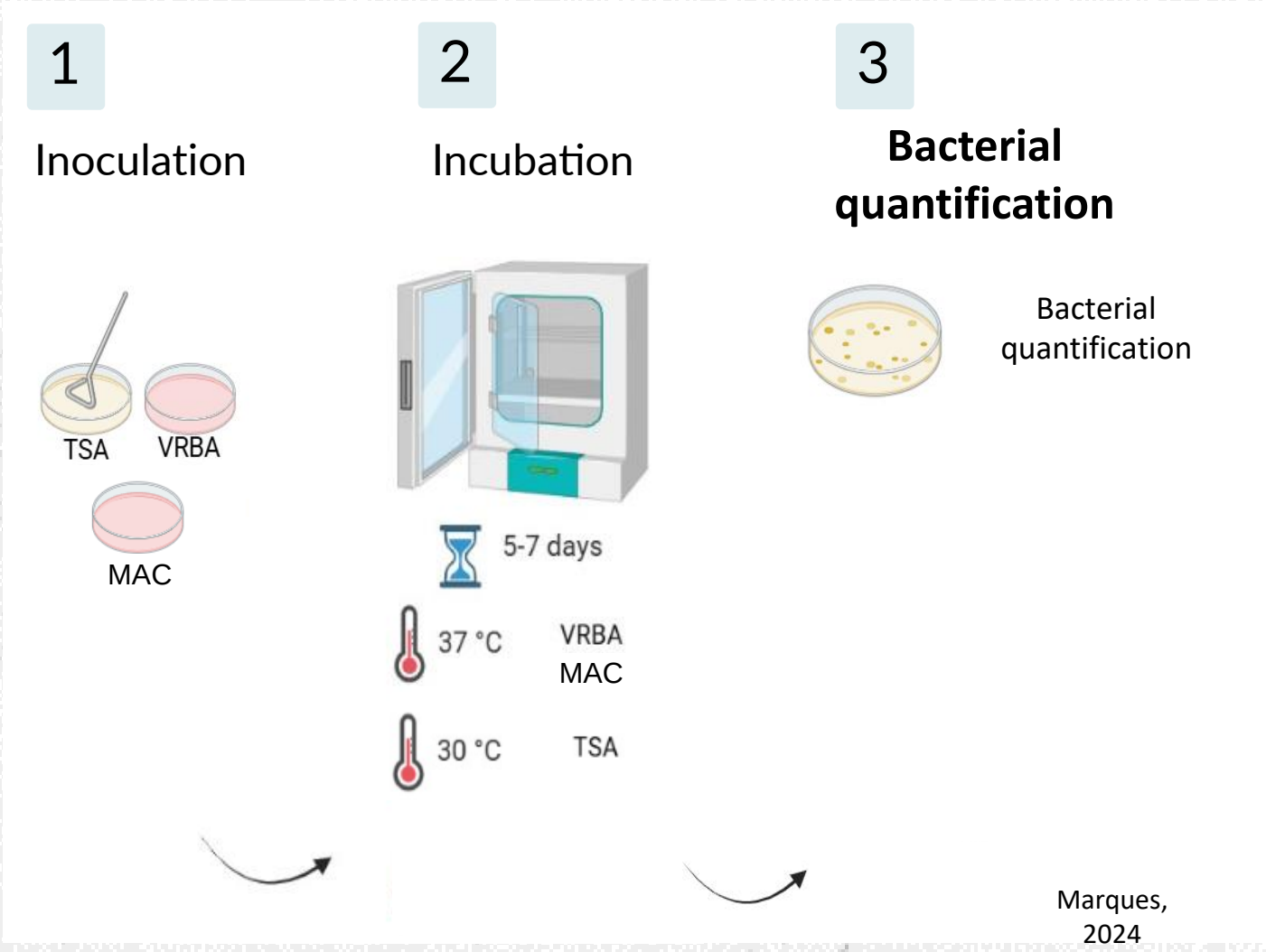
Extracted samples inoculated onto **Tryptic Soy Agar (TSA)**, **Violet Red Bile Agar (VRBA)**, and **MacConkey Agar (MAC)**.

Incubation Conditions:

TSA: Incubated at **30°C for 7 days**.

VRBA: Incubated at **37°C for 7 days**.

MAC: Incubated at **37°C for 24 hours**.



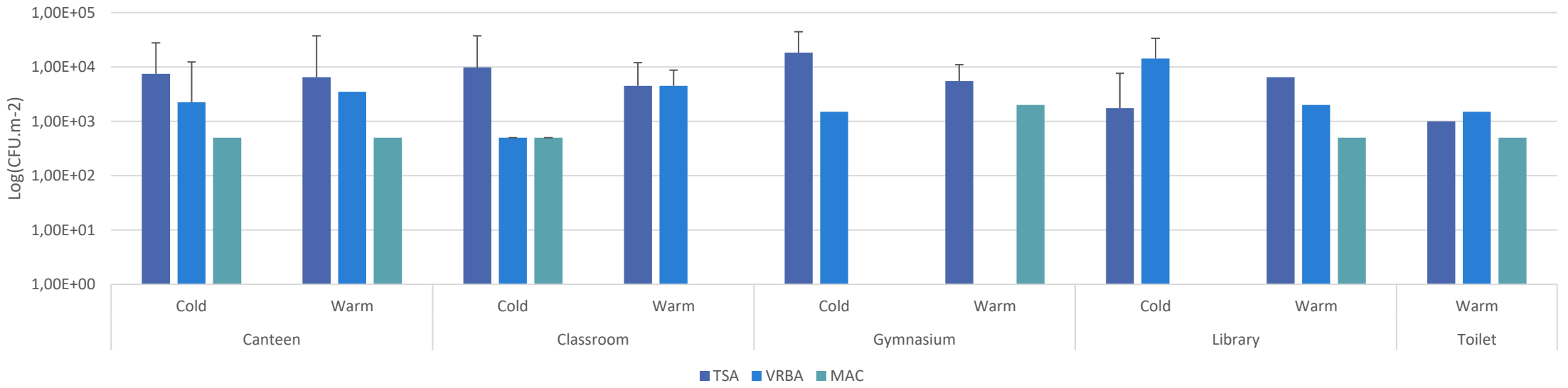
BACTERIAL CONTAMINATION VARIATION

Cold Season Contamination Hotspots:

- **Gymnasiums:** Highest TSA contamination (1.8×10^4 CFU/m²).
- **Libraries:** Highest VRBA contamination (1.4×10^4 CFU/m²)
- **Classrooms:** Lowest VRBA contamination (5.0×10^2 CFU/m²).

Warm Season Contamination Patterns:

- **Canteens:** Highest TSA contamination (6.5×10^3 CFU/m²).
- **Classrooms:** Highest VRBA contamination (4.5×10^3 CFU/m²).
- **Gymnasiums:** Highest MAC contamination (2.0×10^3 CFU/m²).



Bacterial contamination

- ❄ Cold Season:
  - *Canteens* => Elevated Gram-negatives → Persistent food/moisture residues.
  - *Classrooms* => Lowest Gram-negatives → Effective cleaning routines.
  - *Gymnasiums* => General bacteria hotspot (↑TSA) → High activity + inadequate desinfecion.
  - *Libraries* => Gram-negative hotspot (↑VRBA) → Distinct microbial niche (lower disturbance).
- ☼ Warm Season:
  - *Canteens* => Highest general bacteria (↑TSA) → Temperature-driven growth on organic matter.
  - *Classrooms* => Gram-negative surge (↑VRBA) → outdoor air influx.
  - *Gymnasiums* => Enterobacteriaceae focus (↑MAC) → Sweat/skin contact + inadequate disinfection.

Highlights

Seasonal/Spatial Influence: Significant differences in microbial contamination between (Seasons (cold/warm) and Locations (gyms, classrooms, etc.))[6,7]

- **Critical Hotspots:**
  - Gymnasiums: High TSA & MAC contamination
  - Classrooms: Emerging warm-season VRBA risk
- **Variability Patterns:**
  - Fluctuating TSA results (e.g., canteens SD=23,645)
  - Driven by: Occupancy patterns + Cleaning schedules and procedures (data collected through a walkthrough survey)

Management Implications: Implement seasonally-adaptive hygiene protocols; Enhance monitoring in high-traffic zones; Prioritize gyms/classrooms for interventions; **Prevent AMR**[8]

Next Steps

Contextual and operational information collection

- Cleaning procedures applied

Compare results from:

- MAS-100
- Personal air samplers
- Andersen 6-stage air sampler
- Passive samples (EDC, EDCT, Settled dust, Dust filers, Mops)

Risk assessment

Fill the gaps in IAQ policies, supporting regulators and exposure assessors on primary schools' IAQ improvement.

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THANK YOU

Thanks for your attention and looking forward to hearing your questions.