



# Influence of hyperbaric pressures on salbutamol metered dose inhaler performances

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## Background



Salbutamol metered dose inhalers on the Swiss market



Hyperbaric chamber HAUX-STARMED 2400 (HAUX LIFE-SUPPORT GmbH, Germany)

- Hyperbaric oxygenotherapy (HBOT) is used for various clinical conditions. Elective patients may have comorbidities like asthma; a crisis occurring during HBOT session would need to be treated inside the hyperbaric chamber.
- Salbutamol metered dose inhalers (MDIs) may deliver a lower quantity of aerosol under hyperbaric pressures<sup>[1]</sup>.

## Objective

Evaluate the performances of two salbutamol MDIs on the Swiss market: Ventolin<sup>®</sup> aerosol-nebuliser (GSK) and Salamol<sup>®</sup> Autohaler (Teva Pharma) **inside an HAUX-STARMED 2400 hyperbaric chamber.**

## Methods

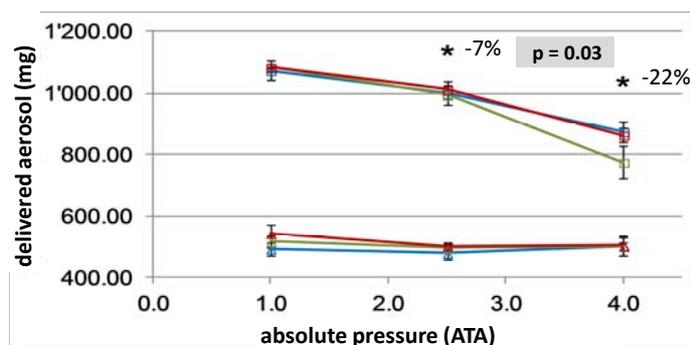
- Each device was weighted before and after 15 actuations into the hyperbaric chamber.
- Conditions of experiment: the filling of the canister (full, half-empty or near-empty) and pressure in the chamber (**1.0, 2.5 and 4.0 ATA**; 1 ATA = 760 mmHg).
- Tests were performed in triplicate for each condition (statistical test: Kruskal-Wallis).

## Results

Quantity of aerosol delivered within 15 actuations for both devices toward the pressure with **full**, **half-empty** and **near-empty** canister.

		Absolute pressure (ATA)			p-value
		1.0	2.5	4.0	
VENTOLIN	near empty	1083.2 (10.4)	1011.5 (15.1)	863.7 (23.6)	0.03
	half empty	1082.5 (2.7)	994.5 (10.9)	775.0 (52.3)	0.03
	full	1073.7 (30.0)	998.8 (37.7)	874.6 (35.5)	0.03
	p-value	> 0.05	> 0.05	0.07	
SALAMOL	near empty	542.7 (30.7)	502.1 (10.2)	502.8 (30.5)	> 0.05
	half empty	515.8 (19.6)	495.9 (13.7)	501.5 (12.0)	> 0.05
	full	492.5 (19.6)	478.7 (19.9)	500.6 (28.0)	> 0.05
	p-value	> 0.05	> 0.05	> 0.05	

Quantity of aerosol delivered within 15 actuations in mg (SD)



**Ventolin<sup>®</sup>**: delivered quantity of aerosol **significantly lower** as pressure increased to 2.5 and 4.0 ATA.

**Salamol<sup>®</sup>**: delivered quantity of aerosol **not significantly influenced** by pressure increase.

Differences observed for the **filling conditions** at a given pressure were **not significant** for both MDIs.

## Conclusion

Increased pressure reduced by 20% the quantity of aerosol delivered by Ventolin at 4.0 ATA. The reasons for the differences observed between the two devices might be explained by the triggering mechanism. Clinical consequences of these observations on the management of an asthma crisis under hyperbaric pressures are unknown and should be investigated. Performances of devices in hypobaric conditions should also be investigated.

<sup>[1]</sup> Johnson GA et al. Undersea Hyperb Med 2009. 36:55-63.