INVESTIGATION OF DRY POWDER INHALATION AEROSOLISATION PROPERTIES AT DIFFERENT FLOW RATES FROM A CONVENTIONAL CAPSULE-BASED INHALER DEVICE

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INTRODUCTION

• Dry powder inhalers (DPIs) have become increasingly common in the treatment of respiratory diseases.
• Passive devices have involved the use of inhalation grade Hypromellose (hydroxypropyl methylcellulose [HPMC]) capsules.
• DPIs are generally required to be used at a flow rate of 60 L/min for effective pulmonary deposition, which may not be appropriate for those with lung diseases.
• In addition, capsule-based DPIs are intended for treatment over a 4-week period and storage conditions can influence the interaction of powder with the capsule affecting the aerosolisation drug deposition and hence reproducibility of inhalation dose and treatment outcome.

AIM

• To investigate the aerosolisation properties of dry powder formulations comprising of inhalation grade lactose and micronised salbutamol, in HPMC (size 3) capsules (Qualicaps®) using a standard resistance 2-pin inhaler device at different flow rates (30 and 60 L/min).

RESULTS & DISCUSSION

Figure 1

Figure 1A: CAPSULES WITH STANDARD INHALER

Figure 1B: DEVICE WITH STANDARD INHALER

Figure 2

Figure 2A: EMITTED DOSE

Figure 2B: FINE PARTICLE DOSE

Figure 2C: FINE PARTICLE FRACTION

Figure 2D: MMAD

COMPARING CAPSULES AND DEVICE

• Less deposition of the drug was observed in capsules with 30 L/min compared to 60 L/min (Figure 1A).
• Neither a significant increase nor decrease can be observed at both the flow rates with time.
• A significant difference in the deposition of salbutamol in the standard inhaler was observed between the flow rates (Figure 1B).
• There is no change in deposition with time except on day 7 and 21 for 30 L/min.

COMPARING EMITTED DOSE, FINE PARTICLE DOSE, FINE PARTICLE FRACTION & MMAD

• There was no significant difference in the deposition of salbutamol across different weeks of analysis (Figure 2).
• Except for the ED day 0 to day 7 and day 7 to day 21 at 60 L/min (Figure 2A).
• However there seems to be a significant difference between the different flow rates used – 30 and 60 L/min for ED, FPD, FPF and MMAD (Figure 2A-D).
• A higher flow rate (60 L/min) indicated more FPD and FPF with lower MMAD when compared with the lower flow rate (30 L/min) (Figure 2B-D).
• There is no change in deposition with time except on day 7 and 21 for 30 L/min.

CONCLUSIONS

• The results indicate significant differences in powder retention with higher deposition at 60 L/min within capsules and 30 L/min in the device.
• In addition, the ED, FPD, FPF was significantly greater at 60 L/min compared to 30 L/min at each time point.
• This demonstrates the important relationship between inhalation, therapeutic dose and lung deposition.
• However, despite these differences there was very little significant variability when comparing each flow rate over time.

REFERENCES


ACKNOWLEDGEMENTS

Dr Imran Saleem would like to acknowledge Qualicaps Europe S.A.U., Spain, for funding this work.