Influence of Cigarette Filter Ventilation on Smokers’ Mouth Level Exposure to Tar and Nicotine: A Retrospective Meta-Analysis of 11 Studies in 9 Countries

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Background

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Background

• Cigarette filter ventilation allows air to be drawn into the mainstream smoke which dilutes the smoke

• This is a design tool which is important in controlling and reducing the yields of particulate and gas phase smoke components produced by cigarettes

• Enables regulated ceilings for cigarette smoke components to be met
  • e.g., tar, nicotine and carbon monoxide
Background

• When cigarettes are machine-smoked using the Health Canada Intense (HCI) method, ventilation holes are fully blocked

• This gives rise to higher smoke yields than those produced under ISO conditions

• However, in typical use, few smokers block all ventilation holes

• Therefore, it is beneficial to study the effect of filter ventilation on human smoke exposure
Methods – filter analysis to estimate mouth level exposure
Methods – field studies

• In previous BAT and RJRT studies we examined mouth level exposure (MLE) to tar and nicotine

• Current analysis used data collated from 11 studies across 9 countries

• Spent filters collected (24h or ≥15 filters) for MLE analysis

• Studies were performed between 2007 and 2013

• MLE to tar and nicotine data from 1,690 products and 6,400 subjects (>80,000 filters)

• Filter ventilation between 0% and 87%
Methods – field study locations
Methods – data analysis

• Per day MLE values were calculated:

• $\text{MLE}_{\text{cig}}$ is the per-cigarette MLE for tar or nicotine

• $\text{MLE}_{\text{day}}$ is the per-day MLE for tar or nicotine

\[
\text{MLE}_{\text{day}} = \text{MLE}_{\text{cig}} \times (\# \text{ butts collected} + \# \text{ butts reported as not collected})
\]

\[
\text{MLE}_{\text{day}} = \text{MLE}_{\text{cig}} \times \# \text{ butts reported}
\]

• Plots of $\text{MLE}_{\text{day}}$ and $\text{MLE}_{\text{cig}}$ versus filter ventilation were fitted with linear regression lines
  • Individual countries as well as all countries combined
Results – combined data

- Increasing filter ventilation from 0% to 87% was associated with a decrease in per cigarette MLE to tar and nicotine

$r^2 = 48.6\%$

$r^2 = 33.3\%$
Results – combined data

- Increasing filter ventilation from 0% to 87% was associated with a decrease in daily MLE to tar and nicotine

\[ r^2 = 47.6\% \]

\[ r^2 = 29.1\% \]
Results – individual countries

• Per cigarette MLE to tar and nicotine tended to decrease as filter ventilation increased
Results – individual countries

• Per cigarette MLE to tar and nicotine tended to decrease as filter ventilation increased
Results – individual countries

- Daily MLE to tar and nicotine tended to decrease as filter ventilation increased.
Results – individual countries

- Daily MLE to tar and nicotine tended to decrease as filter ventilation increased.
Summary and conclusions

• Cigarette filter ventilation was associated with a reduction in MLE to tar and nicotine when examined under subjects’ natural smoking behaviour.

• Data from second USA study likely reflect inclusion of a narrow range of ventilation levels.

• Greater reductions observed at higher ventilation rates.

• These data do not support the view that smokers fully compensate for cigarette ventilation; however, they do suggest that increasing cigarette ventilation tends to reduce exposure to nicotine and tar.

• It is important to note that other confounding factors are present in ventilated cigarettes.
Coming together is a beginning, staying together is progress, and working together is success.

Henry T. Ford