efficiency for an inhaling humanoid model wearing hats with different brim lengths in low velocity wind speeds.

Methods: Computational fluid dynamics modeling was used to solve the fluid flow surrounding an inhaling humanoid with a baseball cap (long brim), hardhat (short brim) or no hat for facing-the-wind orientation. Fluid simulations used the standard k-epsilon turbulence models with freestream velocities of 0.1, 0.2, and 0.4 m s^{-1} and continuous breathing velocities of 1.81, 4.33, and 12.11 m s^{-1} to represent at-rest, moderate, and heavy breathing, respectively. Laminar particle trajectory simulations were used to determine the upstream critical area where particles would be inhaled. These critical areas were used to compute aspiration efficiencies.

Results: Both hat models significantly reduced aspiration (p<0.001) when compared to the no-hat model. Differences in aspiration between the hat models and no hat model were more apparent for particles ≥68 µm (0–84%). Negligible reductions in aspiration were seen for particles <68 µm (0–6%). The presence of hats forced air to converge towards the mouth causing a slight increase in aspiration for particles <22 µm.

Conclusion: Hats with brims significantly reduced aspiration for particles ≥ 68 µm. For particles ≤ 22 µm hats caused an increase in aspiration due to air being forced downward towards the mouth. Hats may reduce exposures to large particles (≥ 68 µm), but may also increase exposures to smaller particles (≤ 22 µm).

47. Evaluation of Pulmonary Function Cross-Shift Changes in Dairy Parlor Workers using Spirometry and Exhaled Nitric Oxide

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Objectives: The objective of this study was to: 1. Quantify exposure concentrations of inhalable dust and endotoxin among dairy parlor workers; 2. Evaluate acute cross-shift changes in respiratory status using spirometry, and 3. Assess the effectiveness of exhaled nitric oxide (eNO) for detecting acute cross-shift bronchial responsiveness changes.

Methods: Nine large herd dairy farms and 62 dairy parlor workers across Iowa, Minnesota, Wisconsin, and South Dakota were recruited into the cross-sectional study by a variety of methods. Dairy workers were eligible if they were over 18 years of age and non-smokers. Spirometry tests, eNO measurements, and pulmonary symptom questionnaires were completed before and after the work shift. Guidelines for spirometry and eNO testing were followed according to the American Thoracic Society (ATS). Personal exposure to inhalable dust was assessed using Button Aerosol Samplers at a flow rate of 4 Liters per minute. Gravimetric analysis was used to determine airborne concentrations in the breathing zone of the workers. Endotoxin analysis was completed using Recombinant Factor C Assay.

Results: Inhalable dust concentrations ranged between 0.09–4.95 mg/m³ with a geometric mean of 0.59 mg/m³. Inhalable endotoxin concentrations ranged between 4–1968 EU/m³ with a geometric mean of 117 EU/m³. Overall forced expiratory volume in the first second decreased by 1% during the work-shift. While 24% of employees were trained to use respirators, no employees participating used a respirator during their shift. Preliminary statistical results found correlations between decreased measures of pulmonary function and hours worked per week, living on a farm currently, and inhalable dust concentrations.

Conclusions: Dairy parlor workers are exposed to concentrations of organic dusts that may adversely impact health. Further studies should test interventions in milking parlors to reduce dust exposure among dairy workers.

ABSTRACTS

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