Evaluating Exposure to Inhalable Dust among Dairy Parlor Workers

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Background

Dairy parlor workers on large-herd farms typically work in the parlor area for 8-12 hours per day and 6-7 days per week.

Dairy farm workers are exposed to a number of different occupational health hazards, including chronic exposure to inhalable organic dust.

Chronic exposure to organic dust has been linked to the development of numerous respiratory diseases, including chronic bronchitis, asthma, and organic dust toxic syndrome (ODTS).

Objectives

1. To measure personal exposures to inhalable dust among dairy parlor workers
2. To determine if there are statistically significant differences in the mean exposures of paired sample groups
3. To determine if between-day-within-worker variability of exposure to inhalable dust is statistically significant
4. To determine the contribution of temperature and relative humidity to the overall variation of inhalable organic dust concentrations

Methods

- Collected inhalable dust exposure samples at 9 farms throughout the Midwest
- Sampled 44 parlor workers for 1 work shift
- Sampled 18 parlor workers for 2 work shifts
  - Equipped each worker with 2 Button samplers
  - Samplers were located on opposite sides (R and L) of each worker's breathing zone
- Pre- and post-calibrated personal sampling pumps
  - 4 liters per minute (Lpm) flow rate
- Calculated a time-weighted average (TWA) of exposure to inhalable dust
- Conducted statistical analyses on data and considered a p-value of 0.05 or less to indicate significance

Results

Parlor worker wearing bilateral Button samplers

Parlor workers in a parallel milking parlor

Objective 1

Summary statistics of inhalable organic dust exposures across 1 work shift.

	$n_{samples}$	n_{farms}	AM (SD)	Range
All Inhalable Dust, mg/m³	158	9	0.77 (0.65)	0.05-3.2
Parallel Parlor Inhalable Dust, mg/m³	118	7	0.73 (0.60)	0.05-3.2
Herringbone Parlor Inhalable Dust, mg/m³	26	1	1.19 (0.80)	0.99-2.7
Rotary Parlor Inhalable Dust, mg/m³	14	1	0.39 (0.37)	0.07-1.6

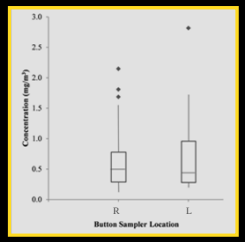
Two exposure samples were excluded from "All Inhalable Dust" analysis due to a pump failure and being an extreme outlier (8.8 mg/m³)

Objective 2

Paired Student's t-test analyses for 2 pairs of sampler groups.

Comparison Group	n	AM (SD)	p
R vs. L	132	0.71 (0.62)	0.617
R vs. L, Only R-handed subjects	86	0.73 (0.65)	0.619

Range = 0.05-2.8 mg/m³ for each group
AM and SD units = mg/m³



Inhalable dust concentrations of all right-side (R) and all left-side (L) located samplers

Objective 3

ANOVA analysis results of repeat measures data (18 workers each sampled over 2 work shifts).

Factor	Levels	n	AM (SD)	Range	p
Sampler Location	2	72	0.97 (1.1)	0.05-8.8	0.702
Sampling Day	2	72	0.97 (1.1)	0.05-8.8	0.744

AM, SD, and Range units = mg/m³

Objective 4

Results of simple linear regression analyses: log Inhalable dust concentrations vs. temperature and relative humidity.

Comparison Groups	n	R^2	β
Outdoor Temp vs. log Concentration	62	0.071	-0.019
Parlor Temp vs. log Concentration	62	0.037	-0.033
Outdoor Relative Humidity vs. log Concentration	62	0.000	0.001

Conclusions

Dairy parlor workers are exposed to concentrations of inhalable dust that may adversely affect their respiratory health.

Button sampler may be positioned on either side of a parlor worker's breathing zone.

Exposure to inhalable dust likely does not vary significantly across different days for parlor workers on large-herd farms.

The majority of variation in inhalable organic dust concentrations cannot be attributed to changing levels of temperature and relative humidity.

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