Measurement of Heat Transfer in Six Mattresses

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Background

•**Sudden infant death syndrome (SIDS)** is still a **leading cause of death** for infants aged one month to one year in developed countries.

•**Thermal stress** has been indentified as a risk factor for SIDS in a number of studies.

•Heavy wrapping and excessive room heating independently increased the risk of SIDS, especially in infants greater than 70 days.

•Heat loss in infants sleeping in the prone position is 60% less effective than for infants lying in the non-prone position with the same clothing and bedding.

•Avoiding overheating is a recommendation of most proffessional authoraties to decrease the risk of SIDS

Objective

To evaluate the thermal resistance of six mattresses

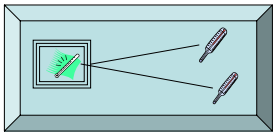
Methods

•An electric blanket with the approximate dimensions of a newborn (43x35x7 cm) was placed on the mattress surface.
•Temperature was measured between the mattress and a blanket which covered the heating element for 65 minutes every 5 minutes using two digital thermometers.
•Temperature measurement was begun immediately after covering the heating element with a blanket, after reaching a stable temperature between the heating element and the mattress.
•A prior experiment showed that more than 90% of the rise in temperature was measured during the first 60 minutes.
•Room temperature was kept at approximately 26ºC±2ºC by using standard heating and cooling techniques.

Mattresses

A – Airnettress – Meshed polyesther netting with an open area of approximately 50%
B - Aminach air – Polyurethane with a 5 m"m honeycomb upper surface
C – Aerosleep - 5 m"m polyesther honeycomb surface placed on standard mattress
D-Airflow – "Egg carton" like polyurethene surface covered with polyesther.
E- Baby Shilav 3000 – Three layered polyurethene surface with polyesther coating
F – Pang - Standard infant mattress polyurethene with polyesther coating.

Methods (cont.)



Results

Table 1. CO_2 elimination - static diffusion (average in seconds)

	Mattress	Mattress + NetSheet	Mattress Cotton Sheet	Standard Mattresses
Mean	62.8	70.1	91.1	198-673
±SD	0.06	2.1	0.6	

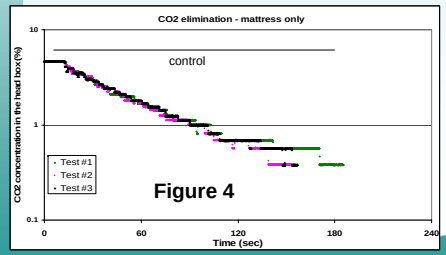


Figure 4

Results (cont.)

Table 2. CO_2 accumulation during infant breathing simulation (max CO_2 conc.-%)

	Closed Headbox + Imperme-able sheet	Mattress	Mattress+ Net Sheet	Mattress + Cotton Sheet
Max CO2 Conc.	4.75	0.70	0.77	1.23
% of Contr.		14.8%	16.2%	25.9%

Table 3. Resistance to air flow (cmH2O/l/sec)

	Mattress	Mattress Net Sheet	Mattress + Cotton Sheet	Contrl*
Mean	0.058	0.152	2.298	2.19
± SD	0.023	0.019	0.030	0.02

***control = resistance of measuring apparatus**

Conclusions

The new mattress has the following qualities:

- **A fast rate of CO_2 elimination**
- **The ability to clear away any CO_2 accumulation, keeping the maximal attainable CO_2 level below 1%**
- **An insignificant resistance to air flow**