

March 2 1992

A Summary of Ergonomic Studies of Anti-fatigue Mats

(Internal report)

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Introduction

The project was conducted in two parts: a laboratory part and a field part.

The lab part was conducted at the Department of Physiology at the University of Copenhagen. In this project acute physiological and biomechanical responses were studied in connection with walking and standing work of two hours duration. The experiments were conducted with 8 young, healthy, female volunteers who each conducted four experiments. These took place on an ERGOMAT® with soft shoes, ERGOMAT® with wooden clogs, hard floor with soft shoes and hard floor with wooden clogs. The lab experiments were planned in the spring of 1990 and conducted that fall. Analysis, computation and writing took place in 1991 and the spring of 1992. (1)

The field project involved 24 people from 3 companies: Holmegårds Glass Works, Stryhns Meats and the pharmaceutical company Ahlgrens DK. People worked for periods of one week on each of the three mats involved - one of which was the ERGOMAT®. (2) In addition they worked for one week with no mat at all - usually on concrete. The development of fatigue and discomfort in lower backs, feet and legs during the day and during the work week was monitored for each of the four conditions using psychophysical methods and questionnaires. Finally the mats were characterized by the participants considering how acceptable they were to work on. A number of variables concerning the participants were investigated such as the degree of musculoskeletal problems and the level of physical activity outside the work place. All field data was collected by the respective company safety and health services. The field project was planned and conducted in 1991.

The following results are listed as mean values for the total group.

(Notes: (1) This is a summary of a 300 page report.

(2) In the following graphs the other two mats are identified as:
mat 1: a representative sample of the blown vinyl anti-fatigue mat frequently used today and
mat 2: a gel filled mat that we evaluate as being the only other product on the market to offer ergonomic features comparable to the ERGOMAT®.

Main Findings

The positive effects of using the ERGOMAT® are presented in the following graphs:

Figure 1: Degree of foot discomfort after work

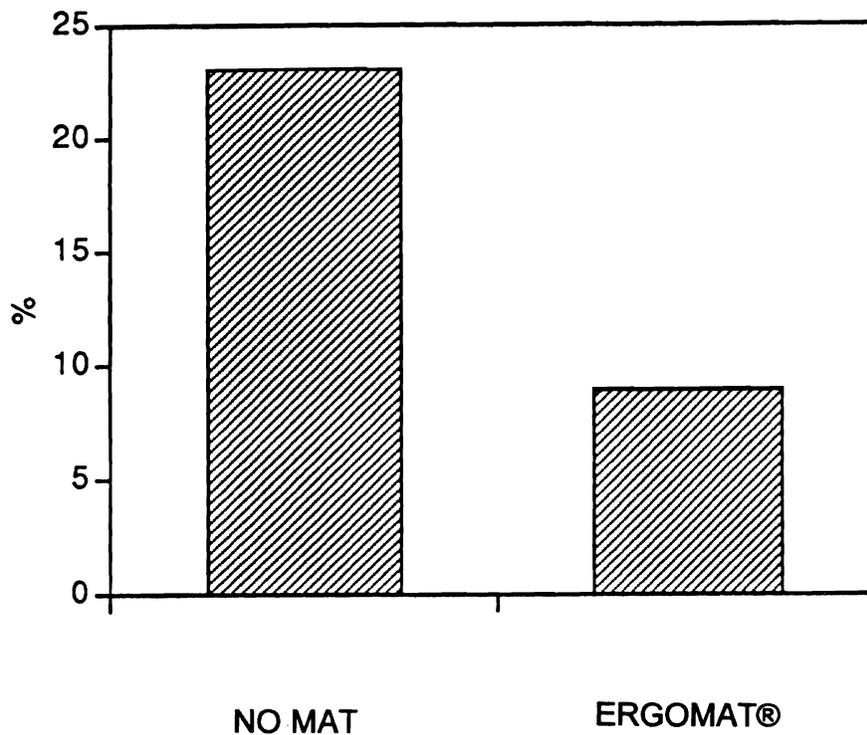
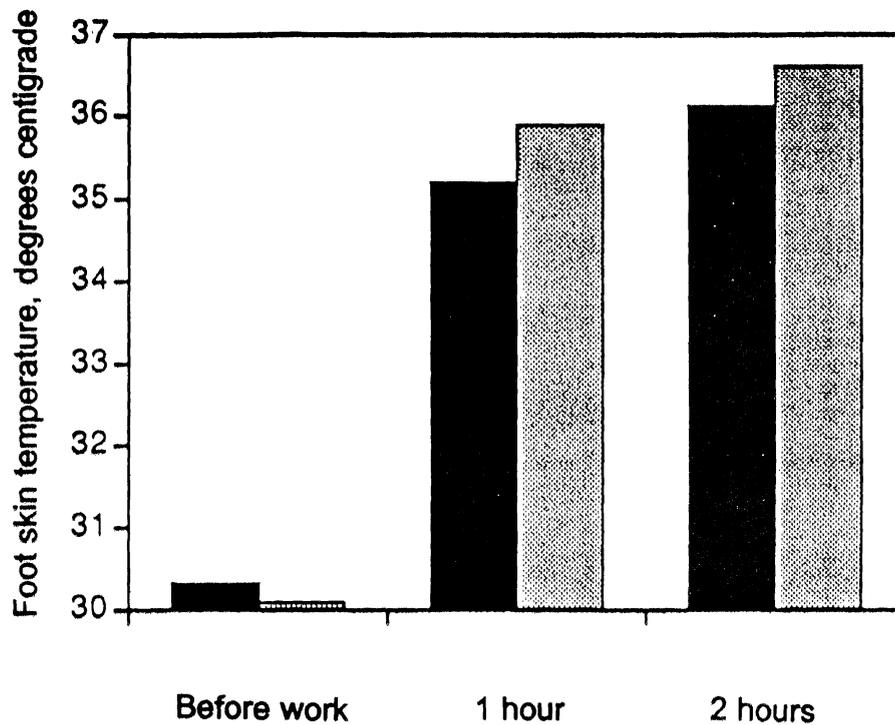


Figure 1 shows the degree of foot discomfort after two hours work with and without use of the ERGOMAT®. Discomfort was measured on a Scientific Analysis Scale measuring 30 variables where 0% equals "no discomfort" and 100% equals "worst possible discomfort". As the figure shows, the feeling of foot discomfort is reduced from 23% to 9% by use of the ERGOMAT®.

(Note: Had the report asked the same question after eight hours work, the difference between using the ERGOMAT® and no mat would have been even more pronounced. (ERGOMATUSA, Inc.))

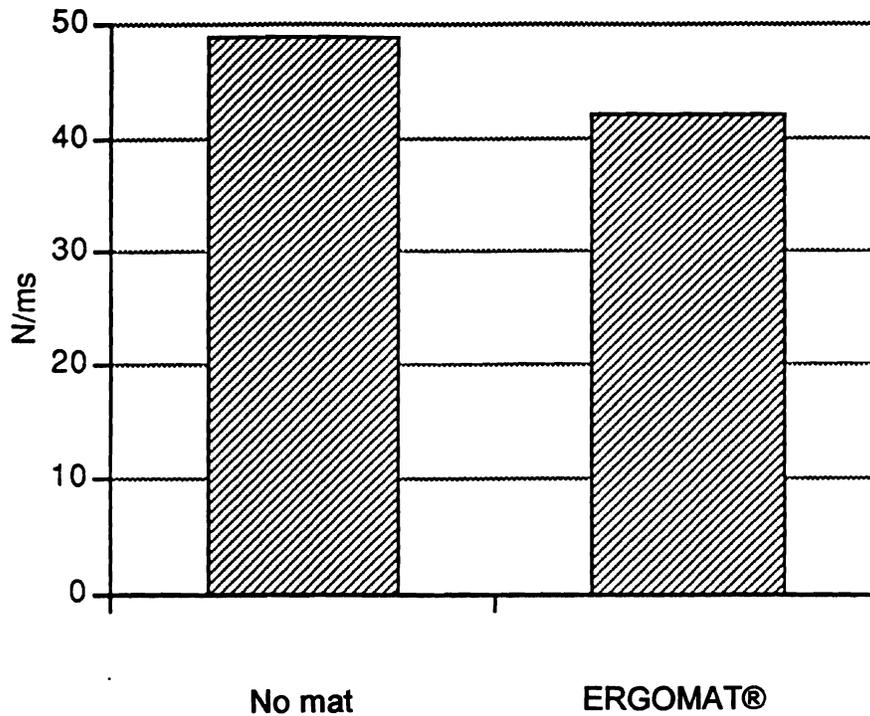
Figure 2: Skin temperature on feet before and during a two-hour-work period



Left column = no mat
Right column = ERGOMAT®

Figure 2 shows how the temperature of the skin on the foot changes during a two-hour-work period with and without the ERGOMAT®. The higher skin temperature developed when working on the ERGOMAT® can probably be attributed to better circulation.

Figure 3: Maximum force increase rate by heel impact



When walking, the heel meets the floor with at certain force. The force increase (Newton, N) per milli-second (ms) reaches a maximum and this value (heel impact) was measured (unit: N/ms). The greater the impact the greater the risk of developing degenerative joint problems in legs and backs. Figure 3 shows how the heel impact is reduced by about 15 % (from 49 N/ms to 42 N/ms) when you use the ERGOMAT® on a hard floor.

Figure 4: Reduction of discomfort / fatigue in feet and lower legs

Perceived discomfort and fatigue in various parts of the body can be measured using various methods. We use the so-called "Borg-scale" that goes from 0 (no discomfort / fatigue) to 10 (maximum discomfort / fatigue). The project participants were asked to describe perceived discomfort in feet and lower backs morning and night on two days of the week. Based on this the degree of change in fatigue / discomfort during the day can be calculated for each of the four test conditions (3 mats and no mat).

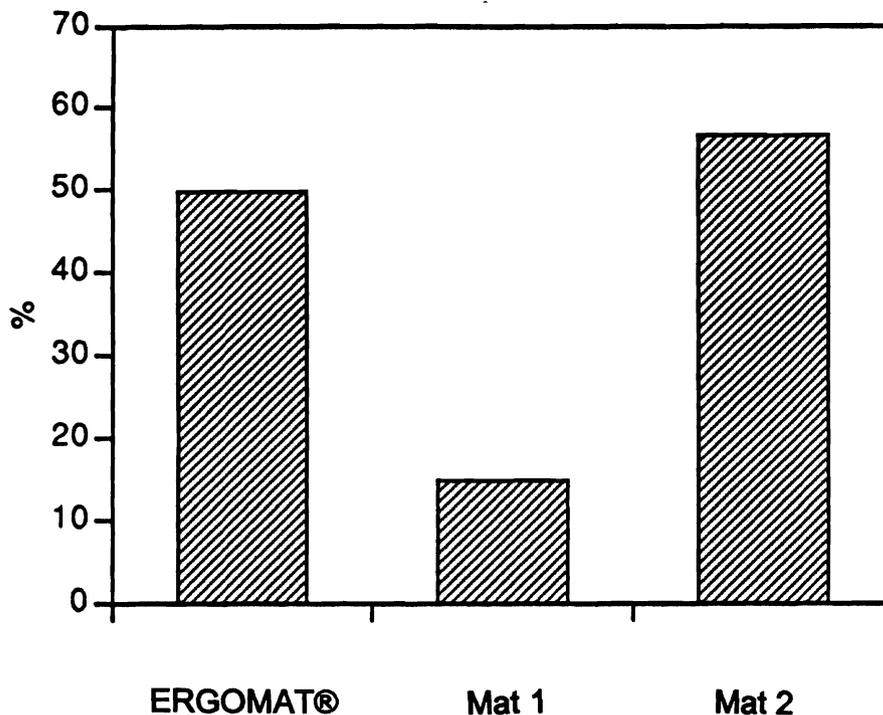


Figure 4 shows the daily change in perceived discomfort / fatigue for each of the three mats relative to the change with no mat. The ERGOMAT® and mat 2 show a reduction in the development of foot discomfort / fatigue of about 50 % whereas mat 1 shows a reduction of about 15 % relative to the discomfort / fatigue on a hard floor.

Figure 5: Reduction of discomfort / fatigue in lower back

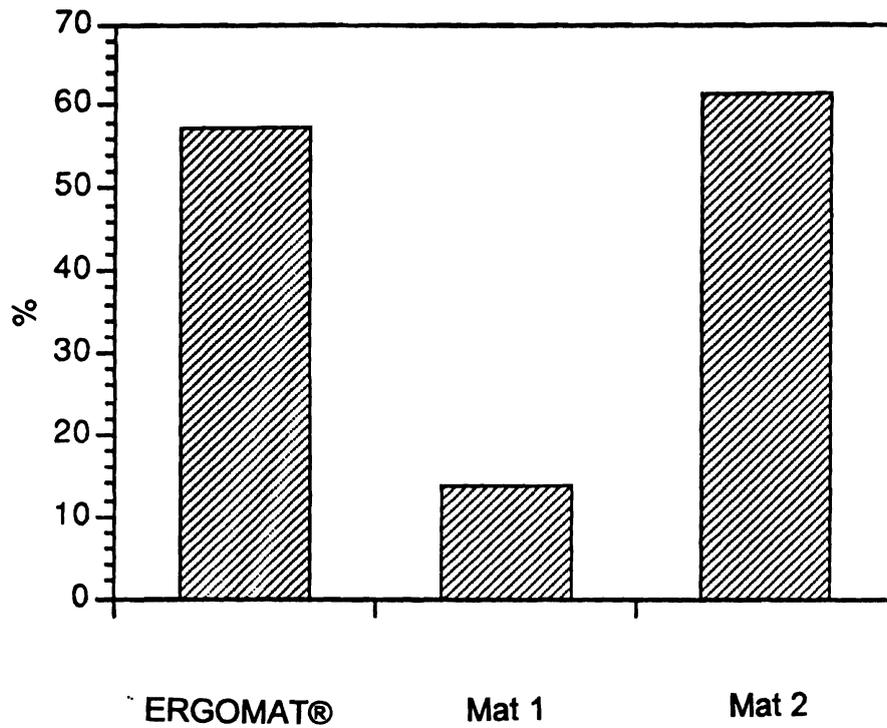


Figure 5 shows calculations similar to those in Figure 4 but for the lower back. The ERGOMAT® and mat 2 reduce discomfort / fatigue by about 60 % whereas mat 1 shows a reduction of only 15 % relative to the discomfort experienced on a hard floor.

The participants in the project graded the 4 kinds of surface on a 5 step scale where 1 is defined as "unacceptable", 3 as "average" and 5 as "perfect".

Figure 6: Evaluation of mats and floor

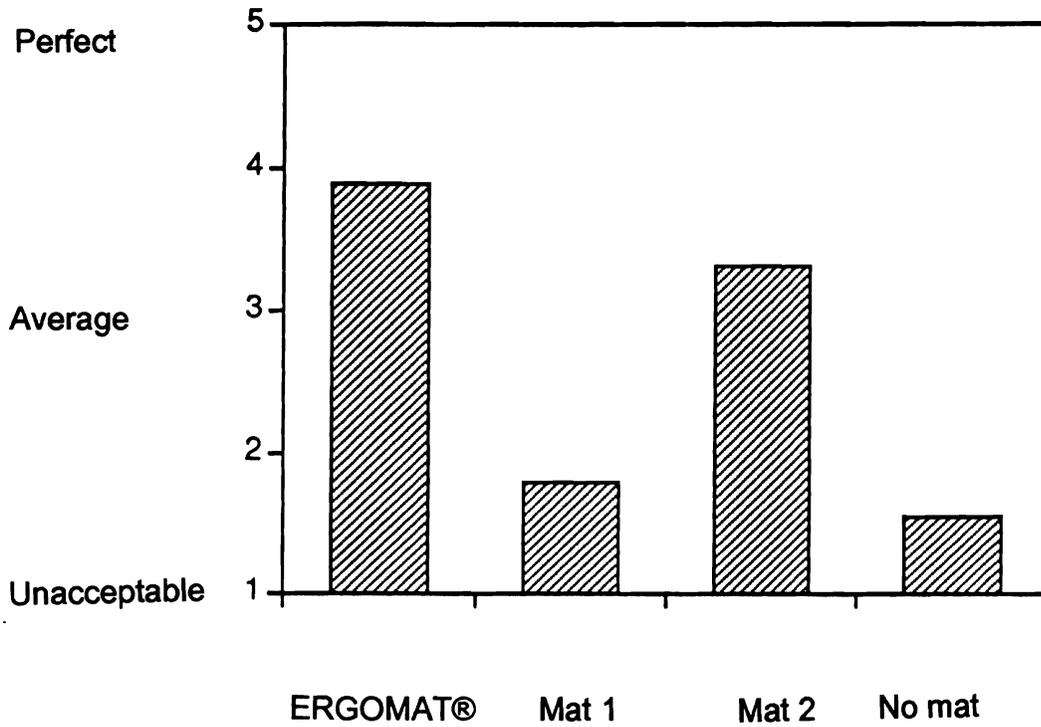
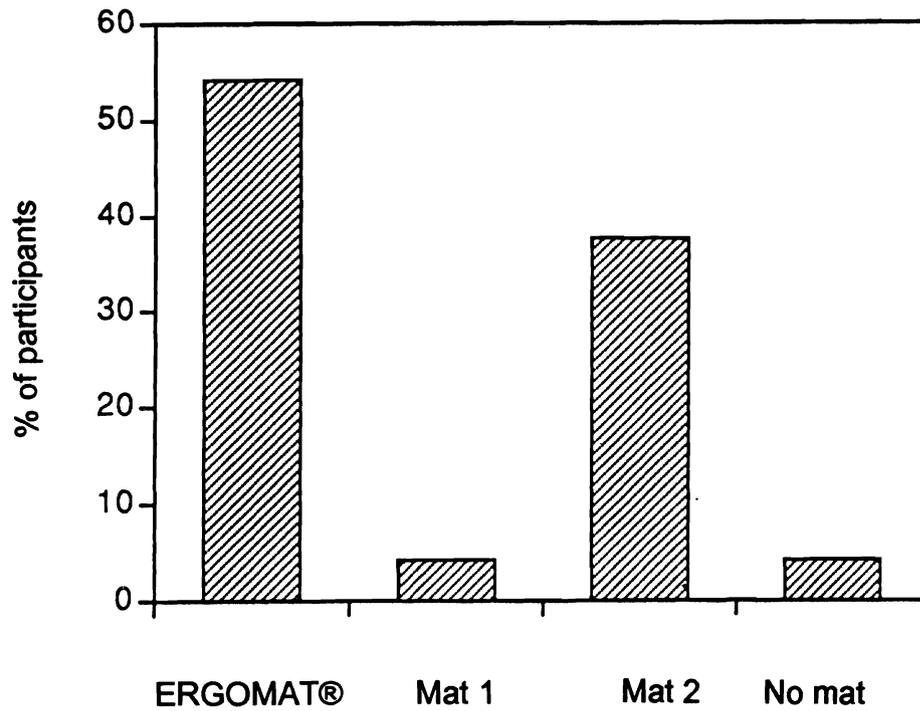


Figure 6 shows the highest average grade for the ERGOMAT® (3.9) followed by mat 2 (3.3), mat 1 (1.8) and no mat (1.5).

Figure 7: Percentage of the participants who would prefer the various surfaces in the future



Finally, the participants were asked what kind of mat they would prefer to work on in the future. As figure 7 shows, more than half would prefer the ERGOMAT®, about a third mat 2 and less than 5 % mat 1 or no mat.