SWEAT LOSS OF CALCIUM DURING BED REST
WITH AND WITHOUT EXERCISE

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INTRODUCTION

Routine Calcium (Ca) balance measurements usually do not include dermal loss of Ca. We have previously shown that the skin patch can be used as a non-invasive method to determine the amount of calcium in human sweat. Our NASA bed rest study, simulating the skeletal unloading that occurs during space flight, includes a group of subjects that perform resistive exercise. Exercise can cause a significant Ca loss in the sweat, when performed at a normal room temperature. For this reason, the bed rest subjects in the current study exercise in a cool temperature (60°F). It is important to determine if ignoring sweat loss of Ca is causing significant error in the routine total body Ca balance measurements in the bed rest subjects. It is assumed that dermal or sweat loss of Ca is relatively constant with and without 1 hour of exercise performed in a cool environment as in the current study. This study tested the validity of this assumption by using a skin patch to collect sweat Ca.

CURRENT STATUS OF RESEARCH

Methods

The participants in the ongoing NASA funded bed rest study, conducted at the Baylor College of Medicine, Biomedical Research Bed Rest Facility located in The Methodist Hospital, Houston, Texas, were recruited as subjects for the sweat Ca study. The participants were between 19-50 years of age. There were two groups of subjects: group 1 (Ex, n=4) performed a resistive exercise program with a workload that progressively increased throughout the bed rest period; group 2 (NonEx, n=10) did not exercise for comparison with the other group. The ten NonEx subjects included 4 subjects taking alendronate. Subjects wore the patches (Osteopatch, Pacific Biometrics Inc.) at 5 different time periods: once during the baseline ambulatory period, at 6, 12 and 17 weeks of bed rest and during the second week of re-ambulation. These time periods were selected to coincide with other tests done on the subjects during the study. Sweat samples were collected for two consecutive days during each collection period. The participants in the Ex group performed resistive exercise 6 days a week and rested one day on Sunday. Sweat collection over two successive Sundays were used as the non-exercise day for the Ex group during their bed rest period. To minimize sweating, the room in which the subjects exercised was maintained at a temperature of 64°F or less while the rest of the unit was between 73 and 79°F.

Results

The average difference in total body sweat Ca between exercise and non-exercise (n=4) periods of bed rest in the Ex group was 1±7 mg/day. The average difference between sweat Ca during the ambulatory period (before or after the bed rest) and during bed rest
in the NonEx group was 3±12 mg/day (n=10). Previously published data indicate that the average calcium balance during bed rest is about −180mg/day. Since the difference in sweat Ca loss due to either bed rest or exercise was small, the error in net total body Ca balance from ignoring sweat Ca during exercise conducted in a cool environment would be small.

**Conclusion**
Changes in sweat calcium from a brief period (1hr/day) of exercise performed in a cool (60° F) environment during bed rest do not significantly affect total body Ca balance.

**FUTURE PLANS**
Measure the sweat resorption bone markers using atomic absorption and correlate with corresponding urine bone markers.

**INDEX TERMS**
Sweat Ca, Total body calcium, Bed rest, Exercise, Calcium balance study.