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# Effect of a Hot Milk Drink on Movements During Sleep

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## Summary

**The effects on sleep of a hot drink of milk and Horlicks were compared with those of hot water taken before retiring by medical student volunteers. Horlicks reduced the number of small movements made during sleep.**

## Introduction

Many people are dissatisfied with the way they sleep. In 1970 there were 20 million (8% of the total) National Health Service prescriptions for hypnotics (Parish, 1971), presumably mainly used to make patients more satisfied with their sleep. Some take hot drinks at bedtime under the impression that it helps them to go to sleep or to sleep better. The present work is concerned with testing one aspect of this impression by studying movements during sleep. It was found that a hot milk drink, Horlicks, did reduce the number of small movements made by a sleeper in the period from 4 to 7 a.m.

## Methods

Records of movements during sleep were made by time lapse cinematography with a 16-mm camera silenced with a hood. A frame was taken every 15 seconds of the subject in dark pyjamas sleeping without bed covers on a white sheet in front of a white screen. On the screen was a clock and a calendar. The sleep room was moderately warm, 20° to 23°C, and there was a radiant electric fire which the subjects adjusted so that they were comfortable *without bed covers*. The room was lit by two tungsten bulbs, 100 and 150 watts, about 15 feet (4·6 m) from the bed.

*Procedure.*—The subjects, four male medical students without disorders of sleep, came to the sleep room between 11 and 11.30 p.m. They had agreed to take no coffee, alcohol, or strenuous exercise for that evening. On arrival at the sleep room the subjects took either no drink (control), or 350 ml of warm water, or 350 ml of warm milk plus five large heaped teaspoons of Horlicks powder. They then lay down and fell asleep. Each subject slept at least three and up to twelve times under the experimental conditions to accustom himself to them before the results were recorded. For the experiment each subject slept twice under each of the three conditions arranged in a block to take out any effect of order of experimental condition.

*Analysis.*—The film was projected slowly until a change in position was detected. After running back it was projected frame by frame, counting the recorded changes of position. These were divided into two categories: (1) big changes in which the trunk was turned or translocated without turning, and (2) small changes involving hand, foot, or head, or more than one of these. Small changes of position during large changes were ignored. The basic unit was a frame of movement. If there were movements in successive frames, and provided that no more than two frames without change of position were interposed between frames of movement, the several frames were classified as a "sequence." Because on some occasions the subjects were still awake at midnight only the records from 1 to 7 a.m. were analysed.

*Statistical Methods.*—The lines of the Chart were fitted by the method of least squares. To assess the differences between frequencies of movements under the three conditions the number of small movements during the first hour on the first occasion with Horlicks was subtracted from the number of small movements during the first hour on the first occasion with water. These differences tended to increase as the night passed. The differences were plotted against time, and a rectilinear regression was fitted by the method of least squares. The difference from zero of the slope of this line divided by the standard error of the slope was used to assess the statistical significance of the difference between the effects of water and Horlicks. To assess the differences in the variability of the movements the ratios of movements/hour, after taking out the variance due to regression, were used. All values of probability (P) were arrived at without preconception—that is, two-tailed.

## Results

The four subjects were studied for six hours each with two replications under three conditions, no drink (control), water, or Horlicks, a total of 144 hours between 1 and 7 a.m. There were 500 frames of movements after no drink (control), 418 after water, and 412 after Horlicks.

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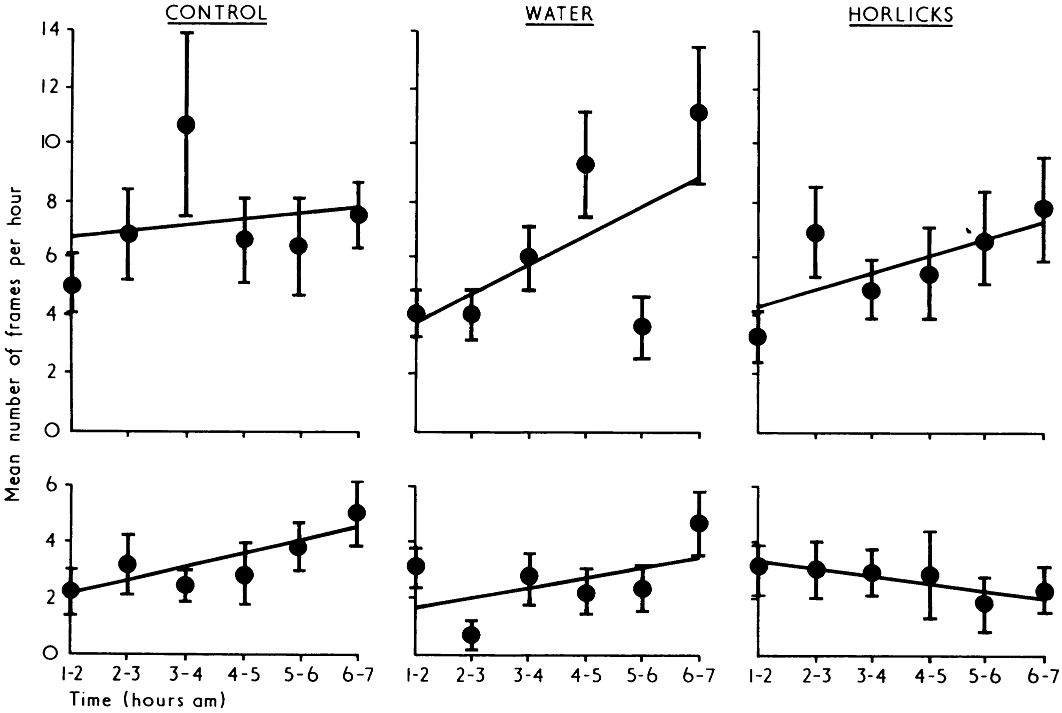


Effects of water and Horlicks on movements during sleep (above shows big movements and below small movements).

The Table shows the mean number of movements and frames of movement/sequence for large and small movements. There were about six frames of large movements and three frames of small movements/hour. Each sequence of movement contained about 3·5 frames of large movements and 2 frames of small movements. Such differences as there were between the results in the Table under control conditions, after water, and after Horlicks might easily have arisen by chance if the water and the Horlicks had no effect.

*Effects of Water and Horlicks on Movements during Sleep. Results are Means of Duplicate Tests on Four Subjects*

| | Control | Water | Horlicks |
|---|---|---|---|
| | | *Large Movements* | |
| Mean frames/hour | 7·18 | 5·88 | 5·33 |
| S.E. | ±0·69 | ±0·76 | ±0·65 |
| Mean frames/sequence | 3·9 | 3·6 | 3·6 |
| | | *Small Movements* | |
| Mean frames/hour | 3·23 | 2·54 | 2·65 |
| S.E. | ±0·38 | ±0·35 | ±0·40 |
| Mean frames/sequence | 2·4 | 2·1 | 2·2 |

S.E. = Standard error of mean.

Overall, the subjects were making more than nine frames of movements/hour. This gives the impression of restless sleep. But there were some intervals of 30 minutes or more in which there were no frames of movement. For frames of big movements the corresponding totals are control 35, water 37, and Horlicks 37 periods of 30 minutes or more without a frame of movement. For small movements the number of intervals of 30 minutes or more without change were: control 23, water 27, and Horlicks 27 during 144 hours.

Thus far the results are consistent with water and Horlicks having little or no action on movements during sleep. The reproducibility of the results gives grounds for confidence in our methods.

In contrast with the above results the Chart shows that Horlicks did have two actions on movements during sleep. (1) For small movements, but not for large ones, there was a gradual fall in frames of movements/hour after Horlicks, whereas after water and control there was a gradual rise with time. By within-subject tests the number of frames/hour fell more with Horlicks than with control or water at the 1 in 30 level of significance. (2) The Chart also shows a large scatter of the mean results for water about their regression lines. This is significantly greater for water than for Horlicks for big movements and for small movements ($P < 0{\cdot}05$ for both).

## Discussion

*Methods.*—Time lapse cinematography as a means of studying movements during sleep has the merit that the movements can be classified. On the other hand, what is recorded is merely position at 15-second intervals and one has no means of knowing how continuous the movements have been between the frames.

*Large and Small Movements.*—From our inspection of the films we decided to classify movements into large and small. The large movements, involving turning and or translocating the body, must in many instances change the pressure points whereas the small movements have such an effect to a minimal extent. Our decision to consider large and small movements as different in kind is apparently justified post hoc by the different effects of Horlicks on them as shown in the Chart. Possibly large and small movements have their origins in a different part of the nervous system.

*Effects of Horlicks.*—That a drink of concentrated hot milk with added processed cereal should increase the likelihood of falling asleep is to be expected. It is known that vasodilation of the feet commonly precedes falling asleep, and a hot drink might be expected to hasten both events (Kleitman, Ramsaroop, and Engelmann, 1948). In our experiments the effects of Horlicks—that is, reduced number of frames of small movements and a greater consistency of small and large movements—were seen mainly between 4 and 7 a.m., whereas the Horlicks was taken at about 11 p.m. From what is known about gastric emptying during the daytime it seems unlikely that any worth-while quantity of Horlicks would remain in the stomach after three hours. It is possible that the Horlicks abolished or reduced the frequency of hunger contractions. Hunger contractions are known to be associated in time with increased movements during sleep (Wada, 1922). Another possibility is that Horlicks may provide amino-acids which are converted into neural transmitters and in this way influence central nervous function. Or the response may be in some way associated with the fat in milk. In this connexion, Fara, Rubenstein, and Sonnenschein (1969) found that milk or 1 ml or corn oil introduced into the duodenum of cats increased the proportion of rapid eye movement sleep. They believe that the phenomenon may be related to the release of cholecystokinin.

That the general state of nutrition may influence sleep patterns is apparent from the work of Crisp and Stonehill (1971), who found that patients successfully treated for anorexia nervosa slept longer with fewer movements than they did before treatment. Whether this change was the result of the state of nutrition or the effect of the size of a recent meal is not apparent.

Experiments are in progress to check our results.

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# Sleep after a Bedtime Beverage

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## Summary

**Sleep after an inert capsule was compared with sleep after a hot, bedtime, milk-cereal drink (Horlicks). All-night electrophysiological recordings were made with 18 persons on 10 nights each.**

**Restlessness during sleep at the end of the night was diminished after Horlicks in a group of 10 young adults. In an older group of eight adults, mean age 55 years, sleep after Horlicks was of longer total duration and was less broken by periods of wakefulness. In the latter group the improvement associated with Horlicks was most apparent late in the night and it increased with repeated administration.**

## Introduction

Hypnotic drugs are much in fashion but popular belief has it that there are simpler aids to good sleep. Many people take a drink before bed, mixing proprietary products with hot milk. One such product has for several generations been claimed to promote good sleep—namely, Horlicks, a milk-cereal powder.

Subjective evaluation of sleep quality is unreliable, and we report here an objective study of sleep after Horlicks. The work of Southwell *et al.* (1972) was known to us, and this permitted the prediction that in young adults sleep after Horlicks would be accompanied by fewer signs of movement at the end of the night. We also used the more general hypotheses that sleep after Horlicks would be of greater duration and less broken. Young adults generally sleep so well that there is little scope for improvement, and so we also studied older people. Broken sleep is an accompaniment of normal ageing (Feinberg, 1968).

Nearly forty years ago Laird and Drexel (1934) reported that the nocturnal sleep of young adults was accompanied by fewer movements after a light meal of cornflakes and milk whereas a heavy meal made sleep more restless. Like Southwell *et al.* (1972) they measured only the frequency of body movements. Unfortunately this does not allow discrimination between movements made while asleep and movements made during episodes of wakefulness. Preconceived ideas about the effect of a food drink might especially reduce motility during wakefulness. We used electroencephalography, which makes possible discrimination between wakefulness and sleep.

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## Subjects and Methods

The drink was prepared by mixing about 32 g of Horlicks with 250 ml of hot milk. As a control we used an inert yellow capsule, intimating that it contained a folk remedy of doubtful efficacy. We considered and rejected the use of water as a control because it would be more rapidly absorbed, leading to a brisk diuresis, rapid bladder filling, and positive disturbance of sleep. We also rejected plain milk because if no difference were found between it and the Horlicks drink we should not know whether both had been without action on sleep or whether each had had a positive but similar effect.

The drink or capsule was administered just before lights-out at about 22.30 hours and always by the same investigator (V.B.), whose own attitude towards Horlicks was one of slightly amused scepticism. Subjects rose at 07.30 hours.

The first group consisted of 10 healthy volunteers (six men, four women) aged 20-30 years (mean 22 years). The women were in the early part of their menstrual cycle.

The older group consisted of eight healthy volunteers (three men, five women) aged 42-66 years (mean 55 years). Four had a professional background, including one distinguished physiologist aged 66. Three subjects were housewives of non-professional background and the eighth was the husband of one.

Subjects were asked not to eat after 19.00 hours and to avoid any irregularities in their normal daily routines. Alcohol was prohibited.

Each subject slept in comfortable circumstances in the sleep laboratory on 10 nights spread over 12-36 days (mean 21 days) according to their availability. In the case of the older people the average interval between laboratory nights was 1·7 days.

On five laboratory nights Horlicks was taken and on five the placebo. The order of administration was based on the sequence HP PHHPPHHP and its obverse. The subjects were studied in concurrent pairs, one always differing from the other in the experimental condition.

All the nights were recorded electrophysiologically, but in accordance with custom in our research unit and a written plan before the study the first two nights were treated as adaptation nights and their results were not included in the main analysis of data.