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# Energy, Tiredness, and Tension Effects of a Sugar Snack Versus Moderate Exercise

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After either eating a candy bar or walking briskly for 10 min on 12 selected days, 18 volunteers made systematic self-ratings of their energy, tiredness, and tension feelings for a fixed 2-hr period each day in the context of their normal daily activities. The snacking or walking activity was randomly selected on each test day after completion of a pretest. Results indicated that walking was associated with higher self-rated energy and lower tension significantly more than was snacking. In the walk condition reliable increases in energy and decreases in tension were observed for 2 hr. The sugar snack condition was associated with significantly higher tension after 1 hr, and a pattern of initially increased energy and reduced tiredness, followed 1 hr later by increased tiredness and reduced energy. The results partially support a general conceptual hypothesis that sugar snacking is often motivated by a low-awareness attempt to raise energy. Additionally, the results clarify an apparent conflict between neurochemical research, which indicates that sugar ingestion increases the tendency to sleep, and popular nutrition theory, which indicates that it increases tension.

Nutrition and exercise are two self-improvement topics that receive immense speculative attention these days. Yet with all the talk and advice, there is relatively little controlled research on the relation between these factors (particularly nutrition) and daily mood variations. For example, there is a good deal of popular theory about the effects of sugar on mood (e.g., Dufty, 1975), but few controlled empirical studies showing the time course of mood changes following sugar ingestion are available (one relevant study is Spring, Maller, Wurtman, Digman, & Cozolino, 1983). Similarly, although there is a growing literature that indicates regular exercise programs affect mood in general (see review by Folkins & Sime, 1981), the mood changes that usually occur in the minutes and hours following a particular type and degree of exercise must be assumed by generalization from studies addressed to qualitatively different kinds of issues.

This paucity of research is curious considering the obviously wide societal interest. Although no information is available regarding the amount of research attempted and unreported, the relatively small number of published experiments on daily mood variations could be due not to the lack of importance of the topic or of the mood affecting factors but, rather, to the subtlety of the dependent feeling states. In my view it is possible to conduct good research in this area, but not using the traditional nomothetic laboratory design in which measures are taken on a single occasion (cf. Epstein, 1980; Rushton, Brainerd, & Pressley, 1983). That traditional procedure may well result in no experimental effects or in atypical self-rated feelings attributable to a variety of extraneous or error variables. In particular, the newness of the experience of being in an experiment, the unusualness of various experimental treatments, and the disruption of daily routines to come to a strange laboratory could affect subtle feeling states to a greater degree than does moderate exercise or nutrition manipulations.

What may be necessary for effective research in this area is a new experimental procedure. For example, it could be more efficacious to focus on small but consistent mood changes over a number of occasions than on a sizable effect during one experimental session. Also, naturalistic settings and procedures, although they reduce experimental control, could provide a truer picture of the way subtle moods are affected by actual exercise and nutrition influences than would be provided by a laboratory setting and blind testing procedures. The present research includes a number of these somewhat nontraditional design characteristics coupled with otherwise rigorous control procedures introduced to study the time course of subtle mood changes following two common exercise and nutrition-related activities.

An important basis for this research was a general conceptual hypothesis regarding motivation for sugar snacking. This hypothesis holds that much of the time, and particularly in low-energy periods when personal demands are high, the primary motive for choosing sugar snacks (simple carbohydrates) arises from an attempt to raise energy. Moreover, it is assumed that this motive is often outside of immediate awareness. Thus the often stated reasons for snacking—"it relieves tension," "I feel better," and "it helps me get through an activity,"—mask the essential energy-raising motive.

The developmental basis of the energy-raising motive could easily be understood in the following way. Over many previous occasions the ingestion of simple carbohydrates rapidly raised blood glucose, which in turn provided short-term energy for meeting required tasks or counteracting stress. This energy surge would probably include subjective energy feelings, particularly if attention to those feelings were present. However, it is

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more likely that a person not used to identifying these feelings as increased energy would simply experience a sense of increased resources for meeting demands. The energy feelings might easily be mislabeled as *good feelings* or just *feeling better.*

Although awareness of the snack–energy feeling link could be absent because of the subtlety of the internal states, the continuous pairing over time of the snack with feelings of increased resources probably would provide a conditioned association that motivates further snacking under circumstances indicating low resources, particularly during periods of tension and personal demand.

The present research was designed to address important elements of the general conceptual hypothesis. Despite abundant speculation in the popular literature about sugar and subjective energy, there is relatively little controlled research on this topic. And even if it were generally accepted that subjective energy is one of the immediate effects of sugar ingestion, the time course of such subjective feelings is not known except by reference to such physiological processes as the blood glucose response curve (Brobeck, 1979), a possible substrate that has no empirically demonstrated and clear relation with subjective energy.

If, in fact, snacking often occurs as a means of raising subjective energy, an immediate question of application arises concerning what alternative, and perhaps more beneficial, energy-raising activity could be used in place of the snack. Such a feasible alternative may be found in previous research from this laboratory that demonstrated substantial increases in subjective energy from a rapid 10-min walk (Thayer, 1978b; also see Folkins & Sime, 1981, for other examples of exercise and mood effects). However, the time course of energy and tension feelings following a rapid walk is not known. This information would, of course, be relevant if moderate exercise were to be considered as a replacement for a sugar snack.

In addition to those already mentioned, a further purpose for the present research was to move toward resolution of a theoretical difference between neurochemically oriented researchers and practitioners of nutrition regarding the effects of sugar ingestion (Kolata, 1982). Various research indicates that two major results of ingestion of sugar are reduced responsiveness to the environment and increased tendency to sleep (Spinweber, 1981; Wurtman, Hefti, & Melamed, 1981). One suggested mechanism of this is that sugar increases the proportion of brain tryptophan, which in turn is a precursor of serotonin, a neurotransmitter thought to be associated with sleep states (see Hartmann, 1983, for a review of the association of tryptophan, increased sleepiness, and reduced-sleep onset).

On the other hand, sugar is widely regarded by popular nutrition writers as the basis of various negative reactions, including increased anxiety or tension (e.g., Dufty, 1975; Fredericks & Goodman, 1969). Thus, one point of view maintains that sugar leads to sleep (low arousal), and the second point of view holds that sugar ingestion produces tension (high arousal).

The actual empirical data demonstrating the association between sugar, feelings of tiredness, and tension is quite limited, perhaps because of the experimental-design inadequacies discussed earlier. Nevertheless, both viewpoints may be correct. A recently presented multidimensional activation model (Thayer, 1978b, 1985) makes clear that two apparently different arousal states may exist simultaneously. On the basis of extensive psychological and psychophysiological evidence, this theoretical model proposes two separate but interdependent activation dimensions: energetic arousal and tense arousal (also called Activation Dimensions A and B, respectively).[1]

The two dimensions combine to produce different subjective energy modes. Two of these, tense–energy and tense–tiredness, are familiar to most achievement-oriented and stress-plagued people. These subjective states involve daily variations in energy combined with varying degrees of often chronic anxiety or tension. Two other modes, calm–energy and calm–tiredness, are much less familiar. Here normal cycles of energy and tiredness occur without appreciable tension. The latter feelings probably represent optimal mood states. An important element of the multidimensional activation model is that energetic and tense arousal are positively correlated at moderate levels and negatively correlated at high levels (levels are defined relative to each other). This complex relation is relevant to the present research problem in the sense that, in times of low energy and personal demand, a sugar snack may be sought not only to raise energy but indirectly to reduce tension.

A major vehicle for investigating these subjective energy states has been the Activation–Deactivation Adjective Check List (AD ACL; Thayer, 1967, 1978a, 1986). This is a short self-report test that has been the object of extensive validational research, including studies showing the association of psychophysiological measures with self-ratings (Thayer, 1970) and research indicating the association between self-ratings and a variety of psychological phenomena ranging from endogenous diurnal rhythms (Thayer, in press) and research to various kinds of information processing (see Thayer, 1978b, for a review of early research).

On the basis of these considerations, the present research used a short-term longitudinal design carried out in natural settings. The self-rated energy, tiredness, and tension effects of a common sugar snack versus a rapid 10-min walk were compared over 2-hr periods for a number of days. From a theory of a partial cause for snacking, it was assumed that the sugar snack would result in immediately increased energy. However, tiredness and tension were also observed as possible secondary effects. For comparison purposes, the rapid walk was included as an alternative means of enhancing energy.

## Method

### *Subjects*

The participants were 15 female and 3 male undergraduates recruited from various classes that I taught. They ranged in age from 19 to 38 years. Each person volunteered for this research on the condition that they would be given complete feedback at the end of the experiment and that they would probably learn important things about themselves. They were explicitly assured that they could stop the experiment without any disfavor at any time that it became too difficult. However, all persons who began the experiment completed its conditions.

[1] Elsewhere, the first activation dimension has also been referred to as *general arousal* in order to suggest its primary association with a wide variety of natural bodily functions. And the second dimension has been called *preparatory-emergency arousal* because it is assumed to be present as a preparatory reaction to danger, real or imagined.

### Measures

The Short Form AD ACL is a self-descriptive test that provides information about the respondent's present feeling state (Thayer, 1967, 1978a, 1986). It takes about 30 s to complete, and it yields four subscales: G Act (energy), Deac-Sl (tiredness), H Act (tension), and G Deac (calmness). This checklist includes five adjectives per subscale, and each adjective is self-rated on a 4-point continuum. The first three subscales have proved most useful in past research and, accordingly, were used in the present experiment.

### Procedure

The experiment was carried out by each volunteer individually in whatever daily setting was natural for that person. Participants were instructed to choose 12 experimental days over approximately 3 weeks. The days were to be as much alike as possible, particularly with regard to previous night sleep, morning awakening, and anticipated daily activities. The experimental conditions were always to commence at the same time of day (different times for different participants) and extend over the same 2-hr period. Participants were instructed to eat nothing and to engage in no significant extraexperimental exercise for at least an hour prior to the experiment and during the 2 hr that it ran. On the basis of their convenience of scheduling, 6 of the participants completed the experiment in the first 2 hr after awakening, 8 completed it at midafternoon, and 4 completed it in the evening.

At the appointed time each day, the participants completed a pre-AD ACL and then rolled a die. It was predetermined that certain numbers would indicate a sugar-snack day and others would indicate an exercise day. After the first 2 days, if one condition randomly occurred two times more than the other, the predetermined numbers of the die were changed so as to increase the probability that both conditions occurred with equal frequency. Thus, on none but the last one or two experimental days did the participants know which condition would occur prior to the pretest and the roll of the die.

If the die indicated a sugar snack day, each participant ate approximately 1.5 oz of a candy of their choice (e.g., any common candy bar). On walk days they walked rapidly for 10 min, breathing deeply and swinging their arms freely. Approximately 20 min after the condition (30 min after pretest), a second AD ACL was completed, 1 hr later a third, and 2 hr later a fourth.

Experimental participants were very carefully instructed in person and in writing that unless they regarded each AD ACL as independent of all others and completed it only according to how they felt at that moment, the experiment would be invalidated. In part the written instructions regarding this point were as follows: "Try not to anticipate one experimental outcome over another. Be scrupulously honest in your ratings even if they are different from what you think should have occurred. Try not to look at or think about previous ratings when making your current rating."

## Results

Self-ratings of energy, tiredness, and tension differed substantially following walking as compared with snacking. Figure 1 gives a general picture of the differences between conditions. Means of energy and tension scores, obtained from 6 days of ratings for each of two conditions, are plotted against time in the periods of observation (subdivisions of morning, afternoon, and evening subjects will be discussed later). Following the rapid walk, at all time periods, subjects reported much greater energy than they did after the snack. Tiredness (not shown in the figure) mirrored energy in the opposite direction. Self-reported tension generally increased after the sugar snack and decreased after the walk as well.

Repeated measures analyses of variance (ANOVAS), 2 (conditions: walking, snack) × 4 (time: pretest to 120 min) × 6 (days), showed significant main effects for conditions on energy, tiredness, and tension scores, $F(1, 17) = 13.66, 9.26, 8.48$, $p < .01$, respectively. Main effects for time were significant on energy and tiredness scores only, $F(3, 51) = 10.16, 9.78$, $p < .01$, respectively. Main effects of the Conditions × Time interaction were significant for energy, tiredness, and tension: $F(3, 51) = 7.84, 6.74, 10.12$, $p < .01$, respectively. No other effects were statistically significant.

Tests of simple effects across conditions indicated that at 30, 60, and 120 min, respectively, walking was associated with significantly increased energy ($M$s = 14.81, 15.03, 13.77, respectively) compared with snacking ($M$s = 12.27, 12.37, 11.19). At these three time periods tiredness significantly decreased after walking ($M$s = 8.13, 7.83, 9.14) compared with snacking ($M$s = 10.03, 10.54, 11.28). And tension significantly decreased after walking ($M$s = 7.56, 7.54, 7.51) compared with snacking ($M$s = 9.19, 10.22, 9.81). All but one test were statistically significant ($p < .01$) by Tukey's procedure for multiple comparisons of pairs of means ($p < .05$ for tension scores at 20 min). Pretest scores did not differ significantly for any measure.

Tests of simple effects for reported tension across time periods (pretest vs. 30 min, pretest vs. 60 min, pretest vs. 120 min) in the walking condition indicated that levels at 30 min (see aforementioned mean) were significantly below pretest levels ($M = 9.10$), $t(17) = 2.75$, $p < .01$. At 60 and 120 min, tension scores remained below pretest levels, $ts(17) = 2.60, 2.27$, $p < .03$, respectively.[2] In the snack condition the ordering of means for tension was reversed. In this condition, levels at 30 min were above pretest levels ($M = 8.24$), $t(17) = 1.41$, $p < .17$. At 60 min in the snack condition tension levels were at their highest, and differences from pretest levels were statistically significant, $t(17) = 2.52$, $p < .02$. Tension remained above pretest levels at 120 min, $t(17) = 2.06$, $p < .05$.

Review of the raw data indicated that tests of simple effects for energy and tiredness across time periods were not appropriate with the inclusion of the 6 persons who completed the study in the first 2 hr of the morning. As can be seen in Figure 1, their pretest levels, which were assessed just after awakening, indicated very low energy. They also reported high tiredness (not shown in figure). And as the morning progressed, arousal increased substantially in both the walking and snacking condi-

[2] Tukey's multiple comparisons procedure (and others like it) are not, in my view, appropriate for these $t$ tests and other similar tests to be described later. In these cases there is a strong probability that the three posttreatment ratings were highly interdependent and that they were simply alternate measures of a common and continuous bodily reaction. Because multiple comparisons procedures are based on an a priori assumption of independence among the comparisons under consideration, in this case the appropriate probability distribution is not known. Note that the present statistical significance decisions are generally conservative ones because they use two-tailed tests (except as specified below) and separately calculated error terms. However, note that if the three pair-wise comparisons were independent, alpha levels of .02 in each would be necessary to assure maintenance of the traditional .05 alpha level throughout.

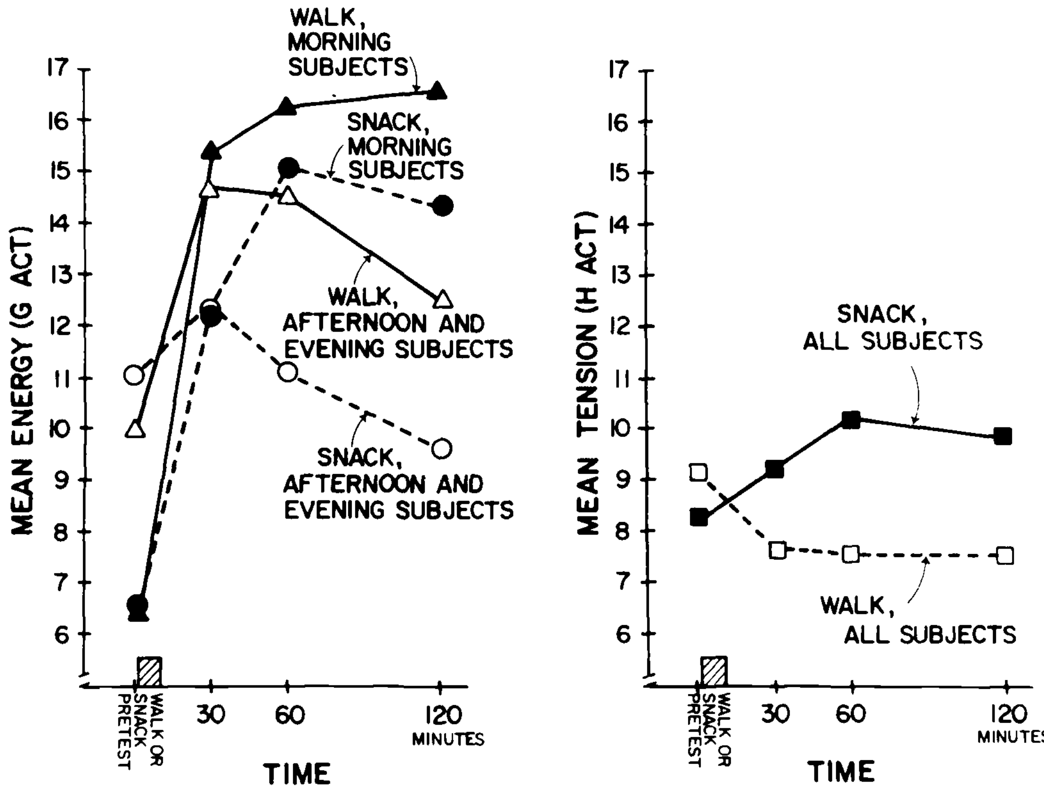


*Figure 1.* Self-ratings of energy and tension (means for 6 days) over 2 hr as a function of a brisk walk versus a sugar snack (morning subjects, afternoon and evening subjects, all subjects).

tions. This change, which should have been predicted from previous research (Thayer, 1978b), was probably a function of the rising energy cycle, not the experimental conditions. Accordingly, the remaining simple effects for energy and tiredness across time periods were tested only on the 12 persons who completed the experiment in the afternoon and evening.

The tests of simple effects for reported energy in the walking condition indicated that, compared with pretest levels ($M$ = 10.20), energy reached its peak at 30 min ($M$ = 14.59), $t(11)$ = 4.06, $p < .001$. It continued at about the same level at 60 min ($M$ = 14.56), $t(11)$ = 4.08, $p < .001$. And at 120 min ($M$ = 12.35) reported energy declined considerably, $t(11)$ = 1.67, $p < .06$.[3]

Tests of simple effects for reported tiredness in the walking condition showed that, compared with pretest levels ($M$ = 12.43), tiredness was low at 30 min ($M$ = 8.71), $t(11)$ = 3.97, $p < .002$. It continued to be low at 60 min ($M$ = 8.73), $t(11)$ = 3.31, $p < .006$. And at 120 min ($M$ = 10.68) tiredness increased, $t(11)$ = 1.34, $p < .10$.

In the sugar snack condition, tests of simple effects across time periods (afternoon and evening subjects) indicated no significant differences for reported energy or tiredness. However, the pattern of change on these measures was probably not random, and this pattern bore further attention because of its particular relevance to the general conceptual hypothesis described earlier. To test the time course of the effects of the sugar snack on energy and tiredness, respectively, simple ANOVAs for repeated measures were calculated on difference scores in this condition (pretest minus 30 min, pretest minus 60 min, pretest minus 120 min) with the following result, $F(2, 22) = 3.73, p < .05$, and $F(2, 22) = 3.21$, $p < .06$. Compared with pretest levels, after snacking, reported energy first increased then decreased over 30, 60, and 120 min, respectively ($M$s = 1.27, 0.00, −1.41, respectively). Reported tiredness first decreased and then increased over the three respective time periods ($M$s = −0.86, 0.50, 1.50, respectively).

Because the range of scores between subjects in this condition was great, a somewhat different picture of these changing energy and tiredness levels across time periods is provided in Figure 2. When inspecting these results bear in mind that scores for individual subjects represent means of six observations and, thus, are quite reliable.

## Discussion

These results were consistent with the general conceptual hypothesis that an important basis for sugar snacking is the low-awareness motive to raise energy. Although not a statistically significant effect, a majority of participants felt increased en-

[3] These analyses and the following ones for tiredness were based on one-tailed tests because of a prediction from previous research (Thayer, 1978b). All other statistical analyses used two-tailed evaluations.

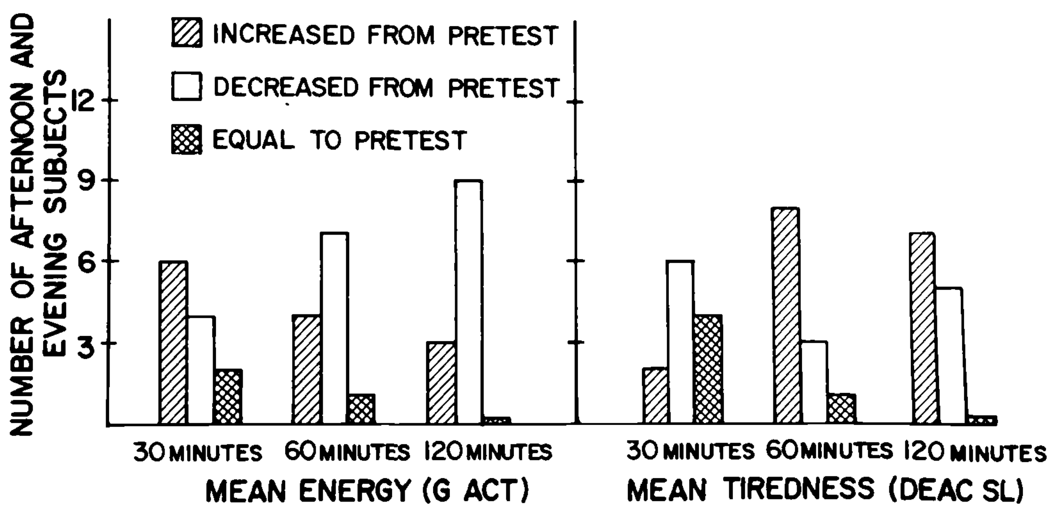


*Figure 2.* Numbers of afternoon and evening subjects who either decreased, increased, or remained the same over 2 hr from pretest levels of energy and tiredness (means for 6 days).

ergy for at least 20 min after they ingested the sugar snack. However, the data suggest that energy derived from sugar snacking may well be short-lived. A majority of that same group felt *less* energy at 1 and 2 hr after eating the snack. This pattern of early energy increases followed by decreases at 1 and 2 hr was statistically significant.

These data may provide a possible resolution of the apparent opposition between neurochemical evidence that sugar produces low-arousal sleep states and the contention of some nutritionists that sugar produces high-arousal tension states. One hour after eating the snack, participants in this experiment felt significantly more tense than they did during the pretest. And a majority of them felt more tired than they did before the snack. The combination of tension and tiredness, which at first thought appears incompatible, is actually quite interpretable on the basis of a multidimensional activation model I proposed (Thayer, 1978b, 1985, 1986). The model holds that two apparently different arousal levels may exist simultaneously.

One possible theoretical explanation to account for the rise in tension following sugar ingestion is that after a brief energy surge, sugar produces increased tiredness, but continued ongoing activity in the presence of that state produces tension as a reactive effect. That is, some period of time after significant sugar intake the natural inclination could be to sleep, but increasing tension might occur when that predisposition is counteracted. This is a complex phenomenon, but some evidence to support the association of tension and tiredness in relation to necessitated wakefulness can be found in the sleep deprivation literature (e.g., Murray, 1965).

### *Calm–Energy Versus Tense–Energy*

The reported results provide good evidence of two subjective energy modes arising from the different experimental conditions. The moderate exercise clearly was associated with calm–energy throughout the period of observation. The results from the 10-min rapid walk are perhaps the most striking of the whole experiment. This relatively small amount of moderate exercise was associated with significantly increased energy and decreased tension for as long as 2 hr after the activity. The sugar snack, on the other hand, first was associated with tense–energy and then tense–tiredness for a majority of the participants. And although the energy and tiredness effects were weak in this condition, the increased tension effects associated with the sugar snack were unmistakable.

It would appear that if the raising of energy to meet immediate demands is an important basis for sugar snacking, a 10-min rapid walk would be a much preferable alternative. It is easy. It apparently raises energy faster and to a greater degree than the sugar snack, and the unpleasant correlate of increased tension is avoided.

The present results do not establish the conceptual hypothesis about the energy raising motive, but they do provide important evidence. However, if the hypothesis is correct, certain questions must be confronted. For example, if the value of alternative energy-raising means, such as exercise, is so clear and if there are negative aftereffects from sugar ingestion, why then is sugar snacking so widely practiced?

Leaving aside the influence of taste, there are a number of probable reasons for the wide practice of sugar snacking. First of all, when one is fatigued and tense, as would occur with some demanding activity, there is often an urge to do something to improve the situation, and as suggested, a means is sought to raise energy. The energizing effects of a small amount of exercise are probably not known by most people, and even if they were, the prospect of an activity such as a 10-min walk might appear highly unpleasant. If one is already tense and tired, the prospect of even moderate exercise may seem quite unpleasant. It is much easier to eat a candy bar! And because the candy may have an immediate, albeit short, energizing effect the eating behavior is reinforced. The fact that 1 hr later increased tiredness and tension may be the result of the sugar ingestion has little effect on the eating behavior because the negative consequences are separated too widely in time from the snacking.

Nevertheless, on an applied level, awareness of these effects may produce changes in behavior. Anecdotal information from the present experiment supports this view. Since the experiment was completed, a number of the participants have informally indicated that their snack-eating behavior has lessened considerably. This happened after they became aware of their own results and, particularly, the tension effects. Apparently the indisputable evidence of the effects of sugar snacking, and of walking as an alternative, allowed them to override short-term tendencies to choose a candy bar when they were tired.

### *Subject Expectation Effects Versus Naturalistic Longitudinal Design*

A possible competing explanation for the reported results is that the experimental participants gleaned the purpose of the experiment and essentially cooperated to produce the expected outcome. For a number of reasons this is not likely to be true.

First, as is essential in this kind of design, there was no obvious motive to produce the obtained results. Quite the contrary, subjects participated primarily to learn more about themselves. Second, each participant was very carefully and explicitly warned that they must complete the AD ACLs only according to how they felt at the moment of taking the test, or the experiment would be invalidated. If there was a motive to cooperate, it was probably on this point. Third, in my experience with studies in which large numbers of AD ACLs are completed over time, each test completion soon becomes a more or less automatic activity in which little thought is given to the overall purpose of the experiment. Fourth, although the results of the experiment support various kinds of nutrition theory, they were not obvious. In fact, when feedback was given to individual participants, a substantial number of them registered surprise, particularly at the large tension effects. And fifth, it might be expected that if demand characteristics were operating here, the experimental effects would change over time as individuals completed more observations. Instead, in the present results, the ANOVA factor for days did not even approach significance on any of the measures. Thus the results were immediate and consistent throughout the 3 weeks of the study.[4]

The concept of demand characteristics has been uncritically accepted by psychologists for years as an invalidating source of error in all kinds of research, including longitudinal designs, naturalistic settings, and self-reports as dependent variables. In an excellent analysis of this possible error, Berkowitz and Donnerstein (1982) have made the point that there is relatively little evidence of a consistent expectation effect. Moreover, they have argued logically and with empirical data that even if subjects are aware of the purpose of an experiment there is no reason to believe that they would necessarily provide confirmatory results. It seems clear that the mere possibility of subject expectation effects does not automatically invalidate otherwise well-controlled research.

Although the unlikely possibility of subject expectation effects cannot be completely ruled out in the present experiment, this is balanced against a substantial advantage derived from repeated measurements taken in a naturalistic setting with highly motivated volunteers. Measurements of subtle-feeling states were not obtained on one or two occasions as is so often done in other psychological research. Rather, each participant provided multiple self-observations over 12 separate days. Thus multiday averages could be derived that substantially reduced the potentially critical influence of initial excitement over participating in an experiment or of unusual events that might have occurred on any single day. This is a good example of the principle that aggregation of data increases the stability of summed scores because it averages out error sources present in any one measurement (e.g., Rushton et al., 1983).

These experimental advantages are exceedingly important. If a scientist's interest is in anxiety, energy, or other mood variables, the subtlety of these states must be recognized. On any single day these mood states may be relatively insignificant, particularly in the presence of other emotional arousal (e.g., caused by being in an experiment), but over time the continued presence of these states can have immense importance. It is this general effect in the everyday life of the participants that is captured by the present experiment.

### *Future Research*

The post-sugar-snack pattern of initially increased energy followed by sublevels of energy and increased tiredness 2 hr later requires more investigation. For one thing, in the present experiment, the exact shape of the apparent energy and tiredness cycles was not clear. The first postingestion measurements occurred 20 min after the snack was eaten, and this may have been past the peak of the cycles. A parametric study with measurements at least as early as 10 min after sugar ingestion should be completed. The exact shape of these energy and tiredness cycles is particularly important in relation to the proposed energy-raising motive. This is because a postingestion energy surge (a reinforcement) would be related to the conditioning of preingestion stimuli with the eating behavior.

In relation to these preingestion stimuli, future research should also concentrate on sugar snacking during periods of low energy and personal demand. These are the conditions assumed to be associated with the energy raising motive. The present experiment made no attempt to produce those conditions or to take measurements during those naturally occurring periods.

The unexpectedly strong effect associated with the 10-min brisk walk—up to 2 hr of reduced tension and increased energy—suggests that this activity could be usefully incorporated into a variety of practical applications in which a short-term energy surge is appropriate. For example, with regard to sugar snacking, one interesting study would include the development of a behavior-modification program for persons concerned with sugar snacking in which short walks are systematically substituted for snacks.

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[4] My thanks to an anonymous reviewer for pointing out that the nonsignificant "days" effect provides some evidence of the usefulness of the AD ACL as a relatively stable measure, even though in this case multiple administrations were used.

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