Effects of Eating Behavior on Mood: A Review of the Literature

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The literature focusing on the use of food as a regulator of a negative mood state is reviewed. This literature reveals that individuals experiencing a negative mood state arising from disorders ranging from tobacco withdrawal to premenstrual symptoms make use of carbohydrate ingestion, especially simple carbohydrates, to provide a temporary lifting of mood. However, other evidence suggests that some individuals may obtain a more permanent control of their negative mood state by eliminating simple carbohydrates from their diet. While the literature is consistent in demonstrating that carbohydrate consumption can alter a negative mood state, the underlying mechanism mediating this relationship is unknown. © 1993 by John Wiley & Sons, Inc.

FOOD AS A MOOD REGULATOR

Mood is a word that is frequently used interchangeably with other terms such as emotion (Thayer, 1989). Although there is considerable overlap, moods are generally considered to differ from emotions in terms of their nonspecificity or pervasiveness (Morris & Reilly, 1987) and are frequently conceptualized along the dimensions of positive and negative affect (Watson & Clark, 1991). A negative mood state is generally viewed as being aversive and something to be avoided whereas a positive mood state is desirable and something to be maintained. Given the aversive characteristics of negative moods and the desirable characteristics of positive moods, it would seem logical that we would be motivated to avoid or eliminate a negative mood state and to maintain a positive mood state.

Morris and Reilly (1987) proposed the idea that individuals may engage in a variety of behaviors for the purpose of regulating their mood state. Their review of the literature revealed that some evidence (e.g., Clark & Isen, 1982) existed indicating that individuals regulate good moods by acting in such a manner as to maintain the positive mood. However, most studies have focused on the incentive for regulating negative moods probably due to its aversive nature. Morris and Reilly's (1987) review of the self-regulatory literature revealed that a behavior such as alcohol consumption seems to be
an effective mood enhancer. Other behaviors such as self-reward or exposure to reinforcing events were of questionable value. One behavior that has been overlooked is the self-rewarding mechanism of food consumption although this is perhaps the most common form of indulgence.

During the past decade studies have documented that specific types of food tend to be consumed more frequently during specific mood states. For example, Lyman (1982) found that subjects requested to imagine a variety of mood states perceived that the preference for junk foods (foods with a value of -10 or less according to Jacobson’s Nutrition Scoreboard; Jacobson, 1975) would increase during negative moods such as frustration and depression and that the preference for healthy foods would increase during positive moods such as happiness. Although such data suggest that the preference for different foods varies with different emotions, they do not provide any indication as to why an alteration in emotions may be accompanied by an alteration in preference for specific foods. There is, however, a literature demonstrating that specific foods seem to be consumed for the purpose of ameliorating a negative mood state. This paper presents a review of the literature suggesting that food is frequently used in the self-regulation of negative mood.

In reviewing the literature, there are two approaches that emerge regarding the use of food as a mood regulator. Specific foods seem to be consumed by individuals afflicted with one of several disorders in an attempt to provide some relief from the negative affect accompanying that disorder. Other research has suggested that elimination of specific foods is an effective technique for ameliorating a negative mood state. Each approach will be reviewed.

FOOD CONSUMPTION AND THE SELF-REGULATION OF MOOD

Regulation of Tobacco Withdrawal Symptoms

It is well established that tobacco use is reinforcing and provides a strong motivation to continue self-administration. This reinforcement seems to come from the tobacco’s stimulant, relaxation, and stress countering effects (Russell, Peto, & Patel, 1974). Nicotine, the major psychoactive element in tobacco, enhances cognition and psychomotor performance (Mangan, 1982; Parrott & Winder, 1989; Hindmarch, Kerr, & Sherwood, 1990). In spite of these seemingly positive effects, it has been well established that tobacco use constitutes a health hazard prompting a desire in many to eliminate its use.

Although there are sufficient health, economic, and social factors (Gritz, 1980) motivating abstinence from tobacco use, it is generally believed that behaviors such as smoking are very difficult conditions to terminate. This difficulty seems to exist primarily among heavy users of tobacco such as smokers of at least one pack of cigarettes a day. Schachter (1982) reported that over 70% of heavy smokers and only 11.8% of light smokers had difficulty in quitting. The difficulty in quitting apparently stems from the experience of withdrawal symptoms (Pederson & Lefcoe, 1976). The withdrawal symptoms range from mild to severe dysphoria, tobacco cravings, mood changes, sleep disturbances, fatigue, concentration difficulties, and increased appetite (Gritz, 1980; Myrsten, Elgerot, & Edgren, 1977). To combat the effect of these symptoms most individuals use some substitute such as food, exercise, or nicotine gum (Pederson & Lefcoe, 1976).

Nicotine gum has been demonstrated to decrease most of the withdrawal symptoms
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(Hughes, Gust, Skoog, Keenan, & Finwick, 1991). However, little if any attention has been devoted to the effectiveness of exercise or food although there are some data indicating that the altered food preference accompanying cessation of tobacco use is motivated by its effect on the withdrawal symptoms.

Investigation of the altered appetite accompanying cessation of tobacco use has been stimulated by the repeated demonstration of a weight gain following smoking cessation. Both animal (Grunberg, Bowen, Maycock, & Nespor, 1985; Grunberg, 1983) and human (Grunberg, 1985; Hall, McGee, Tunstall, Duffy, & Benowitz, 1989; Rodin, 1987) studies have demonstrated that the increased appetite and accompanying weight gain following termination of tobacco use is due to an increased consumption of simple or refined carbohydrates. This increased appetite for sugary foods could be due to the increased preference that quitters have for sweet tasting foods (Redington, 1983). However, smoking does not alter the perceived intensity of taste suggesting that the responsiveness of the taste buds are not altered (Redington, 1983). Additionally, quitters who did not gain weight demonstrated the same degree of preference for sweet tasting foods as did those who gained weight indicating that it is the expression of the preference and not the preference per se that is related to the increased caloric intake from sweets (Rodin, 1987).

Grunberg (1986) has suggested that the increased consumption of simple carbohydrates represents an attempt to modulate and improve mood thereby diminishing the severity of the withdrawal symptoms. This suggestion is supported by evidence (e.g., Brzezinski et al., 1990; Rosenthal et al., 1989) indicating that carbohydrate intake improves mood and diminishes the severity of symptoms similar to many of those occurring from tobacco withdrawal.

Bowen, Spring, and Fox (1991) provide some evidence of the modulating effect that carbohydrate ingestion can have on tobacco withdrawal symptoms. Individuals smoking at least 15 cigarettes daily for 2 years were randomly assigned to a high-carbohydrate, low-protein diet plus 50 mg/kg/day of l-tryptophan or a low-carbohydrate diet plus placebo while participating in a behaviorally oriented smoking cessation treatment program. Results revealed that the high-carbohydrate plus l-tryptophan group experienced significantly less anxiety and less severe withdrawal symptoms than did the low-carbohydrate plus placebo group. This suggests that the increased carbohydrate intake characteristic of abstinent smokers represents a form of self-reward or self-medication to reduce the severity of the withdrawal symptoms and thereby regulate their mood through consumption of simple carbohydrates or sweets.

Alcohol Withdrawal

National surveys of drinking practices have revealed that approximately two thirds of the U.S. population 18 years of age and older consume alcohol (National Institute on Alcohol Abuse and Alcoholism, 1987). The surgeon general’s report on nutrition and health (U.S. Department of Health and Human Service, 1988) has identified the reduction of alcohol intake as a primary dietary priority for public health action because it is a factor in several leading causes of death including cancer, stroke, unintentional injury, cirrhosis of the liver, chronic liver disease, and suicide. In addition to the health issues, alcohol use contributes to public safety, family, and work-related problems (Milgram, 1990). Such issues have prompted a number of researchers to investigate the motives for consuming alcohol.

Studies investigating the motivation to drink have generally revealed that light drink-
ers and nonalcoholics consume alcoholic beverages for different reasons than do heavy
drinkers and alcoholics. Light drinkers and nonalcoholics are more likely to consume
alcohol for sociability reasons such as drinking to be friendly, to celebrate special occa-
sions, or when eating a meal, etc. Heavy drinkers and alcoholics are more likely to con-
sume alcohol for its drug or relief effect such as drinking to relieve feelings of tension,
depression, loneliness, or to receive a lift and combat feelings of fatigue (Beckman &
Bardsley, 1981; Graham, 1988; Cahalan, Cisin, & Crossley, 1969). This improvement in
mood accompanying alcohol ingestion is accompanied by a more prolonged period of
increased anxiety and depression (Pohorecky, 1981). However, the initial positive ef-
fect and not the more prolonged negative experience is the one that is remembered
(Tamerin & Mendelson, 1969). Consequently, it appears as though heavy drinkers and
alcoholics are engaged in a form of self-regulation that involves the use of alcohol to
improve mood and a general state of well-being. It has even been theorized that the
alcoholic drinks “from a state of pain in order to feel normal” (Milgram, 1990).

When heavy drinkers and alcoholics abstain, there is an increased desire or craving
for alcohol probably because the dysphoric feelings are not relieved from alcohol con-
sumption. To compensate, other substances such as coffee, candy, and sweet drinks
have been suggested as being used in the place of alcohol (Johnston, DeVries, & Hough-
ton, 1966; Rosenfield & Stevenson, 1988; Mazdzenz, Goetz, Seanycz, DeVito, & Davis,
1981). Verinis (1986) has demonstrated that a significant increase in coffee consumption
occurs following abstinence from alcohol in recovering alcoholics. Rosenfield and
Stevenson (1988) have revealed that recovering alcoholic women consume more sweet
and starchy foods during days in which they felt more distressed.

This increase in consumption of coffee and sweets during abstinence is reasonable
given the mood altering effects that these substances can have. Caffeine is generally
regarded as a central nervous system stimulant (Rail, 1980) and often has stimulant and
reinforcing effects (Griffiths, Bigelow, & Liebson, 1986) although it may also have de-
pressant effects (Veleber & Templer, 1984). Graham (1988) has demonstrated that cof-
fee is most likely to be consumed to provide a stimulant effect as well as relief from a
negative mood state. Sweets or simple carbohydrates have been demonstrated to pro-
vide a temporary elevation in energy levels (Thayer, 1987) as well as a decline in de-
pression (Lieberman, Wurtman, & Chew, 1986b; Wurtman, Brzezinski, Wurtman, &
Laferre, 1989). These are the same types of symptoms for which alcohol was previ-
ously consumed. Consequently, it appears as though caffeine and sweets may be sub-
stituted for alcohol to regulate mood during periods of abstinence.

**Bulimia**

One of the primary diagnostic characteristics of bulimia includes binge eating or the
“... rapid consumption of a large amount of food in a discrete period of time” (American
Psychiatric Association, 1987, p. 68). Binge eating can even be considered a defini-
ting characteristic of this eating disorder. A number of studies have revealed that binging
episodes revolve around the consumption of high fat and carbohydrate foods charac-
teristic of many sweets and desserts. Rosen, Leitenberg, Fisher, and Khazam (1986) re-
vealed that bulimic patients’ binge eating episodes consisted of predominately snacks
and desserts. Abraham and Beumont (1982) reported that binge foods were typically
high in both fats and carbohydrates. Mitchell, Pyle, and Eckert (1981) revealed that the
typical binge eating episode involved consumption of high calorie foods such as ice
cream, candy, or doughnuts. This is similar to Leon, Carroll, Chernyk, and Finn’s (1985)
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results indicating that most females preferred to binge on pastries and other soft and easily consumed high carbohydrate and fat foods.

It has been repeatedly demonstrated that one of the precipitating antecedents of a binging episode is a negative mood state. Schlundt, Johnson, and Jarrell (1985) revealed that negative moods were predictive of binging whereas positive moods were associated with a reduced probability of binging. Several studies (e.g., Johnson-Sabine, Wood, & Wakeling, 1984; Abraham & Beumont, 1982; Pyle, Mitchell, & Eckert, 1981; Greenberg, 1986) have revealed that both self-reports and measures of stress and depression as well as symptoms of depression were predictive of binge eating in both an eating disordered and a college student population. Greenberg and Harvey (1987) have even demonstrated that mood lability was the best predictor of binge eating among a non-depressed college sample.

The fact that negative moods precipitate binging episodes has led to the suggestion that bulimics may be attempting to control or self-regulate their dysphoric mood with food (e.g., Johnson & Larson, 1982), which would also suggest that the negative mood state may not only precipitate but it may also maintain the binge eating. Abraham and Beumont (1982) revealed that 72% of their subjects stated that they were free of negative mood states while binge eating. Fernstrom, Krowinski, and Kupfer (1987) and Schuman, Gitlin, and Fairbanks (1987) have revealed that depressed individuals increase their preference for carbohydrates, particularly sweets, during a depressive episode. Rosenthal et al. (1989) have demonstrated that consumption of carbohydrates can improve a depressed mood. To the extent that bulimics binge on carbohydrate-rich foods, such evidence suggests that the binging may represent a self-regulatory attempt to improve a dysphoric mood state through ingestion of food.

Seasonal Affective Disorders

Seasonal affective disorder (SAD) is a syndrome characterized by recurrent depressions occurring at the same time of the year (Rosenthal et al., 1984). The primary characteristic differentiating SAD from a nonseasonal affective disorder is carbohydrate cravings or a specific hunger for carbohydrate-rich foods (Wurtman, 1984), although SAD patients also experience significantly more fatigue (Garvey, Wesner, & Godes, 1988). Some SAD patients crave sweets and chocolates whereas other prefer starches (Rosenthal et al., 1984; Krauchi & Wirz-Justice, 1988). Rosenthal et al. (1989) demonstrated that SAD patients experienced an activation in mood and decline in fatigue following consumption of a carbohydrate-rich meal. Such evidence, tentative as it is, suggests that SAD patients may be self-medicating or using carbohydrates to self-regulate their mood.

Obesity

Hopkinson and Bland (1982) reported that 74% of obese individuals experiencing transient episodes of depression also crave carbohydrates, the compulsive eating of carbohydrate-rich foods as snacks in addition to regular caloric intake. This inability to control carbohydrate consumption has been suggested as being one factor hindering the weight loss of the obese. Lieberman et al. (1986b) hypothesized that the carbohydrate cravings of the obese may be due to postprandial changes in mood or the transient episodes of depression they experienced. To test this hypothesis, carbohydrate and noncarbohydrate cravers completed a variety of mood indices prior to and follow-
ing consumption of a carbohydrate-rich meal. The noncarbohydrate cravers experienced a significant increase in fatigue and depression. However, the carbohydrate cravers experienced an improvement in mood or a decline in depression suggesting that the carbohydrate snack may represent an attempt at self-medication or the self-regulation of mood. During the transient dysphoric state, cravings for carbohydrates may emerge because of their mood elevating characteristics.

PREMENSTRUAL SYNDROME

Premenstrual syndrome (PMS) is a term that refers to a “constellation of mood, behavior, and/or physical symptoms which have a regular cyclical relationship to the luteal phase of the menstrual cycle, are present in most (if not all) cycles, and remit by the end of the menstrual flow with a symptom-free interval of at least one week” (Harrison, Rabkin, & Endicott, 1985). One of the primary symptomatic characteristics of PMS is carbohydrate cravings (Wurtman et al., 1989) although other symptoms such as fatigue and depression are also characteristic (Hallman, 1986). Studies (e.g., Lissner, Stevens, Levitsky, Rasmussen, & Strupp, 1988) have revealed that caloric intake increases during the luteal phase of the menstrual cycle and this caloric intake is attained from an increase in carbohydrate but not fat or protein consumption (Dalvit-McPhillips, 1983) which is consistent with the demonstration of the carbohydrate cravings characteristic of PMS patients.

There are several studies that have related the carbohydrate cravings to alterations in mood. Smith and Sauder (1969) and Bancroft, Cook, and Williamson (1988) have revealed that feelings of depression are related to increased appetite and carbohydrate consumption. Both-Orthman, Rubinow, Hoban, Malley, and Grover (1988) have demonstrated that feelings of depression account for most of the variance that exists between mood, appetite, and carbohydrate cravings. These studies indicate that a dysphoric mood is somehow related to the increased desire for and consumption of carbohydrates. Wurtman et al. (1989) revealed that consumption of carbohydrate-rich foods resulted in a lifting of the depression among PMS individuals experiencing depression during the luteal phase of the menstrual cycle. Such evidence suggests that the carbohydrate cravings and consumption represent an attempt at self-regulation of the dysphoric mood experienced by PMS patients.

ELIMINATION OF FOOD AS A MEANS OF SELF-REGULATION

The idea that certain foods may produce a variety of emotional reactions and that elimination of the offending foods would then counteract these emotional reactions has a long history but, until recently, little scientific evidence. Mandell and Rose (1968), for example, presented a case study of a woman experiencing a variety of emotional reactions that were believed to be due in part to reactions to a variety of foods. These investigators reported that elimination of the offending foods resulted in an amelioration of her emotional distress. King (1981) provided some of the initial scientific evidence documenting the fact that foods could cause an emotional reaction. Subjects presenting with one or more psychological symptoms experienced an exacerbation of symptoms such as depression and nervousness following sublingual administration of an allergen.
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extract but not to placebo. Such data suggest that elimination of the food containing the allergen would at least ameliorate the severity of the symptoms.

More recently a series of studies have been conducted demonstrating the effectiveness of a simple carbohydrate and caffeine free diet in the amelioration of emotional distress. Christensen, Krietsch, White, and Stagner (1985) demonstrated that a caffeine and refined sucrose free diet resulted in a reduction of emotional distress and reintroduction of these substances in a double-blind format resulted in a return of the distress. Several additional studies (Christensen, Krietsch, & White, 1989; Krietsch, Christensen, & White, 1988) have replicated these findings providing confirmation of the efficacy of this dietary intervention for ameliorating emotional distress. In a subsequent study Christensen and Burrows (1990) demonstrated that elimination of caffeine and refined sucrose from the diet was particularly effective in the amelioration of depression in a subsample of depressed individuals. Double-blind challenges revealed that the simple carbohydrate, refined sucrose, represented the most frequent contributor to the depression of the sample subjects. Such data suggest that the dysphoric mood of some depressed individuals could be self-regulated by the avoidance of such foods. Unfortunately, most of the sensitive individuals are not aware of the contribution of simple carbohydrates or caffeine to their depression, which means that this mode of self-regulation must be demonstrated to them by either accidental discovery on their own part or from another individual such as a mental health professional.

This literature demonstrating that elimination of refined sucrose from the diet of depressed individuals can effectively ameliorate depression seems to be inconsistent with the literature demonstrating that consumption of carbohydrates results in an improvement in mood. It appears to represent a contradiction because, on the surface, it would seem difficult for the consumption and elimination of a food substance to have a similar effect. However, there is evidence indicating that this dual effect may not represent a contradiction but have real substance. Thayer (1987) has demonstrated that the initial effect of consumption of refined carbohydrates is an increase in energy but the longer term effect is one of increased fatigue and a decline in energy. This finding of increased feelings of fatigue following carbohydrate ingestion is supported by Blouin et al. (1991) who revealed that feelings of fatigue as well as increased cravings for carbohydrate-rich foods increased following a 25-gm glucose load but only in bulimics and not controls. This would suggest that, for a distressed group of individuals, a vicious cycle may be created where simple carbohydrates are consumed to obtain a temporary relief from feelings of dysphoria and fatigue. Following the temporary relief the carbohydrate consumption increases feelings of fatigue and dysphoria contributing to the development and maintenance of negative affect (Christensen, 1991). It may be, similar to the effect noted with regard to alcohol consumption (Tamerin & Mendelson, 1969), that it is the more immediate mood elevating or energy enhancing effect that is remembered and not the subsequent exacerbation and maintenance of negative affect that may accompany the carbohydrate ingestion.

POSSIBLE MECHANISM OF ACTION

The use of food to regulate mood has consistently indicated that carbohydrate consumption, particularly simple carbohydrates, results in a temporary reduction in negative affect in individuals experiencing a variety of different types of emotional disorders. The most frequently proposed explanation for this carbohydrate-induced effect is the
effect that carbohydrate ingestion has on central serotonin synthesis and release (see Wurtman, Hefti, & Melamed, 1981a for a summary of this research). Animal research has demonstrated that consumption of a high-carbohydrate and low-protein meal stimulates the release of insulin from the pancreas. This insulin release in turn has the effect of increasing the uptake of amino acids from plasma but it also causes nonesterified fatty acid molecules to dissociate from albumin and enter adiposites leaving albumin in an unbound state. Tryptophan has an affinity to bind loosely to albumin and when insulin strips the fatty acid molecules from albumin, tryptophan binds to this protein, which spares tryptophan from being taken up by the peripheral cells. This sparing action increases the ratio of plasma tryptophan to the other large neutral amino acids (LNAA), valine, leucine, isoleucine, tyrosine, and phenylalanine, with which tryptophan competes for transport across the blood-brain barrier. An increase in the plasma tryptophan/LNAA ratio facilitates the uptake of tryptophan into the brain (Fernstrom & Wurtman, 1971), which increases the saturation of tryptophan hydroxylase, the enzyme controlling the synthesis of serotonin (Carlsson & Lindqvist, 1978), resulting in an increased synthesis of serotonin.

There are a number of studies (e.g. Lieberman, Spring, & Garfield, 1986a) supporting the hypothesis that carbohydrate consumption mediates its mood enhancing effects through its indirect effect on central serotonin. Most of the supportive evidence comes from studies that demonstrate the effectiveness of fenfluramine, a drug that is believed to mediate its effect by causing a selective increase in serotonin-mediated neurotransmission, in ameliorating one or more of the symptoms, such as increased carbohydrate consumption or cravings, accompanying a negative mood state. It is assumed, because carbohydrates enhance serotonergic neurotransmission, that if similar acting drugs influence carbohydrate cravings, ingestion, or mood, such evidence also indicates that the effect mediated by the carbohydrate ingestion is also mediated by its influence on central serotonin.

There are several studies demonstrating the effectiveness of fenfluramine in moderating carbohydrate cravings and depression. O'Rourke, Wurtman, Wurtman, Chebli, and Gleason (1989) found that a 15-mg dose of d-fenfluramine reduced the carbohydrate cravings of SAD patients. A 20-mg dose of d-l fenfluramine reduced the carbohydrate snacking among normal weight individuals as well as obese carbohydrate cravers (Wurtman et al., 1981b). Brzezinski et al. (1990) demonstrated that d-fenfluramine not only relieves premenstrual depression but it also suppresses the carbohydrate cravings and its concomitant increase in appetite and carbohydrate consumption in women with PMS.

Although several studies have indicated that fenfluramine alters carbohydrate ingestion as well as carbohydrate cravings, such data should not be construed as representing definitive evidence suggesting that the mood altering effect of carbohydrates is mediated by their influence on central serotonin. Spring, Wurtman, Gleason, Wurtman, and Kessler (1991), for example, speculated that the ameliorating effect of carbohydrate ingestion on withdrawal symptoms in abstinent smokers was due to an attempt to elevate brain serotonin. This hypothesis was tested by administering d-fenfluramine in two 15-mg doses daily. However, d-fenfluramine not only failed to decrease the severity of most withdrawal symptoms but even increased some symptoms prior to smoking cessation.

There is also evidence demonstrating that the alteration in plasma tryptophan/LNAA ratios required for an increase in serotonin synthesis and release does not always occur following carbohydrate ingestion even though mood is altered. Wurtman et al. (1989) did not find a difference in the amino acid profile of individuals with PMS versus con-
trol subjects following a carbohydrate-rich meal even though the PMS subjects obtained an elevation in mood not found in controls. Rosenthal et al. (1989) assessed the ratio of tryptophan to the other LNAA in SAD and normal subjects and found no difference in the two groups casting doubt on the speculation carbohydrates produce their mood altering effects in SAD patients by increasing synthesis and neurotransmission of serotonin. Caballero, Finer, and Wurtman (1988) revealed that neither a carbohydrate-rich snack nor supplemental tryptophan ingested 2 hours following a standard lunch, elevated the tryptophan-LNAA ratio in an obese sample whereas it did in a lean sample. It is the obese sample that receives the beneficial effect from carbohydrate ingestion. Such data reveal that one of the critical biochemical steps required for carbohydrate ingestion to alter serotonin synthesis and neurotransmission (Wurtman et al., 1981a) is missing suggesting that the mood altering effects resulting from carbohydrate ingestion are probably mediated by a mechanism other than, or in addition to, the enhancement of serotonin synthesis or neurotransmission.

At the present time, the most accurate conclusion to draw is that the mechanism underlying carbohydrates apparent mood altering effect is unknown. This does not mean that a role does not exist for the effect that carbohydrates may have on central serotonin. Rather, that this proposed mechanism provides an incomplete explanation.

SUMMARY OF THE SELF-REGULATORY LITERATURE AND RESEARCH SUGGESTIONS

The literature relating to the self-regulation of mood has provided preliminary data suggesting that individuals suffering from a variety of afflictions ranging from tobacco withdrawal to premenstrual symptoms may be using food to assist in the regulation of their mood. This research consistently suggests that consumption of carbohydrates, particularly simple carbohydrates, assists in the moderation of negative affect. It is important to be aware of the tentative nature of this proposed connection. At the present time there are few studies supporting such a connection although these studies are consistent in demonstrating a mood altering effect. These studies need to be replicated and extended before a more definitive conclusion can be reached regarding the self-regulating effects of carbohydrate ingestion. This review is designed to present the proposed connection as well as the currently available research to encourage the continued investigation into this area to more definitively identify the role of food, and particularly carbohydrates, as a mood regulator.

The literature also demonstrates that consumption of carbohydrates can produce a temporary elevation in mood but elimination of the simple carbohydrate refined sucrose from the diet may result in a more permanent reduction. It has been suggested that a cyclical effect may be encountered where simple carbohydrate consumption produces a temporary elevation in mood but the longer term effect is an exacerbation and maintenance of negative affect. Research needs to be conducted to determine if this cyclical effect occurs and whether carbohydrate ingestion or elimination of refined sucrose produces the most effective and beneficial effect in terms of ameliorating a negative mood state.

The most frequently proposed mechanism by which carbohydrates exert their mood altering effect is through the influence that carbohydrates have on the synthesis and release of central serotonin. However, the literature supporting this speculation is inconsistent indicating that this proposed mechanism is not only tentative but probably
not the primary route by which carbohydrates exert their mood altering effects. This indicates that there is a need for investigation into the mechanisms by which carbohydrates exert their effect on mood.

**SUMMARY**

A literature is developing suggesting that individuals use food as a regulator of a negative mood state. Individuals abstaining from use of tobacco as well as alcohol increase their consumption of carbohydrates to ameliorate the withdrawal symptoms. Bulimics binge during a negative mood state and report that the negative mood state lifts during the binge. Individuals with SAD, premenstrual symptoms, and the obese experiencing a transient depressive episode crave and increase their consumption of carbohydrates. This carbohydrate consumption is accompanied by an increase in energy and a lifting of depression.

A variety of studies from several different areas provide converging evidence that individuals make use of carbohydrates to provide a lifting of a negative mood state. Although the evidence is not definitive, there are repeated suggestions that the primary carbohydrate consumed for this regulatory function is simple carbohydrates. There is also evidence indicating that eliminating simple carbohydrates from the diet may produce a more permanent amelioration of a negative mood state suggesting that the consumption of simple carbohydrates may provide a temporary lifting of mood but ingestion of this carbohydrate may have the longer term effect of contributing to the development and maintenance of the negative affect.

Although consistent evidence exists for the role of carbohydrates in the regulation of mood, there is little evidence suggesting the underlying mechanism. It has been speculated that the regulatory mechanism is the influence that carbohydrates have on central serotonin synthesis and release. However, the evidence supporting such a contention is inconsistent and indicates that this proposed mechanism provides an incomplete explanation.

**REFERENCES**


