ABSTRACT: Research has shown that breakfast cereal consumption leads to a more positive mood and improved memory. The present study investigated the acute effects of having a fibre cereal bar for breakfast on mood and memory. Twenty volunteers (15 male, 5 female; mean age 22 years) were tested at 09.00 following an overnight fast. They carried out a free recall task involving recall of a list of 20 words and rated their mood using bi-polar visual analogue scales. The volunteers then had a 40 minute break and half of the volunteers consumed cereal bars (37g; 606KJ/144KCcal; 26g carbohydrate, 1.5g protein; 3.74g fat and 1.5g fibre) at the start of the break whereas the others abstained from eating. Following the break the volunteers repeated the memory task and mood rating. The results showed that consumption of the cereal bar led to a more positive mood (greater alertness; being more happy/sociable; and being calmer). Recall of the list of words was also significantly greater in the cereal bar condition. Overall, the results extend previous findings and show that acute benefits of breakfast can be identified following consumption of a fibre cereal bar.

KEYWORDS: Cereal bars, fibre, mood, memory.

INTRODUCTION

There is strong evidence that consumption of breakfast is associated with improved memory (especially episodic memory involving free recall of a list of words) and a more positive mood (Smith and Kendrick 1992). Such effects have been demonstrated with a variety of different types of breakfast (e.g. a cooked breakfast – Smith et al. 1994; breakfast cereal – Smith et al. 1999; a high protein drink – Benton and Sargent 1992; and glucose drinks – Benton and Parker 1998). Commercially available cereal bars have now been developed and as these often have the same nutrient composition as traditional breakfast cereals it is reasonable to assume that similar behavioural effects will be obtained following consumption of a cereal bar for breakfast (Smith and Wilds 2009) and this was tested in the present study. Some studies suggest that the mood changes reflect the nutrient composition of the breakfast (e.g. Holt et al. 1999) whereas others have demonstrated that most types of breakfast lead to a more positive mood (e.g. Benton et al. 2001). Similarly, research on breakfast and cognitive function has produced mixed findings regarding the effect of macro-nutrient composition. Lloyd et al. (1996) found that breakfast composition had no effect on cognitive performance. This view has been supported by findings from a study by Kelley et al. (1994). In contrast, Fischer et al. (2002) found selective effects of carbohydrate, fat and protein in breakfast. The effects of fibre on mood and cognitive function have rarely been studied (see Hoyland et al. 2008). Another aim of the present study was to provide data on this topic.

Research has shown that eating a fibre diet can have a range of health benefits (e.g. cardiovascular health – Pereira et al. 2004; digestive health – Jefferson 2005; and weight loss – Ludwig et al. 1999). Research has shown that a fibre diet is associated with improved well-being as measured by reports of mental/physical health and cognitive function (Smith 2005; Smith, in press). Intervention studies have also found that increasing dietary fibre from wheat bran cereals increases energy (Smith et al. 2001) and improves cognitive function (Deaville et al. in preparation). The present study examined the acute effects of wheat bran cereal on subjective mood and memory. The hypothesis being tested was that breakfast in the form of a fibre cereal bar would lead to a more positive mood and better memory performance that a no breakfast condition.

METHOD

The study was approved by the Cardiff University School of Psychology Ethics Committee and carried out with the informed consent of the volunteers.
Design and Procedure
The study used a between subject design and participants were randomly assigned to either the cereal or breakfast bar condition. A baseline session was carried out at 09.00 followed by a 40 minute break. Those in the breakfast bar condition had fibre cereal bars at the start of the break whereas those in the no-breakfast condition abstained from eating. Participants fasted from 22.00 the previous night and limited their alcohol consumption to 4 units. They were allowed to drink water on the morning of the testing.

Participants
Twenty volunteers (15 males, 5 females; aged between 18 and 36 years; mean age 22 years) were recruited for the study.

Mood and Memory tests
All mood and memory tasks were presented on PCs. A response box was attached so that responses could be made without using the keyboard. The mood rating and memory task have been shown to be sensitive to effects of breakfast (Smith et al. 1994).

Mood
This was measured using 18 bi-polar visual analogue scales (e.g. Drowsy-Alert, Happy-Sad, Tense-Calm) presented on the screen of the computer. Three factor scores were derived: Alertness, Hedonic tone and Anxiety.

Free Recall Task
A list of 20 words was presented on the screen at a rate of one every 2 sec. At the end of the list, the volunteer had 2 min to write down (in any order) as many of the words as possible.

Breakfast bars
The cereal bars weighed 37g and delivered 606KJ /144Kcal. The macronutrient composition was 26g carbohydrate, 1.5g protein; 3.74g fat and 1.5g fibre.

Statistical analyses
Analyses (t-tests) were carried out on the percentage change from baseline scores for the mood and memory data.

RESULTS
The results showed that consumption of the fibre cereal bars led to a significantly more positive mood (greater alertness; higher hedonic tone and reduced anxiety) and better recall of the list words. These results are shown in Figures 1 to 4 and they confirm results from prior studies of breakfast.

FIGURE 1. Baseline and post-consumption scores for the free recall task (scores are the means; s.e.s as bars. Maximum=20). Cereal bar difference from baseline significantly > no bar difference from baseline (p < 0.05).

FIGURE 2. Baseline and post-consumption scores for the rating of alertness (scores are the means; s.e.s as bars; high scores = more positive mood). Cereal bar difference from baseline significantly > no bar difference from baseline (p < 0.05).

FIGURE 3. Baseline and post-consumption scores for the hedonic tone rating (ratings of happiness, sociability etc; scores are the means; s.e.s as bars; high scores= more positive mood). Cereal bar difference from baseline significantly > no bar difference from baseline (p < 0.05).

FIGURE 4. Baseline and post-consumption scores for ratings of calm (scores are the means; s.e.s as bars; high scores= more positive mood). Cereal bar difference from baseline significantly > no bar difference from baseline (p < 0.05).
DISCUSSION

The present results extend previous research on the acute effects of breakfast to show that consumption of cereal bars containing fibre improve mood and recall of a list of words. This confirms results from studies of regular patterns of fibre consumption which have shown that fibre cereals are associated with higher levels of subjective well-being and the reporting of fewer cognitive difficulties. Further research is needed to identify the mechanisms underlying the present effects. It is possible that the effects reported here reflect the same generic mechanisms as have been observed in previous studies of the acute effects of breakfast. These have often been discussed in terms of glucose improving memory and changes in serotonin leading to a more positive mood. Future research must determine whether there are biomarkers that provide a clearer indication of the physiological changes underlying the behavioural effects. While it is now apparent that consumption of breakfast changes behaviour there is less evidence on the effects of different macronutrients. A comparison between high and low fibre breakfast cereals is now required in a study which has greater power to detect more subtle differences. It is also important to remember the practical implications of these beneficial effects of breakfast in education and at work. Similarly, breakfast bars provide a means of consuming breakfast ‘on the go’ which may be important for certain individuals or certain contexts.

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Cereal bars, mood and memory
