

# The role of diet in the prevention and management of adolescent depression

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## Summary

Depression in adolescence is associated with a range of negative outcomes and substantial risk for morbidity and mortality across the lifespan. Dietary improvement and supplementation may offer an inexpensive and acceptable adjunct to standard treatment; yet this has, to date, been largely overlooked, owing to lack of evidence and knowledge. This is important, as improving understanding of the role of diet in mental health and promotion of appropriate dietary practices could significantly reduce the personal and social impact of depression in young people. This article sets out to review the existing research literature on associations between diet and mental health in adolescence, in particular, the role of diet in the prevention and management of adolescent depression. A closer examination of associations between obesity and depression is also included, as these two conditions often co-occur. Research into diet and mental health tends to fall into two main categories: population-based observational studies and intervention studies; however, there is very little research evidence specific to adolescents. Potential implications for mental healthcare policy and practice are discussed.

**Keywords:** adolescence, depression, diet, nutrition, obesity, supplements

## Introduction

Depression is a psychiatric disorder, with the core defining feature being a change from pleasant to unpleasant mood, commonly termed 'dysphoric'. In children and adolescents, dysphoric mood may present as irritability rather than sadness or depression. A mood shift is experienced as pervasive, persisting over time and place, and sufficiently severe to interrupt everyday functioning, for example ability to do schoolwork or enjoy spending time with friends (APA 1994). A particular and severe form of

dysphoric-related mood change is anhedonia, which is a marked loss of interest or pleasure in usual activities. Depression and/or anhedonia are accompanied by other symptoms in varying combinations, including negative and distorted cognitions about the self, and impaired concentration and attention (APA 1994). There are adverse alterations in a range of physical characteristics, for example increased/decreased appetite or a change in eating patterns, sleep disturbance, fatigue, or changes in activity levels. Adolescents may gain or lose weight, although it is important to consider weight changes in the context of expected weight gains. Diagnostic assessment is generally made through direct questioning of the adolescent and his or her parents, occasionally obtaining information from significant others.

For a DSM-IV or an ICD-10 diagnosis of major depressive disorder, five or more symptoms must have

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been present for at least 2 weeks, one of which must be either dysphoric mood or anhedonia (APA 1994; WHO 1994). It is important to establish whether these symptoms are not better accounted for by the direct effects of substance misuse, a general medical condition or recent bereavement, as any of these may reduce the likelihood of reliable and valid mental state assessment. The duration of a depressive episode can range from 2 weeks to several years. Episodes may also differ in their severity from mild, indicating only a modest deviation from normal functioning, to severe, involving an inability to care for oneself and requiring intensive psychiatric care. Mild disorders generally present with the minimal number of symptoms, moderate with six or seven symptoms, and severe with eight symptoms or more. Co-morbidity is common, with depression often presenting concurrently with one or more non-depressive disorders, including antisocial behaviour, obsessionality, anxiety or substance misuse (Harrington 2003).

### Prevalence of adolescent depression

Depression in adolescence is common, persistent and associated with a range of personal and social costs. The national survey of mental health of young people in Great Britain, carried out in 2004, reported a 12-month period prevalence of mental disorder of 11.5% in 11- to 16-year-olds, with emotional disorders among the most common (Green *et al.* 2005). In this survey, parents of adolescents with an emotional disorder were more than four times as likely to report their child's general health as poor or bad. The 12-month period prevalence of depression in adolescents has been estimated to be around 3%, with rates being highest among female adolescents in this age group (Angold & Costello 2001).

Depression is associated with a range of negative outcomes, including: self-harm (Harrington 2001), substance abuse and suicidality (Kovacs *et al.* 1993), declining academic performance (Fleming *et al.* 1989; Hysenbegasi *et al.* 2005), and increased service use (Angold *et al.* 1999). For many, substantial deleterious effects persist into adulthood (Harrington *et al.* 1990; Fombonne *et al.* 2001). Clearly, depression in adolescence represents a major public health concern. There is a pressing need to better understand its aetiology and to identify cost-effective strategies for its prevention and management.

### Diet and mental health: research evidence

Research studies relating diet to psychiatric disorders have, to date, tended to focus on associations between

intakes of specific nutrients in adults and depression and schizophrenia. The most studied nutrients, and those for which the evidence is strongest, are omega-3 (*n*-3) fatty acids and folate/folic acid (Peet *et al.* 1998; Papakostas *et al.* 2004). Observational and intervention studies show these nutrients to be low in the diets of people who are depressed, while supplementation leads to improvements in symptoms (*e.g.* Passeri *et al.* 1993; Coppen & Bailey 2000; Peet & Horrobin 2002; Frangou *et al.* 2006). However, there is growing interest in the potential importance of diet for maintaining good mental health, and research is beginning to investigate other nutrients, foods, food groups and patterns of eating. Within a few years, the evidence base for dietary advice for mental health is likely to develop substantially.

### Population-based observational studies

There is emerging evidence from population-based studies for associations between dietary intakes of certain nutrients and the occurrence of common forms of emotional and behavioural disorders in both adults and adolescents. Depression is more common in those with low serum concentrations of omega-3 fatty acids (Maes *et al.* 1996; Edwards *et al.* 1998; Peet *et al.* 1998). For example, Peet *et al.* (1998) found significantly depleted concentrations of omega-3 polyunsaturated fatty acids (PUFA) and docosahexaenoic acid (DHA) in the red blood cells (RBC) of 15 depressed patients, in comparison with 15 healthy adult controls. RBC membranes provide a measure of fatty acid composition in the membranes, as well as an indication of omega-3 fatty acid levels in the brain. High levels of omega-3 fatty acids lead to increased membrane fluidity, which consequently increases the transport of serotonin into the endothelial cells (Block & Edwards 1987). This has significant implications for people with depression, as they are shown to have reduced serotonin uptake (Mellerup & Plenge 1988).

Similarly, self-harm and attention deficit hyperactivity disorder (ADHD) have also been found to be more common in those people with lower intakes of essential fatty acids (EFA) (Richardson & Puri 2000; Hallahan & Garland 2004). In some studies, an inverse relationship is shown between omega-3 fatty acid blood levels and severity of depression (Adams *et al.* 1996; Edwards *et al.* 1998). In ten adult patients with major depression, a negative correlation has been reported between severity of depression and RBC membrane concentrations of omega-3 PUFA, as well as the dietary intake of omega-3 fatty acids (Edwards *et al.* 1998).

Depression has also been associated with low levels of other vitamins and minerals. For example, lower concentrations of serum and red cell folate in the region of 1.5–2 ng/ml (which indicates borderline low values) have also been observed in adults with depression (Carney *et al.* 1990; Fava *et al.* 1997) and, in some cases, an inverse relationship with severity of depression has been identified (Carney *et al.* 1990; Wesson *et al.* 1994). A recent study in an ethnically diverse US general population aged 15–39 years found lower concentrations of serum and RBC folate in subjects with a lifetime diagnosis of major depression than in never-depressed subjects (Morris *et al.* 2003). Furthermore, low folate concentrations have been shown to predict poor response to antidepressant treatment in a study of 14 patients with major depressive disorder in the USA (Papakostas *et al.* 2004).

Low blood concentrations of vitamin B<sub>12</sub>, typically around 258 pmol/l, were reported in depressed compared with non-depressed adult patients (Penninx *et al.* 2000; Bjelland *et al.* 2003). Subjects with serum levels below 258 pmol/l have been found to be 70% more likely to have severe depression than subjects with more elevated concentrations (Tiemeier *et al.* 2002). Moreover, a selenium deprivation study found low selenium intakes, in the region of 13 µg per day, to correlate negatively with depressed mood in healthy adult volunteers (Hawkes & Hornbostel 1996). Low plasma zinc levels have also been associated with depression when compared with healthy controls (McLoughlin & Hodge 1990). In patients with major depression, serum zinc concentrations were significantly lower than in healthy controls, and patients with minor depression had intermediate values (Maes *et al.* 1994). This study also reported a negative correlation between serum zinc concentrations and depression severity.

### Intervention studies: dietary modification and supplementation

In terms of macronutrients, the influence of both fat and carbohydrate (discussed in 'Obesity and depression' section) on brain function may have implications for mental health. Certain fatty acids, vitamins and minerals are thought to influence mood more than others. For example, several double-blind, placebo-controlled trials have shown omega-3 fatty acids, folic acid, vitamin B<sub>6</sub>, thiamin, zinc and chromium to have effects on mood, generally in those with pre-existing mental health conditions. While many of these studies suggest beneficial effects, the doses used must be taken into account, with respect to whether they are therapeutic doses or repre-

sentative of usual intakes. Both omega-3 fatty acids and folic acid supplementation have yielded therapeutic effects for adults who have not responded to standard antidepressant medications (Godfrey *et al.* 1990; Coppen & Bailey 2000; Peet & Horrobin 2002; Su *et al.* 2003).

With regards to omega-3 fatty acids, the majority of double-blind, placebo-controlled trials in adults with unipolar depression have used eicosapentaenoic acid (EPA) and have consistently reported significant improvements in depressive symptoms (Nemets *et al.* 2002; Peet & Horrobin 2002; Su *et al.* 2003; Frangou *et al.* 2006). In a study of 70 adults with persistent depression that was non-responsive to antidepressant treatment, 1 g of ethyl-eicosapentaenoate per day was significantly more effective at reducing self-reported depressive symptoms than placebo (Peet & Horrobin 2002). It is interesting to note that doses higher than 1 g/day yielded no significant improvement in symptoms compared with placebo. Compared with usual intakes of EPA, ranging from 0.1 to 0.2 g/day, reported in a 1989–1991 Continuing Survey of Food Intakes by Individuals in the USA (Kris-Etherton *et al.* 2000), this dose is extremely high.

In a double-blind, placebo-controlled pilot study, 20 children aged 6–12 years were randomised into an omega-3 fatty acids treatment group (1 g/day) or placebo as pharmacologic monotherapy. Seven of the ten children in the omega-3 fatty acids group showed improvements, with a reduction of greater than 50% on a self-report rating scale of depressive symptoms. This compared with zero in the placebo group (Nemets *et al.* 2006). This is the only trial assessing the benefits of omega-3 fatty acids in the treatment of childhood depression, an area where clearly more research is needed.

There have been a number of controlled trials showing that EFA supplementation is effective in reducing psychopathic, aggressive and impulsive behaviours over periods of several months (Gesch *et al.* 2002; Hallahan & Garland 2004). For example, a double-blind, placebo-controlled trial with 231 adult prisoners reported a 35.1% reduction in disciplinary offences in those receiving multivitamin and mineral and EFA supplements for a period of time ranging from 2 weeks to 9 months (Gesch *et al.* 2002). Whether or not these improvements may be longlasting has yet to be demonstrated.

With regards to vitamins, several double-blind, placebo-controlled trials of folic acid in depression have shown enhanced antidepressant response with folic acid supplementation (Godfrey *et al.* 1990; Passeri *et al.* 1993; Coppen & Bailey 2000). When 127 patients with depression received either 500 µg folic acid or placebo

for 10 weeks, in addition to antidepressant therapy, a significant improvement was observed in the treatment group (Coppen & Bailey 2000). More specifically, 93.9% of women receiving folic acid showed a good response, compared with 61.1% of women receiving the placebo. A good response was characterised by a greater than 50% reduction in score on the Hamilton Rating Scale of depressive symptoms. It is worth noting that this dosage is in line with the inner 95% range of values (which represents the 2.5th percentile to the 97.5th percentile) of a sample of adult males from the National Diet and Nutrition Survey (NDNS) who reported folate intakes from 144–680 µg/day and 111–551 µg/day for adult females (Henderson *et al.* 2003).

Similarly for vitamin B<sub>6</sub>, a recent systematic review of its role in the treatment of depression reported findings from five randomised controlled trials and one intervention study (Williams *et al.* 2005). While it was concluded that there is no obvious role for vitamin B<sub>6</sub> as a treatment for depression in general, for pre-menopausal women there is consistent evidence to support the use of vitamin B<sub>6</sub> to treat depression. Another vitamin studied in similar way is thiamin. In a placebo-controlled study of 120 female adolescents, there was significantly more behavioural improvement in the group treated with 50 mg thiamin, compared with placebo (Benton *et al.* 1997). This level of supplementation is much higher than the inner 95% range of thiamin values (0.63–2.66 mg/day) reported in a NDNS sample of adolescent females (Gregory *et al.* 2000).

With regard to minerals, there has been one placebo-controlled trial with zinc supplementation. In six adults with major unipolar depression, 25 mg of zinc was found to augment antidepressant therapy, a finding not reported in the eight patients receiving the placebo (Nowak *et al.* 2003). This dose is slightly higher than the inner 95% range of zinc values in a sample of NDNS adults, reported as 4.9–19.6 mg/day in males and 3.3–17.3 mg/day in females (Henderson *et al.* 2003). Chromium supplementation at a dose of 600 µg/day has been shown to be effective in a placebo-controlled, double-blind pilot clinical trial in ten patients with major depression and five healthy controls (Davidson *et al.* 2003). This dosage is much higher than usual chromium intakes, which are around 246 to 343 µg/day in UK adults (Rowbotham *et al.* 2000).

### *Mechanisms for effects*

Nutrients may improve mental health via three mechanisms: first, by correcting nutrient inadequacies arising from a long-standing poor diet. This might have been

brought about by, or contributed to, the mental condition through loss of appetite and poor personal care during a depressive episode, leading to inadequate intake. The addition of key nutrients that can contribute to mental health, such as omega-3 fatty acids and folic acid, may be particularly helpful in long-standing disorders where disruption of a normal diet has become chronic. Second, if there is an existing condition where nutrient absorption, transport or storage is affected, then pharmacological doses of certain dietary supplements may be required to meet the raised nutritional need for a particular individual in order to improve his or her mental health. Third, nutrients may influence the effectiveness of antidepressant medication. This has been observed in studies using omega-3 fatty acids and folic acid in the treatment of individuals with treatment-resistant depression (Godfrey *et al.* 1990; Coppen & Bailey 2000; Peet & Horrobin 2002; Su *et al.* 2003).

Nutrients are essential substrates for brain function; therefore, treatment effectiveness may be partially determined by an individual's nutritional status (Bodnar & Wisner 2005). Medication may fail to surmount deficiencies in a poorly nourished brain, commonly found in depression, hence leading to differences in treatment outcomes among patients receiving similar medication.

Polyunsaturated fatty acids (PUFA) are key structural components of phospholipid membranes in tissues throughout the body and are contained in vast quantities in the brain, where they determine neurotransmitter function. Therefore, an alteration in the fatty acid composition of cell membranes will impact upon the function of neurotransmitters, such as serotonin, which is known to influence mood (Salem *et al.* 2001). Folic acid and vitamin B<sub>12</sub> are required for normal central nervous system functioning. They may affect mood as they are required for the synthesis and metabolism of serotonin (Bottiglieri 2005). Moreover, elevated homocysteine concentrations are a consequence of folate or vitamin B<sub>12</sub> deficiency, and this could contribute to the pathogenesis of depression, as high levels of homocysteine are toxic to neuronal cells (Clarke *et al.* 1998; Mattson & Shea 2003).

The mechanism by which selenium affects mood has yet to be specified. However, the metabolism of selenium in the brain is dissimilar to its metabolism in other organs and is therefore postulated to influence brain function (Whanger 2001). Interestingly, when selenium levels are limited, the brain has priority of its supply over other tissues, such as the muscle or kidneys (Hawkes & Hornbostel 1996). Moreover, selenium is needed for both the synthesis and metabolism of thyroid hormones, and symptoms of depression have been associated with

minor changes in thyroid function (Henley & Koehnle 1997). Hence, it may be that selenium acts in the brain indirectly through an effect on thyroid function.

### Food intake, mental health and depression

In recent years, many fields of nutrition and health have moved away from examination of specific nutrients to studies of mixtures of foods or overall patterns of eating. Because nutrients are never eaten in isolation in food, positive results from these studies are more easily translated into public health advice, enabling direct implementation of research results into practice. While there is still little research relating dietary patterns to depression or mental health in general, a number of studies are emerging where this approach has been taken, and there is scope for much work in this area.

Unhealthy eating (assessed by frequency of consumption of common food groups, such as dairy foods; fruits and fruit juice; vegetables; sweets, cakes and soft drinks; and salty snacks, such as crisps) has been associated with problematic behaviours in adolescent boys and girls, including substance misuse, delinquency and suicide attempts (Neumark-Sztainer *et al.* 1997). Eating a healthy diet has been found to be protective against depression and stress in adolescent girls (Brooks *et al.* 2002). The efficacy of an oligoantigenic diet (a diet composed of well-tolerated foods, with the intention of inducing few allergic responses) compared with methylphenidate medication, was examined in a controlled trial involving 49 children with hyperactive/disruptive behaviour (Schmidt *et al.* 1997). Although methylphenidate yielded significantly more behavioural improvement (44%) than dietary changes (24%), this preliminary study highlights the potential value of diet as a treatment and/or adjunct to usual treatment for behavioural problems.

Patterns of dietary behaviours, including social interactions at mealtimes and eating location, may have important influences on mental health. The first non-clinical population-based study to describe associations between depressive symptoms, eating and other health-promoting behaviours in adolescents found that self-reported depressive symptoms were negatively associated with health-promoting behaviours, such as eating breakfast, lunch and dinner (Fulkerson *et al.* 2004). Breakfast consumption has, in fact, been purported to elevate mood (Lombard 2000), wellbeing (Smith 1998), cognitive function and performance (Bellisle 2004). A study of 29 schoolchildren aged 9–16 years reported better mood in the children who regularly consumed breakfast compared to those that did not (Wesnes *et al.* 2003).

Lower self-reported depression scores were also observed in children who consumed breakfast in a cross-sectional study (Murphy *et al.* 1998). Therefore, eating breakfast can be regarded as a health-promoting behaviour, associated with improvements in mood and cognition.

### Obesity and depression

As well as specific nutrients and mixtures of foods having direct effects on the brain, there are a number of complicating factors, which must be taken into account when examining the relationship between diet and depression, particularly in adolescents. A major consideration of this type is obesity, the role it has in depression itself, and the effect that dietary change may have on bodyweight and hence indirectly on depression.

There are several studies showing an association between obesity and depression in adolescents (Erickson *et al.* 2000; Onyike *et al.* 2003; Richardson *et al.* 2006), and adults (Borges *et al.* 2002; Fontelle *et al.* 2003; McElroy *et al.* 2004; Simon *et al.* 2006). Obesity in the US adult population has been found to be associated with a 25% increase in mood and anxiety disorders (Simon *et al.* 2006). A demographic variation was also reported where the association was strongest in non-Hispanic whites and college graduates, suggesting social and cultural impacts on obesity and mood disorder associations.

Obesity in adolescents may lead to a higher risk of depression in later life (Mustillo *et al.* 2003; Herva *et al.* 2006), while depression in childhood or adolescence may be a risk factor for adult obesity (Barefoot *et al.* 1998; Pine *et al.* 2001; Goodman & Whitaker 2002; Stice *et al.* 2002; Richardson *et al.* 2003). Obesity is also listed in the National Institute for Clinical Excellence (NICE 2005) report as a known risk factor for depression, although its precise role is unclear. Gender differences have been reported in obesity and depression associations, with some studies reporting stronger associations in women (Barefoot *et al.* 1998; Richardson *et al.* 2003; Needham & Crosnoe 2005) and others in men (Goodman & Whitaker 2002; Eisenberg *et al.* 2003; Mustillo *et al.* 2003).

In spite of an extensive literature showing a clear association between depression and obesity, there is a lack of consistency, with others not finding such an association (Britz *et al.* 2000; Lamertz *et al.* 2002; Brewis 2003; Eisenberg *et al.* 2003). For example, in a study of 219 children aged 6–12 years, of whom 24.2% were obese, there were no differences in mental wellbeing between the obese and non-obese children (Brewis 2003). Possible explanations for this lack of association include variation in measurement of weight and depres-

sion, and a failure to examine potential moderating variables, such as gender or ethnicity. Indeed, it is important that future research tries to identify other potential moderating factors influencing the relationship between bodyweight and mood, such as pubertal status, self-esteem, environment and genetics.

Structural abnormalities are observed in depressed subjects as a consequence of decreased neurogenesis and neurotrophic factor levels, and evidence exists that neurotrophic and neurogenic actions are involved in the pathophysiology and treatment of depression. Mice with the brain-derived neurotrophic factor (BDNF) gene deleted, demonstrate increases in food intake, bodyweight and locomotor activity (Rios *et al.* 2001; Coppola & Tessarollo 2004; Mattson 2005). These mice also go on to develop insulin-resistance syndrome. However, all of the above are normalised when mice are placed under dietary restriction. This is believed to be because dietary restriction increases the expression of BDNF (Lee *et al.* 2002; Duan *et al.* 2003). On the other hand, a high-fat and refined-sugar diet has been shown to reduce hippocampal BDNF expression in rats (Molteni *et al.* 2002). Hence, there may be direct effects of obesity on depression mediated through neurotrophic and neurogenic factors in the brain, which would be modified by dietary restriction and reduced bodyweight.

During a depressive episode, some sufferers overeat carbohydrate-rich food, which, as indicated, is hypothesised to have a medicating effect through increases in brain serotonin (Wurtman & Wurtman 1995). Therefore, the more carbohydrate is consumed, the greater the release of serotonin from brain neurons, which could result in mood improvement. Unfortunately, a likely consequence of this self-medicating practice is weight gain, which may compound feelings of depression (Eisenberg *et al.* 2003). A higher body mass index has been shown to influence body image relating to feelings of body dissatisfaction in adolescents (Rolland *et al.* 1996; Candy & Fee 1998). Body dissatisfaction has been associated with depressive symptoms (Eisenberg *et al.* 2003), suggesting that the relationship between obesity and depression may be compounded by negative feelings about body image.

A negative body image in an overweight person may lead to intentional food restriction (dieting), where weight loss may be regarded as the solution for improving self-esteem and mood. However, owing to the cyclical nature of the relationship between dieting, self-esteem and mood, the dieting process may lower mood. This was observed in a study by Cachelin and Regan (2006), who reported a positive correlation between dietary restraint, depression and self-esteem.

## Adolescent eating patterns – room for improvement?

In a recent National Opinion Poll, younger people reported consuming higher quantities of less healthy foods (takeaways, ready meals, high-fat/sugary snacks) and lower intakes of healthy foods, such as fruit and vegetables or meals made from scratch. Indeed, only 29% of 15- to 24-year-olds reported eating a daily meal made from scratch (MHF 2006). Evidence suggests that adolescents eating an evening meal with their families have more healthful dietary patterns than adolescents who do not, including: higher intakes of fruit, vegetables and dairy foods; substantially higher intakes of several nutrients; lower glycaemic load; lower consumption of soft drinks; and lower levels of saturated fatty acids and *trans* fatty acids (Gillman *et al.* 2000; Neumark-Sztainer *et al.* 2003; Videon & Manning 2003). Not surprisingly, therefore, obesity is also inversely associated with eating dinner with one's family (Taveras *et al.* 2005). However, if adolescents are not eating meals with their family, they may be obtaining food from fast food outlets or eating while watching television. This is cause for concern, because frequency of fast food restaurant use is positively associated with total energy intake, percentage of energy from fat, soft drink consumption and less healthy food choices, and inversely associated with daily servings of fruit; vegetables and milk (French *et al.* 2001). Similarly, eating while watching television is associated with higher intakes of ready meals, snack foods and soft drinks, but lower intakes of fruit and vegetables (Coon *et al.* 2001).

It is particularly important that age-appropriate measures are used if nutrition education programmes are to be successful (Contento *et al.* 2002). In one study of health-promotion intervention in adolescents in primary care, the efficacy of intervention in improving four key areas of health-related behaviours (diet, exercise, smoking and drinking alcohol) was assessed (Walker *et al.* 2002). The health-related behaviour that adolescents most commonly wanted to discuss was diet (50%), followed by exercise (36%), dealing with stress (23%) and smoking (13%). At 3 months, the intervention group had significantly more positive movement in stage of change (41%) than the control group (31%) in at least one of the four key areas. Diet and exercise were the only two areas demonstrating a significant positive effect of intervention. This study shows the potential impact on diet that intervention strategies targeted at improving adolescent health can have. Importantly, it confirms that adolescents seek and welcome advice and information about health-related behaviours, and primary care is an acceptable access route.

Parental attitude and input is likely to have a crucial impact on young people's eating habits, and is therefore likely to be of importance in any strategies to improve adolescent diet. In one study, adolescents whose mothers felt that eating family meals together was not important were more likely to be overweight by the age of 14 years, compared with those whose mothers felt that eating together was important (Mamun *et al.* 2005). Mothers attributing low importance to eating together also reported increased television viewing and fast food and soft drink consumption in their offspring. Interventions designed to promote healthy eating in adolescents would ideally also engage parents if the social environment is to be conducive to behaviour change in the long-term.

Adolescents with depressive symptoms tend to engage less in health-promoting behaviours and are more likely to possess health-compromising attitudes and behaviours than non-depressed individuals (Fulkerson *et al.* 2004), so interventions aimed at promoting a healthier diet alone may not suffice when attempting to improve the nutrition of this population subgroup.

### **The role of diet in the prevention and management of depression**

The National Service Framework for Children (2004) has outlined the importance of developing policies for the promotion of wellbeing and the prevention of mental disorders (<http://www.dh.gov.uk/PolicyAndGuidance/HealthAndSocialCareTopics/ChildrenServices/ChildrenServicesInformation/fs/en>). Priority is given to community-based models of care and detection of young people at risk for emotional and behavioural difficulties, the prevention of obesity, and improving social and education competencies. There is an urgent need for alternative support of adolescents with mild-moderate mental health difficulties in the community. Increasingly, mental health services are under pressure to target resources to treat those in most urgent need with severe disorders. Up to 50% of referrals would benefit from earlier detection and intervention, prior to the advent of severe illness and impairment.

Waiting lists for treatment from child and adolescent mental health services and paediatric clinics could be markedly diminished if schools and primary care agencies were equipped with evidence-based knowledge, skills and tools to undertake adolescent-focused health programmes. Dietary strategies could play a crucial role in these community-based health-promotion initiatives. Unfortunately, the potentially important role of diet in mental wellbeing remains under-recognised, perhaps owing to a lack of awareness of the research evidence, or

scepticism surrounding diet as capable of influencing mood and behaviour. As a result, dietary strategies are not currently employed in mainstream therapy.

There is a shift towards service user involvement and patient empowerment in treatment and care pathways. Self-help strategies are being developed for the short- and longer-term management of illness. Self-help can mean lifestyle changes, such as eating a healthy diet and increasing physical activity levels. However, in the latest NICE report (2005) of depression in young people, diet is not specifically discussed in the main report and is given only a brief mention in the appendix (K). Indeed, there is only a brief summary of advice that has been promoted by the Department of Health as being important in supporting physical and mental wellbeing. This list comprises: healthy diet (five portions of fruit and vegetables), and three nutrients that potentially ameliorate depressive symptoms, namely omega-3, selenium and magnesium. However, information on effective doses and suitability for children and young people is not provided. This appendix also includes diet in discussion of complementary therapies:

Children, young people and/or their families may choose to use complementary therapies, herbal remedies or nutritional supplements as a self-help intervention for the management of depressive symptoms. They may feel that these complementary treatments are more natural or safe, however, harm and benefit profiles of these treatments have not been convincingly established and it is a largely unregulated industry. (NICE Guidelines, Appendix K, p. 199)

Although it is a positive step that some nutrients are acknowledged as possible forms of therapy, the above statement does little to inspire confident use of dietary supplements. It is clear that there are important deficits in the current evidence base, rendering it difficult to develop self-help strategies employing dietary change. This is an area in need of much input, particularly as the general public report preferences for talking and complementary therapies, including diet, to manage mental health difficulties (Jorm *et al.* 1997).

### **Conclusion and recommendations**

Dietary improvement and specific supplementation offer the potential for inexpensive, safe and acceptable intervention as an adjunct to standard treatment for depression in adolescence, as well as supporting wellbeing in healthy adolescents. However, it is not yet clear what characteristics of adolescent depression, such as degree of severity or duration of illness, are associated with a pos-

itive response to dietary intervention, and more research is needed to clarify this. Overall, there is emerging evidence for an association between low dietary intakes of certain nutrients and certain eating behaviour patterns with the occurrence of common forms of emotional and behavioural disorders across all ages. However, much more research is needed on specific disorders and with young people. In particular, little is known about the longitudinal relations between diet and mental health, and prospective studies should be considered a priority. There is scant research evidence to support the safety and efficacy of supplement use, and randomised controlled trials are urgently needed to provide this information. Further research on the associations between depression and obesity is also needed. With a stronger evidence base, it will be possible to inform dietary intervention and education policies aimed at mental health promotion and illness prevention in mainstream practice.

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