2012

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## Publication Details

Forsyth, A. K., Williams, P. G. & Deane, F. P. (2012). Nutrition status of primary care patients with depression and anxiety. Australian Journal of Primary Health, 18 (2), 172-176.

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**Keywords**
depression, anxiety, primary, care, nutrition, patients, status



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CSIRO PUBLISHING

*Australian Journal of Primary Health*
http://dx.doi.org/10.1071/PY11023

Research

# Nutrition status of primary care patients with depression and anxiety

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**Abstract.** The objective of this study was to evaluate the nutrition status of people referred to a nutrition and physical activity program for the management of mental health in general practice. Patients currently being treated for depression and/or anxiety were referred by their GPs to a lifestyle intervention program. The nutrition status was assessed during a comprehensive assessment at the commencement of the program. The lifestyle intervention program, including all assessments, was offered at multiple sites including GP clinics in the Illawarra, and in clinic rooms at the University of Wollongong. Thirty-two men and seventy-seven women completed the assessment. Patients were referred with depression (52%), anxiety (19%) or both (28%). Eighty percent of participants were overweight or obese. All participants completed an assessment that included a diet history, anthropometric measurements and the completion of several questionnaires including the Depression, Anxiety and Stress Scale (DASS). Nutrition status was assessed using mean nutrient intakes and Australian modified Healthy Eating Index scores evaluated against the National Nutrition Survey intakes and DASS scores. Participants met the estimated average requirements for all nutrients except folate (17%), magnesium (78%) and calcium (57%). Intakes were similar to those reported in the National Nutrition Survey. Only magnesium intakes were significantly related to depression ($r = -0.26$). Australian modified Healthy Eating Index scores were significantly negatively correlated with DASS scores ($P < 0.01$). The associations presented here support the existing body of literature. Nutrition recommendations for patients with depression and anxiety should be based on the Australian Guide to Healthy Eating with particular attention to fruit, vegetables and wholegrains.

Received 25 February 2011, accepted 4 August 2011, published online dd mmm yyyy

## Introduction

Mental illness is experienced by 18% of Australian adults in any given year (Department of Health and Ageing 2007). This represents 24% of the non-fatal disease burden in Australia (Begg *et al.* 2007). Depression, anxiety and substance abuse are the leading diagnoses of mental illness in Australia (Korten and Henderson 2000), and are most commonly treated with medication and psychological interventions (Ellis *et al.* 2004). There is growing interest and evidence to support diet and exercise interventions in the treatment of mental illness including depression and anxiety (Martinsen and Raglin 2007), but little is known about the optimal method of delivery of these services. A study was conducted to test the feasibility and effectiveness of delivering diet and exercise interventions through a primary care model. Patients were referred by GPs and seen by a dually qualified accredited practising dietitian and accredited exercise physiologist (DEP) and individual consultations could be rebated by the Chronic Disease Management Scheme (Newland and Zwar 2006). The study and program were part of the Australian Integrated Mental Health Initiative, which is a 5-year National Health and Medical Research Council funded program aimed at improving recovery from mental illness.

Despite increasing interest, there is little known about the dietary intake of people with depression and anxiety. Some studies have demonstrated that people with depression consume more carbohydrate (Pellegrin *et al.* 1998), less polyunsaturated acids and dietary fibre (Zhang *et al.* 2005) and more saturated fat and cholesterol (Payne *et al.* 2006) than people without depression. The limited evidence in this area and inconsistent results are insufficient to make conclusions, particularly within the Australian context. The baseline data collected from participants entering the diet and exercise intervention study are reported here to contribute to the body of knowledge that can form a basis for the development of nutrition guidelines and programs for patients presenting with depression and anxiety.

## Methods

GPs in the Illawarra Division of General Practice were informed about the program through continuing education events and newsletter articles, and were invited to refer adult patients currently being treated for depression and anxiety via referral

forms available in both electronic and hard copy. Patients under 18 years of age and those with contraindications to participation in physical activity such as uncontrolled hypertension or unstable angina pectoris were excluded from the study. From 2006 to 2008, 142 patients were referred to participate. Of these, 109 met the inclusion criteria and completed an initial assessment. Informed consent was obtained from all participants before participation, and study methods were approved by the University of Wollongong Human Ethics Committee. For a detailed description of the methods used, refer to Forsyth *et al.* (2009).

The data presented in this article were collected from the initial assessment that was conducted before participation in the program. Assessments were conducted by four accredited DEP or trained final year nutrition and exercise science students. The assessments involved a comprehensive diet history (Martin *et al.* 2003), and the collection of completed questionnaires including the Depression, Anxiety and Stress Scale (DASS) (Lovibond and Lovibond 1995). Other measures of anthropometry and fitness were collected at the assessment. Body mass index (BMI) and waist circumference will be reported here, with findings of fitness and participation in physical activity reported elsewhere.

Dietary intake was analysed for energy and micronutrient intake by daily intake and as a percentage of the estimated average requirements (EAR) (National Health and Medical Research Council 2006) using the Xyris Foodworks software program version 3.1 (Brisbane, Qld, Australia). The Australian Modified Healthy Eating Index (Aust-HEI) (Australian Institute of Health and Welfare 2007) was applied to the information collected in the diet histories. This index rates how well diets conform with national dietary guidelines to obtain a rating score out of 60. Associations between DASS scores and both nutrient intake and Aust-HEI scores were evaluated using Pearson's correlations. Under-reporting of energy was determined by taking a ratio of reported energy intake to basal metabolic rate (BMR) and applying the Goldberg cut-off limits of 1.55 × BMR for diet histories (Goldberg *et al.* 1991).

## Results

A total of 32 (29%) men and 77 (71%) women completed an initial assessment. On average, the patients referred were obese and abdominally obese with a mean BMI of 31.1 kg m$^{-2}$ (range 19.6–51.8) and mean waist circumference 104.6 cm (range 76.0–148.0 cm) for males and 92.6 cm (range 61.5–123.5 cm) for females. Twenty-two patients (20%) had BMI within the recommended healthy weight range (BMI 20–25). The other 87 patients (80%) were overweight or obese with a BMI of over 25. Neither BMI nor waist circumference was significantly related to psychological distress. Using the Goldberg cut-offs, 74% of subjects were categorised as under-reporters. The degree of under-reporting was not related to BMI ($r = -0.08$, $P = 0.42$).

Patients referred to this program displayed slightly lower levels of depression, stress and anxiety compared with primary care patients referred for psychological intervention in another Australian study (Vines *et al.* 2004) (Table 1). On average, patients had their first episode of mental illness 14.3 years ago (range 1–50 years ago). Patients described their primary mental health problem as depression (28%), anxiety (7%), schizophrenia (1%), bipolar disorder (9%), or both depression and anxiety (45%). Ten percent of patients did not describe their mental health problems. According to GPs, patients referred were currently being treated for depression (52%), anxiety (19%) or both (28%). Concurrent conditions noted by GPs included bipolar disorder (2%), schizophrenia (1%) and eating disorders (1%).

All nutrient intakes calculated by Foodworks software were expressed as a percentage of EAR and analysed in relation to DASS scores. Although the nutrient intake of the patients referred was similar to that of the general Australian population as measured in the last National Nutrition Survey (NNS) in 1995 (McLennan and Podger 1998), many participants were not meeting the EAR (Fig. 1). Only 17% of participants met the EAR for folate, with 78% and 57% meeting the EAR for magnesium and calcium, respectively. The EAR for folate is 320 µg per day. Study participants consumed a mean of 253 µg per day (range 24–507 µg).

Only magnesium intake was significantly related to DASS scores. Magnesium intake expressed as % EAR was negatively correlated with depression, stress and total DASS scores as shown in Table 2. This relationship was not significant when magnesium was expressed in absolute amount consumed (mg per day).

No significant correlations were found between other micronutients, macronutrients or total energy intake and DASS scores. Intakes of most macronutrients were higher in males than

**Table 1. Mean (s.d.) levels of depression, anxiety and stress measured using the Depression, Anxiety and Stress Scale (DASS), with comparison to results from another recent Australian study of primary care patients (Vines *et al.* 2004)**

| | This study (DASS-21 scores) | Vines *et al.* (2004) referred for psychological intervention (DASS-42 scores) | Vines scores/ 2 for comparison |
|---|---|---|---|
| Depression | 9.08 (5.75) | 20.38 (12.03) | 10.19 |
| Anxiety | 5.75 (4.38) | 15.03 (10.95) | 7.52 |
| Stress | 8.93 (5.29) | 22.71 (10.86) | 11.36 |

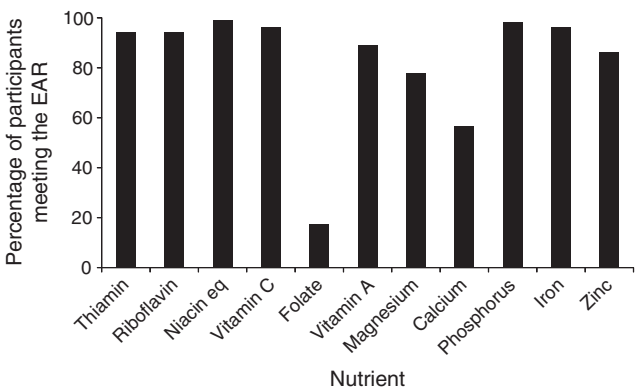


**Fig. 1.** Dietary intake of participants and baseline expressed as % of participants meeting the estimated average requirements (EAR).

**Table 2. Correlations between magnesium intake by percentage of estimated average requirements (EAR) or absolute amount and Depression, Anxiety and Stress Scale (DASS 21-item version) scales (Pearson's correlation coefficient, *r*) (*n* = 109)**

| | | Depression | Anxiety | Stress | Total DASS score |
|---|---|---|---|---|---|
| Mg (%EAR) | *r* | −0.26** | −0.19 | −0.22* | −0.26** |
| Mg (mg day$^{-1}$) | *r* | −0.16 | −0.13 | −0.16 | −0.18 |

*$P < 0.05$, **$P < 0.01$ (2-tailed).

females. This is to be expected given the greater energy needs of males. Only polyunsaturated fatty acid consumption, when expressed as a percentage of energy intake, was slightly but not significantly greater in females (17.9%) than males (16.4%).

The mean total Aust-HEI score of the participants was 42.8 (range 20–60). When the scores were grouped by diet quality, there was a clear reduction in DASS levels in those with the highest Aust-HEI scores. Most subscales of the Aust-HEI were significantly negatively correlated with DASS score except for milk fat and meat fat intake (Table 3). Variety, fruit intake, and total Aust-HEI score were the most significantly associated with depression, anxiety, stress and total DASS score (all $P < 0.01$). Total DASS score was significantly correlated with all subscales.

## Discussion

### *Key findings*

#### *Anthropometry*

The patients referred to this study were overweight and obese. There is a known relationship between depression and obesity (Stunkard *et al.* 2003); however, it is likely that these patients were particularly selected by their GPs for referral to the study program because they were perceived to be in need of counselling from a DEP for their weight problems as well as their mental health problems.

#### *Nutrient intake*

With the exception of magnesium, the energy, macronutrient and micronutrient intake of study participants was not related to DASS scores. A recent study of over 5000 Norwegian adults also found an inverse association (odds ratio 0.70) between magnesium intake and depression (Jacka *et al.* 2009). Magnesium treatment has been used to achieve rapid recovery from depression (Eby and Eby 2006) using 125–300 mg of magnesium four times per day, which is considerably greater than the Australian recommended upper level of intake as a supplement of 350 mg day$^{-1}$ for men and women (NHMRC 2006).

**Table 3. Correlations between subscales of the Australian Modified Healthy Eating Index and Depression Anxiety Stress Scales (DASS) (Pearson's correlation coefficient) (*n* = 109)**

Aust-HEI, Australian modified Healthy Eating Index

| Aus-HEI subscale | Depression | Anxiety | Stress | Total DASS score |
|---|---|---|---|---|
| Variety | −0.33*** | −0.25** | −0.29** | −0.34*** |
| Healthy choices | −0.23* | −0.124 | −0.20* | −0.22* |
| Fruit intake | −0.31** | −0.25** | −0.38*** | −0.37*** |
| Vegetable intake | −0.24* | −0.12 | −0.15 | −0.21* |
| Milk fat | −0.07 | −0.03 | −0.08 | −0.07 |
| Meat fat | −0.12 | −0.14 | −0.14 | −0.15 |
| Junk food | −0.24* | −0.13 | −0.24* | −0.24* |
| Total HEI score | −0.37*** | −0.26** | −0.37*** | −0.39*** |

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$.

The mean total Aust-HEI score of the participants (42.8) was higher than the mean score of 35.0 for the diet intakes recorded in the 1995 NNS (Australian Institute of Health and Welfare 2007). This difference can be mostly attributed to differences in scores for the variety (5.6 in NNS, 9.4 in this study) and healthy choices (4.6 in NNS, 8.5 this study) subscales. This may reflect differences in dietary assessment methods rather than actual dietary differences since a diet history was used in this study, whereas the NNS used a 24-h recall method. A review of the NNS data (Australian Institute of Health and Welfare 2007) found that women scored higher than men, so the scores in our study may be skewed by the large proportion of women participating.

The significant correlations between the Aust-HEI and DASS scores may appear to contradict the apparently adequate individual nutrient findings. However, the Aust-HEI evaluates the consumption of whole foods. This may be an important assessment tool because it reflects the consumption of foods that contain other nutritious compounds that are not quantified in a nutrient software program analysis. There is also evidence to suggest that the consumption of whole nutritious foods provides greater benefit than simply meeting nutrient requirements (Jacobs and Tapsell 2007).

The findings of this study suggest that people with more severe symptoms of depression and anxiety are consuming less variety, fewer healthy choices, fewer serves of fruit and vegetables, and more junk (low nutrient density, high energy density) food than those with less severe depression and anxiety. It is not possible from this cross-sectional study to discern whether this association means that poor diets may be contributing to poor mental health, or whether patients with depression and anxiety find it more difficult to access healthy diets. However this data provides specific findings that can be used by dietitians or GPs to form the basis of recommendations for patients with mental health problems.

The mean intakes of individual nutrients in our study were similar to those published in the NNS (McLennan and Podger 1998). Despite consuming 'normal' amounts of each nutrient, nearly half of the study participants were not consuming the EAR for calcium, and less than one-fifth of study participants met the EAR for folate. There is little research to suggest a role for calcium in mental health problems, but there is a growing body of evidence to suggest that folate plays an important role in maintaining good mental health, particularly with respect to depression. Low folate intake has been associated with depression in French men (Astorg *et al.* 2008), Finnish men (Tolmunen *et al.* 2004), and Korean men and women (Kim *et al.* 2008). The most recent Cochrane review based on three clinical trials suggests that folate may play a role in the treatment of depression (Taylor *et al.* 2003).

It should be noted that the EAR were used as dietary references here rather than the recommended dietary intakes (RDI) for nutrients. The EAR represents the intake that would be adequate to meet the needs of 50% of the population and is used to assess intakes of groups, whereas the RDI represents the intake that would be adequate to meet the needs of 50% plus two standard deviations (or 98%) of the population and is used to assess individual intakes. By using the EAR as a reference point in this study, the intakes of participants were compared with a lower standard. This makes the low levels of calcium and folate consumed even more striking.

With the mandatory fortification of bread with folate introduced in 2009 (see Australia New Zealand Food Standards Code Standard 2.1.1 in Food Standards Australia New Zealand 2010), the folate intake of the study population (measured from 2006 to 2008) would be expected to increase. Eating the mean daily adult Australian intake of three slices of bread daily (Australian Bureau of Statistics 1999) would yield an additional 200 µg of dietary folate equivalents. When added to the mean intake of 253 µg per day, the mean group intake would exceed both the EAR of 320 µg per day and the RDI of 400 µg per day. At this level, 80% of participants would meet the RDI and 93% of participants would meet the EAR for folate.

### *Strengths and limitations of the current study*

There are several important factors to consider when reviewing these results. The population studied may not be reflective of all adults with depression or anxiety. Study participants were all community dwelling men and women referred by their GPs. This means that the most severe cases, such as those receiving inpatient hospital treatment, were not included. Also excluded were people who are not accessing primary health care services for socioeconomic, geographic, or other reasons. There was also considerable diversity among study participants. Patients may have been referred when currently being treated for depression, anxiety or both depression and anxiety. Some patients also had other comorbid mental health conditions. The treatment methods used by patients before entry to and during participation in the study included medications, psychological interventions including cognitive behavioural therapy, and group therapy. Some patients were not receiving any of these treatments.

The results, reported as nutrient intakes and Aust-HEI scores, are based on the reports from participants obtained in the diet histories. Despite significant training of the dietitians and students involved in taking the diet histories to maximise accuracy, the intakes reported are highly dependent on receiving accurate responses from participants. The study population was mostly overweight and obese, and there is typically a high incidence of under-reporting amongst overweight and obese people (Maurer *et al.* 2006). This may be compounded by depression and anxiety, and feelings of guilt over emotional eating (Kretsch *et al.* 1999). The level of under-reporting that occurred in this study was very high, but not unusual, and was not related to BMI. The common relationship between under-reporting and BMI may not have appeared in this population because most of the subjects were overweight or obese. Under-reporting was inversely related to intakes of the key nutrients folate ($P < 0.01$) and magnesium ($P < 0.01$) when expressed as mg $mJ^{-1}$. That is, those with poor intake of folate and magnesium were least likely to under-report their overall intake.

The results presented here are supported by three earlier studies that have found a relationship between diet and mental health. Cohen *et al.* (2002) found that people with mild and moderate psychological distress ate fewer fruit and vegetables and more high fat choices. Adults in Helsinki with poor mental health were less likely to adhere to dietary guidelines including the consumption of fruit, vegetables, reduced fat milk and wholegrains (Sarlio-Lähteenkorva *et al.* 2004). Adults with a history of suicide attempts were also more likely to underconsume fruit and vegetables (Li *et al.* 2009).

### *Recommendations*

Given the demonstrated relationship between dietary intake and mental health, GPs should consider brief screens of their patients' food intake to determine whether further action is required. General messages about healthy eating using the Australian Guide to Healthy Eating (Smith *et al.* 1998) will be appropriate for most patients because they were designed to ensure adequate intake of all nutrients for Australian adults. Particular attention should be paid to consuming a variety of wholegrains, fruit and vegetables (especially dark leafy greens) as these are a good source of magnesium and folate. Individuals should aim for a minimum of two serves of fruit and five serves each of vegetables and wholegrains daily (Smith *et al.* 1998).

## Conclusion

The patients with depression and anxiety referred to this nutrition and exercise program by their GPs tended to be overweight and obese. Their nutrient intakes were similar to those of the general population. Magnesium intake was negatively correlated with DASS score and less than one-fifth of the study population met the EAR for folate. Evidence exists to support the use of folate in the treatment of depression (Taylor *et al.* 2003) and the results presented here warrant further investigation into the use of magnesium in the prevention and treatment of depression. The results of the Aust-HEI indicated that those with more severe depression and anxiety consumed less variety, had fewer healthy choices, fewer fruit and vegetables, and more junk food (low nutrient density, high energy density).

## Conflicts of interest

Funding for this study was received from the National Health and Medical Research Council, and from the Illawarra Division of General Practice. These sources provided financial support only, and were not involved in study design, data collection, analysis and interpretation, or writing of the article. The authors disclose that there are no financial or professional relationships that might pose a competing interest. The supporting sources were not involved in the decision to submit the final manuscript for publication.

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