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Protective lifestyle behaviours and depression in middle-aged Irish men and women: a secondary analysis

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Abstract

Objective: To examine the association between protective lifestyle behaviours (PLB) and depression in middle-aged Irish adults.
Design: Secondary analysis of a cross-sectional study. PLB (non-smoker, moderate alcohol, physical activity, adequate fruit and vegetable intake) were assessed using a general health and lifestyle questionnaire and a validated FFQ. Depression was assessed using the Center for Epidemiologic Studies Depression Scale. A score of 15–21 indicates mild/moderate depression and a score of 22 or more indicates a possibility of major depression. Binary logistic regression was used to examine the association between PLB and depression.
Setting: Livinghealth Clinic, Mitchelstown, North Cork, Republic of Ireland.
Subjects: Men and women aged 50–69 years were selected at random from a list of patients registered at the clinic (n 2047, 67 % response rate).
Results: Over 8 % of participants engaged in zero or one PLB, 24 % and 39 % had two and three PLB respectively, while 28 % had four PLB. Those who practised three/four PLB were significantly more likely to be female, have a higher level of education and were categorised as having no depressive symptoms. Engaging in zero or one PLB was significantly associated with an increased odds of depression compared with four PLB. Results remained significant after adjusting for several confounders, including age, gender, education and BMI (OR = 2·2; 95 % CI 1·2, 4·0; P for trend = 0·001).
Conclusions: While causal inference cannot be established in a cross-sectional study, the findings suggest that healthy behaviours may play a vital role in the promotion of positive mental health or, at a minimum, are associated with lower levels of depression.

Keywords
Lifestyle
Diet
Smoking
Alcohol
Physical activity
Depression
Public health

Depressive disorders are a growing public health concern both on a national and international level, and are posing an ever-increasing burden on the health and economy of both developing and developed countries[1,2]. According to the WHO, more than 350 million people of all ages suffer from depression and there is an average of one million deaths from suicide per year on a global scale[1]. Depressive disorders account for approximately 20 % of the European burden of disease, while in the Irish context it is estimated that one in ten people will be affected in their lifetime[3,4].

Studies have suggested that certain lifestyle behaviours such as a healthy diet, physical activity, moderate alcohol consumption and non-smoking may be linked to positive mental health[5–10], while their underlying mechanisms may be explained by a number of different pathways. For example, a high-quality diet may influence molecular activity and lead to a reduction in inflammatory and oxidative stress[7,11,12]. Physical activity may contribute to an increase in confidence, self-esteem and optimism, as well as an increase in endorphins in the brain[13–17]. Similarly, excessive alcohol consumption and nicotine use are thought to influence the role of neurotransmitter systems[18,19], while both are also associated with other non-communicable diseases such as hypertension, myocardial infarction and stroke, which in turn can lead to an increase in depression[20–25].

The process of linking these isolated behaviours to a condition of complex origin may not always be possible, however, as people tend to engage in several lifestyle choices. As a result, the role of protective lifestyle behaviours (PLB) in combination has been explored[26,27] and

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has been shown to be associated with a reduced odds of chronic diseases such as mental ill health, diabetes, all-cause cancer and cardiovascular morbidity at a population level[28–30].

Furthermore, in the Irish setting, Harrington *et al.* have proposed that combining PLB (being a non-smoker, consuming moderate alcohol, being physically active and having an adequate fruit and vegetable intake) is negatively associated with mental health among free-living individuals over the age of 18 years. Results from the Irish study have outlined that those with four PLB were four times as likely to have better mental health, as well as an increased life expectancy[30].

However, less is known about the PLB–depression relationship among older adults specifically. Therefore, the aim of the present study was to add to the evidence base that practising a combination of PLB may be associated with positive mental health, with a specific focus on middle-aged Irish men and women in the general population.

Methods

Study design/participants

A secondary analysis of a cross-sectional study conducted in Mitchelstown, North County Cork, Republic of Ireland. The Mitchelstown Cohort[31] was originally conducted to examine the association of dietary and lifestyle factors with the risk of diabetes and CVD. Participants were selected at random from a list of patients aged between 50 and 69 years who were registered at the Livinghealth Clinic in Mitchelstown. This clinic has a catchment area of approximately 20 000 people, from a combination of urban and rural areas. A total of 3807 participants were selected as potential participants for the study. However, due to duplications, deaths and those considered ineligible to participate, 3043 were invited to partake. The final study population consisted of 2047 participants, a 67 % response rate.

Exposure: protective lifestyle behaviours

Smoking

Smoking status was defined as follows: (i) never smoked, i.e. having never smoked at least 100 cigarettes (5 packs) in their entire life; (ii) former smoker, i.e. having smoked 100 cigarettes in their entire life and do not smoke at present; and (iii) current smoker, i.e. smoking at present. These definitions were the same as those used in the National Health and Lifestyle Survey (SLÁN 2007)[32]. A binary variable was then created: 'never/former smoker' or 'current smoker'. For the purpose of the present analysis, 'never/former smoker' was compared with 'current smoker' and 'never/former smoker' was defined as the PLB.

Alcohol consumption

Alcohol consumption was measured in units of alcohol consumed on a weekly basis and was categorised into the following levels: (i) non-drinker, i.e. <1 drink per week; (ii) moderate drinker, i.e. between 1 and 14 drinks per week; and (iii) heavy drinker, i.e. >14 drinks per week. Moderate drinker was defined on the basis of previous work from the European Prospective Investigation into Cancer and Nutrition (EPIC) in the UK by Khaw *et al.*[26]. For the current analysis, these were then re-categorised as 'moderate/non-drinker' or 'heavy drinker', with the former being defined as the PLB.

Physical activity

Physical activity was assessed by the self-reported International Physical Activity Questionnaire (IPAQ) and categorised as low, moderate and high levels of activity[33]. This was then recoded as a dichotomous variable: 'moderate/high' or 'low' physical activity, with 'moderate/high' levels of physical activity being defined as the PLB.

Fruit and vegetable intake

Participants completed a validated self-administered, semi-quantitative FFQ consisting of 150 different foods[34]. Frequency of consumption of a medium serving or common household unit was asked for each food and later converted into quantities using standard portion sizes. Outliers were excluded using standard methods based on energy intake[35]. Individual food items were combined into food groups and a dichotomous variable was created indicating if a participant consumed '≥5 servings' of fruit and vegetables per day or '<5 servings'; consuming '≥5 servings' of fruit and vegetables per day was considered to be the PLB.

The number of PLB was then summed for each participant (possible scores were between zero and four PLB), with higher scores indicating a more positive lifestyle.

Outcome variable: depression

Participants completed a general health and lifestyle questionnaire which included a self-report depression scale: the Center for Epidemiologic Studies Depression Scale (CESD). In addition, standard instruments to assess lifestyle behaviours and demographic details were also included. Evidence suggests that the CESD is a reliable and valid screening tool for depression[36–38], with a sensitivity and specificity of approximately 89 % and 86 % respectively[39]. It comprises twenty well-being questions; the response categories were 'rarely/none of the time' (<1 d), 'some of the time' (1–2 d), 'occasionally or a moderate amount of the time' (3–4 d) and 'all of the time' (5–7 d) in the past week. Level of depression was scored 0–3, with the scoring of positive items being reversed. The sum of the twenty questions is the participant's final score. A score of <15 indicates no symptoms of depression, 15–21 indicates mild

to moderate depression and a score of ≥22 indicates a possibility of major depression[38]. For the current analysis, this was then recoded as 'no depressive symptoms' or 'mild/moderate/major depressive symptoms'.

Confounding variables

Based on the literature[30,40–43], potential confounders considered included age, gender, education and BMI. Categories of education included 'some primary (not complete)', 'primary or equivalent', 'intermediate/group certificate or equivalent', 'leaving certificate or equivalent', 'diploma/certificate', 'primary university degree' and 'postgraduate/higher degree'. These were collapsed and recoded to 'primary', 'secondary' and 'tertiary' categories. BMI was calculated as weight/height^2 by a trained researcher by measuring the participant's weight (in kilograms) and height (in metres), and was characterised into three categories using the WHO definition[44]: underweight/normal' (<18·5 kg/m^2/ ≥ 18·5– < 25 kg/m^2); 'overweight' (≥25– < 30 kg/m^2); and 'obese' (≥30·00 kg/m^2). All covariates were entered as categorical variables, with the exception of age.

Data analysis

Data were analysed using the statistical software package IBM SPSS Statistics Version 20.0. Descriptive analysis, stratified by gender, was used to describe characteristics of study participants. Cross-tabulation with a χ^2 significance test was used to test associations between number of PLB (categorical variable) and demographics (using a 5 % significance level and 80 % power). Binary logistic regression was conducted to assess the relationship between PLB score (categorical variable) and depression. The fully adjusted model was adjusted for age, gender, education and BMI. Results are presented as unadjusted; age- and gender-adjusted; age-, gender- and education-adjusted; and fully adjusted.

Results

Demographics

The study consisted of 2047 participants. The current analysis focuses on 1996 after exclusion of outliers based on energy (kcal) intake, assessed in the FFQ. Participants were aged between 50 and 69 years, of whom 49 % (*n* 978) were male and 51 % (*n* 1018) were female. Table 1 shows sociodemographic, lifestyle and mental health characteristics of study participants, stratified by gender. Over 8 % of participants engaged in zero or one PLB, 23·9 % and 39·4 % had two and three PLB respectively, while 28·3 % had four PLB. Table 2 shows a breakdown of the age group, gender, level of education, BMI and category of depression by number of PLB adhered to by participants. Those who practised three or four PLB were significantly more likely to be female, have a higher level

Table 1 Characteristics of study participants by gender: middle-aged men and women, Mitchelstown, North County Cork, Republic of Ireland

		Males (*n* 978)		Females (*n* 1018)		Total (*n* 1996)	
Variable	Category	%	*n*	%	*n*	%	*n*
Age (years)	Mean and SD	59·7	5·5	59·8	5·5	59·7	5·5
Level of education	Tertiary	19·7	183	26·5	251	23·1	434
	Secondary	47·9	446	49·9	473	48·9	919
	Primary	32·4	302	23·6	224	28·0	526
BMI category	Underweight/normal	14·3	139	29·6	301	22·1	440
	Overweight	49·5	482	41·7	425	45·5	907
	Obese	36·2	353	28·7	292	32·4	645
Smoking status	Never smoked	42·9	407	58·9	579	51·1	986
	Former smoker	42·2	400	26·3	259	34·1	659
	Current smoker	14·9	141	14·8	145	14·8	286
Alcohol consumption	Moderate drinker	59·5	427	72·0	425	65·1	852
	Non-drinker	16·7	120	24·6	145	20·3	265
	Heavy drinker	23·8	171	3·4	20	14·6	191
Level of physical activity (IPAQ)	High	29·5	267	15·2	149	22·0	416
	Moderate	28·3	256	31·3	307	29·8	563
	Low	42·3	383	53·5	525	48·1	908
Fruit and vegetable consumption	≥5 servings/d	50·4	490	73·3	745	62·1	1235
	<5 servings/d	49·6	483	26·7	271	37·9	754
Number of protective lifestyle behaviours	Four	24·7	162	32·5	182	28·3	344
	Three	35·8	235	43·8	245	39·4	480
	Two	28·2	185	18·9	106	23·9	291
	Zero or one	11·4	75	4·8	27	8·4	102
Categories of depression (CESD)	No depressive symptoms	83·5	767	79·9	747	81·7	1514
	Mild to moderate symptoms	9·2	85	12·0	112	10·6	197
	Possibility of major depression	7·3	67	8·1	76	7·7	143

IPAQ, International Physical Activity Questionnaire; CESD, Center for Epidemiologic Studies Depression Scale.

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Table 2 Demographic breakdown by number of protective lifestyle behaviours (PLB) among middle-aged men and women, Mitchelstown, North County Cork, Republic of Ireland

		Number of PLB								
		Zero or one (*n* 102)		Two (*n* 291)		Three (*n* 480)		Four (*n* 344)		
Variable	Category	%	*n*	%	*n*	%	*n*	%	*n*	*P* value
Age group (years)	45–54	8·0	28	23·4	82	39·4	138	29·1	102	0·321
	55–64	7·8	51	24·5	161	39·0	256	28·7	188	
	65–74	10·9	23	22·7	48	40·8	86	25·6	54	
Gender	Male	11·4	75	28·2	185	35·8	235	24·7	162	<0·0001
	Female	4·8	27	18·9	106	43·8	245	32·5	182	
Level of education	Tertiary	5·3	17	17·1	55	43·8	141	33·9	109	<0·0001
	Secondary	8·2	47	24·0	137	38·6	220	29·1	166	
	Primary	12·0	33	31·6	87	37·5	103	18·9	52	
BMI category	Underweight/normal	11·8	32	18·0	49	38·2	104	32·0	87	0·437
	Overweight	7·0	39	26·2	146	38·2	213	28·5	159	
	Obese	8·1	31	24·4	94	42·1	162	25·5	98	
Depressive symptoms	No depressive symptoms	7·8	76	22·4	218	39·0	379	30·8	299	0·001
	Mild to moderate	10·8	13	28·3	34	40·8	49	20·0	24	
	Possibility of major depression	9·9	9	31·9	29	38·5	35	19·8	18	

of education and were categorised as having no depressive symptoms.

Associations between protective lifestyle behaviours and depression

Table 3 presents the results of the binary logistic regression, examining the association between PLB and depression, adjusted for age, gender, education and BMI. Unadjusted and adjusted models propose that engaging in PLB may be inversely associated with depression. The final adjusted model suggests that those who practise zero or one PLB are over twice as likely to portray depressive symptoms compared with those who practise four PLB (OR = 2·2; 95 % CI 1·2, 4·0). All models indicate that as the number of PLB practised increases, the odds of depressive symptoms decrease. Results also indicate that males are less likely to experience depressive symptoms compared with females, with this result remaining significant after further adjustment (OR = 0·6; 95 % CI 0·5, 0·9). Models were tested excluding those with a previous doctor-diagnosis of depression and similar results were found (results not shown). Additionally, models were tested excluding non-drinkers and former smokers with similar results in favour of PLB being obtained (results not shown).

Discussion

Principal findings

The aim of the present study was to examine the association between PLB and depression in middle-aged Irish men and women by conducting a secondary analysis of a cross-sectional study. This has yielded three principal findings. First, it appears that engaging in four PLB may be associated with positive mental health. Those who practise zero or one PLB are approximately twice as likely to experience depression when compared with those who practise four PLB. When potential confounders (age, gender, education and BMI) are considered, the odds of depression increase to over 2·2 times when zero or one PLB is compared with four PLB. Results remained statistically significant across all four models of logistic regression. Second, scope for improvement exists with regard to promoting the uptake of PLB, as results suggest that only 28 % of this population-representative sample of 50–69-year-olds engage in four PLB. Finally, results are concordant with the general consensus that gender differences exist with regard to suffering from depression, as females are more likely than males to be depressed[45,46]. This may be important to consider when designing preventive strategies to combat depression at a population level.

The findings of the study are consistent with what was found in the available literature. Studies that assess the relationship between PLB in isolation and in combination suggest that healthy lifestyle choices may be linked to positive mental health. Furthermore, an association between these healthy behaviours and depression has been found in studies in different settings, genders and age groups[5,7–10,13,14,26,30,47,48], while the presence of an inverse relationship further supports the association between PLB and mental health.

A previous Irish study by Harrington *et al.* examined the role of similar key lifestyle behaviours and depression among all adults (18 years and over), with results supporting the notion of better mental health if healthy behaviours are adopted[30]. Our study focuses specifically on 50–69-year-olds in the general population, with benefits of healthy lifestyle behaviours still being observed among this older age group. In a move towards healthy ageing[49], the promotion of health-seeking behaviours at this later stage of life may have a significant impact on the health of older populations.

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Table 3 Binary logistic regression: associations of protective lifestyle behaviours (PLB), age, gender, education and BMI with depression in middle-aged men and women, Mitchelstown, North County Cork, Republic of Ireland

	Model 1			Model 2			Model 3			Model 4		
	OR*	95 % CI	*P* for trend	OR	95 % CI	*P* for trend	OR	95 % CI	*P* for trend	OR	95 % CI	*P* for trend
PLB												
Four (*n* 341)	1·0	Ref.	0·001	1·0	Ref.	<0·0001	1·0	Ref.	0·001	1·0	Ref.	0·001
Three (*n* 463)	1·578	1·057, 2·354		1·596	1·069, 2·384		1·432	0·953, 2·151		1·394	0·926, 2·098	
Two (*n* 281)	2·057	1·341, 3·155		2·155	1·399, 3·319		1·918	1·233, 2·984		1·854	1·188, 2·894	
Zero or one (*n* 98)	2·061	1·161, 3·659		2·225	1·244, 3·979		2·139	1·184, 3·862		2·216	1·223, 4·016	
+ Age	–	–	–	0·983	0·955, 1·011	0·221	0·977	0·948, 1·006	0·131	0·976	0·947, 1·006	0·127
+ Gender												
Female	–	–	–	1·0	Ref.	0·081	1·0	Ref.	0·024	1·0	Ref.	0·006
Male	–	–	–	0·767	0·565, 1·042		0·697	0·509, 0·955		0·645	0·466, 0·893	
+ Education												
Tertiary	–	–	–	–	–	–	1·0	Ref.	0·054	1·0	Ref.	0·081
Secondary	–	–	–	–	–	–	1·079	0·740, 1·575		1·083	0·739, 1·586	
Primary	–	–	–	–	–	–	1·564	1·001, 2·443		1·511	0·961, 2·376	
+ BMI												
Underweight/ normal	–	–	–	–	–	–	–	–	–	1·0	Ref.	0·037
Overweight	–	–	–	–	–	–	–	–	–	1·053	0·692, 1·601	
Obese	–	–	–	–	–	–	–	–	–	1·513	0·980, 2·338	

Ref., reference category.
Model 1 = unadjusted.
Model 2 = adjusted; age, gender.
Model 3 = further adjusted; age, gender, education.
Model 4 = further adjusted; age, gender, education, BMI.
*No depressive symptoms *v.* mild/moderate/major depressive symptoms.

Furthermore, the link between PLB and mental health is biologically plausible. Depressed individuals tend to have higher inflammatory levels of C-reactive protein, which has been linked to the origin of depression[27,50–53]. This elevated level of systemic inflammation has also been observed in those with a poor-quality diet, smokers and those with low levels of physical activity[54–56].

An adequate supply of nutrients is necessary for normal brain function. Therefore, a diet that is rich in antioxidants may lead to a reduction in oxidative stress on mental health. Similarly, green vegetables contain folate, which is required for normal central nervous system function, while it is also known to be involved in the synthesis and metabolism of serotonin[57–59].

Many hypotheses have been put forward to explain the mechanisms of physical activity's role in the promotion of positive mental health. For example, physical activity may promote the production of endorphins which are thought to improve mood, it may pose as a distraction from adverse events, while it may also influence self-esteem[17].

Additionally, physical activity is thought to play a role in preventing against other chronic diseases that are sometimes linked to mental ill health. Therefore, maintaining a physically active lifestyle may prevent the onset of depressive symptoms associated with other illnesses[60,61].

Moreover, it is well documented that excess alcohol consumption and nicotine use may lead to the development of chronic conditions that in turn can lead to depression[20–25], while it is postulated that long-term alcohol and nicotine use may result in changes to neuronal activity, subsequently predisposing individuals to depression[18,25].

Study strengths and limitations

The Mitchelstown Cohort consists of a large sample of 50–69-year-olds with a mixture from urban and rural areas. Many potential confounders were considered in the study including age, gender, education and BMI.

However, there are several limitations to the study including methods used to assess dietary quality. The use of a general health and lifestyle questionnaire and FFQ may be subject to certain biases, namely social desirability bias due to the nature of the questions being asked or recall bias as participants attempted to recall information. The use of FFQ as opposed to food diaries, however, tends to bias results towards the null[62]. Therefore, results are more likely to be an underestimate of the magnitude of the true effect. Findings may also have been limited by non-response bias (response rate = 67 %), while there is also a potential for self-report bias. Additionally, cross-sectional studies provide limited evidence for a causal relationship as the directional effect cannot be determined. The adoption of four PLB may in fact be a marker of better than average mental health as opposed to a protective factor and, in particular, the effects observed in the current study and others may operate in both directions.

Conclusion

The present study adds to the available evidence that engaging in key PLB may be protective against depression or, at a minimum, be associated with lower levels of depression. Examining the cumulative effects of PLB, rather than individual lifestyle components in isolation, may be more applicable to public health interventions

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than the promotion of single lifestyle behaviours, as people tend to live complex and diverse lives.

Contemporary guidelines in many countries promote the practice of PLB analysed herein[63,64]. Therefore promoting healthy lifestyle changes, such as being a non-smoker, moderate alcohol consumption, engaging in physical activity and eating a healthy diet, for the prevention of mental health disorders would have important public health implications considering the modifiable nature of lifestyle choices and the already available evidence base that healthy behaviours can improve other aspects of health. The promotion of health-seeking behaviours is especially valuable, considering the high prevalence of people who do not receive any form of treatment for mental ill health[4]. However, reasons for unhealthy lifestyle behaviours and the assessment of barriers relating to behaviour change are important to consider when researching the lifestyle–mental health relationship as these may also have implications for future policy[65,66].

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