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Depression and lifestyle among university students: A one-year follow-up study

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Abstract
Background and objectives: University stage is a risk period for development of mental disorders and major depression disorder (MDD) is one of the most prevalent disorders. There is increasing evidence about the influence of lifestyle factors on depression onset and maintenance, nevertheless there is a great heterogeneity between analyzed lifestyle factors and few longitudinal studies has been carried out. The current study aims to longitudinally assess the influence of lifestyle on MDD courses among first-year university students.

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Methods: First-onset and persistence of MDD and lifestyle trajectories are measured using baseline and 12-months follow-up online surveys. Multivariate logistic regression analyses were performed to study longitudinal risk/protective associations between lifestyle factors and MDD.
Results: 1,292 participants were included. Mean age of included participants at baseline was 18.5 (SD= 1.16) and 75.7 % were female. First-onset and persistence of MDD at T2 were 10.3 % and 38.9 % respectively. Maintenance of healthy sleep (Adjusted Odds Ratio (aOR) = 0.26; 95 % CI =0.12−0.58) and physical activity (aOR = 0.24; 95 % CI = 0.10−0.58) were protectively associated against MDD first-onset. Adoption of healthy levels of social support showed a protective effect against MDD persistence (aOR = 0.17; 95 % CI = 0.07−0.44).
Conclusions: Lifestyle should be considered in order to improve depression prevention strategies among university students. Sleep, physical activity, and social support seem to have a crucial role in the onset and persistence of depression among this population.

Introduction

According to the World Health Organization, mental health conditions account for 16 % of the global burden of disease and injury in people aged 10−19 years.[1] Half of all mental disorders appear by the age of 14 years and 62.5−75 % by the age of 24 years.[2,3] There has been an increase of young people accessing university education. In developed countries, the population between 25 and 34 years with a college degree has increased from 35 % to 44 % between 2008 and 2018.[4] University experience can contribute to a higher psychological vulnerability. University related events like academic burden, transition to adulthood or relationships instability can lead to a further impairment among university students.[5,6]

Studies suggest that nearly a third of university students would present at least one mental disorder during the last year,[7] being depression the most prevalent disorder among this population.[8] The World Mental Health International College Student initiative,[9] representing 19 universities from eight countries estimated 12-month Major Depression Disorder (MDD) prevalence around 18.5 % among university students.[7] In Spain, 12-month MDD prevalence was estimated at 18.9 %.[10] Depressive disorders among university students are associated with a higher academic and social impairment,[10] and they constitute one of the leading suicide risk factors among this population.[11]

New depression interventions and prevention approaches should be considered. There is strong evidence about the relationship between depression and lifestyle.[12] Several studies and metaanalyses have explored this relationship and highlighted the importance of working on lifestyle to improve mental health by improving modifiable behaviors.[12−14] Interventions aiming to reduce depressive symptoms through lifestyle changes have proven to be effective, not only as complements to conventional treatment,[15] but also as a single intervention, especially in some targeted populations.[16,17] In addition, evidence points out a reciprocal relationship between lifestyle and depression. Unhealthy lifestyles increase the risk of suffering depression and at the same time depressive symptomatology triggers a set of mechanisms that ease the adoption of unhealthy lifestyles.[18]

The consolidation of habits for adulthood and the risk of mental disorder onset makes university students an interesting target population for the study of depression and lifestyle relationships. Several studies have reported an association between depression and lifestyle among this population.[19,20] However, there is a great heterogeneity between analyzed lifestyle factors and few longitudinal studies has been carried out so far. One of them is the "Seguimiento Universidad de Navarra" cohort, which analyzed the association between healthy lifestyle factors and the risk of depression between 1999 and 2016, and the main conclusion is that the adoption of healthy lifestyle patterns was associated with a decreased risk of depression incidence.[19] A recent meta-review of "lifestyle psychiatry" highlighted the growing interest in how lifestyle factors are associated with mental health and provides an important analysis of the evidence on the role of the lifestyle factors, such as physical activity, smoking, diet, and sleep, in the prevention and treatment of mental disorders, including depression, being physical activity the most investigated factor.[12] Moreover, the intensity and continuity of healthy lifestyles needed in order to achieve a protective effect on depression remain unclear.[21,22]

The objective of the present study is to longitudinally assess the relationship between MDD and five lifestyle factors among university students: physical activity, diet, sleep, alcohol consumption and social support. Firstly, we aim to analyze lifestyle trajectories (adoption, loss and maintenance of healthy lifestyle) as MDD risk/protective factors. Secondly, we explore risk/protective associations between first-onset and persistence of MDD and lifestyle trajectories.

Material and methods

Study design

Longitudinal data assessments from baseline (T1) and 12-month follow-up (T2) come from the UNIVERSAL project (University and mental health), a multi-center observational cohort study of first-year university students. Baseline surveys were accomplished between October 2014 and October 2015. All baseline respondents received a link to complete the follow-up survey after 12 months. The UNIVERSAL project is part of the World Mental Health International College Student initiative.[9] Information on rationale and methods of the *UNIVERSAL* is provided elsewhere.[23]

Participants and setting

Five public universities from different Autonomous Regions of Spain participated in this study: University of Balearic Islands (UIB), Basque Country University (UPV-EHU), Cádiz University (UCA), Miguel Hernández University (UMH), and Pompeu Fabra University (UPF). Universities were conveniently selected and represented around 8 % of the total number of students in public universities of Spain in the year 2014−2015. Gender, nationality, and academic field distributions were similar to that of the overall population of students in Spanish public universities.[10] First year students enrolled for the first time in a university degree and with age ranging from 18 to 24 years old were eligible for this study. Non-acceptance of informed consent was the only exclusion criteria for the study. A total of 16,332 students were eligible according to inclusion criteria.

Sample recruitment comprised two stages. First, all eligible students were invited to participate. Secondly, a random subsample of non-respondents to the first stage was contacted offering economic incentive to complete the survey. Only the first stage was carried out at UPV-EHU University. For the recruitment, strategies including personal email invitation letters sent by the university authorities to eligible students and advertising campaigns were implemented.

Students were invited to complete the study registration form via the *UNIVERSAL* website, and written informed consent was obtained from all participants. Upon acceptance, students were provided with a personalized link and password to complete the survey via a secure Web platform. Once completed, respondents received information on how to access local health services. Students with positive responses on suicide items received indications to consult a health professional.

All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Ethical approval was provided by the Parc de Salut Mar-Clinical Research Ethics Committee (Reference: 2013/5252 7I).

Measures

12-Month major depression disorder (MDD)

Assessment of 12-month Major Depression Disorder was based on the Composite Diagnostic Interview 3.0[24] and the CIDI Screening Scales.[25,26] CIDI-3.0[27] and CIDI-SC scales[25,26] have shown good validity in MDD assessment in comparison to standardized clinical assessments. The accuracy of this same online assessment of mental disorders and suicidal behaviors, including depression disorder in Spanish university students have received strong support in a previous study.[28]

Using data from baseline and follow-up three dichotomous MDD outcomes were established: 1) *overall* 12-months MDD (12-month MDD at T2); *first-onset* of MDD (12-months MDD at T2 among those who reported no lifetime MDD at T1); and c) *persistence* of MDD (12-months MDD at T2 among those who reported 12-months MDD at T1).

Lifestyle factors

Lifestyle factors variables were constructed ad hoc from items extracted from the baseline survey (see appendix S1). A dichotomous variable was constructed for each lifestyle factor through selected items assessing lifestyle related information. For each lifestyle factor, a dichotomous variable indicating a healthy behavior according to WHO recommendations and consensus statements[29,30] was created.

Physical activity was assessed using the Youth Risk Behavior Survey (2009),[31] through the two following items: *"How often do you currently engage in light exercise (e.g., walking) for 30 min or longer?"* and *"How often do you currently engage in moderate or vigorous exercise (e.g., jogging, working out) for 30 min or longer?"*. Health criteria was according to the WHO (2020)[29] recommendations: at least 150−300 min of moderate intensity aerobic physical activity; or at least 75−150 min of vigorous intensity aerobic physical activity; or an equivalent combination of moderate and vigorous intensity activity throughout the week.

Sleep was assessed by the Youth Risk Behavior Survey (2009)[31] through the following item: "*How often do you currently get at least 8 h of sleep?*". Health criteria was according to the National Sleep Foundation's sleep duration recommendations[30]: 7−9 sleep hours recommended for young adults.

Alcohol consumption was assessed using AUDIT-10,[32] range of 0−40, indicating the level of risk and dependence of alcohol consumption. It was the only variable that was not constructed ad hoc, and health criteria was the low risk of test punctuation (score ≤ 7).

Social support was evaluated by the WMH-CIDI (social network),[24] through the following items: "*When you have a problem or worry, how often do you let someone in your personal life know about it?*" and *"How much can you rely on your family for help if you have a serious problem?"*. As there is not a defined consensus about a minimum amount of social support considered as healthy, we considered as healthy social support criteria to refer social support in "Most of the cases" at least in one of the items and "Sometimes" in the complementary item.

Once lifestyle factors were categorized under health criteria, using data from baseline and 12-month follow-up we distinguished between three different trajectories in each lifestyle factor: a) *adoption* (healthy lifestyle at T2 among those who reported unhealthy lifestyle at T1); b) *loss* (unhealthy lifestyle at T2 among those who reported healthy lifestyle at T1); and c) *maintenance* (healthy lifestyle at both T1 and T2 assessments).

Sociodemographic and university status

Baseline sociodemographic and university-related characteristics including sex, age, country of birth, university and academic field were assessed.

Analyses

All data transformation and analysis were performed by STATA software version 15.1 (StataCorp). Baseline and

follow-up descriptive statistics were reported in terms of percentage. Proportions of 12-months MDD at both waves, and proportions of first-onset and persistence of 12-months MDD at follow-up were also reported as percentages. MDD longitudinal outcomes (*i.e.* prevalence, first-onset, persistence) were analyzed in function of lifestyle trajectories at follow-up (adoption, loss and maintenance of healthy lifestyle). Bivariate and multiple logistic regression models including all lifestyle factors were estimated to assess the relationship of lifestyle trajectories on depression outcomes. Multivariable models were also adjusted by the following potential confounders: age, gender, country of birth, university and academic field. Statistical significance was set at 5 % level. Discriminant capacity for each model was evaluated with the area under the curve (AUC).

Results

Participants

From all eligible sample (n = 16332), a total of 2118 students completed the baseline. Six of those respondents did not report MDD related data, which reduced the baseline sample to 2112 students. 1292 follow-up respondents were included in this study (61 % response). Mean age at baseline was 18.6 (SD = 1.21) and 72.52 % were female. Sample characteristics at baseline (T1: n = 2,112) and at 12-months follow-up (T2: n = 1292) are reported in Table 1.

22.54 % of students reported 12-month MDD at baseline and 17.57 % reported 12-months MDD at T2. First onset of MDD during follow-up was 10.3 %. Among students with 12-months MDD at T1, 38.9 % also reported 12-months MDD at T2 (persistence). At baseline, the most frequent healthy and unhealthy lifestyle factors among students were alcohol consumption (78.9 % no risk alcohol consumption) and physical activity (51.1 % not enough physical activity) respectively (Table 1).

Risk and protective lifestyle factors associated with MDD at 12-month follow- up

Bivariate and multivariable associations of 12-month MDD and lifestyle factors are shown in Table 2. Bivariate analyses reported protective associations between maintenance of healthy lifestyle during follow-up and 12-month MDD for physical activity (OR = 0.48 CI 0.31—0.76), diet (OR = 0.48 CI

Table 1 Sample characteristics.

		Baseline (n = 2112) n (%)	12-month follow-up (n = 1292) n (%)
Age	18	1506 (71.1)	962 (74.5)
	>18	612 (28.9)	330 (25.5)
Gender	Male	582 (27.5)	313 (24.2)
	Female	1536 (72.5)	979 (75.8)
University	Cádiz University (UCA)	299 (14.1)	159 (12.3)
	Balearic Islands University (UIB)	300 (14.2)	173 (13.3)
	Miguel Hernández University (UMH)	292 (13.8)	146 (11.3)
	Pompeu Fabra University (UPF)	585 (27.6)	385 (29.8)
	Basque Country University (UPV-EHU)	642 (30.3)	429 (33.2)
Country of Birth	Spain	2005 (94.7)	1220 (94.4)
	Other	113 (5.3)	72 (5.6)
Academic Field	Arts and Humanities	242 (11.4)	158 (12.2)
	Science	203 (9.6)	123 (9.5)
	Health Sciences	543 (25.6)	347 (26.9)
	Social and Legal Sciences	839 (39.6)	505 (39.1)
	Engineering and Architecture	291 (13.7)	159 (12.3)
Lifetime MDD	Yes	572 (27)	n.a.
	No	1540 (72.7)	n.a.
12-month MDD	Yes	476 (22.5)	227 (17.56)
	No	1636 (77.2)	1065 (82.44)
Physical Activity	Healthy	1027 (48.9)	631 (47.8)
	Unhealthy	1074 (51.1)	688 (52.2)
Diet	Healthy	1383 (65.6)	806 (61)
	Unhealthy	725 (34.4)	516 (39)
Sleep	Healthy	1306 (62)	849 (64.2)
	Unhealthy	801 (38)	474 (35.8)
Alcohol Consumption	Healthy	1669 (78.9)	1029 (81.7)
	Unhealthy	445 (21.1)	231 (18.3)
Social Support	Healthy	1116 (53.4)	700 (56.9)
	Unhealthy	974 (46.6)	531 (43.1)

Abbreviations: MDD: Major Depression Disorder; Healthy/ Unhealthy: see appendix S1; n.a: not applicable.

Table 2 Bivariate and multivariable associations of lifestyle factors with 12-months MDD at follow-up.

		Bivariate			Multivariable		
		OR	CI	p-value[d]	aOR	CI	p-value[d]
Gender (female)		1.16	0.82—1.63	0.39	1.44	0.94—2.19	0.084
Age (ref = 18)		1.18	0.86—1.62	0.31	1.15	0.80—1.66	0.45
Physical Activity	Adoption[a]	0.91	0.59—1.39	0.65	1.13	0.70—1.83	0.609
	Loss[b]	1.35	0.82—2.23	0.24	1.28	0.74—2.23	0.376
	Maintenance[c]	0.48	0.31—0.76	< 0.01*	0.46	0.28—0.78	< 0.01*
Diet	Adoption	0.59	0.36—0.99	0.0485*	0.61	0.34—1.10	0.095
	Loss	1.49	0.86—2.56	0.159	1.27	0.68—2.39	0.441
	Maintenance	0.48	0.32—0.72	< 0.01*	0.62	0.39—0.98	0.043*
Sleep	Adoption	0.72	0.46—1.13	0.15	0.75	0.45—1.26	0.275
	Loss	1.53	0.92—2.54	0.103	1.56	0.87—2.78	0.135
	Maintenance	0.44	0.29—0.68	< 0.01*	0.54	0.33—0.88	0.016*
Alcohol Consumption	Adoption	1.05	0.56—1.99	0.88	1.93	0.94—3.97	0.074
	Loss	1.37	0.72—2.58	0.34	1.05	0.52—2.13	0.883
	Maintenance	0.56	0.35—0.90	0.015*	0.52	0.31—0.88	0.019*
Social Support	Adoption	0.42	0.27—0.66	< 0.01*	0.36	0.21—0.59	< 0.01*
	Loss	1.09	0.60—1.98	0.79	1.09	0.56—2.14	0.798
	Maintenance	0.66	0.39—1.12	0.13	0.86	0.47—1.54	0.606

Abbreviations: MDD: Major Depression Disorder; aOR: adjusted Odds Ratio; CI: Confidence Interval; ref: reference category. Multivariable model adjusted by: age, gender, country of birth, university, academic field and all lifestyle factors.

[a] Unhealthy lifestyle at T1 and healthy lifestyle at T2.

[b] Healthy lifestyle at T1 and unhealthy lifestyle at T2.

[c] Healthy lifestyle at both T1 and T2.

[d] Estimated through likelihood ratio tests.

* statistically significance at 5 % level.

0.32—0.72), sleep (OR = 0.44 CI 0.29—0.68) and alcohol consumption (OR = 0.56 CI 0.35—0.90). They also revealed that adoption of a healthy lifestyle in terms of diet (OR = 0.59 CI 0.36—0.99) and social support (OR = 0.42 CI 0.27—0.66) during follow-up year was associated with lower 12-month MDD rate at T2.

After adjustment, multivariable analysis showed that the same protective lifestyle courses remain statistically significant except the adoption of a healthy diet. The strongest protective association was for adoption of social support (OR = 0.36 CI 0.21—0.59). There were also protective significant associations for maintenance of healthy physical activity (OR = 0.46 CI 0.28—0.78), diet (OR = 0.62 CI 0.39—0.98), sleep (OR = 0.54 CI 0.33—0.88) and alcohol consumption (OR = 0.52 CI 0.31—0.88) during follow-up year. It was not found any statistically significant lifestyle risk factor for 12-month MDD. The area under the curve (AUC) of the model was 0.73 (SE = 0.02).

Risk and protective lifestyle factors associated with first onset and persistence of MDD at 12-month follow- up

Multivariate risk/protective associations between lifestyle factors and first-onset and persistence of 12-month MDD at T2 are reported in Table 3. Statistically significant protective associations for MDD first-onset at T2 were found for maintenance of healthy levels of physical activity (OR = 0.24 CI 0.10—0.58) and sleep (OR = 0.26 CI 0.12—0.58) during follow-up. Female gender was significantly associated with higher risk of MDD first- onset at T2 (OR = 3.38 CI 1.52—7.49).

Regarding MDD persistence, after adjustment the only protective significant association was for adoption of healthy social support during follow-up year (OR = 0.17 CI 0.07—0.44). It was not found any statistically significant risk association for MDD persistence. Areas under the curve in first-onset and persistence final models were 0.82 (SE = 0.27) and 0.71 (SE = 0.03) respectively.

Discussion

Regarding obtained results, there are some findings that should be considered. First of all, our results point out that the maintenance of a healthy lifestyle is highly associated with lower 12-months MDD rates at follow-up for all lifestyle factors except for social support. Similar findings have been found in the “Seguimiento Universidad de Navarra” cohort. Their results indicate that those participants with greater number of healthy lifestyle behaviors showed more than 30% of relative risk reduction of depression, compared with those with the smaller number of lifestyle behaviors.[19] Although it is important to note that this study includes more lifestyle factors than our analysis. This reinforces the importance of fostering lifestyle interventions addressed to consolidate healthy lifestyle habits in the long term. In that sense, the study of adherence to lifestyle interventions for depression treatment may have a crucial role.[33] The adoption of healthy social support also showed a protective effect of the MDD persistence. Several studies also report

Table 3 Multivariable associations of lifestyle factors with first-onset and persistence of MDD at follow-up.

		First-onset			Persistence		
		aOR	CI	p-value[d]	aOR	CI	p-value[d]
Gender (female)		3.38	1.52–7.49	< 0.01*	0.91	0.44–1.88	0.416
Age (ref = 18)		1.57	0.86–2.86	0.147	0.68	0.37–1.27	0.160
Physical Activity	Adoption[a]	1.57	0.72–3.44	0.269	0.64	0.28–1.46	0.331
	Loss[b]	1.64	0.70–3.86	0.251	2.17	0.78–6.06	0.18
	Maintenance[c]	0.24	0.10–0.58	< 0.01*	0.58	0.24–1.41	0.267
Diet	Adoption	0.54	0.21–1.36	0.178	0.84	0.31–2.27	0.243
	Loss	0.76	0.27–2.16	0.610	1.71	0.58–5.11	0.113
	Maintenance	0.80	0.36–1.82	0.609	0.47	0.28–1.03	0.058
Sleep	Adoption	0.81	0.36–1.81	0.599	1.33	0.58–3.09	0.564
	Loss	1.62	0.66–3.97	0.290	1.16	0.43–3.10	0.779
	Maintenance	0.26	0.12–0.58	< 0.01*	0.97	0.42–2.28	0.539
Alcohol Consumption	Adoption	3.10	0.86–11.22	0.087	1.21	0.40–3.66	0.884
	Loss	0.81	0.23–2.82	0.738	1.03	0.34–3.11	0.862
	Maintenance	0.56	0.22–1.40	0.231	0.56	0.24–1.29	0.261
Social Support	Adoption	0.91	0.43–1.92	0.806	0.17	0.07–0.44	< 0.01*
	Loss	0.44	0.15–1.27	0.117	2.40	0.77–7.48	0.132
	Maintenance	0.91	0.33–2.49	0.855	2.47	0.38–2.73	0.988

Note. MDD, Major Depression Disorder; aOR, adjusted Odds Ratio; CI, Confidence Interval; ref, reference category. Multivariable model adjusted by: age, gender, country of birth, university, academic field and all lifestyle factors.

[a] Unhealthy lifestyle at T1 and healthy lifestyle at T2.

[b] Healthy lifestyle at T1 and unhealthy lifestyle at T2.

[c] Healthy lifestyle at both T1 and T2.

[d] Estimated through likelihood ratio tests.

* statistically significance at 5 % level.

the association between social support and depression but the mechanisms of this relationship remain unclear.[34] Some authors focus on the benefits of social support by itself on depression,[35] but there are also studies pointing that social support might ease the development of other healthy lifestyles with protective effects on depression.[36] These data are consistent with the "call to action" expressed by Merlo & Vela,[37] which indicates that "there is a critical opportunity for the field of lifestyle medicine to incorporate mental health into each of the foundational pillars (diet, exercise, substance use, psychological well-being/stress, relationships, sleep) while also specifically targeting lifestyle interventions for populations with mental disorders".

Second, we observed that maintenance of healthy habits of sleep and physical activity during the first academic year protects against MDD first-onset. These results accord with several studies and reviews on the issue.[38,39] In addition, our results show that female gender was significantly associated with higher risk of developing MDD first-onset at follow up. This result is in line with the literature. It is well known that there are gender differences in depression, being more prevalent in women than in men.[40] Specifically, the Lundby Study found that females are more likely than males to develop specific types of depression. Moreover, from the age of 15 is the specific time to be more susceptible to develop unipolar depression, according to the age-specific rate.[41] Depression prevention strategies in universities should incorporate actions in this regard. Actions such as establishing an academic schedule compatible with students resting time or ease the access to sport practice through an adequate infrastructure may be helpful.

Last, our results showed that adoption of healthy social support during the first academic year was a protective factor against MDD persistence. As we mentioned previously, transition to university stage can be a challenge due to reconfiguration of students' social networks.[6] Our findings suggest that consolidation of proper relationships during the first university year may have a positive effect on MDD. One more time, this prompts the idea that social support may have a key role in depression, and that relationships between social support and depression should be addressed from a different approach than other lifestyle factors. Also, this stands out the need to enhance the social climate through the establishment of spaces for socialization[42] and strategies addressed to engage new students in the university community.

Several strengths of the study should be mentioned. First, we have only analyzed evidence-based lifestyle factors. In lifestyle and depression research there exist a wide range of lifestyle factors that have been studied. This entails a great heterogeneity between the lifestyle factors included in different studies. However, not all lifestyle factors have the same empirical strength in relation to depression improvement.[12] For this study we have only selected evidence-based lifestyle factors. Second, we analyze three different MDD outcomes (overall, first-onset, persistence), which gives a more detailed view of MDD courses and its specific relationships with lifestyle factors. Third and similar to this, we also analyze three different outcomes for each lifestyle factor in function of lifestyle factors trajectories during follow-up year, resulting in a deeper and comprehensive exploration of lifestyle influence on depression.

However, several limitations should be considered when interpreting our results. First, low response rate at baseline and loss of sample at follow-up might have caused a biased representation of the entire population of university students. Also, a convenience sample of universities was selected for this study. Nonetheless, characteristics of students in terms of gender, nationality and academic field were similar to general Spanish university students.[10] Second, longitudinal MDD outcomes were constructed through 12-months MDD data. This retrospective outcome encompasses a wide period of time, making it difficult to know accurately if a change in a MDD outcome comes before or after a change in lifestyle. Thus, reported data should be interpreted cautiously. Third, the assessment of MDD was based on self-reports, not on face-to-face clinical assessments. However, clinical reappraisals showed reasonable concordance with blinded clinical diagnoses.[28] Fourth, except for alcohol consumption, all lifestyle factors were constructed ad hoc through selected items. This lack of specific assessment tools may endanger the validity and generalization of our results. Moreover, it is important to emphasize that lifestyle is now considered multidimensional, and its behaviors are intertwined and naturally cluster among individuals. For this reason, lifestyles should be assessed with multidimensional questionnaires. Fifth, the variable diet was constructed through the item *"How many do you currently eat three balanced meals?"*. This may imply two problems. On one hand, this item does not specify what is considered a balanced meal, leaving its consideration to the subjective judgment of participants. On the other hand, the number of recommended meals per day remains a controversial issue. While it is common to find recommendations related to the benefits of five food intakes per day, there is also growing evidence about the benefits of fasting.[43] Either way, for this study we considered a healthy diet to eat at least three balanced meals per day. Sixth and similar to this, we considered as healthy sleep criteria getting 8 h of sleep at least 3—4 days per week. Although this is quite adjusted to sleep recommendations for young adults, there exists a great interpersonal variability about the hours of sleep needed.[30] Seventh and last, for this study results were not adjusted for some relevant variables like recent stressful experiences or other mental disorders.

Conclusions

The present study points out the relevance of lifestyle on first-year university students' depression and highlights the benefits of keeping a healthy lifestyle all along the first university year. An adequate amount of sleep and physical activity seem to have a crucial role on students' depression prevention. Although our results need to be confirmed by future studies, it appears prudent to direct depression prevention strategies within this population towards these specific lifestyle factors. Thus, depression prevention strategies among this population should particularly focus on these lifestyle factors.

We also stand out that social support might have a special role on student's depression. Unlike the rest of lifestyle factors, the benefits of social support on depression were observed when the students adopted adequate levels of social support during follow-up, but not when adequate levels of social support were maintained. This reinforces the importance of peer relationships among adolescents and young adults and suggests that the establishment of new relationships at this life stage might have special benefits in terms of subjective well-being and sense of belonging.

Nevertheless, owing to the limitations of the present study our results and conclusions should be interpreted cautiously. Further studies with specific and validated lifestyle factors assessment tools, such as FANTASTIC lifestyle questionnaire,[44] and more accurate MDD outcomes should be implemented in the future.

Conflict of interest

In the past 3 years, Dr. Kessler was a consultant for Datastat, Inc., Holmusk, RallyPoint Networks, Inc., and Sage Therapeutics. Dr. Roca received research funds from Lundbeck and Janssen.

Ethical considerations

All procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Ethical approval was provided by the Parc de Salut Mar-Clinical Research Ethics Committee (Reference: 2013/52527I).

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.ejpsy.2024.100250.

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