Health Behaviors, Life Skills, Mental Health, and Demographic Factors Associated with Mental Health among University Students in a Developing Country.

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Abstract

University students in developing countries may be at high risk for mental health disorders due to many financial, political, and social stressors. In the present study, we intended to explore the association of mental health with health behaviors and life skills. Participants included 2789 university students in Lebanon. Bivariate and multivariate regression analysis were performed. Results suggested that the risk for mental health disorders is associated with the socio-demographic factors of being a first year university student, being female, and living in rural areas. Also, consumption of high-calorie dietary pattern, low physical activity, and high level of risky behaviors associated with higher occurrence of mental health disorders. Life Skills are associated with less occurrence of mental health disorders in our data. Sociodemographic factors such as gender, university year, and area of residence (rural vs. urban), healthy behaviors, and life skills showed to be strongly associated with university students' mental health. Life skills based interventions addressing the aforementioned mental health determinants would benefit university students in developing countries.

Background:

Mental health (MH) entails the flexibility of individuals to be able to make decisions and overcome life stressors from daily life experiences (Carta et. al, 2004; Lindert et. al, 2014). Thus, learning skills related to coping, adaptability, and flexibility might enhance the mental health of an individual. University students experience great psychological pressure due to the competitive, demanding environment, the transitions of leaving home and accommodating to a new type of life (Sarokhani et al. 2013) as well as changing career market, and an increased job competition (Al-Nakeeb et. Al, 2015). Depressive symptoms can also interfere with learning (Steptoe et al. 2007). Managing stressful college life has become a goal of counseling practitioners as well as many public health professionals who work on mitigating the external stressors and cope with the academic requirements. This requires the integration of more than technical skills.

Recently, a variety of non pharmacological approaches for enhancing mental health and well-being have emerged such as the lifestyle medicine discipline. It seeks to treat the causes of lifestyle-related chronic conditions through lifestyle based interventions leading to lower internalized mental disorders prevalence. Indeed, some of these interventions might include life skill based interventions (Morton et al., 2020). A systematic review conducted by Snacassiani et al. (2015) demonstrated the effectiveness of the life skills programs in enhancing mental health and reducing future problems related to emotion and behaviors in schools and among college students. These programs showed a positive impact on the psychosocial health of reducing depression, anxiety and anger and improving their self-esteem (Smith et al, 2004;Luna-Adame et., al, 2013). Providing youth with quality education and life skills will help them remain healthy, increase academic performance, and gain employment (Ministry of Youth Affairs and Sports, Government of India, 2017; International Institute for Population Sciences and Population Council, 2010, IYF, 2013), and ultimately enable youth to contribute productively to their society (Desai, 2010; Galagali, 2011).

Students' transition to university provides them with opportunities for exploration and challenges them to endorse healthy behaviors (Simons-Morton et al., 2017). Several behavioral factors might be associated with mental health of university students, such as smoking, physical activity, sleeping hours, adopting risky behaviors, and eating habits. The association between smoking and mental health is still not clear. According to a systematic review conducted by Taylor et al. (2014), regular smokers report that smoking would help in alleviating emotional disorders, depression, and anxiety while helping them in relaxing and mitigating stress. Despite smokers' perception about the benefits of smoking, there is a strong association between smoking and poor mental health that can have different explanations; smoking and poor mental health might have common causes (Kendler et al., 1993), smoking exacerbates mental health problems while people perceive smoking will help decrease their anxiety and other mental health disorders, expecting that they will be able to abolish nicotine withdrawal. Another explanation is that people who try smoking cessation might experience irritability and anxiety which in turns leads to a perception that smoking releases the psychological disorders, while in fact it is smoking that contributes to these disturbances in the first place (Taylor et al, 2014).

The amount of sleep is also an important factor associated with mental health of the individuals (Al-Nakeeb et al., 2015). During their first year of college, students might suffer the most from sleep disturbance due to the transition phase in their lives. Perceived stress can serve as a perpetuating factor for sleep difficulties in this specific population group, due to the events and situations such as midterms, final exams, and deadlines as well as their susceptibility to arousal-related sleep difficulties because of ongoing changes and maturation in the neuroendocrine system (Assaad et al., 2014) .

Students' residence (rural/city) might play a role in shaping their mental health. A study conducted by Gruebneret al. (2017) showed that poor mental health is generally higher in cities compared to rural areas due to poverty, social isolation and urbanization while university students in Turkey, had similar mental health outcomes, comparing rural or urban areas or genders (C, A., & Caldwell-Harris,2016).

Moreover, students who practice vigorous physical exercises are less likely to report poor mental health than students who don't (Vankim & Nelson, 2013). However, university student populations are widely reported to engage in high rates of physical inactivity and sedentary behaviors (Deliens et al., 2015). These findings are similar to those in Lebanon, showing a minimal physical activity and high sedentary behavior among university students (El-Kassas & Ziade, 2016 ;Salameh et al, 2014; Musharrafieh et al., 2008). On the other hand, Body Mass Index (BMI) and eating patterns showed to be correlated with mental health. According to the American Psychiatric Association, individuals suffering from depression are accompanied by increased appetite, eating more frequently and high consumption of high calories snacks (APA, 2000). These eating patterns may be related to the brain's reward mechanisms in regulating stress (Colantioni et al., 2002). However, the World Mental Health Surveys Initiative showed a significant but modest association between mental disorders, eating patterns and obesity (Scott et al., 2008).

The literature clearly showed the association between all the above-mentioned factors and mental health. However, there is a gap in studies addressing all the socio- demographic, behavioral and life skills

variables in a critical context such as Lebanon. University students in Lebanon are living under a variety of stressors as a result of the demographic transition, nutrition transition, high unemployment rates, political conflict and economic crisis which have their social and financial implications on youth leading to an increase demand for educational employment and employment opportunities to mitigate health and economic burdens (UNDP, 2016). Therefore, exploring factors that might enhance university students' mental health in such a context is crucial to be adopted in other developing countries facing similar circumstances. This study is essential to frame health promotion interventions that are evidence, theory and innovation- driven interventions. Therefore, this paper aims to study the association between life skills, health behaviors and mental health as health outcome among university students in Lebanon allowing us to ultimately design an appropriate intervention accordingly.

Methods

Participants

Two thousand seven hundred eighty-nine university students, with mean age 20.9 (± 6.14) enrolled in 12 public and private universities have participated in this study. We were able to get the larger universities participate and have the one public university in the study.

Procedures

An online survey was filled randomly by university students. Written consent was obtained from all participants; it was added to the first page of the questionnaire. All students over 18 years of age were eligible to participate, and no other exclusion criterion. The sample size needed for sufficient power was achieved where 2789 questionnaires were completed. All the incomplete questionnaires were discarded. The Institutional Review Boards of the participating universities approved the present study.

Measures

BMI

The corrected BMI designed and validated by Salameh et al., (2014) was adopted in this study. It aims to mitigate the social desirability among responses. The equations are: for males [corrected weight = (1.003* reported weight) and corrected height = (0.959* reported height) + 7.59 and for females corrected weight= (0.942* reported weight) + 3.14 and corrected height = (0.943* reported height) + 9.42. The corrected body mass index (BMI) was calculated as follows: corrected weight in kilograms /corrected $(height)^2$ (in meter). BMI values were classified into four categories for emerging adults (> 18 years old); underweight (BMI < 18.5 kg/m2), normal weight (BMI 18.5–24.9 kg/m2), overweight (BMI 25–29.9 kg/m2), and obese (> = 30 kg/m2) (WHO, 2000).

Sleep Hours

Students' self-reporting of the number of hours slept during weekdays and weekends.

Smoking

Participants were asked if they smoke cigarettes, water pipe, both; we refer to it as "mixed smokers" or non- smokers.

Life Skills Questionnaire. Casey Life Skills questionnaire (CLS, 2012) (inprint) was used in our study which shows a high internal reliability.In this study, this survey was validated among 1200 youth adults with Cronbach Alpha of 0.95. The CLS is formed of seven subscales with 112 items; Daily Living, Self-Care, Relationships and Communication, Housing and money management, Work and Study, Career and Education Planning, and Goal settings. Responses were on a Likert scale ranging from 1 = No, 2 = Mostly No, 3 = Somewhat, 4 = Mostly Yes, and 5 = Yes.

Food Frequency Questionnaire (FFQ). The validated FFQ adopted in Lebanon by Salameh et al. (2014) was used in the present study. Participants indicated how often each food item was usually consumed with four possible answers for each of the food categories: (1) never, (2) once or twice per week, (3) three to six times per week, and (4) daily consumption.

Physical Activity Level. Amount of physical activity was assessed by the 7-item, International Physical Activity Questionnaire-Short Form (IPAQ-SF), validated for use among university students in Lebanon and showed a strong internal consistency with Cronbach's alpha ranged from .77 to 1.00 (Salameh et al., 2014). Data collected with the IPAQ-SF are reported as median metabolic equivalent (MET) minutes.

Risky Behavior. Risk Involvement and Risk Perception Scale, developed and validated in Lebanon by Salameh at al. (2014), comprised 31 items (e.g., unprotected sex; drug abuse). Responses were on a Likert scale, ranging from 0 (not at all) to 4 (very much), assessed young adults' perceptions towards risk intake actions. Cronbach's alpha in the present study was .89.

Mental Health Status. The Arab Youth Mental Health survey (AYMH), a 21-item scale, developed and validated by Makhoul et al. (2011), in Lebanon, was adopted in our study to epidemiologically and not a diagnostically assess depression and anxiety among youth. It has 3-point scale from always, sometimes, to rarely. Cronbach's alpha in the present study was .80.

Data Analysis

To examine the association between Mental Health, Life Skills and Health Behaviors. Bivariate analysis was used to study the relationship of Mental Health to potential cofounding variables and linear regressions were used to study the relationship between: a) Physical activity, Food intake, Sleeping Hours, Smoking, Risk Intake, BMI, Life Skills and Mental Health outcomes. Adjusted Betas were calculated for

each variable in relation to MH. All results were considered statistically significant with $p < .05$, CI = 95%. Multivariate models were used to decompose the covariance between demographics, health behaviors and life skills to better explore the predictors that are correlated with the health outcomes. Four models were introduced in the multivariate analysis; in first model, the demographic factors(Rural/Urban residence, university year, age, sex)and sleeping hours were studied in correlation with Mental Health. In Model 2, Life Skills components were added while in model 3, we added BMI, and Model 4 studied the correlation between health behaviors (physical activity, risk taking actions, smoking, food intake).

Results

A total of 2789 university students participated in this study. Their mean age is 20.9 (SD = 6.14) years. Most of them were females (64%), came from outside the capital Beirut (85%), were in their first (27%) and second (27%) year of university. The majority of the students are non-smokers (70%); 16% were water-pipe smokers, 11% cigarette smokers, and 3% were mixed smokers. The mean of students' risky behaviors is 2.6± (SD = 0.67).

The majority of them sleep five to eight hours during the weekends (65%) and the weekdays (77%). The percentage of students who sleep less than five hours during weekdays is 17% and 8% during weekends. While 59% of the participants have a low physical activity level, the BMI mean is 22.72 Kg/m^2 (SD = 3.61) with 68% of the university students having a normal weight status, 16% are overweight, 11% are underweight, and 5% are obese.

Concerning the food frequency intake, 60% have low calorie food consumption and 19% adopt high calorie food, 18% adopt processed food, while 3% consume hot beverages. Moreover, the results show that 20% of the participants are prone to anxiety and/or depression. According to the life skills, 89% of the participants have the overall life skills: 90% of the students have Relationship and Communication skills, 89% have the Self-Care skills, 86% of them have the Daily living skills, 84% have the skills for Goal Setting, 82% have skills in Work and Study Skills, 80% have the Career and Education Planning skills. The lowest percentage is 67% for Housing and money management skills.

Bivariate analysis was performed to examine the association between university students' mental health and demographic and behavioral factors as well as life skills (Table 1).

Results showed a strong association between mental health and participants' sex (p = 0.028); females are more prone to anxiety/depression (M = 35.02 ± 7.23 compared to 34.60 ± 6.25 for males). Also, the residence of the participants is a significant variable associated with their mental health (p = 0.026). Post-Hoc analysis showed a significant difference in the mental health status between Beirut and regions outside Beirut (p = 0.024). Students living outside the capital were more prone to anxiety and depression (36.42 ± 8.42).

Smoking is another variable that showed to be significantly associated with students' mental health (p = 0.040). Post-Hoc analysis showed that differences were detected among sub variables (cigarettes, water

pipes, and mixed smokers). Risk taking behaviors are also significantly and positively associated with students' mental health with $p < 0.001$ and $R = 0.10$.

Moreover, a significant association was observed between mental health and physical activity ($p = 0.047$) while according to the Post-Hoc analysis, there is an absence in significant difference among the sub categories; low, moderate, and vigorous activities.

BMI is another significant factor associated with students' mental health ($p < 0.001$). According to the Post-Hoc analysis, the significant differences are among underweight and normal students ($p < 0.001$) and between underweight and overweight students ($p = 0.045$). Underweight students have the highest mental health mean ($M = 36.62 \pm 5.95$) while the normal weight students have the lowest mental health mean score ($M = 34.74 \pm 6.91$). As for eating patterns, only low calorie diet (factor 1), and high calorie diet (factor 2) are significantly associated with students' mental health where this latter is negatively associated with factor 1 ($R = -0.072$) and positively associated with factor 2 ($R = 0.132$), the correlation with processed food and hot beverages is non-significant.

Analysis of the relation between life skills and mental health showed lower mental health mean scores among students who have the life skills compared to those who do not have them; For instance, students who have the Daily Living skills have a mental health mean score equal to 34.73 ± 7.09 compared to 36.88 ± 5.15. The difference is very remarkable among students who have the Self-Care skills where their mental health mean score is equal to $M = 22.71 \pm 4.62$ compared to $M = 37.39 \pm 7.08$ among those who do not have this skill.

Table 1
Characteristics of University students (n = 2789) according to the MH

Characteristic	MH (M ± SD)	P-Value
Sex		**0.028**
Males	**34.60 ± 6.25**	
Females	**35.02 ± 7.23**	
Region		**0.026****
Beirut	**34.37 ± 7.80**	
Outside Beirut	**36.42 ± 8.42**	
Year at university		**0.342**
First	**35.15 ± 6.84**	
Second	**34.75 ± 6.55**	
Third	**35.42 ± 7.75**	
Forth	**34.99 ± 7.17**	
Master or PhD	**34.39 ± 6.28**	
Smoking		
Non-Smokers	35.00 ± 6.90	0.040
Cigarette Smokers	35.83 ± 7.29	
Water pipe Smokers	34.80 ± 6.38	
Both smokers	33.87 ± 7.49	
Sleeping Hours (SH)		

P value is significant at $p < 0.05$

M = mean

*All the results represent the subjects who have the life skills.

**Post-Hoc: Beirut and South ($p = 0.024$).

*** Post-Hoc: Underweight and Normal ($p < 0.001$), Underweight and Overweight ($p = 0.045$).

(+) students who have the life skills

(-) students who do not have the life skills

Weekdays < 5 hours	36.76 ± 3.07	0.510
Weekdays 5–8 hours	35.61 ± 5.91	
> 8 hours	35.27 ± 6.47	
Weekend < 5 hours	35.36 ± 7.56	0.169
Weekend 5–8 hours	34.75 ± 6.67	
Weekend > 8 hours	35.54 ± 7.23	
Age (mean)	R = 0.01	0.980
Risk Intake (RI) (mean)	R = 0.10	< 0.001
Physical Activity Questionnaire-Short Form (IPAQ-SF)		0.047
Low	34.89 ± 7.56	
Moderate	35.52 ± 5.69	
High	34.54 ± 5.82	
Body Mass Index (BMI)		< 0.001***
Underweight	36.62 ± 5.95	
Normal	34.74 ± 6.91	
Overweight	35.26 ± 6.90	
Obese	34.88 ± 7.91	
Food Frequency Questionnaire (FFQ)		
Factor1-Low calorie diet	R=-0.072	< 0.001
Factor 2- High calorie diet	R = 0.132	< 0.001
Factor 3- Processed food	R = 0.008	0.688
P value is significant at p < 0.05		
M = mean		
*All the results represent the subjects who have the life skills.		
**Post-Hoc: Beirut and South (p = 0.024).		
*** Post-Hoc: Underweight and Normal (p < 0.001), Underweight and Overweight (p = 0.045).		
(+) students who have the life skills		
(-) students who do not have the life skills		

Factor 4- Hot beverages	R = 0.034	0.073
Life Skills*		
Daily living	(+)34.73 ± 7.09	< 0.001
	(-) 36.88 ± 5.15	
Self-Care	(+)22.71 ± 4.62	< 0.001
	(-)37.39 ± 7.08	
Relationship & Communication	(+)34.76 ± 7.05	< 0.001
	(-)37.29 ± 4.87	
Housing & Money Management	(+)34.26 ± 6.51	0.024
	(-)36.57 ± 7.37	
Work & Study Life	(+)34.77 ± 7.10	< 0.001
	(-)36.12 ±5.78	
Career & Education Planning	(+)34.75 ± 6.25	0.009
	(-)36.12 ± 6.25	
Looking forward: Goal setting	(+)34.71 ± 6.95	0.029
	(-)36.73 ± 6.34	
life skills(total)	(+)34.77 ± 7.06	< 0.001
	(-) 37.22 ± 4.67	
P value is significant at p < 0.05		
M = mean		
*All the results represent the subjects who have the life skills.		
**Post-Hoc: Beirut and South (p = 0.024).		
*** Post-Hoc: Underweight and Normal (p < 0.001), Underweight and Overweight (p = 0.045). (+) students who have the life skills (-) students who do not have the life skills		

Multivariate Regressions

Linear regression models were conducted to adjust the effect of covariates on the students' mental health. Based on testing several models in multivariate linear regression, the R^2 was 0.76 for the final model which means that this model explains 76% of the variance for mental health (Table 2). This model was a significant predictor of the outcome variable with p value < 0.001.

In Model 1, region (p < 0.001), gender (p = 0.018), and university year (p = 0.028) were significant variables associated with students' mental health. Female students are more prone to have anxiety and depression than male students (B = 0.045). Students who come from outside Beirut are more at a higher risk for depression and anxiety (B= -0.075). As for university year; the more advanced the student's year is, the less likely they are to show signs of mental health disorders (B= -0.043)

When life skills were added in Model 2, the region (p = 0.03), university year (p = 0.019), and gender (p < 0.001) remained significant variables while only Housing & Money Management skills (p < 0.001) and Work & Study skills (p = 0.019) showed to be significantly associated with students' mental health; students who have these skills have lower mental health score.with B= -0.13 and − 0.06 respectively.

BMI was added in Model 3 to show that it is not significantly associated with students' mental health.

Finally, in Model 4, the behavioral factors were added including smoking, physical activity, food dietary intake, and risky behaviors. Variables from the previous models showed to be significant; region, gender, university year, Housing & Money Management skills as well as Work & Study life skills in addition to risky behaviors (RI) (p < 0.001), factor 1- low diet food (p < 0.001), and factor 2- high calorie diet (p < 0.001).

Age, sleeping hours, physical activity, smoking, body mass index, hot beverages and processed food, life skills components of Daily living, Self-Care, Relationship and Communications, Career and Education Planning showed to have non-significant association with university students' mental health.

Table 2
Correlates of BMI among university students: multivariate analysis.

Model 1	Explanatory variables	Unstandardized coefficients		Standardized Coefficients	t	P value
		β	Std. error	B		
	Constant	39.371	1.557		25.284	0
	Year	-0.779	0.355	-0.043	-2.192	0.028
	Sex	0.650	0.274	0.045	2.371	0.018
	Region	-1.591	0.405	-0.075	-3.926	< 0.001
Model 2	**Explanatory variables**	**Unstandardized coefficients**		**Standardized Coefficients**	**t**	**P value**
		β	**Std. error**	**B**		
	Constant	39.62	1.00		39.55	0
	Sex	0.99	0.28	0.07	3.57	< 0.001
	Region	-1.19	0.04	-0.05	-2.559	0.03
	University year	-0.80	0.34	-0.04	-2.35	0.019
	Housing & Money Management	-1.97	0.32	-0.13	-6.06	< 0.001
	Work& Study Life	-1.19	0.50	-0.06	-2.34	0.019
Model 3	**Explanatory variables**	**Unstandardized coefficients**		**Standardized Coefficients**	**t**	**P value**
		β	**Std. error**	**B**		
	Constant	39.67	1.07		37.06	0
	Sex	0.77	0.27	0.05	2.83	0.005
	Region	-1.46	0.40	-0.06	-3.65	< 0.001
	University year	-0.76	0.34	-0.04	-2.21	0.027

Model 1: y (MH) = β0 + (β1 * Demographics (age, gender, university year, sleeping hours)

Model 2: y (MH) = β0'+ (β1' * Demographics) + (β2' * Life skills)

Model 3: y (MH) = β0"+ (β1" * Demographics) + (β2" * Life skills) + (β3" *BMI)

Model 4: y (MH) = β0"'+ (β1"' * Demographics) + (β2"' * Life skills) + (β3"' *BMI) + (β4"' * Behavioral factors :physical activity, smoking, risk intake, eating patterns)

Model 1	Explanatory variables	Unstandardized coefficients		Standardized Coefficients	t	P value
		β	Std. error	B		
	Money & House Management	-2.27	0.31	-0.15	-7.13	< 0.001
	Work & Study Life	-0.14	0.39	-0.08	-0.37	0.017
Model 4	**Explanatory variables**	**Unstandardized coefficients**		**Standardized Coefficients**	**t**	**P value**
		β	**Std. error**	**B**		
	Constant	37.49	1.22	0	30.57	0
	Sex	0.88	0.27	0.06	3.24	0.001
	Region	-1.21	0.39	-0.05	-3.09	0.002
	University Year	-0.61	0.33	-0.03	-1.82	0.049
	Money & House Management	-0.64	0.19	-0.09	-3.30	0.001
	Work & Study Life	-0.61	0.21	-0.07	-2.81	0.005
	Low calorie diet	-0.13	0.02	-0.09	-4.82	< 0.001
	High calorie diet	0.36	0.04	0.15	7.46	< 0.001
	Risk Intake	1.09	0.19	0.10	5.75	< 0.001
	Physical Activity	-1.02	0.21	-0.05	6.24	0.039

Model 1: y (MH) = β0 + (β1 * Demographics (age, gender, university year, sleeping hours)

Model 2: y (MH) = β0'+ (β1' * Demographics) + (β2' * Life skills)

Model 3: y (MH) = β0"+ (β1" * Demographics) + (β2" * Life skills) + (β3" *BMI)

Model 4: y (MH) = β0"'+ (β1"' * Demographics) + (β2"' * Life skills) + (β3"' *BMI) + (β4"' * Behavioral factors :physical activity, smoking, risk intake, eating patterns)

Stratification by gender

The data were stratified by gender (Table 3). The same models were conducted. The R^2 was 0.83 for both males and females for the final model. These models were significant predictors of the outcome variable, mental health, with p value < 0.001.

For female students, the results of model 1 showed that university years and region are both significantly and negatively associated with female students' mental health. Female students who belonged to areas outside Beirut are at higher risk for anxiety or/and depression ($p = < 0.001$, B= -0.082), also students who are at senior year in university are less likely to suffer with mental disorders ($p = 0.014$, B= -0.067).

In Model 2, life skills were added to show that three life skills components; Money & House Management, Work & Study Life, and Goal Settings showed to have a significant and inverse association with female students' mental health scores ($p < 0.001$ and B = 1.570, -0.083, -0.075 respectively) in addition to the previous significant variables (region and university students).

Adding the BMI score as a variable to model 3 did not change the association between the previous significant variable and female students' mental health.

The behavioral factors were added in model 4 to show that in addition to university year, region, and life skills (housing & money management, work & study life, and goal settings); risk taken action is significantly and positively associated with female students' mental health (B = 0.116), $p < 0.001$, whereby a high mental health score is associated with higher risky behaviors. Also, low calorie food is inversely associated with female students' mental health scores (B=-0.129) with $p < 0.001$, while high calorie food is positively associated with the mental health scores (B = 0.145) with $P < 0.001$. Female students with anxiety/depression are more likely to eat high calorie food.

Age, sleeping hours, physical activity, smoking, body mass index, hot beverage and processed food, life skills components: Daily living, Self-Care, Relationship and Communications, Career and Education Planning showed to have non-significant direct association with female emerging adults' mental health.

As for the male students, model 1 showed that none of the demographic factors were significantly associated with male students' mental health.

Adding life skills to model 2 showed that Daily living and Housing & Money Management are significant variables that are negatively associated with male students' mental health scores ($p = 0.046$ and 0.042; B= -0.116, -0.071 respectively)In model 3, BMI was not a significant variable associated with male students' mental health.

Model 4 showed that in addition to these two life skills components, high calorie intake and risk taking actions are both significantly and positively associated with students' mental health. Therefore, students who have Daily living and Housing & Money Management skills are less likely to have mental health problems, while students who are adopting risky behaviors ($p = 0.006$, B = 0.085) and eating processed food ($p < 0.001$, B = 0.166) are more likely to have higher mental health scores, this means more mental health disturbance.

Age, sleeping hours, region, university years, physical activity, body mass index, low calorie food, hot beverages and processed food, life skills components: Self-Care, Relationship and Communications,

Career and Education Planning, Work and Study Life, Goal Setting, showed to have non-significant association with male emerging adults' mental health.

Table 3
Correlates of BMI among university students stratified by gender: multivariate analysis.

Gender	Model	Explanatory variables	Unstandardized coefficients		Standardized Coefficients	t	P value
			B	Std. error	β		
Females	1	Constant	41.502	1.931		21.451	< 0.001
		University Year	-1.124	0.451	-0.067	-2.448	0.014
		Region	-1.900	0.522	-0.082	-3.623	< 0.001
		Constant	41.523	1.392		29.837	< 0.001
	2	University Year	-1.013	0.446	-0.054	-2.271	0.023
		Region	-1.567	0.522	-0.072	-3.000	0.003
		Housing & Money Management	-2.425	0.407	-1.570	-5.965	< 0.001
		Work & Study Life	-1.714	0.640	-0.083	-2.679	0.007
		Goal settings	-1.701	0.723	-0.075	-2.352	0.019
	3	Constant	42.020	1.371		30.651	< 0.001
		University year	-1.046	0.444	-0.056	-2.355	0.019
		Region	-1.817	0.521	-0.083	-3.488	< 0.001
		Housing & Money Management	-2.475	0.401	-0.160	-6.170	< 0.001
		Work & Study Life	1.762	0.589	0.085	2.990	0.003
		Goal settings	-1.604	0.609	-0.071	-2.634	0.009
	4	Constant	36.979	1.487		24.868	< 0.001

Model 1: y (MH) = β0 + (β1 * Demographics (age, gender, university year, sleeping hours)

Model 2: y (MH) = β0'+ (β1' * Demographics) + (β2' * Life skills)

Model 3: y (MH) = β0"+ (β1" * Demographics) + (β2" * Life skills) + (β3" *BMI)

Model 4: y (MH) = β0"'+ (β1"' * Demographics) + (β2"' * Life skills) + (β3"' *BMI) + (β4"' * Behavioral factors :physical activity, smoking, risk intake, eating patterns)

Gender	Model	Explanatory variables	Unstandardized coefficients		Standardized Coefficients	t	P value
			B	Std. error	β		
		University year	-0.751	0.437	-0.040	-1.718	0.04
		Region	-1.451	0.508	-0.067	-2.857	0.004
		Housing & Money Management	-2.444	0.397	-0.159	-6.152	< 0.001
		Work & Study Life	1.776	0.581	0.086	3.056	0.002
		Goal settings	-1.631	0.599	-0.072	-2.725	0.006
		Risk Intake	1.222	0.249	0.116	4.914	< 0.001
		Low Calorie Food	-0.191	0.037	-0.129	-5.199	< 0.001
		Calorie Food	0.365	0.065	0.145	5.652	< 0.001
Males	1	Constant	38.296	2.632		14.553	< 0.001
	2	Constant	37.858	0.461		82.034	< 0.001
		Daily Living	-1.733	0.867	-0.1160	-1.998	0.046
		Housing & Money Management	-0.927	0.546	-0.071	-1.696	0.042
	3	Constant	38.244	0.710		53.898	< 0.001
		Daily Living	-2.811	0.558	-0.187	-5.038	< 0.001
		Housing & Money Management	-1.191	0.486	-0.091	-2.451	0.014
	4	Constant	34.104	1.081		31.562	< 0.001

Model 1: y (MH) = β0 + (β1 * Demographics (age, gender, university year, sleeping hours)

Model 2: y (MH) = β0'+ (β1' * Demographics) + (β2' * Life skills)

Model 3: y (MH) = β0"+ (β1" * Demographics) + (β2" * Life skills) + (β3" *BMI)

Model 4: y (MH) = β0"'+ (β1"' * Demographics) + (β2"' * Life skills) + (β3"' *BMI) + (β4"' * Behavioral factors :physical activity, smoking, risk intake, eating patterns)

Gender	Model	Explanatory variables	Unstandardized coefficients		Standardized Coefficients	t	P value
			B	Std. error	β		
		Daily Living	-2.741	0.564	-0.184	-4.860	< 0.001
		Housing & Money Management	-1.304	0.485	-0.100	-2.689	0.007
		Processed food	0.340	0.072	0.166	4.754	< 0.001
		Risk intake	0.784	0.286	0.085	2.740	0.006
		Physical Activity	0.121	0.274	0.054	3.21	0.047

Model 1: y (MH) = β0 + (β1 * Demographics (age, gender, university year, sleeping hours)

Model 2: y (MH) = β0'+ (β1' * Demographics) + (β2' * Life skills)

Model 3: y (MH) = β0"+ (β1" * Demographics) + (β2" * Life skills) + (β3" *BMI)

Model 4: y (MH) = β0"'+ (β1"' * Demographics) + (β2"' * Life skills) + (β3"' *BMI) + (β4"' * Behavioral factors :physical activity, smoking, risk intake, eating patterns)

Discussion:

This paper provides a clear overview of the factors that are associated with university students' mental health. Health behaviors of particular importance among emerging adults including risk taking behaviors, sleep, diet, smoking, and physical activity in addition to the demographic factors and life skills showed to have asignificant association to emerging adults' mental health.

This study reveals that 20% of the university students in Lebanon are suffering from anxiety or/and depression which is similar to the previous reports in Lebanon that showed 24.2% of university students are categorized as mild-to-moderately depressed (Kabrita & Hajjar-Muca, 2016). This percentage is alarming not only in Lebanon but in similar context such as Jordan that has high unemployment rates, high number of Syrian refugees, and cultural and religious restrictions (Dalky & Gharaibeh, 2019). Due to the social, political and economic crisis, one in 4 Lebanese suffers from a mental illness sometime during his or her lifetime, leading to more comorbidities and even death. However, very few seek treatment due to the stigma and social taboos in this context preventing them from living healthy and productive lives (Embrace, 2020).

The socio-demographic factors of university years, sex, and urban vs. rural residence, significantly related to mental health. While no significant association between mental health status and the region students belonged to was shown among male students, results showed that female rural dwellers are at higher risk

for anxiety or/and depression than female urban dwellers. This can be explained by the fear and concerns of rural emerging adults about making decisions especially among girls who are living away from their parents' home to continue their education as the result of social expectations. The social norms and the parents put more restrictions on female students (San Antonio, 2016). Emerging adults who are originally from rural areas are suffering from a higher risk of mental health disorders due to the lack of resources and stigmatization while they used to rely on spiritual leaders, family and friends to solve their problems in their villages (Gsell, 2010). Rural dwellers might experience culture shock due to their exposure to new social norms and a number of environmental stressors in the first two university years (Gsell, 2010). Studies showed that male were more successfully able to adapt than female students as the latter have a higher concern regarding public transportation use, dressing styles, reactions to greetings, separation from family,, lack of social support structure, and the need for time and money management (Smith, 2004).

Interestingly, we also show that contrary to university year, age was not a significant variable in our study. A meta-analysis showed that first year students had the highest rates of internalized mental health problems then gradually decreased at the final year. This might be explained by an increase in students coping and adaptation skills gradually throughout the university year (Puthran et al., 2016). This is similar to the results of the multivariate analysis in this study that showed an increase in depression and anxiety in the first university year, then it will start to decrease gradually by years. This can be explained by the adjustments that first year university student, female in specific needs to adopt, accompanied by the social restrictions and taboos that will be accountable for as a female living in a developing country. However, students start to acquire the coping skills needed gradually throughout the university years.

Health Behavior Variables Related to MH

The behavioral factors of physical activity, risky behaviors, diet, and life skills significantly related to mental health. In contrast, BMI, smoking, and hours of sleep, did not significantly relate to mental health of college students.

Our findings showed that risky behaviors (excluding smoking) are significantly and positively related with college students' mental health among both males and females; risk taking actions are associated with higher risk of depression and anxiety. Salameh et al. (2014) have shown similar results where they found that mental distress was associated with higher adoption of risky behaviors among the Lebanese university students. Same results were also explored by other researchers (Bersamin et al.,2014; Tavolacci et al., 2013). This transition phase in emerging adults' lives is a self-discovery period where students are more prone to experience risky behaviors and are more susceptible to media and peer influences. Moreover, college students do not consider themselves as vulnerable to dangers (e.g., drugs, binge drinking, unsafe sex practices) while they are more exposed to risky behaviors on a regular basis associated with lack of continuous parental monitoring (Aldeis & Afifi, 2013). Similar to the study conducted by Cheah et al. (2010), our study did not show smoking as significant risky behavior affecting

students' mental health among both male and female students. The association between smoking and mental health is still not clear (Morton et al., 2020). According to a systematic review conducted by Taylor et al. (2014), several studies indicate that regular smokers report that smoking would help in improving emotional disorders, depression, and anxiety while helping them in relaxing and mitigating stress regardless of the mental health situation of these individuals (Clancy et al., 2013; Lawn et al., 2002; Lerman et al., 1996). The complexity of the association between smoking and mental health can explain the lack of significant association among these two variables in this study. More qualitative studies are needed to get a deep insight on this complex association and to capture the nuances of this complexity.

Physical activity and dietary behaviors are both shown to be significant variables associated with emerging adults' mental health. Both variables are known to be sensitive to environmental influences, including financial situations, social norms and the availability of suitable space and programs. For instance, the high registration fees in sports clubs accompanied with more social restrictions on female registrations in gyms and fitness zones are factors that preclude youth motivation to practice sports. Also, due to the financial needs most of the university students work after school to cover their tuition fees preventing them from accommodating time to practice healthy habits such as cooking or practicing physical exercises (Simons et al., 2017). The association between physical activity (PA) and mental health is well-documented providing strong evidence on mental health benefits of PA (Biddle, 2016; Chekroud et al., 2018; White et al., 2017). Students who practice physical exercises are less likely to report mental health disorders than students who do not (Vankim & Nelson, 2013). Moreover, increased sedentary behavior relative to other behaviors was significantly associated with increased depression symptoms ($p < 0.001$) as explored in a study conducted in the United States among young and older adults (Del Pozo et al., 2020; Deliens et al., 2015). In our study, physical activity is significantly associated with only male students' mental health, this might be explained by the higher level of physical activity conducted by male than female students (Arroyo et al., 2000).

As for the diet patterns, both the bivariate and multivariate analysis showed a significant association between high/low calorie food and students' mental health. While high calorie food showed to be positively associated with males' and females' mental health status, low calorie food showed to be a significant factor that is negatively associated with only female students' mental health. The consumption of low food calorie is associated with lower mental health disturbances in the literature. In California, surveys showed that more consumption of fast food is associated with high prevalence of neurosis and psychosis (Banta et al., 2019). This might be explained by the biological effect of nutrients on the hormonal physiology. Unfortunately, the Lebanese youth population is moving toward a nutrition transition where they rely less on the Mediterranean diet and increase their intake of processed and fast foods. A longitudinal epidemiologic study among college students in Spain (Sánchez-Villegas et al., 2009) suggested that the Mediterranean diet (low in processed food) is more likely to be associated with lower risk of clinical depression and considered it as a protective factor to prevent depression. People at this age group (less than 30 years old) do not have a complete brain maturation. The level of brain maturation and changes in brain functions may necessitate healthy dietary plans for improving mental well-being (Begdache et al., 2019). Emerging adults' mood is depending on food that increases

availability of neurotransmitter precursors and concentrations in the brain such as frequent meat, vegetables, nuts consumption (Bastos et al., 2020). High calorie food and saturated, trans- and omega-6 fatty acids promote systemic low-grade inflammation (LGI) which is related to symptoms of anxiety and depression (Begdache et al., 2019).

Body mass index did not relate significantly to internalizing problem behaviors of anxiety and depression in our study. The findings are similar to the modest relation found between mental health disorders and obesity in a cross-national study, based on the World Mental Health survey (Scott et al., 2008). This might be explained by the findings of Janssen et al. (2004) who explained obesity-related health risks by the waist circumference (WC) and not by BMI. Therefore, WC should be taken into consideration in future research.

There is minimal information on the prevalence of sleep disorders among college students and their impact on mental health and neurocognitive functioning (Petrov et al., 2014). Assaad et al., (2104) in their study conducted among university students in Lebanon showed that sleep disturbance is associated with stress due to the external stressors during high schools, tertiary education phase, with midterms, final exams, and deadlines as well as their susceptibility to changes and maturation in the neuroendocrine system (Assaad et al., 2014). However, in our study we did not find a significant association between hours of sleep and mental health. Studies relying on clinical examination of neurodocrine system can further explain this association.

Life skills and MH

Both multivariate and bivariate analysis showed a significant negative association between mental health and life skills components. As showed by the systematic review conducted by Snacassiani et al. (2015), the life skills programs are effective in enhancing mental health problems such as depression, anxiety, anger, self-esteem and substance abuse addiction (Smith et al, 2004;Luna-Adame et., al, 2013), which is similar to what we have explored in the present study where anxiety and depression are associated with low level of life skills among college students. Specifically, male students showed to have daily living (meal planning and preparation, cleaning and food storage, home maintenance, etc.), housing & money management (banking and credit, finding and keeping affordable housing, budgeting and living within one's means) as significant life skills components associated with their mental health status. These results were similar to the findings of a study conducted among subjects who participated in a daily living skills program in Tehran that was effective in declining depression, anxiety, and stress (Piadehkouhsar et al., 2019). Also, a study conducted by Sages et al. (2013) among college students in mid-western US university showed that the students retention rate is associated with their financial status. An increase in financial knowledge and management through holistic training services might mitigate the stress and anxiety among university students thus enhancing the retention rate (Sages et al., 2013). This can be explained clearly in the Lebanese context where the financial crisis negatively affected students' retention rate which in turn required a deep understanding and implications of money and

house management skills among university students. As for female university students, in addition to housing and money management skills, goal settings (vision for future, self-confidence, and self-efficacy) and study & work plans (basic of employment, legal issues, study skills and time management) are the life skills components that are significantly correlated with their mental health. Time management, Study and Work life skills were shown to have a positive impact on decreasing anxiety/ depression (Ping & Xiaochun,2018; Kunnen, 2014). In addition Kunnen, (2014) found that a career choice intervention was shown to be an effective way to decrease psychological problems such as depression and anxiety among people aged 17–23 years old. Goal settings skills, which include youth's level of confidence and internal feelings important to success, were also linked to decreased levels of depression as reported by Henriksen et al. (2017) study who showed that high self-esteem decreased symptoms of depression. Mental illness associated with low self-esteem might disrupt relationships and limit the ability to obtain housing, jobs and an education (Storrie et al., 2010). Therefore, it is clear that the significant life skills components affecting Lebanese university students' mental health are related to the financial, career and future planning which are the stressors affecting students' mental health. The importance of these factors in youth's life in Lebanon is closely related to the struggling economic situation, the lack of employment opportunities for youth and the absence of trust in the state for youth to capitalize on to be able to plan for their future.

In addition to the fact that being emerging adults is a very critical and life-complex transition phase, the Lebanese university students are suffering from a variety of other stressors (political, financial, social, etc.) where life-skills training (LST) might be an effective approach to improving their mental health. Life skills provides the abilities needed to engage in adaptive and positive behaviors, which enable individuals to deal effectively with the challenges of everyday life (WHO, 1994). Several systematic and meta-analytic reviews have also suggested that life skills can decrease depressive tendencies and their related unhealthy behaviors; for instance: use/misuse of alcohol, tobacco, and/or drugs (Botvin & Griffin, 2015; Singla et al., 2019), and strengthen one's sense of coherence, which plays a role in promoting mental and physical health (Kase, et al., 2019). Although LST usually aims to improve all the life skills components it comprises comprehensively, it may be more effective to focus on specific skills that showed a strong correlation with students' mental health in our study (Fagan & Mihalic, 2003). The financial, political, and social complexities of the developing countries such as Lebanon add more burdens on students' choices of healthy behaviors leading to negative health outcomes. Developing countries that are similar to the Lebanese context are in need for life skills based intervention to enhance youth wellbeing to overcome the ecological barriers and challenges (IYF, 2013). This will provide them with a safe and healthy environment to be more productive and flexible in their university and career life (Al-Nakeeb et. Al, 2015). Intervention can be selective in focusing on the components that are of importance to the lives of university students in a specific context to increase their effectiveness and efficiency.

Limitations:

The nature of this study is cross-sectional, this design precludes the causality relationship between variables in this present study. A cohort design might lead to better understanding of the association

between mental health and other variables studied in this present paper. Also, the participants belonged to 12 universities and not all the universities in Lebanon, therefore, the results might not represent the whole university students' community. Reporting bias is another limitation where self-reporting data were collected through the questionnaire. Due to the large sample size, conducting an accurate clinical psychological assessment of the participants rather than relying on an epidemiological tool was difficult. The results of the study cannot be extrapolated on emerging adults who are out of universities. Despite all these limitations, exploring the effect of life skills and healthy habits is very essential to better identify the social determinants factors affecting university students' mental health in order to design a proper health promotion intervention to mitigate the burden of diseases among emerging adults.

Declarations

Consent for publication:

All participants have received consent form prior to the questionnaire.

Availability of data and material:

The datasets during and/or analysed during the current study available from the corresponding author on reasonable request.

Competing interests:

No conflict of interest

Ethics approval and consent to participate:

All the participated universities have shared with us their IRB approval based on Belmont report.

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Authors' contributions:

Mrs. Diana Maddah has analyzed the data and has written the final paper, Dr. Tamar Kabakian has contributed in paper writing, Dr. Rouba Zeidan has contributed in data analysis and interpretation, Ms. Nathalie Al Saady has collected and entered the data, Dr. Nael Alami has contributed in the discussion and article writing, Dr. Pascale Salameh has edited and supervised the whole process of paper preparation and writing.

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References

1. Aldeis, D., & Afifi, T. D. (2013). College students' willingness to reveal risky behaviors: The influence of relationship and message type. *Journal of Family Communication*, *13*(2), 92-113.
2. Al-Nakeeb, Y., Lyons, M., Dodd, L. J., & Al-Nuaim, A. (2015). An investigation into the lifestyle, health habits and risk factors of young adults. *International journal of environmental research and public health*, *12*(4), 4380-4394.
3. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders (2000).4th ed. Text Revision. Washington: American Psychiatric Press.
4. Arnett, J. J., Žukauskienė, R., & Sugimura, K. (2014). The new life stage of emerging adulthood at ages 18–29 years: Implications for mental health. The Lancet Psychiatry, 1(7), 569-576.
5. Arroyo, A. Loria, V. Fernandez et al., "Prevalence of pre-´obesity and obesity in urban adult Mexicans in comparison with other large surveys," Obesity Research, vol. 8, no. 2, pp. 179–185, 2000.
6. Assaad, S., Costanian, C., Haddad, G., & Tannous, F. (2014). Sleep patterns and disorders among university students in Lebanon. *Journal of research in health sciences*, *14*(3), 198-204.
7. Ayçiçeği dinn, a., & caldwell-harris, c. L. (2016). Understanding gender and urban/rural differences in depressive symptoms: insights from university students in turkey. *Electronic Journal of Social Sciences*, *15*(56).
8. Bagalman, E., & Napili, A. (2014). Prevalence of mental illness in the United States: data sources and estimates.Washington, DC: Congressional Research Service
9. Banta, J. E., Segovia-Siapco, G., Crocker, C. B., Montoya, D., & Alhusseini, N. (2019). Mental health status and dietary intake among California adults: A population-based survey. *International journal of food sciences and nutrition*, *70*(6), 759-770.
10. Bastos, A. A., Nogueira, L. R., Neto, J. V., Fisberg, R. M., Yannakoulia, M., & Ribeiro, S. M. L. (2020). Association between the adherence to the Mediterranean dietary pattern and common mental disorders among community-dwelling elders: 2015 Health Survey of São Paulo, SP, Brazil. *Journal of Affective Disorders*, *265*, 389-394.
11. Begdache, L., Chaar, M., Sabounchi, N., & Kianmehr, H. (2019). Assessment of dietary factors, dietary practices and exercise on mental distress in young adults versus matured adults: A cross-sectional study. *Nutritional neuroscience*, *22*(7), 488-498.
12. Bersamin, M. M., Zamboanga, B. L., Schwartz, S. J., Donnellan, M. B., Hudson, M., Weisskirch, R. S., ... & Caraway, S. J. (2014). Risky business: Is there an association between casual sex and mental health among emerging adults?. *Journal of Sex Research*, *51*(1), 43-51.
13. Biddle, S. (2016). Physical activity and mental health: Evidence is growing.WorldPsychiatry: Official Journal of the World Psychiatric Association (WPA), 15(2), 176–177.https://doi.org/10.1002/wps.20331
14. Botvin, G. J., & Griffin, K. W. (2015). Life Skills Training: A competence enhancement approach to tobacco, alcohol, and drug abuse prevention.

15. Carta MG, Kovess V, Hardoy MC, Brugha T, Fryers T, Lehtinen V, et al. (2004). Psychosocial wellbeing and psychiatric care in the European Communities: analysis of macro indicators. Soc Psychiatry Psychiatr Epidemiol; 39: 883-892.
16. Education in Lebanon,Statistics In Focus (SIF), Central Administration of Statistics, Lebanon, Issue number 3, April 2012.
17. Center for Educational Research and Development. (2018). Retrieved from: http://www.crdp.org/stat-details?id=26000&la=en
18. Cheah, C. S., Trinder, K. M., & Gokavi, T. N. (2010). Urban/rural and gender differences among Canadian emerging adults. *International journal of behavioral development*, *34*(4), 339-344.
19. Chekroud, S. R., Gueorguieva, R., Zheutlin, A. B., Paulus, M., Krumholz, H. M., Krystal, J.H., et al. (2018). Association between physical exercise and mental health in 1.2million individuals in the USA between 2011 and 2015: A cross-sectional study.TheLancet Psychiatry, 5(9), 739–746.https://doi.org/10.1016/S2215-0366(18)30227-X.
20. Clancy N, Zwar N, Richmond R. Depression, smoking and smoking cessation: a qualitative study. Fam Pract2013;30:587-92. Abstract/FREE Full TextGoogle Scholar
21. Colantioni C, Rada P, McCarthy J, Patten C, Avena N, Chadeayne A y Hoebel B. Evidence that intermittent excessive sugar intake causes endogenous opioid dependence. Obes Research 2002; 10 (6): 478-88.
22. Craig, C. L., Marshall, A. L., Sjorstrom, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., ... & Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine and Science in Sports and Exercise*, *35*(8), 1381-1395.
23. Dalky, H. F., & Gharaibeh, A. (2019, April). Depression, anxiety, and stress among college students in Jordan and their need for mental health services. In Nursing forum (Vol. 54, No. 2, pp. 205-212).
24. Del Pozo Cruz, B., Alfonso-Rosa, R. M., McGregor, D., Chastin, S. F., Palarea-Albaladejo, J., & del Pozo-Cruz, J. (2020). Sedentary behaviour is associated with depression symptoms: compositional data analysis from a representative sample of 3,233 US adults and older adults assessed with accelerometers. *Journal of Affective Disorders*.
25. Desai, M. (2010). A rights-based preventive approach for psychosocial well-being in childhood. Mumbai: Spinger
26. Durlak JA, Weissberg RP, Dymnicki AB, Taylor RD, Schellinger KB. (2011).The impact of enhancing students' social and emotional learning: a meta-analysis of school-based universal interventions. Child Dev; 82: 405-432.
27. Embrace (2020). https://embracelebanon.org/about-embrace/
28. El-Kassas, G., & Ziade, F. (2016). Exploration of the dietary and lifestyle behaviors and weight status and their self-perceptions among health sciences university students in north Lebanon. *BioMed Research International*, *2016*.
29. Fagan, A. A., & Mihalic, S. (2003). Strategies for enhancing the adoption of school-based prevention programs: Lessons learned from the Blueprints for Violence Prevention replications of the Life Skills

Training program. Journal of Community Psychology, 31(3), 235-253.

30. Galagali, P. M. (2011). Adolescence and life skills. In R. Olyai & D. K. Dutta (Eds.), Recent advances in adolescent health (pp. 209–218). New Delhi: JAYPEE Brothers Medical Publishers (P) LTD
31. Gruebner, O., Rapp, M. A., Adli, M., Kluge, U., Galea, S., & Heinz, A. (2017). Cities and mental health. *Deutsches Ärzteblatt International*, *114*(8), 121.
32. Gsell, M. (2010). Individual Contributions to Stigma and Attitudes Toward Help-Seeking among Rural Emerging Adult College Students.inprint.
33. Helou, K., El Helou, N., Mahfouz, M., Mahfouz, Y., Salameh, P., & Harmouche-Karaki, M. (2018). Validity and reliability of an adapted arabic version of the long international physical activity questionnaire. *BMC public health*, *18*(1), 49.
34. Henriksen, I. O., Ranøyen, I., Indredavik, M. S., & Stenseng, F. (2017). The role of self-esteem in the development of psychiatric problems: a three-year prospective study in a clinical sample of adolescents. *Child and adolescent psychiatry and mental health*, *11*(1), 68.
35. International Youth Foundation (2013). Preparing Youth for Success.
36. Issa, C., Darmon, N., Salameh, P., Maillot, M., Batal, M., & Lairon, D. (2011). A Mediterranean diet pattern with low consumption of liquid sweets and refined cereals is negatively associated with adiposity in adults from rural Lebanon. *International journal of obesity*, *35*(2), 251-258.
37. Janssen, I., Katzmarzyk, P. T., & Ross, R. (2004). Waist circumference and not body mass index explains obesity-related health risk. The American journal of clinical nutrition, 79(3), 379-384.
38. Kabrita, C. S., & Hajjar-Muca, T. A. (2016). Sex-specific sleep patterns among university students in Lebanon: impact on depression and academic performance. *Nature and science of sleep*, *8*, 189.
39. Kase, T., Ueno, Y., Shimamoto, K., & Oishi, K. (2019). Causal relationships between sense of coherence and life skills: Examining the short-term longitudinal data of Japanese youths. *Mental Health & Prevention*, *13*, 14-20.
40. Kendler K, Neale M, MacLean C, Heath A, Eaves LJ, Kessler RC. Smoking and major depression: a causal analysis. Arch Gen Psychiatry1993;50:36-43. CrossRefPubMedWeb of ScienceGoogle Scholar
41. Kunnen, E. S. (2014). The effect of a career choice guidance on self-reported psychological problems. *Frontiers in psychology*, *5*, 547.
42. Lawn S, Pols R, Barber J. Smoking and quitting: a qualitative study with community-living psychiatric clients. Soc Sci Med2002;54:93-104. CrossRefPubMedWeb of ScienceGoogle Scholar
43. Lazarevich, I., Irigoyen-Camacho, M. E., & del Consuelo Velázquez-Alva, M. (2013). Obesity, eating behaviour and mental health among university students in Mexico City. *Nutricion hospitalaria*, *28*(6), 1892-1899.
44. Lerman C, Audrain J, Orleans CT, Boyd R, Gold K, Main D, et al. Investigation of mechanisms linking depressed mood to nicotine dependence. Addict Behav1996;21:9-19. CrossRefPubMedWeb of ScienceGoogle Scholar

45. Lindert J, von Ehrenstein OS, Grashow R, Gal G, Braehler E, Weisskopf MG. (2014).Sexual and physical abuse in childhood is associated with depression and anxiety over the life course: systematic review and meta-analysis. Int J Public Health; 59: 359-372.
46. Luna-Adame M, Carrasco-Gimenez TJ, Rueda-Garcia Mdel M. Evaluation of the effectiveness of a smoking prevention program based on the 'Life Skills Training' approach. Health Educ Res 2013; 28: 673-682.
47. Makhoul, J., Nakkash, R. T., El Hajj, T., Abdulrahim, S., Kanj, M., Mahfoud, Z., & Afifi, R. A. (2011). Development and validation of the Arab youth mental health scale. *Community Mental Health Journal*, *47* (3), 331-340.
48. Ministry of Youth Affairs and Sports, Government of India. (2017). India youth development index and report. Rajiv Gandhi National Institute of Youth Development.
49. Moreno-Gomez, D. Romaguera-Bosch, P. Tauler-Riera et al., ´"Clustering of lifestyle factors in Spanish university students: the relationship between smoking, alcohol consumption, physical activity and diet quality," Public Health Nutrition, vol. 15, no.11, pp. 2131–2139, 2012.
50. Morton, D. P., Hinze, J., Craig, B., Herman, W., Kent, L., Beamish, P., ... & Przybylko, G. (2020). A multimodal intervention for improving the mental health and emotional well-being of college students. *American Journal of Lifestyle Medicine*, *14*(2), 216-224.
51. Musharrafieh, U., Tamim, H. M., Rahi, A. C., El-Hajj, M. A., Al-Sahab, B., El-Asmar, K., & Tamim, H. M. (2008). Determinants of university students physical exercise: a study from Lebanon. International Journal of Public Health, 53(4), 208-213.
52. Newby, P. K., & Tucker, K. L. (2004). Empirically derived eating patterns using factor or cluster analysis: a review. *Nutrition reviews*, *62*(5), 177-203.
53. Petrov, M. E., Lichstein, K. L., & Baldwin, C. M. (2014). Prevalence of sleep disorders by sex and ethnicity among older adolescents and emerging adults: relations to daytime functioning, working memory and mental health. *Journal of adolescence*, *37*(5), 587-597.
54. Piadehkouhsar, M., Ahmadi, F., Khoshknab, M. F., & Rasekhi, A. A. (2019). The effect of orientation program based on activities of daily livingon depression, anxiety, and stress in the elderly. *International journal of community based nursing and midwifery*, *7*(3), 170.
55. Ping, W. A. N. G., & Xiaochun, W. A. N. G. (2018). Effect of time management training on anxiety, depression, and sleep quality. *Iranian journal of public health*, *47*(12), 1822.
56. Puthran, R., Zhang, M. W., Tam, W. W., & Ho, R. C. (2016). Prevalence of depression amongst medical students: A meta-analysis. *Medical education*, *50*(4), 456-468.
57. Rohde, P., Clarke, G. N., Mace, D. E., Jorgensen, J. S., & Seeley, J. R. (2004). An efficacy/effectiveness study of cognitive-behavioral treatment for adolescents with comorbid major depression and conduct disorder. *Journal of the American Academy of Child & Adolescent Psychiatry*, *43*(6), 660-668.
58. Sabbah, I., Sabbah, H., Khamis, R., Sabbah, S., & Droubi, N. (2013). Health related quality of life of university students in Lebanon: Lifestyles behaviors and socio-demographic

predictors. *Health*, *5*(07), 1.

59. Sages, R., Britt, S., & Cumbie, J. (2013). The correlation between anxiety and money management. *College Student Journal*, *47*(1), 1-11.
60. Salameh, P., Jomaa, L., Issa, C., Farhat, G., Salamé, J., Zeidan, N., ... & Lebanese National Conference for Health in University Research Group. (2014). Assessment of dietary intake patterns and their correlates among university students in Lebanon. *Frontiers in Public Health*, *2*, 185.
61. Salameh, P., Salamé, J., Waked, M., Barbour, B., Zeidan, N., & Baldi, I. (2014). Risk perception, motives and behaviours in university students. *International Journal of adolescence and youth*, *19*(3), 279-292.
62. Salameh, P., Jomaa, L., Issa, C., Farhat, G., Zeghondi, H., Gerges, N., ... & Salamé, J. (2014). Assessment of health risk behaviours among university students: a cross-sectional study in Lebanon. International Journal of Adolescence and Youth, 19(2), 203-216.
63. San Antonio, D. M. (2016). The complex decision-making processes of rural emerging adults: Counseling beyond dualism. Peabody Journal of Education, 91(2), 246-269.
64. Sancassiani F, Pintus E, Holte A, Paulus P, Moro MF, Cossu G, et al. Enhancing the Emotional and Social Skills of the Youth to Promote their Wellbeing and Positive Development: A Systematic Review of Universal School-based Randomized Controlled Trials. Clin Pract Epidemiol Ment Health 2015; 11: 21-40
65. Sánchez-Villegas, A., Delgado-Rodríguez, M., Alonso, A., Schlatter, J., Lahortiga, F., Majem, L. S., & Martínez-González, M. A. (2009). Association of the Mediterranean dietary pattern with the incidence of depression: the Seguimiento Universidad de Navarra/University of Navarra follow-up (SUN) cohort. *Archives of general psychiatry*, *66*(10), 1090-1098.
66. Sarokhani, D., Delpisheh, A., Veisani, Y., Sarokhani, M. T., Manesh, R. E., & Sayehmiri, K. (2013). Prevalence of depression among university students: a systematic review and meta-analysis study. *Depression research and treatment*, *2013*.
67. Savoji, A. P., & Ganji, K. (2013). Increasing mental health of university students through life skills training (LST). Procedia-Social and Behavioral Sciences, 84, 1255-1259.
68. Simons-Morton, B., Haynie, D., O'Brien, F., Lipsky, L., Bible, J., & Liu, D. (2017). Variability in measures of health and health behavior among emerging adults 1 year after high school according to college status. Journal of American college health, 65(1), 58-66.
69. Scott, K. M., Bruffaerts, R., Simon, G. E., Alonso, J., Angermeyer, M., De Girolamo, G., ... & Kessler, R. C. (2008). Obesity and mental disorders in the general population: results from the world mental health surveys. *International journal of obesity*, *32*(1), 192-200.
70. Simons-Morton, B., Haynie, D., O'Brien, F., Lipsky, L., Bible, J., & Liu, D. (2017). Variability in measures of health and health behavior among emerging adults 1 year after high school according to college status. *Journal of American college health*, *65*(1), 58-66.
71. Singla, D. R., Waqas, A., Hamdani, S. U., Suleman, N., Zafar, S. W., Saeed, K., ... & Rahman, A. (2019). Implementation and effectiveness of adolescent life skills programs in low-and middle-income

countries: A critical review and meta-analysis. *Behaviour research and therapy*, 103402.

72. Smith, T.W. (2004). Coming of age in twenty-first century America: public attitudes towards the importance and timing of transitions to adulthood. Ageing International, 29(2), 136e148. http://dx.doi.org/10.1007/s12126-004-1014-3.
73. Smith, E. A., Swisher, J. D., Vicary, J. R., Bechtel, L. J., Minner, D., Henry, K. L., & Palmer, R. (2004). Evaluation of life skills training and infused-life skills training in a rural setting: Outcomes at two years. *Journal of Alcohol and Drug Education,48*(1), 51–70.
74. Steptoe, A., Wardle, J., Cui, W., Bellisle, F., Zotti, A. M., Baranyai, R., & Sanderman, R. (2002). Trends in smoking, diet, physical exercise, and attitudes toward health in European university students from 13 countries, 1990–2000. *Preventive medicine*, *35*(2), 97-104.
75. Storrie, K., Ahern, K., & Tuckett, A. (2010). A systematic review: students with mental health problems—a growing problem. *International journal of nursing practice*, *16*(1), 1-6.
76. Tavolacci, M. P., Ladner, J., Grigioni, S., Richard, L., Villet, H., & Dechelotte, P. (2013). Prevalence and association of perceived stress, substance use and behavioral addictions: a cross-sectional study among university students in France, 2009–2011. *BMC public health*, *13*(1), 724.
77. Taylor, G., McNeill, A., Girling, A., Farley, A., Lindson-Hawley, N., & Aveyard, P. (2014). Change in mental health after smoking cessation: systematic review and meta-analysis. *Bmj*, *348*, g1151.
78. T. Deliens, B. Deforche, I. De Bourdeaudhuij, and P. Clarys, "Determinants of physical activity and sedentary behavior in university students: a qualitative study using focus group discussions," BMC Public Health, vol. 15, article 201, 2015.
79. Trujillo-Hernandez, C. V ´ asquez, J. R. Almanza-Silva et al., ´"The frequency of risk factors associated with obesity and being overweight in university students from Colima, Mexico," Revista de Salud Publica, vol. 12, no. 2, pp. 197–207, 2010.
80. UNDP (2016). Demography of Youth. http://www.undp.org.lb/programme/governance/advocacy/nhdr/nhdr98/chptr4.pdf
81. VanKim, N. A., & Nelson, T. F. (2013). Vigorous physical activity, mental health, perceived stress, and socializing among college students. *American Journal of Health Promotion*, *28*(1), 7-15.
82. White, R. L., Babic, M. J., Parker, P. D., Lubans, D. R., Astell-Burt, T., & Lonsdale, C.(2017). Domain-specific physical activity and mental health: A meta-analysis.American Journal of Preventive Medicine, 52(5), 653–666.https://doi.org/10.1016/j.amepre.2016.12.008.
83. World Health Organization. (2016). Adolescents: Health risks and solutions. Retrieved from http://www.who.int/mediacentre/factsheets/fs345/en/
84. World Health Organization. (2001). Regional framework for introducing lifeskills education to promote the health of adolescents. World Health Project: ICP HSD 002/II.
85. World Health Organization. (2000). *Obesity: preventing and managing the global epidemic* (No. 894).
86. World Health Organization. (1994). Life skills education for children and adolescents in schools. Retrieved from http://apps.who.int/iris/bitstream/10665/63552/1/WHO_MNH_PSF_93.7A_Rev.2.pdf

(July 3, 2019)
87. World Health Organization. (1993). Life skills education in schools. WHO/MNH/PSF/93.7A.Rev.2.

Appendix

Appendix A

Food items consumed by participants were categorized into factors extracted from principal component analysis and Promax rotation. Sample adequacy with the Kaiser–Meyer–Olkin (KMO) index and Bartlett's Chi-square test of sphericity was calculated. Factors with Eigen values higher than 1 were retained. Items with factor loading of ≥ 0.4 were considered to be a factor, resulting into four factors; Low calorie diet, High calorie diet, Processed food, and Hot beverages. Factor analysis explored the correlation between the food items and the groups of items. It facilitated the study of the association between dietary habit and mental health.