

Somatic health and its association with negative psychosocial factors in a sample of Moroccan adolescents

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Abstract

Background: Adolescence is a distinct developmental phase characterized by multiple physical and psychological changes and by an increased vulnerability to somatic and mental health problems. These risk and vulnerability factors are part of a complex biopsychosocial matrix, encompassing multiple factors, such as inherited biological determinants and psychological, societal, and cultural influences, which affect an adolescent's overall wellbeing. In Morocco, similar to other developing countries, adolescents (young people aged from 15 to 19 years) constitute a substantial proportion of the population (almost 9%). However, studies about adolescents' health in developing countries are scarce. In this study, we describe adolescents' somatic health in a sample of high school students from the city of Tetouan, Morocco, and investigate how negative psychosocial factors, such as parental alcohol use problems and/or the experience of abuse, may influence them.

Methods: The study sample included 655 adolescents (315 boys and 340 girls, $M = 16.64$ years, range = 15–18 years) from conveniently selected classes of four high schools in the city of Tetouan in Morocco. The students responded to a survey that assessed the prevalence of somatic complaints/disorders. They also indicated whether they had ever experienced physical and/or psychological abuse and whether they had parents with alcohol use problems.

Results: More than half of the adolescents suffered from headaches and one-third had substantial problems with diarrhea or constipation. Both problems were more common in female students. The third most frequent somatic problem, affecting one in four in both genders, was allergy. Almost one-third of Moroccan adolescents (significantly more boys than girls; $p = 0.004$) reported no somatic complaints. In adolescents who reported parental alcohol use problems and/or experience of physical and/or psychological abuse, the prevalence of several somatic complaints (epilepsy, migraine, headache, diarrhea/constipation, gluten intolerance, allergy, and skin or thyroid disease) increased highly significantly compared to the adolescents who reported no such psychosocial environmental factors.

Conclusion: The results suggest that only 3 in 10 urban-living Moroccan adolescents are free of somatic complaints, while the majority suffer from some somatic problems, most often headaches and diarrhea/constipation. The association of certain negative psychosocial factors with adolescents' somatic health suggests the need of a holistic approach to the treatment of affected adolescents.

Keywords

adolescents, Morocco, parental alcohol use problems, physical or psychological abuse, somatic health

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Introduction

Despite being a developing country with relatively limited understanding of the importance of improving the health and wellbeing of young people,¹ Morocco has, over the past decade, developed several health strategies pertaining to health-care and equal access to care for all citizens.² In Morocco, similar to other developing countries,³ adolescents (young people aged from 15 to 19 years) constitute a substantial proportion

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of the population (8.9% in Morocco in 2014).⁴ The promotion of adolescents' health is a priority matter at both national and international levels. In Morocco, the Ministry of Health and the Ministry of Education work closely together to improve the psychosocial development of Moroccan adolescents.⁵ Nevertheless, there are few scientific studies that explore the actual health profile of Moroccan adolescents. This study aims at providing a general picture of the somatic health of a sample of high school students living in a city in northern Morocco.

The brain has an adaptive function through which it adjusts to environmental demands. This adaptive function accelerates during adolescence.⁶ The environmental demands can vary considerably across individual environments and cultures.⁷ The demands and the related risks are parts of a complex biopsychosocial matrix, encompassing multiple factors, such as inherited biological determinants and psychological, societal, and cultural influences, which affect an adolescent's behavior, somatic and mental health, and overall wellbeing.

During adolescence, the brain undergoes significant development and re-wiring. Frequently used synapses become stronger, whereas less used ones are progressively eliminated. The cerebral cortex becomes thinner and more efficient during this period in life.⁸ The environment and experiences to which adolescents are exposed play an important role in determining which synapses are eliminated and which ones are strengthened.⁹ It has been shown that traumatic childhood events are linked to specific changes in certain brain areas.^{10–12} For example, children and adolescents with posttraumatic stress disorder have been found to manifest significant volume reductions of their temporal lobe, prefrontal cortex, and areas of the corpus callosum and its subregions.¹³ The alterations of these brain regions can extend to other functionally connected areas, especially the limbic areas, and potentially cause dysregulation of cognitive, emotional, behavioral and biological functions, which may manifest itself in the form of insecure attachment¹⁴ and mental and somatic health problems.^{15–18}

Previous studies have shown that traumatic, stressful life events, such as growing up in a family with alcoholic parents and/or experiencing physical and/or psychological abuse (PPA), increases the probability of somatization, in particular as regards the frequency of gastrointestinal problems, migraine, headaches,^{19,20} thyroid dysfunction,²¹ chronic lung-, liver-, and vascular diseases, and even cancer.¹⁹

In this study, we aim to (1) investigate the frequency of defined somatic symptoms/disorders in a sample of urban Moroccan adolescents and (2) define the prevalence of somatic complaints in adolescents who report parental alcohol use problems and/or the experience of PPA.

Methods

Study population

Data collection was carried out within the framework of the "Mental and Somatic Health without borders (MeSHe)" project,

which is an international project identifying culture-specific aspects of mental and somatic health in adolescents for early identification of substance abuse and aggressive, antisocial behaviors.²²

The population of this study included students ($N=655$; 315 boys and 340 girls) from the 10th ($n=250$), 11th ($n=287$), and 12th ($n=118$) grades of four high schools in the city of Tetouan. Tetouan is located in the far north of the African-Arabic country of Morocco, about 20 km from the Strait of Gibraltar. During the 2013/2014 academic year, data were collected from one high school, comprising a total of 50 10th, 11th, and 12th grade classes. Four classes from each grade were selected to participate in the study. In these 12 classes, there were 456 students, of which 280 (61%) completed the survey. During the 2014/2015 academic year, data collection continued and three additional high schools were included in the study. These high schools comprised a total of 97 10th, 11th, and 12th grade classes. Two classes from each grade and from each school were selected by convenience to participate in the study. In these 24 classes, there were 876 students, of which 375 (43%) completed the survey.

The students received oral and written information about the study (background, aim, and content). Those students who agreed to participate completed the survey individually in a classroom without any outside disturbance. Only a research assistant remained in the room to answer any questions.

The overall study sample represents 4.2% of the total high school student population in the city of Tetouan ($N=15,506$ students in 17 high schools). The age range in the study population was 15–18 years, and the mean age was 16.64 ($SD=1.0$) years.

Measures and study design

The overall aim of the "Mental and Somatic Health without borders" (MeSHe) study (www.meshe.se) is to identify culture-specific risk and protective factors pertaining to adolescent health. Data are collected by means of the MeSHe survey, which comprises several validated measures and a background questionnaire that assesses basic sociodemographic data, self-declared somatic health complaints, and the presence of specific negative psychosocial factors in the respondent's life. The validated measures included in the MeSHe survey are the following ones: (1) the Life History of Aggression Inventory, which measures the occurrence of aggressive and antisocial behaviors; (2) the Brief Symptom Inventory, which measures the degree of psychological distress; (3) the Alcohol Use Disorder Identification Test is used to assess alcohol consumption, drinking behaviors, and alcohol-related problems; (4) the Drug Use Disorder Identification Test assesses an individual's illicit drug use and related consequences; (5) the Positive Affect and Negative Affect Schedule Expanded Form 30 items questionnaire measures two general affective states distributed over four dimensions:

Table 1. Test–retest reliability of the MeSHe background questionnaire assessed in a class of high school students ($N=31$) with a 2-week interval.

	Time 1 (yes/no) ^a %	Time 2 (yes/no) ^a %	Chi-square test		
			χ^2	p -value	Cramer's V
Headaches	(14/13) 51.8	(10/20) 33.3	0.65	0.34	0.16
Diarrhea/ constipation	(5/24) 17.2	(5/23) 17.8	1.13	0.40	0.21
Allergy	(5/25) 16.7	(4/25) 13.8	0.56	0.60	0.14
Skin disease	(8/23) 25.8	(5/26) 16.1	0.63	0.38	0.14
Migraine	(3/28) 9.7	(2/29) 6.4	0.23	0.81	0.09
Asthma	(2/29) 6.4	(2/29) 6.4	0.15	0.88	0.07
Epilepsy	(1/30) 3.2	(1/29) 3.3	0.04	0.97	0.03
Gluten intolerance	(1/29) 3.3	(0/29) 0	No statistics computed		
Diabetes	(0/29) 0	(0/29) 0	No statistics computed		
Cancer	(0/31) 0	(0/31) 0	No statistics computed		
Tuberculosis	(0/31) 0	(0/31) 0	No statistics computed		
Thyroid disease	(0/31) 0	(0/31) 0	No statistics computed		

MeSHe: Mental and Somatic Health without borders.

^an includes those answering yes or no to the question.

positive (activated and deactivated) and negative (activated and deactivated) affect; (6) the Godin Leisure-Time Exercise Questionnaire, which measures frequency and intensity of leisure-time physical activity; and (7) the Temperament and Character Inventory (TCI) capturing individual differences in personality traits.

The questionnaire about self-reported somatic complaints was developed by the project leader (N.K.) based on a similar questionnaire used in the Child and Adolescent Twin Study in Sweden.²³ The test–retest reliability of the questionnaire was tested in this study, showing no significant differences in the reports of any of the items (p -values between 0.34 and 0.97; Table 1).

Two items of the questionnaire assess the presence of negative psychosocial factors: “Have you ever been physically and/or psychologically abused?” and “Do you have a parent who has problems with alcohol?”

Ethical considerations

The survey was designed and used in accordance with the Declaration of Helsinki.²⁴ Participation was voluntary, and data were collected on anonymous survey sheets ensuring

that the answers provided would in no way affect the respondent's academic evaluation. All participants received a written and an oral presentation of the MeSHe project and its aims and were given the opportunity to ask questions about the project and discuss their participation with a researcher.

Completion of the survey was considered as consent to participate. The survey was approved with the registration number 85, by the Regional Directorate of the Ministry of National Education in Tetouan, responsible for managing and directing all matters concerning students from primary to high school education at Tetouan province. The use of the survey also was approved by the Faculty of Science, University Abdelmalek Essaadi, by the concerned high schools' directors and by the high schools' parent associations.

Statistical analysis

The sample characteristics were defined by descriptive statistics using the Statistical Package for the Social Sciences (SPSS) 21.0 (IBM) software tool. The chi-square test was applied to test the association between group membership and the defined somatic symptoms and diseases. Significance was set at $p < 0.05$. The strength of the statistically significant relationship was evaluated using Cramer's V effect size with the following measure of association: values from 0.07 to 0.21 indicate a small effect, values from 0.21 to 0.35 indicate a medium effect, and values greater than 0.35 indicate a large effect.²⁵

Subsequently, contingency square analysis was performed to assess the relationship within groups. The adjusted Z scores were calculated and transformed to chi-square by multiplying them with each other. Corrections for type I errors were made using the Bonferroni correction,^{26,27} setting the significance cut-off at α/n ($0.05/3=0.017$), where n refers to the number of compared groups.

To determine the test–retest reliability for the background questionnaire, one class was selected. The students in this class ($N=31$; 8 boys and 23 girls; $M=17.10$ years; $SD=0.47$) completed the questionnaire twice with a 2-week interval. Chi-square analysis was performed to compare any differences in the prevalence of each somatic complaint.

Results

Prevalence of somatic health problems in a sample of urban Moroccan high school students

The detailed prevalence of defined somatic symptoms and diseases is presented in Table 2. The most prevalent somatic problem was headaches, which was reported by 57.5% of the total sample (62.8% in girls, 51.8% in boys), followed by problems with diarrhea or constipation, reported by 30.3% (37.8% in girls, 22.6% in boys), and allergy reported by 24.6% (29.6% in girls, 19.3% in boys).

In general, girls reported headaches, allergy, and diarrhea/constipation significantly more often than boys ($p=0.002$,

Table 2. Prevalence of defined somatic symptoms and diseases in a sample of Moroccan adolescents ($N = 655$).

	Total sample (yes/no) ^a %	Boys (yes/no) ^a %	Girls (yes/no) ^a %	Chi-square test		
				χ^2	p-value	Cramer's V
Headaches	(335/248) 57.5	(146/136) 51.8	(189/112) 62.8	12.6	0.002	0.14
Diarrhea/ constipation	(166/382) 30.3	(61/209) 22.6	(105/173) 37.8	15.12	0.001	0.15
Allergy	(138/423) 24.6	(53/221) 19.3	(85/202) 29.6	7.67	0.020	0.11
Skin disease	(107/492) 17.9	(47/246) 16	(60/246) 19.6	1.52	0.46	0.05
Migraine	(85/503) 14.5	(44/243) 15.3	(41/260) 13.6	2.4	0.30	0.06
Gluten intolerance	(41/547) 7	(15/272) 5.2	(26/375) 6.5	5.12	0.08	0.09
Asthma	(33/557) 5.6	(12/278) 4.1	(21/279) 7	2.36	0.31	0.06
Thyroid disease	(26/580) 4.3	(7/287) 2.4	(19/293) 6.1	5.09	0.08	0.09
Epilepsy	(18/570) 3.2	(11/271) 3.9	(7/299) 2.3	4.36	0.11	0.08
Diabetes	(11/580) 1.9	(6/283) 2.1	(5/297) 1.7	0.34	0.84	0.02
Cancer	(8/609) 1.3	(5/302) 1.6	(3/307) 1	1.46	0.48	0.05
Tuberculosis	(7/602) 1.1	(2/295) 0.7	(5/307) 1.6	3.76	0.15	0.08
None of the above	(187/449) 29.4	108/203 34.7	79/246 24.3	8.31	0.004	0.11

^an includes those answering yes or no to the question.

0.02, 0.001, respectively). The prevalence of epilepsy, diabetes, and cancer was low (3.2%, 1.9%, 1.3%, respectively), and 1% of the students reported a diagnosis of tuberculosis (two boys and five girls). Significantly, more boys (34.7%) than girls (24.3%) reported having none of the defined somatic symptoms or diseases.

Somatic complaints in adolescents reporting parental alcohol problems or experience of being abused

Of the 655 students participating in this study, 42 (6.4%) did not answer one or both of the following questions: "Have you ever been physically and/or psychologically abused?" and "Do you have a parent who has problems with alcohol?" Of the remaining 613 students, 44 (7.2%, 12 girls and 32 boys) answered "Yes" to both questions.

To determine the association of each negative psychosocial factor with somatic health separately, the answers of the remaining 569 students were classified into three groups: adolescents not reporting having parents with alcohol problems (PAP) nor the experience of being abused (comparison group (CG); $n=407$), adolescents reporting

having PAP ($n=61$, 10%); and adolescents reporting the experience of PPA ($n=101$, 16.5%). There were 44 students reporting having both PAP and the experience of PPA. We decided not to create a PAP + PPA group of these students, because in addition to its low prevalence (6.7%), no significant divergency in the prevalence of any somatic complain was found in this group.

The comparison of the frequencies of somatic complaints between the three groups (CG, PAP, and PPA) revealed significant interaction (Table 3). The prevalence of allergy ($\chi^2(2, n=605)=7.17, p=0.03$), diarrhea/constipation ($\chi^2(2, n=611)=9.28, p=0.02$), skin disease ($\chi^2(2, n=606)=8.48, p=0.01$), epilepsy ($\chi^2(2, n=602)=12.83, p=0.002$), migraine ($\chi^2(2, n=607)=54.16, p<0.001$), headaches ($\chi^2(2, n=607)=23.72, p<0.001$), gluten intolerance ($\chi^2(2, n=605)=32.3, p<0.001$), or thyroid disease ($\chi^2(2, n=606)=33.74, p<0.001$) differed significantly between the groups, each differing with a small to moderate effect size (Cramer's V between 0.13 and 0.32; Table 3).

Post hoc comparisons revealed that adolescents belonging to the CG reported significantly fewer problems with gluten intolerance ($\chi^2(2, n=605)=13.22, p=0.001$), migraine ($\chi^2(2, n=607)=38.07, p<0.001$), headaches ($\chi^2(2,$

Table 3. Prevalence and risk ratio (RR) of defined somatic symptoms and diseases according to psychosocial variable groups.

	CG (<i>n</i> =407)		PAP (<i>n</i> =61)		PPA (<i>n</i> =101)		Chi-square test		
	%		%	RR	%	RR	χ^2	<i>p</i> -value	Cramer's <i>V</i>
Headaches	49.20		67.80	1.38	75.30	1.53	23.72	<0.001	0.21
Diarrhea/constipation	24.50		30.20	1.23	39.80	1.56	8.00	0.020	0.13
Allergy	24.50		15.30	0.62	34.50	1.41	7.17	0.030	0.12
Skin disease	16.10		12.10	0.75	28.60	1.78	9.28	0.010	0.13
Migraine	6.80		12.30	1.81	34.70	5.10	54.16	<0.001	0.32
Gluten intolerance	4.30		1.70	0.39	20.00	4.65	32.30	<0.001	0.25
Asthma	4.70		7.10	1.51	8.70	1.85	2.53	0.28	0.07
Thyroid disease	1.80		1.70	0.94	14.60	8.11	33.74	<0.001	0.25
Epilepsy	1.60		1.80	1.12	8.30	5.19	12.83	<0.001	0.16
Diabetes	1.10		1.80	1.64	3.10	2.82	2.23	0.33	0.06
Cancer	1.00		0.00	0.00	3.10	1.78	3.49	0.17	0.08
Tuberculosis	1.80		0.00	0.00	0.00	0.00	2.80	0.25	0.07

CG: comparison group; PAP: adolescents reporting parental alcohol use problems; PPA: adolescents reporting the experience of physical and/or psychological abuse.

$n=607$)=22.94, $p<0.001$), or thyroid disease ($\chi^2(2, n=606)=17.98, p<0.001$) than the adolescents belonging to the PAP or PPA groups.

The adolescents reporting the experience of PPA were significantly more likely to have epilepsy ($\chi^2(2, n=602)=12.82, p=0.002$), migraine ($\chi^2(2, n=607)=53.29, p<0.001$), headaches ($\chi^2(2, n=607)=16.56, p<0.001$), gluten intolerance ($\chi^2(2, n=605)=31.81, p<0.001$), skin disease ($\chi^2(2, n=606)=2.95, p=0.01$), or thyroid disease ($\chi^2(2, n=606)=33.76, p<0.01$) than the adolescents reporting parental alcohol use problems or reporting none of the psychosocial problems considered (Table 4).

In those who reported the experience of PPA, the risk of having somatic complaints increased significantly for several of the defined complaints. The risk of having thyroid disease was eight times higher for the PPA group (risk ratio (RR)=8.11), while the risk of having complaints for migraine, epilepsy, or gluten intolerance increased about five times in these students (RR=5.19, 5.1, and 4.65, respectively). The risk that these adolescents (PPA) also have diabetes almost tripled (RR=2.82), and their risk of having asthma almost doubled (RR=1.85). The risk of having any of these somatic complaints did not increase significantly in the adolescents who reported parental alcohol use problems (PAP group), with the exception of the risk of headaches, which increased about 50% (RR=1.53; Table 3).

Discussion

To the best of our knowledge, the present work is the first explorative study focusing on a sample of Moroccan adolescents. Only about a third of the 15- to 18-year-old high school students reported no somatic complaints at all; consequently, the vast majority (over 70%) of the students from this urban area in Morocco suffered from some kind of

somatic condition. Our finding is in line with some previous results showing that 83% of African-American adolescents reported at least one somatic symptom in 2007.²⁸ However, studies in Swedish and Croatian adolescent populations have reported relatively low prevalences (30%–50%) of somatic symptoms.^{29,30} While the physical diagnoses may not be culture sensitive (epilepsy, diabetes, and tuberculosis, for instance, should be diagnosed according to the same medical criteria in all countries), the prevalence of complaints for digestion problems or pain (such as headaches) may be influenced by the culture and should be compared with caution between different countries.³¹ However, the finding that almost 1% of Moroccan adolescents living in an urban area still suffer from tuberculosis should be noted and discussed in the light of lacking medical resources for monitoring and control of this disease in Morocco.³²

Although the prevalence of somatic problems may differ significantly between studies from different countries, the type of the most common somatic complaints in adolescents is very similar. This study showed that headache was the most prevalent somatic problem reported by over half of the Moroccan adolescent sample, in line with earlier surveys conducted in different countries.^{33–35} The presence of headaches in adolescents has previously been associated with psychiatric illness and psychosocial problems,^{36–38} and with the presence of other somatic complaints.³⁹

Importantly, the sample consisted of high school students. Although the school environment promotes the development of the adolescent, it also places constraints and demands on them that may entail stress.⁴⁰ A series of studies have implicated stress in the development and maintenance of health complaints,^{41–43} especially headaches,^{44,45} gastrointestinal disorders,^{46,47} and allergy.^{48,49} Consequently, the most prevalent somatic problems reported by the adolescent students in this study, namely headaches, diarrhea and/or constipation

Table 4. Post hoc analyses for prevalence of defined somatic symptoms and diseases according to psychosocial variable groups.

		CG (n=407)	PAP (n=61)	PPA (n=101)
Headaches	Adjusted Z scores	-4.79	1.98	4.07
	χ^2	22.94	3.92	16.56
	p-value	<0.001	0.14	<0.001
Diarrhea/ constipation	Adjusted Z scores	-2.55	0.43	2.69
	χ^2	6.50	0.18	7.24
	p-value	0.04	0.91	0.03
Allergy	Adjusted Z scores	-0.52	-1.86	2.21
	χ^2	0.27	3.46	4.88
	p-value	0.87	0.18	0.09
Skin disease	Adjusted Z scores	-1.64	-1.21	2.95
	χ^2	2.69	1.46	8.70
	p-value	0.26	0.48	0.013
Migraine	Adjusted Z scores	-6.17	-0.02	7.30
	χ^2	38.07	0.0004	53.29
	p-value	<0.001	1.00	<0.001
Gluten intolerance	Adjusted Z scores	-3.65	-1.63	5.64
	χ^2	13.22	2.66	31.81
	p-value	0.001	0.26	<0.001
Asthma	Adjusted Z scores	-1.54	0.52	1.40
	χ^2	2.37	0.27	1.96
	p-value	0.31	0.87	0.37
Thyroid disease	Adjusted Z scores	-4.24	-0.96	5.81
	χ^2	17.98	0.92	33.76
	p-value	<0.001	0.63	<0.001
Epilepsy	Adjusted Z scores	-2.69	-0.52	3.58
	χ^2	7.24	0.27	12.82
	p-value	0.03	0.87	0.002
Diabetes	Adjusted Z scores	-1.34	0.18	1.43
	χ^2	1.79	0.03	2.04
	p-value	0.40	0.98	0.36
Cancer	Adjusted Z scores	-0.82	-0.94	1.75
	χ^2	0.67	0.88	3.06
	p-value	0.71	0.64	0.21
Tuberculosis	Adjusted Z scores	1.67	-0.92	-1.23
	χ^2	2.79	0.85	1.51
	p-value	0.25	0.65	0.47

CG: comparison group; PAP: adolescents reporting parental alcohol use problems; PPA: adolescents reporting the experience of physical and/or psychological abuse.

Significance level set at $p < 0.017$ after Bonferroni adjustment.

problems, and allergy, in that order of importance, may be at least, in part, associated to the school environment and more specifically to school-related stress.

We found that adolescent females from an urban area of Morocco report more somatic complaints compared to their male classmates, which is in line with other international studies on adolescent health.^{29,50} In two Scandinavian studies, lower self-esteem and higher levels of perceived stress in the school environment could partially explain the increased prevalence of health complaints reported by girls.^{51,52} As suggested by one of the Nordic studies, boys seem to be more casual about the demands placed on them

by their school and be more relaxed about ideal body standards, whereas girls seem to be under the double pressure to conform to the ideal body image and to perform well at school.⁵²

The observed gender differences may be related to biological changes, including pubertal maturity,^{53,54} physiological, and psychological differences, such as females being more attentive to their wellbeing and more sensitive in perceiving and reporting symptoms of illness,⁵⁵ and to sociocultural characteristics associated with greater expression of emotions and concerns by females and, consequently, easier seeking of medical care.^{56,57}

Negative psychosocial environmental factors and adolescent somatic health

Our study suggests that the experience of physical and/or psychological abuse (PPA) has a dramatic effect on the somatic health of adolescents. The prevalence of thyroid disease was significantly increased in the group of adolescents who reported the experience of PPA. This result may also be associated with the chronic stress caused by the experience of abuse. Indeed, thyroid function is usually down-regulated during such stressful conditions.²¹ Stressful life events may cause alteration in serum thyroid hormone levels and initiate the synthesis of anti-thyroid antibodies, causing autoimmune thyroiditis.^{58–60}

Another significantly increased somatic complaint in adolescents reporting this negative psychosocial factor in their life was skin problems. Earlier research indicates that skin problems are often comorbid with psychiatric disorders (anxiety, depression, and obsessive–compulsive personality disorders).^{61,62} In addition, PPA constitute stressful life events that may play an important role in triggering or aggravating skin problems and disorders.^{62–64}

Adolescents belonging to the PPA group had a substantially increased risk of having neurological complaints (like migraine and epilepsy) and gastrointestinal complaints (diarrhea/constipation and gluten intolerance).

As regards neurological complaints, this study showed a strong and significant increase in the prevalence of epilepsy in adolescents with experience of PPA compared to those not reporting having parents with alcohol use problems or the experience of being abused. Similar results have been found by various studies explaining the negative effect of sexual abuse on brain development, resulting in changes in both brain structure and function.^{12,14,65–67} This increase of epilepsy prevalence among adolescents who reported the experience of PPA may also be explained by the fact that negative life events, such as PPA, may increase the probability of having a greater response to stressors, which in turn increases the probability of inducing epileptic activity.⁶⁸

The risk of having migraine and headaches in students who reported experience of PPA was also significantly increased compared to their classmates without such experiences. This finding is in accordance with a recently published retrospective study, which found that young adults having experienced any of the three types of abuse (i.e. physical, emotional, or sexual) are twice as likely to suffer from migraine than their non-abused peers.⁶⁹ Moreover, increased prevalence of migraine and headaches in adult survivors of physical abuse has been documented²⁰ and has been suggested to be linked to the neurological effects of abuse on brain functions.^{14,70} Early stress has been found to be involved in the pathogenesis of migraine and headaches.^{71,72}

We also found that the risk of having headaches was almost doubled among adolescents who reported that they have a parent with alcohol use problems. In fact, the increased

prevalence of headaches in adolescents with this kind of familial problems could be environmental. For instance, it has been noted that children of alcoholic parents are often victims of physical abuse^{73,74} or neglect^{75,76} and that, as a result, these youngsters may develop stress-related health problems like headaches and migraines.^{20,77}

In adolescents belonging to the PPA group, the prevalences of gluten intolerance and complaints for diarrhea/constipation were significantly increased. The relationship between abuse history and gastrointestinal problems may be explained by the fact that abuse history, by virtue of its multi-component psycho-physiological effects, can influence gastrointestinal reactivity, either directly or indirectly as a consequence of psychological comorbidities.⁷⁸ This can occur via changes in gut motility, especially as there are a variety of neural and humoral pathways that link brain and gut, which may be influenced by the exposure to stress.⁷⁹

Furthermore, exposure to stress results in an alteration of the brain–gut interactions.⁸⁰ This alteration in the gastrointestinal system is among the predisposing factors that may contribute to the development of gluten intolerance symptoms.⁸¹ In addition, stress alters the structure and composition of the enteric nervous system that orchestrates various gastrointestinal functions.⁸² Consequently, changes of the enteric nervous system may also be associated with gastrointestinal disorders.⁸³

We also found that the risk of diabetes was tripled for adolescents in the PPA group. This result may be explained by the fact that stressful experiences may lead to the activation of the hypothalamic–pituitary–adrenal (HPA) axis, leading in turn to various endocrine abnormalities (such as high cortisol) and cytokine-mediated immunologic responses, which may play an important role in the development of diabetes by contributing to insulin resistance.^{84,85}

Finally, our results showed that the risk of asthma was one and a half times increased in those reporting a parent with alcohol use problems and nearly doubled in those reporting the experience of PPA. Again, stressful life events have been identified as a risk factor affecting the onset, progression, and severity of asthma in adolescents.^{86,87} The relationship between stressful life events and asthma may be associated with the alteration of immune function through the release of HPA's and sympatho medullary pathway's hormones, as well as of inflammatory cytokines (IL-5, IL-13, IL-4, and IFN- γ).^{88,89}

Conclusion

A majority of Moroccan adolescents from urban high schools report the existence of some somatic complaint. The most frequent complaints are headaches, diarrhea and/or constipation, and allergies. Female students suffer from somatic complaints more often than their male classmates. The experience of PPA is associated with increased prevalence of somatic problems.

The present findings highlight the importance of screening for parental alcohol use problems and for the experience of PPA when treating adolescents with somatic health problems. Our results strengthen previous findings and emphasize the importance of cooperation between social support and healthcare personnel when managing the recovery of adolescents who have experienced abuse.

Limitations

The study had a cross-sectional design; consequently, no conclusions about causal associations should be drawn. Headaches and constipation/diarrhea were the most frequently reported somatic problems among Moroccan adolescents; however, these complaints may vary greatly in the same individual over a short time period, which may affect the reliability of the report. A respondent who has experienced headaches or gastrointestinal problems just before answering the questionnaire may be more prone to acknowledging the existence of these problems during the past year. Conversely, the absence of these complaints during the recent past may lead the respondent to forget about them and deny the existence of these complaints when assessed over a 12-month perspective. This tendency was recognized by our test–retest assessment as well, which found that these items varied the most (but not significantly) over a 2-week interval. The reliability of the assessment of these complaints over a 1-year period should therefore be interpreted with caution.

Moreover, the higher prevalence of headaches and gastrointestinal problems may be coupled to the menstrual cycle of girls, for which no correction was made in this study.

The assessment of the presence of parental alcohol use problems or the experience of PPA did not include any structured measures or archive or register information; consequently, the assessment of abuse did not consider the degree or frequency of abuse, any associated disability, or information on the specific type of abuse experienced by the adolescent.

Furthermore, due to the anonymous data collection method and the lack of healthcare registers in Morocco, the prevalence of the medical diagnoses among the surveyed adolescents relied on self-reports and could not be checked against actual medical records.

It is noteworthy that, based on the recognized limitations of the assessed data, an improved version of the survey has been developed for future use in the MeSHe project.

Compliance with ethical standards

All procedures performed in the course of this study involving human participants were carried out in accordance with the ethical standards of the Faculty of Science, University Abdelmalek Essaadi, Tetouan, Morocco, and with the 1964 Declaration of Helsinki and its later amendments.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

The Regional Directorate of the Ministry of National Education in Tetouan, responsible for managing and directing all matters concerning students from primary to high school education at Tetouan province, retrospectively authorized the study and registered this authorization under the number 85 (2019). The study was also approved by the Faculty of Science, University Abdelmalek Essaadi. This last document does not have a number, therefore the authors enclose it. The use of the survey was approved by the concerned high school directors and by the high school parent associations.

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Informed consent

Participation in the study was voluntary and anonymous. The cover page of the survey informed the participants about the questionnaire's content and the aims of the study, and they also received oral information, during which, they had the freedom to choose whether or not to participate in the anonymous data collection. In addition, the cover page of the survey (uploaded as supplementary file) contained the following statement: "If you accept to participate in this study please fill in the questionnaire below. If you do not agree to participate, please return the questionnaire without completing it." Consequently, the completion of the survey was considered as consent of participation. No additional written consent was obtained from the legally authorized representatives of students, as there was no way to identify respondents and thereby neither their parents. However, the use of the survey was approved by the high school parent associations prior to its use.

Supplemental material

Supplemental material for this article is available online.

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