Original Article
Risk factors of fatigue status among Chinese adolescents

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Abstract: In recent years, fatigue is common among adolescents. The aim of this study is to evaluate fatigue status and find related factors of fatigue among students ranged from 13-26 years from Wuhu, China. This is a case-control, cross-sectional observational study. The students from six middle schools (high school? 26 years old?) in Wuhu city were recruited, Self-Rating Fatigue Scale (SFS) was used to measure the fatigue status among students ranged from 13-26 years, and some demographic characteristics of students also was determined. A total of 726 students are included in our study. A significant difference was observed between fatigue status and grade, a balanced diet, the partial eclipse, picky for food, lack of sleep, excessive fatigue, drinking (P < 0.05). The risk factors of fatigue status include myopia, partial eclipse, picky for food, lacking of sleep, drinking; grade while a balanced diet is the protective factor of fatigue. Therefore, the school should pay more attention to the fatigue among students in middle school in China, and take some properly measures to reduce the fatigue.

Keywords: China, adolescents, fatigue status, influencing factors, recurrent and chronic pain

Introduction

Simple fatigability is a problem teenagers commonly seen in modern society [1]. However, fatigue is a well-known status, which is estimated from 0.1% to 1.0% among adolescents [2, 3]. Among chronic fatigue syndrome (CFS), which is defined by the tough body and mental fatigue lasting more than 6 months with a number of accompanying symptoms, has been well investigated [4, 5]. Fatigue is often referred to a feeling of fatigue, reduced alertness, fatigue damage ability and willingness to perform a task [6-8]. It is worth noting that chronic fatigue is associated with depression or anxiety symptoms and future chronic fatigue syndrome in these reports [9, 10]. Reduce fatigue of common strategy is to use some relatively comfortable stimulus, such as high frequency stimulation [11, 12]. However, it is unclear about the status of mental health among students in Wuhu, China. Therefore, we try to investigate the current health fatigue state of Chinese teenagers, paying special attention to their lifestyle.

Subjects and methods

Subjects

This study was carried out in Wuhu city from October 3, 2014 to December 10. A total of 726 students were included in our study. Among them, the approximate population of children and adolescents are 45,000 whose age is ranged from 13 to 26 years old. At school, they were asked to complete a questionnaire about their fatigue status and normal lifestyles over the past one month. At the same time, the questionnaire is anonymous with no records or code. The consent was obtained from all students for this study.

Questionnaire

Before carried out the survey, we have checked the validity and the reliability using 50 students aged 13-26 years at both public and private middle school. They were asked to answer anonymously our questionnaire about their fatigue. Self-assessment fatigue scale (SFS) was used to measure students' state of fatigue,

Table 1. Characteristics of sample

Socio-demographic variables	n	%
Gender	726	
Boy	372	51.2
Girl	354	48.8
Age (years)		
Ten-twelve	63	8.7
Thirteen-sixteen	628	86.5
Seventeen	35	4.8
Grade		
Grade five and six in elementary school	66	9.1
Grade one and two in junior middle school	552	76.0
Grade one and two in high middle school	108	14.9
Height		
75-125	2	0.2
125-175	668	91.6
175-	56	8.2

which consists of 9 questions. Each question score ranged from 1 to 6 on behalf of "never", "rarely", "sometimes", "very little for a month", "most of the time", and "always", respectively. The total raw score was range from 0 to 100 (9-54??), and then, we transferred raw score into standard score according to the formula: standard score = Total score/9. In this study, we defined as the "fatigue status" when the standard score less than 75.

Statistics

EpiData3.1 software is used to establish a database, data is analyzed by SAS. Fatigue scores and the relationship between the demographic variables were evaluated by univariate logistic regression. If a variable has a *P* value less than 0.1, then we include the variables for multivariate logistic regression analysis. The results are represented as adjusted odds ratios and their 95% confidence interval. *P* value less than 0.05 was considered as a significant level.

Results

Baseline characteristics of participants

Among the 758 students, the participant rate was 95.79% (726/758), of which 48.8% were girls aged 13-26 years and 51.2% were boys aged 13-26; the average height of boys and girls were 125-175 cm (91.6%), respectively. The majority of participants were junior middle school students (76.0%). The characteristics of subjects are summarized in **Table 1**.

Univariate logistic regression analysis to the influencing factors of student fatigue status

No matter you are tired or not, as the dependent variable, the related factors as independent variables, the single factor and multiple factors unconditioned logistic regression analysis. And exit into the model of the standard model of 0.05 and 0.10, respectively.

Logistic regression analysis results show that myopia, partial eclipse, picky for food, lacking of sleep, excessive fatigue, drinking are? Risk factors of fatigue status; grade, a balanced diet are? The protective factors of fatigue, found no statistical significance (P > 0.05), and other variables in the study are shown in **Table 2**.

Multivariate regression analyses of the dependent variable fatigue scores against demographic and menstrual variables

Table 3 shows the correlation between gender and grade after adjusting to income, grade, myopia, a balanced diet, drinking. Based on the results of the univariate logistic regression analysis, the following variables: gender, grade, a balanced diet, the partial eclipse, picky about food, lack of sleep, excessive fatigue, drinking is into the multiple regression analysis model is shown in **Table 3**. Univariate logistic regression analysis results show that myopia, drinking is fatigue status of risk factors; grade, a balanced diet are the protective factors of fatigue.

Discussion

In this study, a total of 726 subjects (372 male and 354 female) was recruited in 2014. In the present study, we use a reference [Fatigue Status references in China (2004)]. This fact should be further investigated, since severe or chronic fatigue is thought to disrupt daily life, for example resulting in picky about food [13]. What is more, the association of unhealthy dietary habits with fatigue is consistent with previous studies [14]. Although it is difficult to exactly with previous research, our research puts forward a few questions. There is no gender difference in physical or mental fatigue, compared to the previous research which has shown that women's dominant position [15, 16]. An important finding which emerged in our study was that the severity of fatigue remained

Table 2. Univariate Logistic regression analysis to the influencing factors of adolescents' fatigue

Variables	Number of people		P	OR	95% CI
	Fatigue	Healthy controls			
Gender					
Girl	287	67		1.00	
Boy	284	88	0.120	0.753	0.527-1.077
Age					
Ten-twelve	46	17		1.00	
Thirteen-sixteen	494	134	0.074	2.864	0.880-9.326
Seventeen-	31	4	0.302	0.734	0.408-1.322
Grade					
Grade five and six in elementary school	50	16		1.00	
Grade one and two in junior middle school	425	127	0.822	0.934	0.514-1.696
Grade one and two in high middle school	96	12	0.023	0.391	0.172-0.889
Myopia (apart from parents)					
No	256	77		1.00	
Yes	315	78	0.284	1.215	0.851-1.733
Myopia					
No	242	102		1.00	
Yes	323	51	<0.001	2.670	1.834-3.885
Seafood intake					
No	55	12		1.00	
By chance	357	94	0.580	0.829	0.426-1.611
Yes	159	49	0.334	0.708	0.351-1.428
Green leafy vegetables intake					
No	16	2		1.00	
By chance	97	21	0.483	0.577	0.123-2.704
Yes	458	132	0.257	0.434	0.099-1.910
Fruit intake					
No	13	2		1.00	
By chance	127	30	0.584	0.651	0.140-3.041
Yes	430	123	0.412	0.538	0.120-2.416
A balanced diet					
No	46	1		1.00	
By chance	185	32	0.018	0.126	0.017-0.944
Yes	340	122	<0.001	0.061	0.008-0.444
Partial eclipse, picky about food					
No	152	60		1.00	
By chance	298	76	0.028	1.548	1.047-2.288
Yes	121	19	0.001	2.514	1.424-4.439
Lack of sleep					
No	115	57		1.00	
By chance	297	72	0.001	2.045	1.359-3.077
Yes	159	26	<0.001	3.031	1.798-5.110
Excessive fatigue					
No	149	69		1.00	
By chance	325	73	0.001	2.062	1.407-3.021
Yes	97	13	<0.001	3.455	1.181-6.589
Whether to have the digestive tract symptoms such as nausea and vomiting					
No	372	107		1.00	
By chance	167	44	0.664	1.092	0.735-1.622
Yes	32	4	0.115	2.301	0.796-6.651
Smoking					
No	535	147		1.00	
By chance	26	6	0.706	1.191	0.481-2.947
Yes	10	2	0.683	1.374	0.298-6.339

Drinking					
No	481	143		1.00	
By chance	74	10	0.021	0.200	1.108-4.370
Yes	16	2	0.238	2.378	0.540-10.467

Table 3. Multivariate unconditioned Logistic regression analysis of fatigue status

Variables	Number of people		*P*	OR	95% CI
	Fatigue	Healthy controls			
Gender			0.062	1.450	0.982-2.140
Girl	287	67			
Boy	284	88			
Grade			0.024	1.680	1.070-2.639
Grade five and six in elementary school	50	16			
Grade one and two in junior middle school	425	127			
Grade one and two in high middle school	96	12			
Myopia			<0.001	0.407	0.272-0.608
No	242	102			
Yes	323	51			
A balanced di			<0.001	2.749	1.849-4.088
No	46	1			
By chance	185	32			
Yes	340	122			
Partial eclipse, picky about food			0.111	0.787	0.587-1.056
No	152	60			
By chance	298	76			
Yes	121	19			
Lack of sleep			0.165	0.789	0.565-1.102
No	115	57			
By chance	297	72			
Yes	159	26			
Excessive fatigue			0.077	0.724	0.506-1.036
No	149	69			
By chance	325	73			
Yes	97	13			
Drinking			0.025	0.532	0.307-0.924
No	481	143			
By chance	74	10			
Yes	16	2			

Note: Adjusted for gender, grade.

relatively the partial eclipse for adolescents with chronic pain and healthy adolescents. There are objective markers newly invented for evaluation of fatigue [17]. In a variety of self-reported questionnaire [18, 19], the CIS score was originally developed for adults, which has been most widely used [19]. The study showed that the myopia, drinking were the risk factors of fatigue; while grade, a balanced diet were protective factors of fatigue status. The OR value of myopia, drinking were greater than 1, which were considered as risk factors of fatigue. While sex, grade, a balanced diet the OR value were less than 1, which were protective factors of fatigue status.

Strengths and limitations

This study has a number of limitations, the participants were students but not including all

grades, therefore not representative population characteristics of adolescents.

However, even given these weaknesses, there were missing data on the cognitive tests and some data missing in the questionnaire responses. The relative high number of participants is a strength of the study. Although a self-reported questionnaire has a weakness of not being objective, it is still considered the most reliable and acceptable method of collection of activity data from a large population of youth.

Conclusions

The finding indicats that fatigue symptoms are common in school students. A balanced diet is very important for students to improve students' fatigue. Preventive and treatment strategies are highly recommended. The school and government department should take some measures to reduce the fatigue symptoms.

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Disclosure of conflict of interest

None.

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References

[1] Ranjith G. Epidemiology of chronic fatigue syndrome. Occup Med (Lond) 2005; 55: 13-19.

[2] Nijhof SL, Maijer K, Bleijenberg G, Uiterwaal CS, Kimpen JL and van de Putte EM. Adolescent chronic fatigue syndrome: prevalence, incidence, and morbidity. Pediatrics 2011; 127: e1169-1175.

[3] Crawley EM, Emond AM and Sterne JA. Unidentified Chronic Fatigue Syndrome/myalgic encephalomyelitis (CFS/ME) is a major cause of school absence: surveillance outcomes from school-based clinics. BMJ Open 2011; 1: e000252.

[4] Fukuda K, Straus SE, Hickie I, Sharpe MC, Dobbins JG and Komaroff A. The chronic fatigue syndrome: a comprehensive approach to its definition and study. International Chronic Fatigue Syndrome Study Group. Ann Intern Med 1994; 121: 953-959.

[5] Reeves WC, Lloyd A, Vernon SD, Klimas N, Jason LA, Bleijenberg G, Evengard B, White PD, Nisenbaum R, Unger ER; International Chronic Fatigue Syndrome Study Group. Identification of ambiguities in the 1994 chronic fatigue syndrome research case definition and recommendations for resolution. BMC Health Serv Res 2003; 3: 25.

[6] Shen J, Barbera J and Shapiro CM. Distinguishing sleepiness and fatigue: focus on definition and measurement. Sleep Med Rev 2006; 10: 63-76.

[7] Craig A, Tran Y, Wijesuriya N and Boord P. A controlled investigation into the psychological determinants of fatigue. Biol Psychol 2006; 72: 78-87.

[8] Craig A, Tran Y, Wijesuriya N and Nguyen H. Regional brain wave activity changes associated with fatigue. Psychophysiology 2012; 49: 574-582.

[9] ter Wolbeek M, van Doornen LJ, Kavelaars A and Heijnen CJ. Severe fatigue in adolescents: a common phenomenon? Pediatrics 2006; 117: e1078-1086.

[10] ter Wolbeek M, van Doornen LJ, Kavelaars A and Heijnen CJ. Predictors of persistent and new-onset fatigue in adolescent girls. Pediatrics 2008; 121: e449-457.

[11] Diez PF, Mut VA, Avila Perona EM and Laciar Leber E. Asynchronous BCI control using high-frequency SSVEP. J Neuroeng Rehabil 2011; 8: 39.

[12] Volosyak I, Valbuena D, Luth T, Malechka T and Graser A. BCI demographics II: how many (and what kinds of) people can use a high-frequency SSVEP BCI? IEEE Trans Neural Syst Rehabil Eng 2011; 19: 232-239.

[13] Bakker RJ, van de Putte EM, Kuis W and Sinnema G. Risk factors for persistent fatigue with significant school absence in children and adolescents. Pediatrics 2009; 124: e89-95.

[14] Okamoto M, Tan F, Suyama A, Okada H, Miyamoto T and Kishimoto T. The characteristics of fatigue symptoms and their association with the life style and the health status in school children. J Epidemiol 2000; 10: 241-248.

[15] Rimes KA, Goodman R, Hotopf M, Wessely S, Meltzer H and Chalder T. Incidence, prognosis, and risk factors for fatigue and chronic fatigue syndrome in adolescents: a prospective community study. Pediatrics 2007; 119: e603-609.

[16] Viner RM, Clark C, Taylor SJ, Bhui K, Klineberg E, Head J, Booy R and Stansfeld SA. Longitudinal risk factors for persistent fatigue in adolescents. Arch Pediatr Adolesc Med 2008; 162: 469-475.

[17] Nozaki S, Tanaka M, Mizuno K, Ataka S, Mizuma H, Tahara T, Sugino T, Shirai T, Eguchi A, Okuyama K, Yoshida K, Kajimoto Y, Kuratsune H, Kajimoto O and Watanabe Y. Mental and physical fatigue-related biochemical alterations. Nutrition 2009; 25: 51-57.

[18] Chalder T, Berelowitz G, Pawlikowska T, Watts L, Wessely S, Wright D and Wallace EP. Development of a fatigue scale. J Psychosom Res 1993; 37: 147-153.

[19] Krupp LB, LaRocca NG, Muir-Nash J and Steinberg AD. The fatigue severity scale. Application to patients with multiple sclerosis and systemic lupus erythematosus. Arch Neurol 1989; 46: 1121-1123.