Acta Technica *62* (2017), No. 6B, 271–280

Effects of Physical Exercise on Mental Health of College Students

Yuelong Ji[1], Haiyan Zhu[1]

Abstract. To increase the accuracy of mental health analysis researches for university students, this paper has put forward one university students' metal health analysis method based on random grid regression. Firstly, this paper introduces Symptom Checklist for mental health assessment, establishes university students' metal health analysis model and select 17683 university students for online test by cluster sampling; secondly, this paper introduces MonteCarlo solution scheme against the assessment targets, establish MonteCarlo regression scheme by random grid method and achieves algorithm performance improvement for the purpose of resolving the problems with higher state space dimension, complex calculation and lower accuracy existed in standard MonteCarlo scheme; finally, the simulation experiment shows the physical exercise can mitigate the mental health problems for university students and verifies the effectiveness of method mentioned in this paper.

Key words. Random grid Regression analysis University students Mental health Symptom Checklist Physical exercise.

1. Introduction

The university students' mental health problem has increasingly become a major concern in our society. The previous researches show that many factors have impact on the university students' mental health level, such as parenting pattern, social support and coping modes etc. The researchers seldom consider improving the mental health level by using the university students' potentials. Seligman, the founder of positive psychology, holds that the positive mental quality is a powerful weapon for the people to triumph over mental diseases. He holds that the positive mental quality is the powerful strength existed in human itself to protect against mental diseases. The positive mental quality refers to relatively stable positive mental traits formed for individuals on the basis on congenital quality acquired environment education. These mental traits influence the individuals' positive attitudes towards

[1]Linyi University, Linyi Shangdong, 276005, China

recognizing, feeling and coping with problems. It is the basis of individuals' inner strength and potential realization.

The Symptom Checklist (hereinafter referred to as SCL-90) is an important research tool among many researches regarding to university students' mental health. Taking "university students" and "SCL90" as theme word to search in China Journal Net, it has been found that there are 1139 relevant researches in the recent 5 years, including 166 master theses and 1 doctor thesis. SCL-90 is prepared by Derogatis etc., including 90 problems describing feeling, emotion, thought, consciousness and behaviors etc. These problems are used to measure somatization, obsession, interpersonal relationship, depression, anxiety, hostility, fear, bigotry and mental diseases. The experiment objects make self-assessment in 1-5 scores for each item description based on their own status. The scoring indexes includes total score (add scores for 90 problems together), average total score (the total scores are divided by 90), positive item number (number of "symptom", generally subject to factor ($\geq$2 or $\geq$3)) and factor score.

This paper introduces grid regression algorithm to make mental health analysis for university students, establishes university students' metal health analysis model, introduces MonteCarlo solution scheme for university students' mental health analysis, establishes MonteCarlo regression scheme by random grid method and achieves algorithm performance improvement for the purpose of resolving the problems with higher state space dimension, complex calculation and lower accuracy existed in standard MonteCarlo scheme based on above indexes.

2. Description of experimental object and method

2.1. Experiment object

There are 17683 university students from a university in Hainan selected for online test, including 7833 boys and 9850 girls; 6881 freshman (2852 boys and 4029 girls); 6802 sophomores (2981 boys and 3821 girls); 2011 junior students (982 boys and 1029 girls); 1989 senior students (1018 boys and 971 girls).

2.2. Experiment method

The self-made scale is used. Such scale includes 6 sub-scales (knowledge and wisdom, courage, kindheartedness, justice, self-control and spirit outreaching), 24 factors (creativity, curiosity, love learning, judgment, insight; enthusiasm, perseverance, sincerity, braveness; amicability, love, social wisdom; fairness, team spirit, leadership; carefulness, modesty, tolerance, self-discipline; belief, humor, gratitude, hope and beauty-appreciation) and 76 items in total. The five-level rating scale in 1-5 scores is adopted to respectively denote very not like me, not like me, uncertainty, like me and very like me. The test-retest reliability, split-half reliability and Cronbach α coefficient in total scale and all sub-scales are 0.803-0.935, 0.755-0.902 and 0.782-0.948 respectively. The confirmatory factor analysis shows that the model fitting indexes (χ^2/df = 29.059, RMSEA = 0.056, NFI = 0.919, RFI = 0.913, CFI

= 0.917, IFI = 0.919) conform to psychometrics indexes, which indicates that the structure validity of scale is well.

Such scale has 10 dimensions and 90 items in total. The five-level rating scale in 1-5 scores is adopted, respectively referring to none, mild, moderate, severe and extremely severe. The 10 dimensions include somatization, obsessive-compulsive symptom, interpersonal sensitivity, depression, anxiety, hostility, fear, bigotry, mental diseases and others. Such scale has higher reliability and validity. Totally 17683 university students which were selected in September to October, 2013 through cluster sampling are made with online test and the investigation time is 40min.

3. MonteCarlo mental health model analysis through random grid regression

3.1. MonteCarlo solution scheme

The dynamic optimization is conducted for value function by using Markov characters and its value status transfer process can be defined as [14]:

$$v_k(z) := g(z) + \min_{u_k, u_{k+1}, \cdots, u_{K-1}} E\left[\sum_{l=k+1}^{K} g\left(z_l\right) | z_k = k\right]. \tag{1}$$

Where, $u_k \in U(z_k)$, $U(z)$ refers to status dependence space. For $k = K$, $V_K(z) = g(z)$. For $k \in \{0, 1, \cdots, K-1\}$, the cost can be calculated as below:

$$\begin{aligned} V_k(z) &= g(z) + \min_{u \in U(z)} E\left[V_{k+1}\left(z'\right) | z, u\right] \\ &= g(z) + \min_{u \in U(z)} \int V_{k+1}\left(z'\right) p\left(z' | z, u\right) dz' . \end{aligned} \tag{2}$$

Thus the optimal strategy can be expressed as:

$$\mu_k^*(z) = \arg \min_{u \in U(z)} \left(g(z) + E[V_{k+1}(z') | z, u]\right). \tag{3}$$

For $k \in (K-1, K-2, \cdots, 0)$, the final return rate is $J^*(z) = V_0(z), \forall z \in Z$, $J^*(z)$ refers to the minimum value of target (1) in optimal strategy (3).

In standard Monte Carlo method, its calculation method is approximating empirical mean. For the given $z \in Z$, the following can be obtained:

$$V_k(z) \approx g(z) + \min_{u \in U(z)} \frac{1}{N_s} \sum_{i=1}^{N_s} V_{k+1}(\tilde{z}^{(i)}). \tag{4}$$

Where, $\tilde{z}^{(i)}$ refers to N_s Monte Carlo samplings randomly selected from $p(z'|z, u)$. To limit the object function near the set value, the object function and optimal

strategy can be appropriated:

$$\begin{cases} V_k(z) \approx g(z) + \min\limits_{u\in U(z)} \frac{1}{N_s} \sum\limits_{i=1}^{N_s} V_{k+1}(q\left(\tilde{z}^{(i)}, Z\right)) \\ \mu_k^*(\mathrm{z}) = \arg\min\limits_{u\in U(z)} \left[g(z) + \frac{1}{N_s} \sum\limits_{i=1}^{N_s} V_{k+1}(q\left(\tilde{z}^{(i)}, Z\right)) \right] . \end{cases} \tag{5}$$

In formula, q refers to the given quantification function:

$$q(s, X) := \arg\min_{x\in X} \|s - x\|_1 . \tag{6}$$

In furmula, $s \in R^n$, finite set $X \subset R^n$. Seek the optimum command u_k of any status $z \in Z\backslash z$, $u_k = \mu_k^*(q(z, Z))$.

3.2. Regression MonteCarlo solution strategy

The Q value theory is used to conduct algorithm design [15]:

$$Q_k(z, u) := \min_{u_{k+1:K-1}} E[\sum_{l=k}^{K} g(z_l)|z_k = z, u_k = u] . \tag{7}$$

Where, $u_{k+1:K-1}$ is the shorthand mark of sequence $u_{k+1}, u_{k+2}, \cdots, u_{K-1}$. Q value refers to the expected accumulated cost after using strategy $u \in U(z)$ at time k. As for $t \in \{k+1, k+2, \cdots, K-1\}$, u_t is feedback strategy, namely, $u_t = \mu_t(z_t)$. The relation between Q value and object function is as below:

$$\begin{aligned} Q_k(z, u) &= g(z) + E[V_{k+1}(z')|z, u] \\ &= g(z) + \int V_{k+1}(z')p(z'|z, u)dz' . \end{aligned} \tag{8}$$

$$V_k(z) = \min_{u\in U(z)} Q_k(z, u) . \tag{9}$$

Therefore, the optimum strategy can be expressed as:

$$\mu_k^*(z) = \arg\min_{u\in U(z)} Q_k(z, u) . \tag{10}$$

As mentioned above, the MonteCarlo quantification method conducts point estimation on the basis of using several MonteCarlo simulation methods on each point z and the algorithm requires higher computation complexity. However, the MonteCarlo regression method in this paper establishes simulation path based on Q value theory, which decreases MonteCarlo simulation solution quantity and increases object control efficiency. For the continuous cost $Q_{k-1}(z, u)$ and specific control effect $u \in U$ in the algorithm mentioned, the continuous cost $\bar{q}_{K-1}^{(i,u)}$ can be expressed as:

$$\bar{q}_{K-1}^{(i,u)} = g(z_{K-1}^{(i)}) + g(\bar{z}_K^{(i,u)}) , \tag{11}$$

Where, $\bar{z}_K^{(i,u)}$ refers to MonteCarlo sample status at the time considering point $z\,(i) \in Z$ at time k-1 as start point for time k and the strategy u is applied for every point. The approximately optimum strategy for time $K-1$ is:

$$\hat{\mu}_{K-1}^{*}(z) = \arg\min_{u \in U} \hat{Q}_{K-1}(z,u)\,. \tag{12}$$

In the formula, $\hat{Q}_{K-1}(z,u)$ refers to the continuous cost obtained at time through k regression. Similarly, $\mu_k^*(z)$ refers to the optimum strategy estimation at time k. In standard MonteCarlo iteration:

$$\hat{V}_{K-1}(z) = \min_{u \in U} \hat{Q}_{K-1}\,(z,u)\ . \tag{13}$$

In formula (10), $\hat{V}_{K-1}(z)$ is used to substitute $V_{K-1}(z)$ and execute same process for $k = K-2$. However, this will cause rapid error accumulation. To decrease such error to the greatest extent, RMC pays attention to how to approach to the optimum strategy $\mu_k^*(z)$, rather than continuous cost.

$$\tilde{q}_k^{(i,u)} = g(z_k^{(i)}) + g(\tilde{z}_{k+1}^{(i,u)}) + \sum_{t=k+1}^{K-1} g(\tilde{z}_{t+1}^{(i,u_t)})\,, \tag{14}$$

Where, $u_t = \hat{\mu}_t^*(z)$.

3.3. Mental health model analysis through random grid regression

In traditional RMC algorithm, the random grid Z corresponds with one simulation path $\{z_{0:K}^{(i)}\}$ for one set, where $i \in \{1,2,\cdots,M\}$; the initial strategy is $u_k^{(0)}(z)$ and initial status is $\{z_0^{(i)}\}$. Therefore, in traditional RMC, Z refers to time correlative and is equal to $\{z_k^{(1)}, z_k^{(2)}, \cdots, z_k^{(M)}\}$ at time k; the initial strategy has great impacts on prediction accuracy. The random grid partition is shown in Fig. 1.

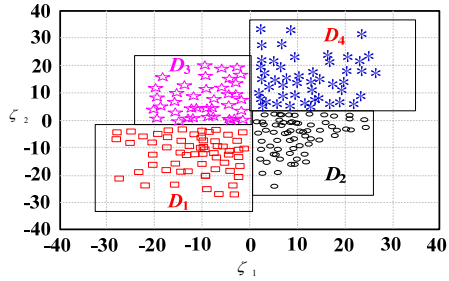

Fig. 1. Partition strategy

$I_l \subset \{1,2,\cdots,M\}$ refers to the indexing subset of random grid partition, where $|I_l| = m = M/N_p$. In addition, for $I_l = \{i_1, i_2, \cdots, i_m\}$, do $y^{(l)} := (q_{i_1}, q_{i_2}, \cdots, q_{i_m})$, where q_i refers to sample path cost. Furthermore, let if $H^{(l)} = h^T(z^{(i)})$, where

$h : R^n \to R^{N_b}$ is used to access the quadratic-base function of each point $z^{(i)}$ in partition l. Assuming the regression equation form is:

$$y^{(l)} = H^{(l)}\beta^{(l)} + \beta_0^{(l)} 1_{m\times 1} + E^{(l)}\,, \tag{15}$$

Where, $\varepsilon^{(l)} \in R^m$ refers to residual vector in partition l, $1_{m\times 1}$ refers to unit vector of length m. $\beta^{(l)} = (\beta_1^{(l)}, \beta_2^{(l)}, \cdots, \beta_{N_b}^{l}) \in R^{N_b}$ and $\beta_0^{(l)} \in R$ refer to coefficients determined in regression. To increase the robustness of regression coefficient, it shall reduce:

$$\left\| y^{(l)} - \beta_0^{(e)} 1_{m\times 1} - H^{(l)}\beta^{(l)} \right\|_2 + \lambda \left\| \beta^{(l)} \right\|_1\,, \tag{16}$$

Where, $\lambda > 0$ refers to adjustment parameter. Once the regression coefficient is determined, the Q value can be estimated:

$$\hat{Q}_k(z,u) = \left\langle \beta_k^{(l,u)}, h(z_k) \right\rangle + \beta_{0,k}^{(l)}, z_k \in D_l\,, \tag{17}$$

Where, $\langle,\rangle$ refers to inner product, $h(z_k) \in R^{N_b}$ is the line mapping of prediction matrix $H^{(l)}$, l is the indexing of partition D_l for which z_k is located. The processes of MonteCarlo mental health model analysis through random grid regression are shown in pseudo-code 1.

Pseudo-code 1: MonteCarlo mental health model analysis through random grid regression

1. Initialization: set condition $X \subset R^7$, where $|X| = M$; set angle $\mathcal{C} \subseteq C^2$ and space $\mathcal{U}(r)$.
2. $N_r \to |\mathcal{C}|$;
3. for $k = K-1, K-2, \cdots, 0$ do
4. for $s = 1, 2, \cdots, N_r$ do
5. Form initial condition set Z from X, $\chi^{(i)} = (P_1^{(i)}, p_2^{(i)}, v^{(i)}) \in X$
Calculate relation status in accordance with Section 2.1-2.2:
$i \in \{1, 2, \cdots, M\}$
6. $N_u \to |\mathcal{U}(r^{(s)})|$;
7. for $l = 1, 2, \cdots, N_u$ do
8. Generate continuous cost vector $q \in R^M$ for each point in accordance with Section 3.2 through application strategy $u^{(l)} \in \mathcal{U}(r^{(s)})$.
9. Obtain $\hat{Q}_k(z, u^{(l)})$ from $\chi^{(i)}$ in accordance with Section 3.3.
10. endfor
11. endfor
12. endfor
13. Return to Q value $\hat{Q}_k(z,u)$, where, $k \in \{0, 1, \cdots, K-1\}$, select minimum $\hat{Q}_k(z,u)$ position as the optimum position of mental health model and output.

The above algorithm has one nesting loop in calculation process, its computation complexity is $O(K\log(N))$, where K refers to the quantity of sample points randomly selected in regression MonteCarlo solution strategy, N refers to the total quantity of sample points. For the standard MonteCarlo quantification method in status space, its computation complexity is $O(N\log(N))$. It is obvious that the improved algorithm is better than original algorithm in terms of computation complexity.

4. Experiment analysis

The 24 factors for university students' positive mental quality have significant negative correlation with each dimension in mental health symptom checklist ($P<0.01$); the results of random grid regression analysis made by 24 factors of university students' positive mental quality for each dimension in mental health symptom checklist are shown in Table 1.

The random grid regression analysis is made taking the 9 symptom factors in SCL-90 (somatization, obsessive-compulsive symptom, interpersonal relationship sensibility, depression, anxiety, hostility, fear, bigotry and mental diseases) and average total score as dependent variables, 24 factors of positive mental quality as independent variable (predictive variable). There are 4 predictive variables in fear regression model, including hope, enthusiasm, sincerity and social wisdom, which can explain 9.2% of accumulated variance in fear. The random grid regression analysis is made taking the 9 symptom factors in SCL-90 (somatization, obsessive-compulsive symptom, interpersonal relationship sensibility, depression, anxiety, hostility, fear, bigotry and mental diseases) and average total score as dependent variables, 24 factors (creativity, curiosity, love learning, judgment, insight; enthusiasm, perseverance, sincerity, braveness; amicability, love, social wisdom; fairness, team spirit, leadership; carefulness, modesty, tolerance, self-discipline; belief, humor, gratitude, hope and beauty-appreciation) of positive mental quality as independent variable (predictive variable). The predictive variables, Beta value and explained variables for regression model are shown in Table 2. There are 4 predictive variables in somatization regression model, including tolerance, hope, sincerity and self-discipline respectively, which can explain 8.1% of accumulated variance in somatization. There are 5 predictive variables in obsessive-compulsive symptom regression model, including hope, leadership, self-discipline, carefulness and modesty respectively, which can explain 14.4% of accumulated variance in obsessive-compulsive symptom. There are 5 predictive variables in interpersonal relationship sensibility regression model, including hope, leadership, tolerance, enthusiasm and beauty appreciation respectively, which can explain 17.0% of accumulated variance in interpersonal relationship sensibility. There are 5 predictive variables in depression regression model, including hope, enthusiasm, self-discipline, beauty appreciation and love respectively, which can explain 21.1% of accumulated variance in depression. There are 5 predictive variables in anxiety regression model, including hope, self-discipline, enthusiasm, tolerance and beauty appreciation respectively, which can explain 12.8% of accumulated variance in anxiety. There are 5 predictive variables in hostility regression model, including tolerance, self-discipline, braveness, hope and modesty respectively, which can explain 17.0% of accumulated variance in hostility. There are 5 predictive variables in bigotry regression model, including tolerance, team spirit, hope, modesty and beauty appreciation, which can explain 13.9% of accumulated variance in bigotry. There are 5 predictive variables in mental disease regression model, including hope, self-discipline, love, leadership and beauty appreciation respectively, which can explain 13.3% of accumulated variance in mental disease. There are 5 predictive variables in average total score regression model, including hope, self-discipline, love, leadership and beauty appreciation respectively, which can explain 20.0% of accumulated variance in average total scores.

Table 1. Random grid regression analysis for SCL-90 average total scores and each factors to university students' positive mental quality

Dependent variable	Predictive variable	B	Standard error	Beta	t	Determination coefficient	Increment	F
Somatization	Tolerance	-0.065	0.011	-0.107	-6.046	0.050	0.050	228.845
	Hope	-0.061	0.009	-0.110	-6.431	0.066	0.016	74.904
	Sincerity	-0.057	0.010	-0.091	-5.428	0.076	0.010	45.774
	Self-discipline	-0.038	0.008	-0.077	-4.682	0.081	0.005	21.920
Obsessive-compulsive symptom	Hope	-0.130	0.012	-0.173	-10.995	0.083	0.083	394.181
	Leadership	-0.108	0.012	-0.152	-9.171	0.117	0.034	167.885
	Self-discipline	0.100	0.012	-0.149	-8.664	0.132	0.014	71.990
	Carefulness	0.073	0.011	0.102	6.606	0.138	0.006	31.427
	Modesty	-0.064	0.011	-0.089	-5.754	0.144	0.007	33.108
Interpersonal relationship	Hope	-0.141	0.013	-0.186	-10.599	0.109	0.109	530.562
	Leadership	-0.106	0.011	-0.149	-9.232	0.144	0.034	173.302
	Tolerance	-0.110	0.014	-0.130	-7.837	0.158	0.014	73.128
	Enthusiasm	-0.090	0.013	-0.123	-6.882	0.164	0.007	34.557
	Beauty appreciation	0.074	0.013	0.089	5.557	0.170	0.006	30.885
Depression	Hope	-0.167	0.012	-0.237	-14.139	0.144	0.144	725.457
	Enthusiasm	-0.132	0.012	-0.193	-11.139	0.185	0.041	219.620
	Self-discipline	-0.083	0.010	-0.133	-8.770	0.198	0.013	67.576
	Beauty appreciation	0.084	0.012	0.109	6.788	0.203	0.005	27.381
	Love	-0.084	0.013	-0.106	-6.634	0.211	0.008	44.010
Anxiety	Hope	0.111	0.012	-0.168	-9.365	0.084	0.084	394.493
	Self-discipline	-0.071	0.009	-0.122	-7.555	0.107	0.024	114.955
	Enthusiasm	-0.085	0.012	-0.133	-7.359	0.119	0.012	58.622
	Tolerance	-0.066	0.013	-0.089	-5.222	0.124	0.004	21.410
	Beauty appreciation	0.057	0.012	0.079	4.806	0.128	0.005	23.094
Hostility	Hope	0.005	0.109	0.076	5.557	0.203	0.158	509.044
	Self-discipline	0.008	0.144	0.081	-14.139	0.211	0.164	181.865
	Braveness	0.084	0.158	0.083	-11.139	0.084	0.170	49.723
	Hope	0.024	0.164	0.117	-8.770	0.107	0.144	73.960
	Modesty	0.012	0.170	0.014	0.211	-0.089	0.185	29.385
Fear	Hope	0.004	0.144	0.013	0.084	-0.186	0.014	294.412
	Enthusiasm	0.005	0.185	0.013	0.013	-0.149	0.007	76.826
	Sincerity	0.158	-14.139	0.012	0.012	-0.130	0.006	39.999
	Social wisdom	0.164	-11.139	0.012	0.012	-0.123	0.144	14.581
Bigotry	Tolerance	0.016	-8.770	0.144	0.010	0.089	0.041	458.646
	Team spirit	0.010	6.788	0.158	0.012	0.074	-0.110	86.160
	Hope	0.005	-6.634	0.144	0.013	-0.167	-0.091	56.427
	Modesty	0.083	-0.193	0.041	0.013	-0.132	-0.077	41.788
	Appreciation	0.034	-0.133	0.013	0.012	-0.083	-0.173	33.175
Mental disease	Hope	0.014	0.109	0.005	0.009	0.084	-0.152	379.281
	Self-discipline	0.006	-0.106	0.008	0.012	-0.084	-0.149	118.384
	Love	0.007	-0.168	0.084	0.013	0.170	0.102	80.475
	Leadership	0.109	0.109	0.005	0.009	0.084	-0.089	31.928
	Beauty appreciation	0.005	-6.634	0.144	0.013	-0.167	-0.186	27.112
Average total score	Hope	-0.101	0.007	-0.187	-13.639	0.118	0.118	969.547
	Self-discipline	-0.095	0.006	-0.188	-15.958	0.164	0.046	402.506
	Love	-0.090	0.008	-0.146	-11.646	0.180	0.015	135.752
	Leadership	-0.075	0.007	-0.142	-10.652	0.189	0.009	80.503
	Beauty appreciation	0.073	0.007	0.126	10.298	0.200	0.012	106.051

5. Discussion

The university students' positive mental quality has significant negative correlation with each dimension in mental health symptom checklist, which is in conformity with the researches made by He Hongmei [6]. The hope has significant negative correlation with each mental health symptom factor and has backward prediction effects on each mental health symptom factor and average total score, which is in conformity with the domestic researches and foreign researches. The hope can explain 8.3% of variance in obsessive-compulsive symptom, 10.9% of variance in interpersonal relationship sensibility, 14.4% of variance in depression, 8.4% of variance in anxiety, 6.4% of variance in fear, 8.1% of variance in mental diseases and 11.8% of variance in average total score of SCL-90 factors, which is in conformity with relevant researches. The hope is a positive motivation state. Such state is based on inner feeling of success and includes willing motivation (goal-oriented energy) and pathway thoughts (plan to realize the goal). When researching the effects of hope in mental disease prevention, Snyder etc. have found that the hope has protective effects for people if they encounter the difficulties or stressful events. When the stressful events occur, the individuals with high hope will adopt positive coping method to cope with stress and show more problem solving behaviors. Therefore, they will easily get rid of negative emotions, such as depression, anxiety etc. Snyder and Luthans consider the hope as strong psychological capitals and psychological strength possessed by the individuals in challenging environment. It suggests that training and improving the university students' positive mental quality-hope is very critical in methods and measures of improving the university students' mental health level. Moreover, the physical exercise can effectively mitigate these mental health problems.

The tolerance has significant negative correlation with each mental health symptom factor, which is in conformity with the domestic researches and foreign researches. The tolerance can explain 5.0% of variance in somatization, 1.4% of variance in interpersonal relationship sensibility, 10.5% of variance in hostility and 9.6% of variance in bigotry. Maybe it is because the individuals with high tolerance can form positive cognition. They have pro-social changes to the violator's motivation, reduce its avoidance and vengeance motivation to the violators, change from negativity to positivity and thus mitigate interpersonal relationship sensibility, hostility and bigotry. Similarly, the individuals with high tolerance tend to look on themselves from positive aspects. They will easily accept themselves, be more confident, cope with stress and difficulties in a positive way, and reduce somatization behaviors brought by stress or negative emotions. It suggests that improving the university students' positive mental quality-tolerance is very critical in reducing the university students' somatization, interpersonal relationship sensibility and bigotry as well as improving the university students' mental health level. Therefore, the university students' mental health level can be effectively increased by training and improving the university students' positive mental quality.

References

[1] Biddle S J H, Asare M: (2011) *Physical activity and mental health in children and adolescents: a review of reviews*[J]. British Journal of Sports Medicine, 45(11):886-95.

[2] Gino F, Schweitzer M E, Mead N L, et al.: (2011) *PUnable to resist temptation: How self-control depletion promotes unethical behavior*[J]. Organizational Behavior & Human Decision Processes, 115(2):191-203.

[3] Thompson C J, Boddy K, Stein K, et al.: (2011) *PDoes participating in physical activity in outdoor natural environments have a greater effect on physical and mental wellbeing than physical activity indoors? A systematic review*[J]. Environmental Science & Technology, 45(5):1761-72.

[4] Klein M H, Al E: (2015) *PA comparative outcome study of group psychotherapy vs. exercise treatments for depression.*[J]. International Journal of Mental Health, 13(3/4):148-176.

[5] Fujita K: (2011) *POn conceptualizing self-control as more than the effortful inhibition of impulses.*[J]. Personality and Social Psychology Review, 15(4):352-366.

[6] Leary M R, Schreindorfer L S, Haupt A L: (2011) *PThe Role of Low Self-Esteem in Emotional and Behavioral Problems: Why is Low Self-Esteem Dysfunctional?*[J]. Journal of Social & Clinical Psychology, 14(3):297-314.

[7] Brewer J A, Mallik S, Babuscio T A, et al.: (2011) *PMindfulness training for smoking cessation: Results from a randomized controlled trial*[J]. Drug & Alcohol Dependence, 119(1–2):72-80.

[8] García-Mesa Y, López-Ramos J C, Giménez-Llort L, et al.: (2011) *PPhysical exercise protects against Alzheimer's disease in 3xTg-AD mice*[J]. Journal of Alzheimers Disease Jad, 24(3):421.

[9] Braveman P A, Egerter S A, Mockenhaupt R E: (2011) *PBroadening the Focus: The Need to Address the Social Determinants of Health*[J]. American Journal of Preventive Medicine, 40(1):S4-S18.

[10] Marsh H W, Morin A J S, Parker P D, et al.: (2014) *PExploratory structural equation modeling: an integration of the best features of exploratory and confirmatory factor analysis.*[J]. Annu Rev Clin Psychol, 10(10):85.

[11] Zschucke E, Gaudlitz K, Ströhle A: (2011) *PExercise and Physical Activity in Mental Disorders: Clinical and Experimental Evidence*[J]. European Archives of Psychiatry and Clinical Neuroscience, 261(2):186-191.

Received May 7, 2017