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油田野外作业工人慢性疾病调查及职业紧张与神经递质的相关性研究 *

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摘要 目的:调查油田野外作业工人慢性疾病患病情况,分析职业紧张与神经递质的相关性。**方法:**通过整群抽样的方式选取油田野外作业工人 2000 例作为研究对象,采用自制的慢性非传染性疾病调查量表对所有工人的慢性疾病情况予以调查,采用职业紧张量表对所有工人的职业紧张情况予以调查。采用酶联免疫吸附法检测所有工人血清五羟色胺、去甲肾上腺素以及神经肽 Y 水平,并采用偏相关分析油田野外作业工人职业紧张与神经递质的相关性。**结果:**2000 例油田野外作业工人慢性疾病发病率最高的前三种疾病分别为颈腰部疾病、高血压、高血脂,占比分别为 20.60%、15.35%、11.20%。油田野外作业工人中男性职业任务、个体应对资源评分高于女性,而锻炼工人的个体紧张反应评分低于不锻炼工人($P<0.05$)。油田野外作业工人中饮酒工人神经肽 Y 水平低于不饮酒工人,锻炼工人的去甲肾上腺素水平高于不锻炼工人($P<0.05$)。经偏相关分析可得:油田野外作业工人的职业任务评分与五羟色胺、去甲肾上腺素水平呈正相关($P<0.05$),个体紧张反应评分与神经肽 Y 水平呈负相关($P<0.05$)。**结论:**油田野外作业工人慢性疾病患病情况不容乐观,且其职业紧张与神经递质存在密切相关,在临床工作中可通过改善油田野外作业工人的职业紧张,从而达到改善其神经递质水平的目的。

关键词:油田野外作业工人;慢性疾病;职业紧张;神经递质;相关性

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Investigation of Chronic Diseases of Oilfield Field Workers and Correlation between Occupational Stress and Neurotransmitter*

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ABSTRACT Objective: To investigate the prevalence of chronic diseases among field workers and analyze the correlation between occupational stress and neurotransmitters. **Methods:** 2000 oilfield field workers were selected as observation objects by cluster sampling, and the chronic diseases of all workers were investigated by using the self-made chronic noncommunicable disease survey scale, and the occupational stress scale was used to investigate the occupational stress of all workers. The levels of serum serotonin, norepinephrine and neuropeptide Y were measured by enzyme-linked immunosorbent assay. The correlation between occupational stress and neurotransmitters in oilfield field workers was analyzed by partial correlation analysis. **Results:** The first three diseases with the highest incidence of chronic diseases among 2000 oilfield field workers were neck, waist, hypertension and hyperlipidemia, accounting for 20.60%, 15.35% and 11.20% respectively. Among oilfield field workers, the scores of male occupation task and individual coping resources were higher than those of female, while the scores of individual stress response of the exerciser was higher than that of the non-exerciser ($P<0.05$). The neuropeptide Y level of the drinkers was lower than that of the non-drinkers, and the norepinephrine level of the exercisers was higher than that of the non-exercisers ($P<0.05$). Partial correlation analysis showed that occupational tasks scores of oilfield field workers were positively correlated with serotonin and norepinephrine levels($P<0.05$). There was a negative correlation between individual stress scores and neuropeptide Y level ($P<0.05$). **Conclusion:** Chronic diseases of oilfield field workers are not optimistic, and their occupational stress is closely related to neurotransmitters. In clinical work, we may improve the occupational stress of oilfield field workers, so as to improve their neurotransmitters.

Key words: Oilfield field workers; Chronic diseases; Occupational stress; Neurotransmitters; Correlation

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前言

油田野外作业工人具有工作强度大、工作单调的特点,加之工作以及生活的环境较为艰苦,从而普遍伴有不同程度的健康状况,而不理想的健康状况会在一定程度上增加工人在工作过程中突发疾病或死亡的风险^[1,2]。有研究报道显示,随着生产技术以及工艺的逐渐精进,野外作业的工作要求随之提高,而相匹配的资源 and 工人应付能力无法满足企业作业日益发展的需求,致使工人长期处于高度紧张的状态,进一步可能对其身心健康造成不利影响^[3,4]。职业紧张主要是指在某种职业条件下,客观需求和主观能力的平衡被打破所引起的心理、生理压力。一旦职业紧张负荷严重超过机体的调节能力而发生机体功能失衡时,会导致职业人群的睡眠-觉醒节律发生改变,进一步导致其睡眠质量降低,失眠风险增加,患病率增加^[5,6]。另有研究报道显示,长期处于紧张状态会导致机体出现一系列的神经内分泌改变,促进下丘脑-垂体-肾上腺皮质轴以及交感神经系统的激活,从而释放多种神经递质,导致生理、生化反应^[7,8]。鉴于此,本研究通过调查油田野外作业工人慢性患病情况以及分析职业紧张与神经递质的相关性,旨在为保护油田野外作业工人的健康提供参考,现作以下报道。

1 资料与方法

1.1 一般资料

通过整群抽样的方式选取油田野外作业工人 2000 例作为研究对象,其中男性 1528 例,女性 472 例,年龄 24~60 岁,平均年龄(39.34 ± 6.38)岁;工龄 1~37 年,平均工龄(18.25 ± 4.71)年;婚姻状况:已婚 1627 例,未婚 373 例;吸烟 1099 例,不吸烟 901 例;饮酒 1044 例,不饮酒 956 例;锻炼 1237 例,不锻炼 763 例。纳入标准:(1)年龄 ≥ 18 周岁;(2)在岗工作时间 ≥ 1 年;(3)可正常交流沟通。所有工人已知情本次研究。

1.2 研究方法

(1)慢性疾病调查:采用由课题组自制的慢性非传染性疾病病调查量表对所有工人的慢性慢病情况予以调查,要求工人务必根据自身所患的慢性疾病自填问卷,主要调查目标包括颈、腰部疾病、高血压、高血脂、骨关节疾病、慢性消化系统疾病、慢性泌尿系统疾病、呼吸系统疾病、恶性肿瘤以及冠心病等。(2)通过职业紧张量表对工人的职业紧张状况予以调查^[9],该量表主要包括职业任务、个体紧张反应以及个体应对资源 3 个方面,每个方面含有不同的维度,每个维度包括 10 个条目,每个条目按照强度的不同分为 5 级,具体为 1 分(没有),2 分(较少有),3 分(时而有),4 分(较多有),5 分(经常有),职业紧张评分越高说明工人的紧张程度越明显。(3)神经递质水平的检测:采集所有工人清晨空腹静脉血 5 mL,加入含有乙二胺四乙酸抗凝剂的真空采血管中,以 10 cm 作为离心半径,进行 10 min 的离心处理,采集上层血清送检,检测方式为酶联免疫吸附法,具体操作务必以试剂盒说明书为准,其中相关试剂盒均购自北京尚柏生物技术有限公司,使用仪器为北京普朗新技术有限公司生产的 DNM-9602G 自动酶标分析仪检测五羟色胺、去甲肾上腺素以及神经肽 Y 水平。

1.3 统计学方法

以 SPSS20.0 软件完成数据的分析,计数资料通过[n(%)]予以表示,行 χ^2 检验。计量资料通过($\bar{x} \pm s$)表示,行 t 检验。油田野外作业工人职业紧张评分与神经递质水平的关系予以偏相关分析。以 $P < 0.05$ 表示差异有统计学意义。

2 结果

2.1 2000 例油田野外作业工人慢性疾病调查结果分析

2000 例油田野外作业工人慢性疾病发病率最高的前三种疾病分别为颈腰部疾病、高血压、高血脂,占比分别为 20.60%、15.35%、11.20%。见表 1。

表 1 2000 例油田野外作业工人慢性疾病调查结果分析(%)

Table 1 Analysis of chronic disease survey results of 2000 oilfield field workers (%)

Disease types	n	Proportion
Neck and waist diseases	412	20.60
Hypertension	307	15.35
Hyperlipemia	224	11.20
Osteoarthropathy	198	9.90
Chronic digestive system diseases	194	9.70
Chronic urinary system diseases	87	4.35
Respiratory diseases	83	4.15
Malignant tumor	12	0.60
Coronary heart disease	61	3.05
Other	37	1.85

2.2 油田野外作业工人职业紧张评分与个体特征的关系分析

油田野外作业工人中男性职业任务、个体应对资源评分高于女性,而锻炼工人的个体紧张反应评分低于不锻炼工人($P < 0.05$)。见表 2。

2.3 油田野外作业工人神经递质水平与个体特征的关系分析

油田野外作业工人中饮酒工人神经肽 Y 水平低于不饮酒工人,锻炼工人的去甲肾上腺素水平高于不锻炼工人($P < 0.05$)。见表 3。

表 2 油田野外作业工人职业紧张评分与个体特征的关系分析(分, $\bar{x} \pm s$)Table 2 Analysis of the relationship between occupational stress score and individual characteristics of oilfield field workers (scores, $\bar{x} \pm s$)

Individual characteristics	n	Occupation task	Individual stress response	Individual coping resources
Age (years)	<40	1298	190.22± 24.03	110.94± 22.39
	≥ 40	702	189.78± 25.13	110.97± 21.89
Gender	Male	1528	192.72± 25.30	110.98± 22.39
	Female	472	188.05± 21.74*	110.96± 20.04
Length of service (years)	<20	1256	192.31± 24.19	111.84± 21.48
	≥ 20	744	191.94± 23.05	112.05± 21.55
Marital status	Unmarried	373	190.52± 24.83	109.94± 22.08
	Married	1627	190.91± 24.13	111.45± 21.56
Smoking	Yes	1099	191.08± 23.74	111.26± 22.03
	No	901	190.28± 24.38	112.25± 21.08
Drinking	Yes	1044	190.42± 23.58	110.06± 21.39
	No	956	190.38± 23.61	111.88± 21.44
Exercise	Yes	1237	190.12± 23.18	110.83± 21.33
	No	763	190.50± 23.57	114.38± 21.65 [#]

Note: Compared with male, * $P<0.05$; Compared with exercise, [#] $P<0.05$.

表 3 油田野外作业工人神经递质水平与个体特征的关系分析($\bar{x} \pm s$)Table 3 Analysis of the relationship between neurotransmitter levels and individual characteristics of oilfield field workers ($\bar{x} \pm s$)

Individual characteristics	n	Serotonin (ng/mL)	Norepinephrine (pg/mL)	Neuropeptide Y (pg/mL)
Age (years)	<40	1298	1.62± 0.51	1.82± 0.23
	≥ 40	702	1.66± 0.53	1.80± 0.32
Gender	Male	1528	1.63± 0.48	1.80± 0.25
	Female	472	1.66± 0.52	1.82± 0.26
Length of service (years)	<20	1256	1.64± 0.50	1.81± 0.31
	≥ 20	744	1.65± 0.49	1.80± 0.24
Marital status	Unmarried	373	1.58± 0.44	1.82± 0.30
	Married	1627	1.63± 0.50	1.80± 0.25
Smoking	Yes	1099	1.62± 0.50	1.82± 0.25
	No	901	1.60± 0.55	1.80± 0.27
Drinking	Yes	1044	1.65± 0.49	1.80± 0.24
	No	956	1.64± 0.51	1.81± 0.26
Exercise	Yes	1237	1.63± 0.51	1.89± 0.26
	No	763	1.60± 0.44	1.76± 0.24 [#]

Note: Compared with drinking, * $P<0.05$; Compared with exercise, [#] $P<0.05$.

2.4 油田野外作业工人职业紧张评分与神经递质水平的偏相关分析

在控制性别、工龄、年龄、婚姻状况、吸烟等混杂因素后,经偏相关分析可得:油田野外作业工人的职业任务评分与五羟色胺、去甲肾上腺素水平呈正相关($P<0.05$),个体紧张反应评分与神经肽 Y 水平呈负相关($P<0.05$)。见表 4。

油田野外作业工人属于一种特殊的工种,其往往工作任务多,工作强度重,通常长期处于紧张而枯燥的工作环境中,身体易出现亚健康状态,且较易引发慢性疾病^[10]。以往对此类职业群体的研究报道较少,为了科学地统计分析油田野外作业工人的身体状况,及时开展其慢性疾病调查及职业紧张与神经递质的相关性研究十分必要。

3 讨论

表 4 油田野外作业工人职业紧张评分与神经递质水平的偏相关分析

Table 4 Partial correlation analysis between occupational stress score and neurotransmitter level of oilfields field workers

Occupational stress	Serotonin		Norepinephrine		Neuropeptide Y	
	r	P	r	P	r	P
Occupation task	0.372	0.000	0.369	0.013	-0.145	0.123
Individual stress response	0.087	0.394	0.009	0.687	-0.360	0.015
Individual coping resources	-0.062	0.403	-0.129	0.173	0.129	0.174

本研究结果显示,2000 例油田野外作业工人慢性疾病发病率较高的疾病分别为颈腰部疾病、高血压、高血脂,这与谭卫国等人的研究报道相符^[11],表明了油田野外作业工人慢性疾病发生风险较高,应予以重视。分析原因,可能与下述因素有关^[12-14]: (1)大部分工人受教育程度较低,自我保健常识掌握程度较低,在出现伤病时不及时就医,导致了病情的迁延不愈;(2)工人普遍饮食习惯不合理以及进餐时间不规律,大多数工人为补充作业时所消耗的能力,多摄入高热量低纤维的饮食,引发高血压、高血脂;(3)大部分男性工人存在吸烟、饮酒等不良生活习惯,且缺乏娱乐和休闲,加之睡眠不规律,增加了慢性疾病发生的风险;(4)在工作时工人往往会受噪音、高温、有毒气体以及震动等因素的影响,继而引发身体健康问题^[15]。此外,油田野外作业工人中男性职业任务、个体应对资源评分相比女性较高,而锻炼工人的个体紧张反应评分相比不锻炼工人较低,这表明男性工人的职业紧张程度较明显,而有锻炼工人的职业紧张程度较低。可能是由于男性工人是野外石油基地的主力军,往往承担着一些高难度以及高风险的作业,普遍对自己具有较高的要求,加之长期面临晋升压力,身上扛着赡养父母以及养育子女的重担,承受着工作以及家庭的双重压力,从而使得其出现职业紧张的概率较高^[16-18]。在工作之余进行适量的锻炼可有效缓解工作以及家庭所带来的压力,同时有利于增强机体免疫力以及抵抗力,为预防慢性疾病的发生创造有利条件^[19-21]。另外,油田野外作业工人中饮酒工人神经肽 Y 水平相比不饮酒工人较低,锻炼工人的去甲肾上腺素水平相比不锻炼工人较高,可能与酒精对中枢神经系统会产生一定的作用有关,而体育锻炼可有利于保持头脑清醒,从而有效调节神经递质的释放。经偏相关分析可得:油田野外作业工人的职业任务评分与五羟色胺、去甲肾上腺素水平呈正相关,个体紧张反应评分与神经肽 Y 水平呈负相关,五羟色胺表达水平可有效反映机体受到压力和应激程度的作用,其中慢性职业应激会导致五羟色胺受体结合的潜力降低,从而提高五羟色胺的释放,并会改变大脑结构,促使尾状核以及海马体积减少,应对压力的能力降低,最终导致提出与反复超强应激状态^[22-24]。去甲肾上腺素可通过不同的受体对压力感受性发射发挥不同的调节作用,其作为神经营养因子的 mRNA 表达,是应激过程导致焦虑、抑郁发生的重要原因^[25-27]。神经肽 Y 和五羟色胺、去甲肾上腺素存在相互调节作用,其可通过调节单脑皮质的五羟色胺、去甲肾上腺素表达,进一步发挥抗紧张作用^[28-30]。

综上所述,油田野外作业工人发生慢性疾病的风险较高,且职业紧张程度与神经递质水平密切相关,油田企业应积极调控工人年龄,尽量招聘年轻的工人,同时加强对工人疾病健康教育以及健康管理,提高工人的自我保健意识,纠正其不良生

活习惯,并积极疏导工人的心理问题,尽量增加娱乐、健身设施。

参 考 文 献(References)

- [1] 李新楠,刘继文,张艳霞,等. 野外油田作业工人职业紧张与睡眠质量的关系研究[J]. 新疆医科大学学报, 2017, 40(7): 959-962
- [2] Nieuwenhuijsen K, Schoutens AMC, Frings-Dresen MHW, et al. Evaluation of a randomized controlled trial on the effect on return to work with coaching combined with light therapy and pulsed electromagnetic field therapy for workers with work-related chronic stress [J]. BMC Public Health, 2017, 17(1): 761-761
- [3] Stutz-Tanenbaum P, Greene D, Hanson DJ, et al. Professional Reward in the Academic Fieldwork Coordinator Role [J]. Am J Occup Ther, 2017,71(2): 7102230010p1-7102230010p7
- [4] 武文凤,陶宁,韩瑞,等. 野外油田工人职业紧张对心理障碍影响的研究[J]. 现代预防医学, 2017, 44(7): 1178-1182
- [5] 王清波,刘洁欣,赵玫,等. 健康教育对 2 型糖尿病患者野外作业时的自护行为及生活质量的影响 [J]. 中华现代护理杂志, 2010, 16(34): 4114-4116
- [6] Khan M, Lamelas P, Musa H, et al. Development, Testing, and Implementation of a Training Curriculum for Nonphysician Health Workers to Reduce Cardiovascular Disease[J]. Glob Heart, 2018, 13(2): 93-100
- [7] Howarth HM, Alaziz T, Nicolds B, et al. Redistribution of nerve strain enables end-to-end repair under tension without inhibiting nerve regeneration[J]. Neural Regen Res, 2019, 14(7): 1280-1288
- [8] Barrera C, Wild P, Dorribo V, et al. Exposure to field vs. storage wheat dust: different consequences on respiratory symptoms and immune response among grain workers [J]. Int Arch Occup Environ Health, 2018, 91(6): 745-757
- [9] 宁丽,关素珍,徐欢,等. 新疆油田野外作业工人职业紧张与睡眠障碍调查[J]. 环境与职业医学, 2017, 34(11): 978-982
- [10] 熊菲,姜雨,赵云娟,等. 新疆油田野外作业女工职业紧张调查[J]. 中华行为医学与脑科学杂志, 2015, 24(9): 848-849
- [11] 谭卫国,熊菲,万红,等. 沙漠油田野外作业工人身心健康状况调查[J]. 中国公共卫生, 2015, 31(6): 720-722
- [12] Lau A, Tarlo SM. Update on the Management of Occupational Asthma and Work-Exacerbated Asthma[J]. Allergy Asthma Immunol Res, 2019, 11(2): 188-200
- [13] Mazhaeva TV, Dubenko SE, Pogozheva AV, et al. Characteristics of the diet and nutritional status of workers at various industrial enterprises of the Sverdlovsk Region[J]. Vopr Pitan, 2018, 87(1): 72-78
- [14] Hatanaka Y, Shimokata K, Osugi S, et al. Impact of drinking and smoking habits on cerebrovascular disease risk among male employees[J]. Sangyo Eiseigaku Zasshi, 2016, 58(5): 155-163
- [15] Roelen CAM, van Hoffen MFA, Waage S, et al. Psychosocial work environment and mental health-related long-term sickness absence a

- mong nurses [J]. *Int Arch Occup Environ Health*, 2018, 91 (2): 195-203
- [16] Havermans BM, Boot CRL, Houtman IL, et al. The role of autonomy and social support in the relation between psychosocial safety climate and stress in health care workers [J]. *BMC Public Health*, 2017, 17(1): 558
- [17] 姜雨, 赵云娟, 崔长勇, 等. 油田野外作业工人职业紧张、神经递质水平与睡眠质量的关系[J]. *环境与职业医学*, 2016, 33(7): 638-643
- [18] Hyon JY, Yang HK, Han SB. Association between Dry Eye Disease and Psychological Stress among Paramedical Workers in Korea [J]. *Sci Rep*, 2019, 9(1): 3783
- [19] D'Ettorre G, Pellicani V, Vullo A. Gender assessment of job stress in healthcare workers. Implications for practice [J]. *Med Lav*, 2019, 110 (1): 22-28
- [20] Komano Y, Shimada K, Naito H, et al. Efficacy of heat-killed *Lactococcus lactis* JCM 5805 on immunity and fatigue during consecutive high intensity exercise in male athletes: a randomized, placebo-controlled, double-blinded trial[J]. *J Int Soc Sports Nutr*, 2018, 15(1): 39
- [21] Singleton ST, Lein PJ, Dadson OA, et al. Longitudinal assessment of occupational exposures to the organophosphorous insecticides chlorpyrifos and profenofos in Egyptian cotton field workers [J]. *Int J Hyg Environ Health*, 2015, 218(2): 203-211
- [22] Mousa HA. Short-term effects of subchronic low-level hydrogen sulfide exposure on oil fieldworkers[J]. *Environ Health Prev Med*, 2015, 20(1): 12-17
- [23] Puig MV, Gener T. Serotonin Modulation of Prefronto-Hippocampal Rhythms in Health and Disease [J]. *ACS Chem Neurosci*, 2015, 6(7): 1017-1025
- [24] Atasever M, Namlı Kalem M, Sönmez Ç, et al. Lower serotonin level and higher rate of fibromyalgia syndrome with advancing pregnancy [J]. *J Matern Fetal Neonatal Med*, 2017, 30(18): 2204-2211
- [25] 袁伟峰, 刘月娥, 张梅, 等. 去甲肾上腺素联合多巴酚丁胺治疗感染性休克对患者血流动力学、血乳酸及 CCR, FEH₂O, FENa 的影响 [J]. *现代生物医学进展*, 2017, 17(25): 4852-4855, 4923
- [26] 刘移民, 赖建民, 肖启华, 等. 职业性噪声对暴露人群外周血中去甲肾上腺素及心血管系统的影响 [J]. *中华劳动卫生职业病杂志*, 2007, 25(4): 227-229
- [27] Golovin RM, Ward NJ. Neuromodulatory influence of norepinephrine during developmental experience-dependent plasticity[J]. *J Neurophysiol*, 2016, 116(1): 1-4
- [28] Gareeva AE, Kinyasheva KO, Galaktionova DY, et al. Brain neurotransmitter systems gene Polymorphism: the Search for pharmacogenetic markers of efficacy of haloperidol in Russians and Tatars [J]. *Mol Biol (Mosk)*, 2015, 49(6): 959-967
- [29] Roganović J, Petrović N, Djukić L. Effect of neuropeptide Y on norepinephrine-induced constriction in the rabbit facial artery after carotid artery occlusion[J]. *Vojnosanit Pregl*, 2014, 71(6): 571-575
- [30] 熊青明, 王汉兵, 杨承祥, 等. 神经肽与神经病理性疼痛研究新进展[J]. *中国疼痛医学杂志*, 2016, 22(2): 137-140, 143

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- [11] Zhu P, Ge N, Liu D, et al. Preliminary investigation of the function of hsa_circ_0006215 in pancreatic cancer [J]. *Oncol Lett*, 2018, 16(1): 603-611
- [12] Ma C, Luo C, Yin H, et al. Kallistatin inhibits lymphangiogenesis and lymphatic metastasis of gastric cancer by downregulating VEGF-C expression and secretion[J]. *Gastric Cancer*, 2018, 21(4): 617-631
- [13] Chao J, Guo Y, Li P, et al. Opposing Effects of Oxygen Regulation on Kallistatin Expression: Kallistatin as a Novel Mediator of Oxygen-Induced HIF-1-eNOS-NO Pathway [J]. *Oxid Med Cell Longev*, 2017, 2017: 5262958
- [14] Ma C, Yin H, Zhong J, et al. Kallistatin exerts anti-lymphangiogenic effects by inhibiting lymphatic endothelial cell proliferation, migration and tube formation[J]. *Int J Oncol*, 2017, 50(6): 2000-2010
- [15] Wang T, Shi F, Wang J, et al. Kallistatin Suppresses Cell Proliferation and Invasion and Promotes Apoptosis in Cervical Cancer Through Blocking NF-κB Signaling [J]. *Oncol Res*, 2017, 25 (5): 809-817
- [16] Wang G, Wang X, Huang X, et al. Inhibition of integrin β3, a binding partner of kallistatin, leads to reduced viability, invasion and proliferation in NCI-H446 cells[J]. *Cancer Cell Int*, 2016, 16: 90
- [17] Sun HM, Mi YS, Yu FD, et al. SERPINA4 is a novel independent prognostic indicator and a potential therapeutic target for colorectal cancer[J]. *Am J Cancer Res*, 2016, 6(8): 1636-1649
- [18] Zhi X, Lin L, Yang S, et al. βII-Spectrin (SPTBN1) suppresses progression of hepatocellular carcinoma and Wnt signaling by regulation of Wnt inhibitor kallistatin[J]. *Hepatology*, 2015, 61(2): 598-612
- [19] Bateman NW, Dubil EA, Wang G, et al. Race-specific molecular alterations correlate with differential outcomes for black and white endometrioid endometrial cancer patients [J]. *Cancer*, 2017, 123 (20): 4004-4012
- [20] Chao J, Li P, Chao L. Kallistatin: double-edged role in angiogenesis, apoptosis and oxidative stress [J]. *Biol Chem*, 2017, 398 (12): 1309-1317
- [21] Chao J, Li P, Chao L. Kallistatin suppresses cancer development by multi-factorial actions[J]. *Crit Rev Oncol Hematol*, 2017, 113: 71-78