

## 糖尿病发病的社会心理风险因素流行病学研究进展

周磊 林岑 蔡伦 韩耀风 杨叔禹 方亚

361102 厦门大学公共卫生学院卫生技术评估福建省高校重点实验室(周磊、林岑、蔡伦、韩耀风、方亚); 361003 厦门市糖尿病研究所(杨叔禹)

通信作者:方亚, Email:fangya@xmu.edu.cn

DOI: 10.3760/cma.j.issn.0254-6450.2018.10.021

**【摘要】** 糖尿病的患病率和疾病负担不断增加,成为全球重大公共卫生问题。随着生物-心理-社会医学模式的提出,社会心理因素对糖尿病的影响逐渐引起重视。本文对影响糖尿病发病的社会心理因素流行病学研究进行综述,国外研究显示心理因素与糖尿病的发病密切相关,关于社会因素的研究较少且结论不一致。国内相关研究相对较少且多为小样本横断面研究,仍需更多纵向研究来证实社会心理因素对糖尿病发病的作用。

**【关键词】** 糖尿病; 社会心理因素; 发病风险

**基金项目:** 国家自然科学基金(81573257); 国家自然科学基金青年基金(81602941, 71403229); 福建省自然科学基金(2016J01408)

**Advances in epidemiological studies regarding related psychosocial risk factors on the incidence of diabetes mellitus** Zhou Zi, Lin Cen, Cai Lun, Han Yaofeng, Yang Shuyu, Fang Ya

Key Laboratory of Health Technology Assessment of Fujian Province University, School of Public Health, Xiamen University, Xiamen 361102, China (Zhou Z, Lin C, Cai L, Han YF, Fang Y); Xiamen Diabetes Institute, Xiamen 361003, China (Yang SY)

Corresponding author: Fang Ya, Email: fangya@xmu.edu.cn

**【Abstract】** Both the increasing prevalence and growing burden of diabetes mellitus have caused global public health concerns. With the development of bio-psycho-social medical model, the impact of psychosocial factors on diabetes has attracted more attentions among the researchers. This paper summarizes findings from epidemiological studies that focusing on the association between diabetes and related psychosocial risk factors. Foreign studies have shown that psychological factors are closely related to diabetes, but the conclusions on social factors are inconsistent. Domestic studies have only targeted on small-sample-sized and cross-sectional studies. More longitudinal research is needed to confirm the impact of psychosocial factors on the risk of diabetes.

**【Key words】** Diabetes mellitus; Psychosocial factors; Risk of onset

**Fund programs:** National Natural Science Foundation of China (81573257); National Natural Science Youth Foundation of China (81602941, 71403229); Natural Science Foundation Project of Fujian Province (2016J01408)

糖尿病是以血糖升高为主要症状的内分泌代谢障碍疾病,后期合并多种并发症,导致各组织器官慢性损伤与功能障碍。由于人口老龄化及不健康的生活方式等原因,糖尿病的患病人数不断增加<sup>[1]</sup>,成为严重威胁人类健康的重大公共卫生问题。2015年,全球20~79岁的成年人中约有8.8%的人(4.15亿人)患有糖尿病,导致的卫生支出总额约为673亿美元(12%);预计到2040年,糖尿病全球患病率将上升至10.4%(6.42亿人),患病人数增长54.7%,预计支出880亿美元,同比增长25.4%,且大部分增长将会发生在低、中等收入国家<sup>[2]</sup>。2010年,我国约1.14亿成年人患有糖尿病,患病率11.6%,患病人数居世界首位<sup>[3]</sup>。2014年,我国糖尿病医疗费用总量为803.30亿元,人均治疗费用为2 188.73元<sup>[4]</sup>。此外,

糖尿病还会带来劳动力减少和经济生产力下降等间接成本<sup>[5]</sup>,给家庭和社会带来了沉重负担。

尽管已基于吸烟、饮酒等常规危险因素采取了一系列干预措施,糖尿病的发病率仍持续上升。近年来,随着生物-心理-社会医学模式和“心身医学”概念的提出,社会心理因素对健康的影响逐渐引起重视。糖尿病作为重要的心身疾病之一,引发越来越多的学者开始关注社会心理因素在糖尿病发病中的作用<sup>[6-9]</sup>。社会心理因素指与个人的心理和社会环境或过程相关的因素<sup>[10]</sup>。本文对影响糖尿病发病的社会心理因素的流行病学研究进行综述,为开展糖尿病的社会心理因素干预,降低人群糖尿病发病率提供参考。

### 1. 社会心理因素与糖尿病发病风险:

(1) 抑郁症状与糖尿病发病风险: 抑郁症状是糖尿病发病中常见的心理因素, 大部分前瞻性研究对抑郁症状的测量采用流调中心用抑郁量表(CES-D)。Meta分析表明, 抑郁症状可以增加糖尿病发生的风险<sup>[11-12]</sup>, 同时糖尿病患者发生抑郁症状的风险也高于健康人群<sup>[12-13]</sup>。进一步的队列研究探讨了抑郁症状与其他因素的相互作用和糖尿病的关系。英国老龄化纵向研究结果提示, 在52~65岁之间的人群中, 抑郁症状与糖尿病之间存在双向关联; 而在>65岁的人群中, 二者之间则无明显关联<sup>[14]</sup>。抑郁症状可增加男性患糖尿病风险, 在女性中未发现抑郁症状与糖尿病发病的关联<sup>[15-16]</sup>。抑郁症状与受教育程度之间也存在相互作用, 受教育程度低的抑郁患者发生糖尿病的风险要高于受教育程度高的抑郁患者<sup>[17-18]</sup>。加拿大的随访研究则指出抑郁本身和糖尿病无关联, 但抑郁症状与代谢失调之间的相互作用是糖尿病的危险因素<sup>[19]</sup>。

(2) 焦虑症状与糖尿病发病风险: 有关焦虑症状与糖尿病发病风险相关关系的研究较少, 但是焦虑症状和抑郁症状常同时存在<sup>[20]</sup>, 且二者的测度方式也是相关的<sup>[21]</sup>。挪威一项纳入37 291名≥20岁参与者的10年随访研究发现, 调整混杂因素后, 基线有抑郁和焦虑症状的个体发生糖尿病的风险增加( $OR=1.5, 95\%CI: 1.3 \sim 1.8$ )<sup>[22]</sup>, 在荷兰的队列中也观察到类似关联<sup>[23]</sup>。但是这两项研究都没有单独分析焦虑症状或抑郁症状对糖尿病的影响, 因此无法评价焦虑症状对糖尿病的影响是否独立于抑郁症状。美国的队列研究单独分析了焦虑症状对糖尿病的影响, 但结论并不一致。一项纳入3 675名≥60岁老年人的10年随访研究指出焦虑症状是老年人患糖尿病的危险因素( $OR=1.35, 95\%CI: 1.12 \sim 1.61$ ), 且该影响独立于抑郁症状和传统危险因素<sup>[24]</sup>。也有研究发现抑郁和焦虑症状与2型糖尿病的发病风险有性别差异, 在女性中抑郁和焦虑症状会增加糖尿病的发病风险, 在男性中该关联无统计学意义<sup>[25]</sup>。然而, 焦虑症状和糖尿病发病之间的关联未在另外两项纵向研究中发现<sup>[26-27]</sup>。

(3) 压力与糖尿病发病风险: 压力与糖尿病发病的关系受到许多学者关注, 但是关于压力的测度尚无统一标准。日本和瑞典的大队列研究均发现, 自报有高水平压力感受的个体发生糖尿病的风险较高<sup>[28-29]</sup>。压力与糖尿病的关系存在性别差异, 日本研究发现相对于女性, 男性发生糖尿病可能性更高<sup>[28]</sup>; 而丹麦哥本哈根市心脏队列研究发现自报处于高压水平下的男性发生糖尿病的风险增高( $OR=2.36, 95\%CI: 1.22 \sim 4.59$ ), 但在女性中没有发现关联<sup>[30]</sup>。

工作压力与糖尿病发生风险增高相关。工作压力指在某种职业条件下客观要求与个人适应能力之间失衡所带来的生理和心理压力, 主要来自于高工作要求、低工作控制水平以及低社会支持<sup>[31-32]</sup>。Meta分析结果显示工作压力导致糖尿病的发病风险增加1.15倍( $95\%CI: 1.06 \sim 1.25$ ), 并且该效应独立于其他生活方式<sup>[33]</sup>。张利新等<sup>[34]</sup>对中国天津市6 075名男性警察进行了2.61年随访, 调整传统危险因素后, 职业紧张和紧张反应是警察发生糖尿病的独立危险因素。长时间

工作(≥55 h/周)仅在社会经济状况较差的群体中, 增加发生糖尿病的风险, 在社会经济状况较好的群体中未发现类似关联<sup>[35]</sup>。

(4) 负性生活事件与糖尿病发病风险: 因为人们准确描述压力感受的能力受到质疑<sup>[36]</sup>, 一些研究人员更倾向于测量引起压力的事件或环境<sup>[37]</sup>。英国Whitehall II队列研究调查了10 308名参与者过去12个月中发生亲友死亡、婚姻问题或意外等负性生活事件, 发现在控制其他危险因素后, 负性生活事件与糖尿病发病风险的关系无统计学意义<sup>[38]</sup>。但是, 负性生活事件对糖尿病发病的影响可能是长期的。李玉卿等<sup>[39]</sup>对中国河北省19 347名研究对象进行回顾性分析指出, 生命早期经历饥荒增加了成年后糖尿病的患病风险( $OR=1.22, 95\%CI: 1.06 \sim 1.40$ )。丹麦一项长达16年的随访研究表明失去子女的双亲发生糖尿病的风险增高( $RR=1.44, 95\%CI: 1.21 \sim 1.71$ )<sup>[40]</sup>。Meta分析结果显示有儿童期不良经历, 如受到忽视、身体虐待、性虐待的人群患糖尿病的风险增加( $OR=1.32, 95\%CI: 1.16 \sim 1.51$ )<sup>[41]</sup>。

(5) 性格特征与糖尿病发病风险: 关于性格特征与糖尿病发病风险研究的文献较少, 但现有的证据表明, 性格特征也可能与糖尿病发病风险增加有关。A型行为人群具有较强的好胜心和支配欲、努力工作但急躁易怒。日本研究人员对55 826名40~69岁的参与者随访10年发现, 女性随着A型行为水平的升高, 患糖尿病的风险也相应增加( $OR=1.22, 95\%CI: 1.01 \sim 1.47$ )<sup>[28]</sup>。Abraham等<sup>[26]</sup>对5 598名参与者进行了平均11.4年的随访, 发现在调整常规风险因素后, 基线时报告高愤怒特质评分者发生糖尿病的风险较高( $HR=1.48, 95\%CI: 1.04 \sim 2.12$ ), 然而, 调整腰围后该关联无统计学意义( $HR=1.32, 95\%CI: 0.94 \sim 1.86$ )。一项Meta分析纳入了5个前瞻性研究, 每个研究均探讨了开放性、尽责性、外向性、亲和性和神经质5大性格特征对糖尿病的影响, 结果显示, 在调整了糖尿病的其他相关危险因素后, 仅低尽责性与糖尿病发病风险的关联有统计学意义( $OR=0.87, 95\%CI: 0.82 \sim 0.91$ ), 其他4个性格特征与糖尿病的关联无一致结论<sup>[42]</sup>。

(6) 积极心理与糖尿病发病风险: 积极心理包括积极的认知、情绪体验和态度, 例如幸福感等<sup>[43-44]</sup>。少数研究评估了积极心理与糖尿病发病风险的关联。Whitehall II队列研究调查了7 800名英国中年参与者的心理幸福感和糖尿病发病等情况, 经过13年的随访发现具有高生活满意度和情感活力的个体患糖尿病的风险降低了约15%<sup>[45]</sup>。Shirom等<sup>[46]</sup>纳入了以色列特拉维夫市医疗中心的2 305名体检参与者, 在控制其他风险因素后, 基线生活满意度水平较高的个体患糖尿病的风险较低。Kouvonen等<sup>[47]</sup>从有意义、可理解和可管理3个方面调查了芬兰5 827名18~65岁的男性职员的心理一致感(sense of coherence), 发现较低的心理一致感会提高个体患糖尿病的风险( $OR=1.46, 95\%CI: 1.05 \sim 2.03$ )。

(7) 社会因素与糖尿病发病风险: 目前关于社会因素对糖尿病的影响的研究较少且存在争议, 社会因素主要包括社会支持、社交网络和社会参与3部分。美国一项纳入5 181名

拉美裔参与者的功能性社会支持(感知到的社会支持)和结构性社会支持(社交网络)与糖尿病发生率之间的关系研究发现,高水平的结构性社会支持( $OR=0.84, 95\%CI: 0.72 \sim 0.98$ )和功能性社会支持( $OR=0.83, 95\%CI: 0.71 \sim 0.99$ )均能降低糖尿病的发生率<sup>[48]</sup>。国内针对糖尿病患者和正常人的病例对照研究发现,糖尿病患者与正常人在客观支持方面无显著性差异,但在主观体验和对支持资源的利用方面明显低于正常人<sup>[49]</sup>。英国老龄化纵向研究表明,较强的社会支持可降低糖尿病发生风险,但是这种影响可被已知的糖尿病危险因素解释,而社会网络与糖尿病发病风险的关系无统计学意义<sup>[50]</sup>。Whitehall II 研究认为糖尿病发病与个体婚姻状况及外界的社会支持无关<sup>[38]</sup>。但瑞典的一项研究指出在婚或与人同居可降低男性患糖尿病的风险( $RR=0.57, 95\%CI: 0.33 \sim 0.97$ ),虽然在调整混杂因素后,该关联无统计学意义,而参与社会活动或可降低女性患糖尿病的风险( $RR=0.43, 95\%CI: 0.24 \sim 0.77$ )<sup>[51]</sup>。

## 2. 社会心理因素与糖尿病发病相关的机制:

(1) 行为机制:社会心理因素可能通过行为机制增加糖尿病的发病风险。处于抑郁、焦虑、压力等不良社会心理状态可引发一些不利于身体健康的生活行为习惯。国内外均有研究发现,抑郁、焦虑症状、职业压力和社会支持与吸烟、饮酒、肥胖和缺乏运动相关<sup>[52-53]</sup>。而吸烟、饮酒、缺乏运动等因素是糖尿病发病的已知危险因素<sup>[54]</sup>。Hamilton 等<sup>[55]</sup>的研究还指出久坐行为是糖尿病发病的中介因素,减少久坐时间可以改善糖代谢,预防和治疗糖尿病。

(2) 生物学机制:社会心理因素可引起应激反应,导致丘脑-垂体-肾上腺素轴和交感神经系统过度激活,血液中皮质醇、儿茶酚胺等物质含量增高,内分泌功能紊乱,体内胰高血糖素、肾上腺素等激素分泌持续亢进,对抗胰岛素的作用增加从而使血糖升高<sup>[56-58]</sup>。另外,免疫应激及炎症反应也是糖尿病发病的途径,炎症细胞因子浓度的升高可导致胰岛β细胞凋亡和胰岛素抵抗<sup>[59-60]</sup>。刘海行等<sup>[61]</sup>对北京大学社区队列的 1 045 名 45~74 岁的参与者进行 5 年随访后发现,调整混杂因素后,男性中血清高敏 C 反应蛋白较高者发生糖尿病的危险提高了 2.3 倍,女性的糖尿病发病危险提高了 1.58 倍。

综上所述,抑郁、焦虑等心理因素对糖尿病的发病有密切关系,但关于社会因素的研究较少且结论不一致。目前国内的相关研究多为小样本的横断面设计,难以检验社会心理因素与糖尿病发病之间的因果关联,需要更多的大样本纵向研究来证实社会心理因素对糖尿病发病的作用。

利益冲突 无

## 参 考 文 献

- [1] Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030[J]. *Diabetes Res Clin Pract*, 2010, 87(1):4-14. DOI: 10.1016/j.diabres.2009.10.007.
- [2] Ogurtsova K, Da Rocha Fernandes JD, Huang Y, et al. IDF diabetes atlas: global estimates for the prevalence of diabetes for 2015 and 2040[J]. *Diabetes Res Clin Pract*, 2017, 128: 40-50. DOI: 10.1016/j.diabres.2017.03.024.
- [3] Xu Y, Wang LM, He J, et al. Prevalence and control of diabetes in Chinese adults[J]. *JAMA*, 2013, 310(9): 948-959. DOI: 10.1001/jama.2013.168118.
- [4] 张毓辉, 万泉, 柴培培, 等. 我国糖尿病医疗费用及筹资负担研究[J]. *中国卫生经济*, 2017, 36(4): 17-19. DOI: 10.7664/che.20170404. Zhang YH, Wan Q, Chai PP, et al. The medical costs and financing burden of diabetes mellitus in China[J]. *Chin Health Econom*, 2017, 36(4): 17-19. DOI: 10.7664/che.20170404.
- [5] Seuring T, Archangelidi O, Suhrcke M. The economic costs of type 2 diabetes: a global systematic review[J]. *Pharmacoeconomics*, 2015, 33(8): 811-831. DOI: 10.1007/s40273-015-0268-9.
- [6] 龚耀先, 姚树桥, 戴晓阳, 等. 社会心理因素在糖尿病发生过程中的作用及机理研究 I. 理论框架[J]. *中国临床心理学杂志*, 1997, 5(2): 69-73. DOI: 10.16128/j.cnki.1005-3611.1997.02.002. Gong YX, Yao SQ, Dai XY, et al. The contributory and mechanism of psychosocial factors in the onset of diabetes mellitus I. Theoretical framework[J]. *Chin J Clin Psychol*, 1997, 5(2): 69-73. DOI: 10.16128/j.cnki.1005-3611.1997.02.002.
- [7] Slawson PF, Flynn WR, Kollar EJ. Psychological factors associated with the onset of diabetes mellitus[J]. *JAMA*, 1963, 185(3): 166-170. DOI: 10.1001/jama.1963.03060030024019.
- [8] Kelly SJ, Ismail M. Stress and type 2 diabetes: a review of how stress contributes to the development of type 2 diabetes[J]. *Annu Rev Publ Health*, 2015, 36: 441-462. DOI: 10.1146/annurev-publhealth-031914-122921.
- [9] Helz JW, Templeton B. Evidence of the role of psychosocial factors in diabetes mellitus: a review[J]. *Am J Psychiat*, 1990, 147(10): 1275-1282. DOI: 10.1176/ajp.147.10.1275.
- [10] Bruce ML. Psychosocial risk factors for depressive disorders in late life[J]. *Biol Psychiat*, 2002, 52(3): 175-184. DOI: 10.1016/S0006-3223(02)01410-5.
- [11] Knol MJ, Twisk JWR, Beekman ATF, et al. Depression as a risk factor for the onset of type 2 diabetes mellitus. A Meta-analysis[J]. *Diabetologia*, 2006, 49(5): 837-845. DOI: 10.1007/s00125-006-0159-x.
- [12] Mezuk B, Eaton WW, Albrecht S, et al. Depression and type 2 diabetes over the lifespan: a Meta-analysis[J]. *Diabetes Care*, 2008, 31(12): 2383-2390. DOI: 10.2337/dc08-0985.
- [13] Rotella F, Mannucci E. Diabetes mellitus as a risk factor for depression: a Meta-analysis of longitudinal studies[J]. *Diabetes Res Clin Pract*, 2013, 99(2): 98-104. DOI: 10.1016/j.diabres.2012.11.022.
- [14] Demakakos P, Zaninotto P, Nouwen A. Is the association between depressive symptoms and glucose metabolism bidirectional? Evidence from the English Longitudinal Study of Ageing[J]. *Psychosom Med*, 2014, 76(7): 555-561. DOI: 10.1097/Psy.0000000000000082.
- [15] Eriksson AK, Ekblom A, Granath F, et al. Psychological distress and risk of pre-diabetes and type 2 diabetes in a prospective study of Swedish middle-aged men and women[J]. *Diabetic*

- med, 2008, 25 (7) : 834-842. DOI: 10.1111/j.1464-5491.2008.02463.x.
- [16] van Den Akker M, Schuurman A, Metsemakers J, et al. Is depression related to subsequent diabetes mellitus? [J]. *Acta Psychiatr Scand*, 2004, 110 (3) : 178-183. DOI: 10.1111/j.1600-0447.2004.00333.x.
- [17] Carnethon MR, Kinder LS, Fair JM, et al. Symptoms of depression as a risk factor for incident diabetes: findings from the National Health and Nutrition Examination Epidemiologic Follow-up study, 1971-1992[J]. *Am J Epidemiol*, 2003, 158(5): 416-423. DOI:10.1093/aje/kwg172.
- [18] Mezuk B, Eaton WW, Golden SH, et al. The influence of educational attainment on depression and risk of type 2 diabetes [J]. *Am J Public Health*, 2008, 98 (8) : 1480-1485. DOI: 10.2105/Ajph.2007.126441.
- [19] Schmitz N, Deschênes SS, Burns RJ, et al. Depression and risk of type 2 diabetes: the potential role of metabolic factors[J]. *Mol Psychiatry*, 2016, 21(12): 1726-1732. DOI:10.1038/mp.2016.7.
- [20] Katon W, Roy-Byrne P. Anxiety disorders: Efficient screening is the first step in improving outcomes[J]. *Ann Intern Med*, 2007, 146 (5) : 390-392. DOI: 10.7326/0003-4819-146-5-200703060-00011.
- [21] Clark LA, Watson D. Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications [J]. *J Abnorm Psychol*, 1991, 100 (3) : 316-336. DOI: 10.1037/0021-843x.100.3.316.
- [22] Engum A. The role of depression and anxiety in onset of diabetes in a large population-based study[J]. *J Psychosom Res*, 2007, 62 (1): 31-38. DOI: 10.1016/j.jpsychores.2006.07.009.
- [23] Atlantis E, Vogelzangs N, Cashman K, et al. Common mental disorders associated with 2-year diabetes incidence: the Netherlands Study of Depression and Anxiety (NESDA) [J]. *J Affect Disord*, 2012, 142 Suppl 1: S30-35. DOI: 10.1016/S0165-0327(12)70006-X.
- [24] Khambaty T, Callahan CM, Perkins AJ, et al. Depression and anxiety screens as simultaneous predictors of 10-year incidence of diabetes mellitus in older adults in primary care [J]. *J Am Geriatr Soc*, 2017, 65(2): 294-300. DOI: 10.1111/jgs.14454.
- [25] Demmer RT, Gelb S, Suglia SF, et al. Sex differences in the association between depression, anxiety, and type 2 diabetes mellitus [J]. *Psychosom Med*, 2015, 77 (4) : 467-477. DOI: 10.1097/PSY.000000000000169.
- [26] Abraham S, Shah NG, Roux AD, et al. Trait anger but not anxiety predicts incident type 2 diabetes: the Multi-Ethnic Study of Atherosclerosis (MESA) [J]. *Psychoneuroendocrinology*, 2015, 60: 105-113. DOI: 10.1016/j.psyneuen.2015.06.007.
- [27] Edwards LE, Mezuk B. Anxiety and risk of type 2 diabetes: evidence from the Baltimore Epidemiologic Catchment Area Study [J]. *J Psychosom Res*, 2012, 73 (6) : 418-423. DOI: 10.1016/j.jpsychores.2012.09.018.
- [28] Kato M, Noda M, Inoue M, et al. Psychological factors, coffee and risk of diabetes mellitus among middle-aged Japanese: a population-based prospective study in the JPHC study cohort [J]. *Endocr J*, 2009, 56 (3) : 459-468. DOI: 10.1507/endocrj.K09E-003.
- [29] Crump C, Sundquist J, Winkleby MA, et al. Stress resilience and subsequent risk of type 2 diabetes in 1.5 million young men [J]. *Diabetologia*, 2016, 59 (4) : 728-733. DOI: 10.1007/s00125-015-3846-7.
- [30] Rod NH, Grønbaek M, Schnohr P, et al. Perceived stress as a risk factor for changes in health behaviour and cardiac risk profile: a longitudinal study [J]. *J Intern Med*, 2009, 266 (5) : 467-475. DOI: 10.1111/j.1365-2796.2009.02124.x.
- [31] Karasek R, Theorell T. *Healthy work: stress, productivity, and the reconstruction of working life* [M]. New York: Basic Books, 1990.
- [32] Fransson EI, Nyberg ST, Heikkilä K, et al. Comparison of alternative versions of the job demand-control scales in 17 European cohort studies: the IPD-Work consortium [J]. *Bmc Public Health*, 2012, 12: 62. DOI: 10.1186/1471-2458-12-62.
- [33] Nyberg ST, Eleonor IF, Heikkilä K, et al. Job strain as a risk factor for type 2 diabetes: a pooled analysis of 124, 808 men and women [J]. *Diabetes Care*, 2014, 37 (8) : 2268-2275. DOI: 10.2337/dc13-2936.
- [34] 张利新, 于浩, 罗晓燕, 等. 职业紧张与工作条件对男性警察糖尿病发病影响前瞻性研究[J]. *中国公共卫生*, 2015, 31(2): 164-168. DOI: 10.11847/zgggws2015-31-02-10.
- Zhang LX, Yu H, Luo XY, et al. Effects of occupational stress and working conditions on diabetes mellitus in male police officers: a prospective cohort study [J]. *Chin J Public Health*, 2015, 31(2): 164-168. DOI: 10.11847/zgggws2015-31-02-10.
- [35] Kivimäki M, Virtanen M, Kawachi I, et al. Long working hours, socioeconomic status, and the risk of incident type 2 diabetes: a Meta-analysis of published and unpublished data from 222 120 individuals [J]. *Lancet Diabetes Endocrinol*, 2015, 3(1) : 27-34. DOI: 10.1016/s2213-8587(14)70178-0.
- [36] Salminen JK, Saarijärvi S, Aärelä E, et al. Prevalence of alexithymia and its association with sociodemographic variables in the general population of Finland [J]. *J Psychosom Res*, 1999, 46(1): 75-82. DOI: 10.1016/S0022-3999(98)00053-1.
- [37] Turner RJ, Avison WR. Status Variations in stress exposure: implications for the interpretation of research on race, socioeconomic status, and gender [J]. *J Health Soc Behav*, 2003, 44(4): 488-505. DOI: 10.2307/1519795.
- [38] Kumari M, Head J, Marmot M. Prospective study of social and other risk factors for incidence of type 2 diabetes in the Whitehall II Study [J]. *Arch Intern Med*, 2004, 164(17): 1873-1880. DOI: 10.1001/archinte.164.17.1873.
- [39] 李玉卿, 韩红锋, 陈朔华, 等. 生命早期饥荒暴露对成年后患糖尿病及空腹血糖受损检出率的影响[J]. *中华流行病学杂志*, 2014, 35(7): 852-855. DOI: 10.3760/cma.j.issn.0254-6450.2014.07.021.
- Li YQ, Han HF, Chen SH, et al. Effects related to experiences of famine during early life on diabetes mellitus and impaired fasting

- glucose during adulthood [J]. *Chin J Epidemiol*, 2014, 35 (7) : 852-855. DOI: 10.3760/cma.j.issn.0254-6450.2014.07.021.
- [40] Olsen J, Li J, Precht DH. Hospitalization because of diabetes and bereavement: a national cohort study of parents who lost a child [J]. *Diabetic Med*, 2005, 22 (10) : 1338-1342. DOI: 10.1111/j.1464-5491.2005.01642.x.
- [41] Huang H, Yan PP, Shan ZL, et al. Adverse childhood experiences and risk of type 2 diabetes: A systematic review and Meta-analysis [J]. *Metabolism*, 2015, 64 (11) : 1408-1418. DOI: 10.1016/j.metabol.2015.08.019.
- [42] Jokela M, Elovainio M, Nyberg ST, et al. Supplemental material for personality and risk of diabetes in adults: pooled analysis of 5 cohort studies [J]. *Health Psychol*, 2014, 33 (12) : 1618-1621. DOI: 10.1037/hea0000003.
- [43] 周崧, 石国兴. 积极心理学介绍 [J]. *中国心理卫生杂志*, 2006, 20 (2) : 129-132. DOI: 10.3321/j.issn: 1000-6729.2006.02.018.
- Zhou Q, Shi GX. Introduction of positive psychology [J]. *Chin Ment Health J*. 2006, 20 (2) : 129-132. DOI: 10.3321/j.issn: 1000-6729.2006.02.018.
- [44] Celano CM, Beale EE, Moore SV, et al. Positive psychological characteristics in diabetes: a review [J]. *Curr Diabetes Rep*, 2013, 13 (6) : 917-929. DOI: 10.1007/s11892-013-0430-8.
- [45] Boehm JK, Trudel-Fitzgerald C, Kivimaki M, et al. The Prospective Association Between Positive Psychological Well-Being and Diabetes [J]. *Health Psychol*, 2015, 34 (10) : 1013-1021. DOI: 10.1037/hea0000200.
- [46] Shirom A, Toker S, Melamed S, et al. Life and job satisfaction as predictors of the incidence of diabetes [J]. *Appl Psychol-Health Well Being*, 2012, 4 (1) : 31-48. DOI: 10.1111/j.1758-0854.2011.01054.x.
- [47] Kouvonen AM, Väänänen A, Woods SA, et al. Sense of coherence and diabetes: a prospective occupational cohort study [J]. *Bmc Public Health*, 2008, 8: 46. DOI: 10.1186/1471-2458-8-46.
- [48] Gallo LC, Fortmann AL, McCurley JL, et al. Associations of structural and functional social support with diabetes prevalence in US Hispanics/Latinos: results from the HCHS/SOL Sociocultural Ancillary Study [J]. *J Behav Med*, 2015, 38 (1) : 160-170. DOI: 10.1007/s10865-014-9588-z.
- [49] 杨昆, 叶海燕, 周为, 等. 2 型糖尿病病人个性、生活事件及社会支持的对照研究 [J]. *现代预防医学*, 2007, 34 (14) : 2799-2800. DOI: 10.3969/j.issn.1003-8507.2007.14.021.
- Yang K, Ye HY, Zhou W, et al. Studies of Type 2 Diabetes Mellitus Patients on Personality, Life Event and Social Support [J]. *Mod Prev Med*, 2007, 34 (14) : 2799-2800. DOI: 10.3969/j.issn.1003-8507.2007.14.021.
- [50] Laursen KR, Hulman A, Witte DR, et al. Social relations, depressive symptoms, and incident type 2 diabetes mellitus: The English Longitudinal Study of Ageing [J]. *Diabetes Res Clin Pract*, 2017, 126: 86-94. DOI: 10.1016/j.diabres.2017.01.006.
- [51] Hilding A, Shen C, Östenson CG. Social network and development of prediabetes and type 2 diabetes in middle-aged Swedish women and men [J]. *Diabetes Res Clin Pract*, 2015, 107 (1) : 166-177. DOI: 10.1016/j.diabres.2014.09.057.
- [52] Strine TW, Mokdad AH, Dube SR, et al. The association of depression and anxiety with obesity and unhealthy behaviors among community-dwelling US adults [J]. *Gen Hosp Psychiat*, 2008, 30 (2) : 127-137. DOI: 10.1016/j.genhosppsych.2007.12.008.
- [53] Chen WQ, Wong TW, Yu ITS. Association of occupational stress and social support with health-related behaviors among Chinese offshore oil workers [J]. *J Occup Health*, 2008, 50 (3) : 262-269. DOI: 10.1539/Joh.L7149.
- [54] 周婷, 刘祥, 李晓松, 等. 中国人群 2 型糖尿病影响因素的 Meta 分析 [J]. *中华流行病学杂志*, 2016, 37 (5) : 730-736. DOI: 10.3760/cma.j.issn.0254-6450.2016.05.030.
- Zhou T, Liu X, Li XS, et al. Influencing factors of type 2 diabetes mellitus in China: a Meta-analysis [J]. *Chin J Epidemiol*, 2016, 37 (5) : 730-736. DOI: 10.3760/cma.j.issn.0254-6450.2016.05.030.
- [55] Hamilton MT, Hamilton DG, Zderic TW. Sedentary behavior as a mediator of type 2 diabetes [J]. *Med Sport Sci*, 2014, 60: 11-26. DOI: 10.1159/000357332.
- [56] Brown ES, Varghese FP, McEwen BS. Association of depression with medical illness: does cortisol play a role? [J]. *Biol Psychiat*, 2004, 55 (1) : 1-9. DOI: 10.1016/s0006-3223 (03) 00473-6.
- [57] Champaneri S, Wand GS, Malhotra SS, et al. Biological basis of depression in adults with diabetes [J]. *Curr Diabetes Rep*, 2010, 10 (6) : 396-405. DOI: 10.1007/s11892-010-0148-9.
- [58] Gragnoli C. Depression and type 2 diabetes: cortisol pathway implication and investigational needs [J]. *J Cell Physiol*, 2012, 227 (6) : 2318-2322. DOI: 10.1002/jcp.23012.
- [59] Pickup JC, Crook MA. Is type II diabetes mellitus a disease of the innate immune system? [J]. *Diabetologia*, 1998, 41 (10) : 1241-1248. DOI: 10.1007/s001250051058.
- [60] Howren MB, Lamkin DM, Suls J. Associations of depression with C-reactive protein, IL-1, and IL-6: a Meta-analysis [J]. *Psychosom Med*, 2009, 71 (2) : 171-186. DOI: 10.1097/PSY.0b013e3181907c1b.
- [61] 刘海行, 赵冬, 王薇, 等. 血清高敏 C 反应蛋白水平与五年累积糖尿病发病风险的关系 [J]. *中华流行病学杂志*, 2011, 32 (1) : 1-4. DOI: 10.3760/cma.j.issn.0254-6450.2011.01.001.
- Liu HX, Zhao D, Wang W, et al. Association between high sensitivity C-reactive protein levels in serum and the 5-year-accumulative-risk of diabetes [J]. *Chin J Epidemiol*, 2011, 32 (1) : 1-4. DOI: 10.3760/cma.j.issn.0254-6450.2011.01.001.

(收稿日期: 2017-12-20)

(本文编辑: 李银鸽)