

• 科研论著 •

母亲孕期增重和孕前体质量指数及其联合作用与学龄前儿童情绪行为问题的关联

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摘要: **目的** 了解南通市学龄前儿童情绪行为问题, 并分析母亲孕期增重、孕前 BMI 以及二者联合作用与儿童情绪行为问题的关系, 为孕期和孕前的健康管理提供依据。 **方法** 2023 年 9—12 月在南通市 8 所幼儿园进行横断面调查, 共纳入 2 176 名学龄前儿童。母亲的孕期增重及孕前 BMI 通过问卷获得, 儿童情绪行为问题通过情绪与行为问题优势与困难问卷(SDQ)评估, 采用多因素 logistic 回归模型分析数据。 **结果** 学龄前儿童在同伴交往问题、多动、亲社会行为、品行问题和情绪症状方面的异常检出率分别为 30.33%(660/2 176)、29.60%(644/2 176)、26.01%(566/2 176)、22.62%(492/2 176)和 18.00%(392/2 176), 总体异常检出率为 23.90%(521/2 176), 男童情绪行为问题检出率高于女童($\chi^2 = 94.732, P < 0.01$)。母亲孕前超重肥胖和孕期增重过度是学龄前儿童情绪行为问题的危险因素($OR = 1.19, 95\%CI: 1.01 \sim 1.31, P < 0.05$; $OR = 1.12, 95\%CI: 1.03 \sim 1.22, P < 0.05$);按孕前 BMI 分层, 孕前 BMI 正常、消瘦和超重肥胖组中, 孕期增重过度均为学龄前儿童情绪行为问题的独立危险因素($OR = 1.09, 95\%CI: 1.03 \sim 1.43, P < 0.05$; $OR = 1.37, 95\%CI: 1.02 \sim 1.89, P < 0.05$; $OR = 1.35, 95\%CI: 1.07 \sim 1.71, P < 0.05$);孕期增重不足合并孕前超重肥胖、孕期增重过度合并孕前消瘦以及孕前 BMI 正常的母亲其子代学龄儿童出现情绪行为问题的风险显著增加($OR = 1.30, 95\%CI: 1.15 \sim 1.56, P < 0.05$; $OR = 1.20, 95\%CI: 1.02 \sim 1.46, P < 0.05$; $OR = 1.10, 95\%CI: 1.02 \sim 1.23, P < 0.05$);性别分层后发现母亲孕期增重不足联合孕前超重肥胖是男童情绪行为问题的危险因素。 **结论** 母亲孕期增重不足或过度以及孕前 BMI 异常显著与学龄前儿童情绪行为问题相关, 尤其在男童中更为明显。孕期增重不足和孕前超重肥胖的联合作用对情绪行为问题影响显著。

关键词: 孕期增重; 体质量指数; 情绪行为问题; 学龄前儿童

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Association of maternal weight gain during pregnancy, pre-pregnancy body mass index, and their combined effect with emotional and behavioral problems in preschool children

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Abstract: **Objective** To investigate emotional and behavioral problems in preschool children in Nantong City, and to analyze the relationship between maternal gestational weight gain (GWG), pre-pregnancy body mass index (BMI), and their combined effects on children's emotional and behavioral problems, so as to provide evidence for health management during and before pregnancy. **Methods** A cross-sectional survey was conducted in eight kindergartens in Nantong City from September to December 2023, involving 2 176 preschool children. Maternal GWG and pre-pregnancy BMI were obtained through questionnaires, and children's emotional and behavioral problems were assessed using the Strengths and Difficulties Questionnaire (SDQ). Multivariate Logistic regression models were used for data analysis. **Results** The abnormal detection rates of preschool children in peer relationship problems, hyperactivity, prosocial behavior, conduct problems, and emotional symptoms were 30.33%(660/2 176)、29.60%(644/2 176)、26.01%(566/2 176)、22.62%(492/2 176), and 18.00%(392/2 176), respectively, with an overall abnormal detection rate of 23.90%(521/2 176). Boys had

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a higher abnormal detection rate than girls ($\chi^2 = 94.732, P < 0.01$). Maternal pre-pregnancy overweight/obesity and excessive GWG were identified as risk factors for emotional and behavioral problems in preschool children ($OR = 1.19, 95\%CI: 1.01 - 1.31, P < 0.05$; $OR = 1.12, 95\%CI: 1.03 - 1.22, P < 0.05$). Stratified by pre-pregnancy BMI, excessive GWG was an independent risk factor for emotional and behavioral problems in children across normal-weight, underweight, and overweight/obese groups ($OR = 1.09, 95\%CI: 1.03 - 1.43, P < 0.05$; $OR = 1.37, 95\%CI: 1.02 - 1.89, P < 0.05$; $OR = 1.35, 95\%CI: 1.07 - 1.71, P < 0.05$). The combined effects of insufficient GWG with pre-pregnancy overweight/obesity, excessive GWG with pre-pregnancy underweight, and normal pre-pregnancy BMI significantly increased the risk of emotional and behavioral problems in offspring ($OR = 1.30, 95\%CI: 1.15 - 1.56, P < 0.05$; $OR = 1.20, 95\%CI: 1.02 - 1.46, P < 0.05$; $OR = 1.10, 95\%CI: 1.02 - 1.23, P < 0.05$). Gender-stratified analysis revealed that insufficient GWG combined with pre-pregnancy overweight/obesity was a risk factor for emotional and behavioral problems in boys.

Conclusions Maternal insufficient or excessive GWG and abnormal pre-pregnancy BMI are significantly associated with emotional and behavioral problems in preschool children, especially in boys. The combined effects of insufficient GWG and pre-pregnancy overweight/obesity have a pronounced impact on emotional and behavioral problems.

Keywords: gestational weight gain; body mass index; emotional-behavioral problems; preschool children

情绪行为问题(emotional and behavioral problems, EBPs)是学龄前儿童常见的心理行为问题,包括多动、情绪症状和同伴交往困难等^[1]。全球约有10%~20%的儿童受到影响^[2-4],中国学龄前儿童情绪行为问题的检出率为11.2%~18.2%^[5]。这些问题可能导致缺课、学业困难和健康风险行为,且可能持续影响其一生^[6-8],成为公共卫生问题。

妊娠期体重增加(gestational weight gain, GWG)是评估胎儿正常发育和孕期母体适应性变化的重要指标^[9]。全球约47%的孕妇妊娠期体重增加超过医学研究所(IOM)标准^[10],且约1/4的孕妇在怀孕前已肥胖^[2]。母亲较高的孕前体质量指数(body mass index, BMI)和过度增重可能会导致不利的宫内环境^[11-12],影响胎儿发育,并可能引起后代认知、行为和情绪问题^[13-14]。然而,关于母亲GWG和孕前BMI与学龄前儿童情绪行为问题的相关性研究尚不一致,且对二者联合作用的研究较少。本研究旨在探讨南通市学龄前儿童的情绪行为问题,分析母亲孕前BMI、GWG及其联合作用对学龄前儿童情绪行为问题的影响,为孕期和孕前的健康管理提供依据。

1 对象和方法

1.1 对象 本研究采取分层整群抽样方法,在2023年9—12月期间,选取南通市8所幼儿园的所有3~6岁学龄前儿童作为研究对象,共调查2350名儿童,排除不符合条件者,最终有效问卷2176份,问卷有效应答率92.6%。所有监护人及老师均提供知情同意,并通过伦理委员会审查(批号:Y2022032)。

1.2 方法

1.2.1 基本人口学信息 通过自填式问卷收集基

本人口学信息(如母亲年龄、文化程度、职业、家庭年收入等)及孕期增重、孕前BMI和相关信息。

1.2.2 孕前BMI和孕期增重 孕前BMI参照中国分类标准分为消瘦($<18.5\text{kg}/\text{m}^2$)、正常($18.5 \sim 23.9\text{kg}/\text{m}^2$)、超重($24 \sim 27.9\text{kg}/\text{m}^2$)和肥胖($\geq 28\text{kg}/\text{m}^2$)^[15]。根据2022年《妊娠期妇女体重增长推荐值标准》将孕期增重分类为适宜、不足或过度^[16]。孕期增重适宜定义为:孕前消瘦妇女的增重范围为11.0~16.0kg,正常体重女性为8.0~14.0kg,超重女性为7.0~11.0kg,肥胖女性为5.0~9.0kg。

1.2.3 儿童情绪行为问题 采用长处和困难问卷(Strengths and Difficulties Questionnaire, SDQ, 父母版)评估儿童的情绪行为问题,问卷包括情绪症状、品行问题、多动、同伴交往问题和亲社会行为5个维度。每个条目有3个等级,得分 $\geq$ 标准值视为可能存在行为问题。将情绪症状 ≥ 4 分、品行问题 ≥ 3 分、多动 ≥ 6 分、同伴交往问题 ≥ 3 分和亲社会行为 ≤ 5 分的儿童划分为异常,总分 ≥ 14 分为有情绪行为问题。该量表的Cronbach's α 系数为0.72。

1.3 质量控制 问卷填写前通过幼儿园向监护人解释隐私保护及研究目的,确保匿名性,减少信息偏倚。数据核实时排除逻辑不符的问卷,确保数据的准确性。

1.4 统计学方法 数据录入和分析使用EpiData 3.0和SPSS 26.0软件,使用频数(%)描述困难总分及5个维度的异常人数及占比,比较采用 χ^2 检验,采用logistic回归分析GWG、孕前BMI及其联合作用对情绪和行为问题的影响,调整混杂因素并计算校正优势比(OR)和95%置信区间(95%CI), $P < 0.05$ 为差异有统计学意义。

2 结 果

2.1 研究对象的基本情况 共纳入 2 176 名学龄前儿童, 年龄为 (4.35 ± 0.83) 岁, 其中男童占 51.29% (1 116/2 176), 女童占 48.71% (1 060/2 176)。情绪行为问题的总异常率为 23.90% (521/2 176), 按维度分析异常检出率由高到低依次为同

伴交往问题 30.33% (660/2 176)、多动 29.60% (644/2 176)、亲社会行为 26.01% (566/2 176)、品行问题 22.61% (492/2 176)、情绪症状 18.00% (392/2 176)。不同性别、分娩年龄、是否独生子女、父母文化程度、是否糖尿病、是否母乳喂养、孕前 BMI、孕期增重均与学龄前儿童情绪行为问题显著相关 ($P < 0.05$)。见表 1。

表 1 不同特征组学龄前儿童情绪行为问题检出率比较(例, %)
Tab. 1 Comparison of detection rate of emotional and behavioral problems in preschool children with different characteristic group (n, %)

项目	组别	人数	情绪行为问题人数(%)	χ^2 值	P 值
性别	男	1 118	295(26.3)	94.732	<0.01
	女	1 058	226(21.4)		
出生体重(kg)	<2.5	84	22(26.2)	2.483	0.230
	2.5~4.0	1 902	309(16.2)		
	>4.0	190	190(100.0)		
分娩方式	顺产	803	193(24.0)	13.010	0.985
	剖宫产	1 373	328(23.4)		
怀孕周期	早产	97	26(26.8)	5.574	0.060
	足月	2 056	489(23.8)		
	过期产	23	6(26.1)		
分娩年龄(岁)	<29	543	158(29.9)	135.652	<0.001
	29~34	1 070	243(22.7)		
	≥35	563	120(21.3)		
独生子女	是	1 433	353((24.6)	15.489	<0.001
	否	743	168(22.6)		
母亲文化程度	初中及以下	272	83(30.5)	175.601	<0.001
	高中/中专	614	162(26.4)		
	大专	428	96(22.4)		
父亲文化程度	本科及以上	862	179(20.7)	203.257	<0.001
	初中及以下	222	69(31.8)		
	高中/中专	595	164(27.6)		
	大专	430	95(22.1)		
家庭经济状况	本科及以上	929	193(20.8)	109.243	<0.001
	较好	323	61(18.9)		
	中等	1 746	424(24.3)		
高血压	较差	107	36(33.6)	5.982	0.050
	有	2 121	507(23.9)		
糖尿病	无	55	14(25.4)	9.130	0.010
	有	2 086	496(23.8)		
母乳喂养	无	90	25(27.8)	9.308	0.002
	是	886	221(24.9)		
孕前 BMI	否	1 290	300(23.2)	15.227	0.002
	消瘦	459	106(23.9)		
	正常	1 524	363(23.8)		
孕期增重	超重肥胖	193	52(26.9)	19.652	0.01
	适宜	1 145	268(23.4)		
	不足	706	186(26.4)		
	过度	325	80(24.6)		

2.2 母亲孕期增重和孕前 BMI 与学龄儿童情绪行为问题的相关性 在多因素 logistic 回归模型中, 控制性别、出生体重、分娩方式、怀孕周期、分娩年龄、独生子女、父亲母亲文化、家庭年收入、分娩方式, 孕期糖尿病、高血压和母乳喂养后, 以儿童是否存在情

绪行为问题为因变量(0=否, 1=是), 母亲孕前超重肥胖和孕期增重过度是儿童存在情绪行为问题的危险因素 ($OR = 1.19, 95\%CI: 1.01 \sim 1.31, P < 0.05$; $OR = 1.12, 95\%CI: 1.03 \sim 1.22, P < 0.05$)。从各个维度分析, 母亲孕前超重肥胖是品行问题、多动、

同伴交往和亲社会行为问题的危险因素 ($P < 0.05$); 母亲孕期增重不足则是学龄前儿童品行问题、同伴交往和亲社会行为问题的危险因素 ($P < 0.05$)。见表 2。

表 2 孕期增重和孕前 BMI 对学龄儿童情绪行为问题影响的多因素 logistic 回归分析(OR, 95%CI)
Tab. 2 Multivariable logistic regression analysis of the correlation of gestational weight gain and pre-pregnancy BMI with emotional and behavioral problems in school-age children(OR, 95%CI)

变量	情绪和行为问题	情绪症状	品行问题	多动	同伴交往	亲社会行为
孕前 BMI						
正常	1	1	1	1	1	1
消瘦	0.96(0.89~1.03)	0.93(0.86~1.01)	1.01(0.94~1.08)	1.02(0.96~1.09)	0.96(0.91~1.02)	0.94(0.88~1.00)
超重肥胖	1.19(1.01~1.31)*	1.06(0.95~1.18)	1.13(1.03~1.25)*	1.18(1.08~1.54)*	1.24(1.14~1.35)*	1.11(1.01~1.22)*
孕期增重						
正常	1	1	1	1	1	1
不足	0.99(0.93~1.05)	1.05(0.98~1.12)	1.09(1.03~1.18)*	1.03(0.98~1.10)	1.18(1.09~1.24)*	1.12(1.06~1.19)*
过度	1.12(1.03~1.22)*	1.08(0.98~1.19)	1.08(0.99~1.18)	1.16(1.12~1.25)*	1.25(1.16~1.34)*	1.32(1.21~1.43)*

注:控制性别、出生体重、分娩方式、怀孕周期、分娩年龄、独生子女、父亲母亲文化、家庭年收入、分娩方式,孕期糖尿病、高血压和母乳喂养。* $P < 0.05$ 。

2.3 按孕前 BMI 类别分层后,孕期增重与学龄儿童情绪行为问题的关系 控制混杂因素后按孕前 BMI 分层发现,孕前 BMI 正常、消瘦和超重肥胖组中,孕期增重过度均为学龄前儿童情绪行为问题的独立危险因素($OR = 1.09, 95\%CI: 1.03 \sim 1.43$; $OR = 1.37, 95\%CI: 1.02 \sim 1.89$; $OR = 1.35, 95\%CI: 1.07 \sim 1.71$)。从各个维度分析,母亲孕前 BMI 正常组中,孕期增重过度与学龄前儿童品行问题、多动、同伴交

往和亲社会行为问题增加显著相关($P < 0.05$),孕期增重不足则与学龄前儿童同伴交往和亲社会行为问题增加相关($P < 0.05$);在母亲孕前消瘦组,孕期增重过度与学龄儿童品行问题和多动问题增加显著相关($P < 0.05$);在母亲孕前超重肥胖组,孕期增重不足与学龄前儿童同伴交往和亲社会行为问题增加显著相关($P < 0.05$)。见表 3。

表 3 按孕前 BMI 类别分层后,孕期增重与学龄儿童情绪行为问题的关系(OR, 95%CI)
Tab. 3 Association of gestational weight gain with emotional and behavioral problems in preschool children stratified by pre-pregnancy BMI categories(OR, 95%CI)

孕期增重分类	情绪和行为问题	情绪症状	品行问题	多动	同伴交往	亲社会行为
孕前正常						
增重适宜	1	1	1	1	1	1
增重不足	0.91(0.92~1.07)	1.04(0.96~1.13)	1.06(0.98~1.14)	1.05(0.96~1.13)	1.09(1.03~1.17)*	1.16(1.08~1.25)*
增重过度	1.09(1.03~1.43)*	1.05(0.94~1.17)	1.03(1.01~1.36)*	1.18(1.06~1.30)*	1.26(1.16~1.38)*	1.34(1.22~1.47)*
孕前消瘦						
增重适宜	1	1	1	1	1	1
增重不足	0.93(0.82~1.06)	1.02(0.88~1.18)	1.03(0.91~1.17)	1.01(0.90~1.14)	1.03(0.92~1.14)	0.96(0.85~1.09)
增重过度	1.37(1.02~1.89)*	1.03(0.96~1.16)	1.41(1.03~1.95)*	1.32(1.14~1.60)*	1.30(0.93~1.28)	0.99(0.71~1.38)
孕前超重肥胖						
增重适宜	1	1	1	1	1	1
增重不足	1.19(0.88~1.61)	1.56(0.81~3.02)	1.38(0.75~2.55)	1.23(0.68~2.20)	1.14(1.07~1.29)*	1.49(1.10~1.97)*
增重过度	1.35(1.07~1.71)*	1.06(0.62~1.83)	1.14(0.70~1.86)	1.10(0.86~1.53)	1.13(0.73~1.75)	1.08(0.96~1.65)

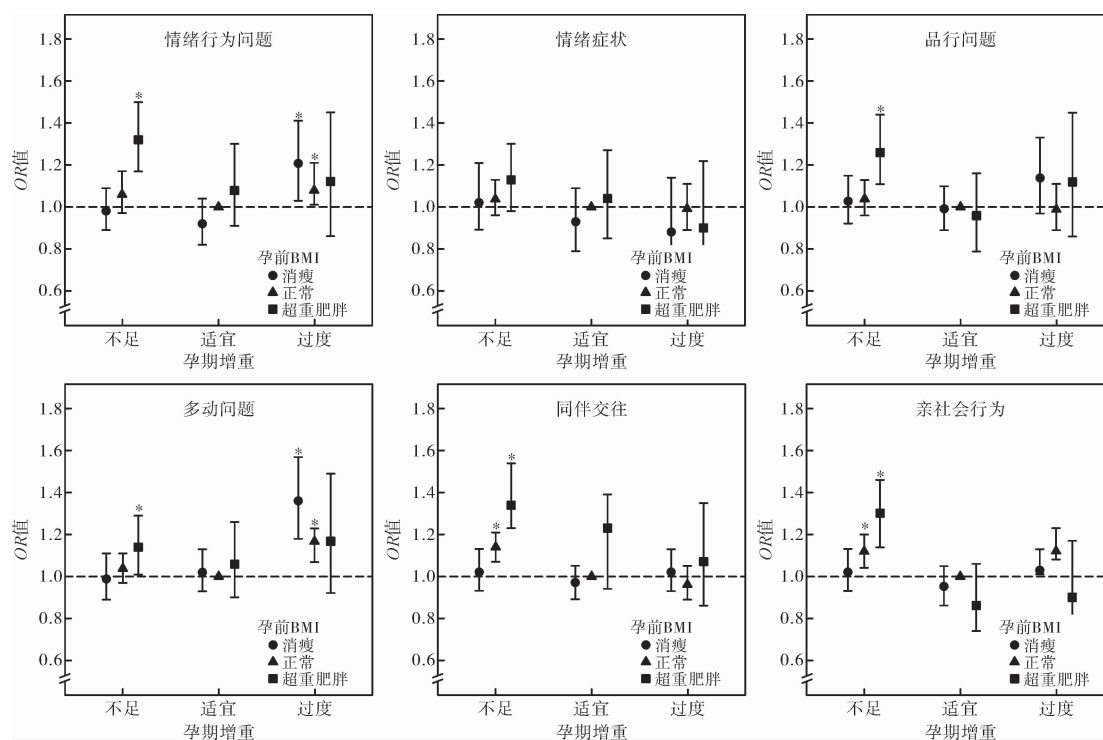
注:控制儿童性别、年龄、父母年龄、是否早产、独生子女情况、父母文化程度、家庭经济状况等。* $P < 0.05$ 。

2.4 母亲孕期增重联合孕前 BMI 与学龄儿童情绪行为问题的相关性 控制混杂因素后,与孕期增重适宜且孕前 BMI 正常组相比,孕期增重不足合并孕前超重肥胖、孕期增重过度合并孕前消瘦及孕前 BMI 正常的母亲,其子代学龄儿童出现情绪行为问题的风险显著增加($OR = 1.30, 95\%CI: 1.15 \sim$

1.56 ; $OR = 1.20, 95\%CI: 1.02 \sim 1.46$; $OR = 1.10, 95\%CI: 1.02 \sim 1.23$)。从各维度分析,母亲孕期增重不足联合孕前超重肥胖的母亲,其子代学龄儿童品行问题风险显著增加($P < 0.05$);孕期增重不足合并孕前超重肥胖、增重过度合并孕前消瘦及孕前 BMI 正常的母亲,其子代学龄儿童多动问题风险显

著增加($P<0.05$);孕期增重不足合并孕前 BMI 正常及孕前超重肥胖的母亲,其子代学龄儿童同伴交

往和亲社会行为问题的风险也显著增加($P<0.05$)。见图 1。



注: * 与孕期增重适宜且孕前 BMI 正常组相比, $P<0.05$ 。

图 1 母亲孕期增重联合孕前 BMI 与学龄儿童情绪行为问题的相关性(OR,95%CI)

Fig. 1 Association of maternal weight gain during pregnancy and pre-pregnancy BMI with emotional/behavioral problems in school-aged children (OR,95%CI)

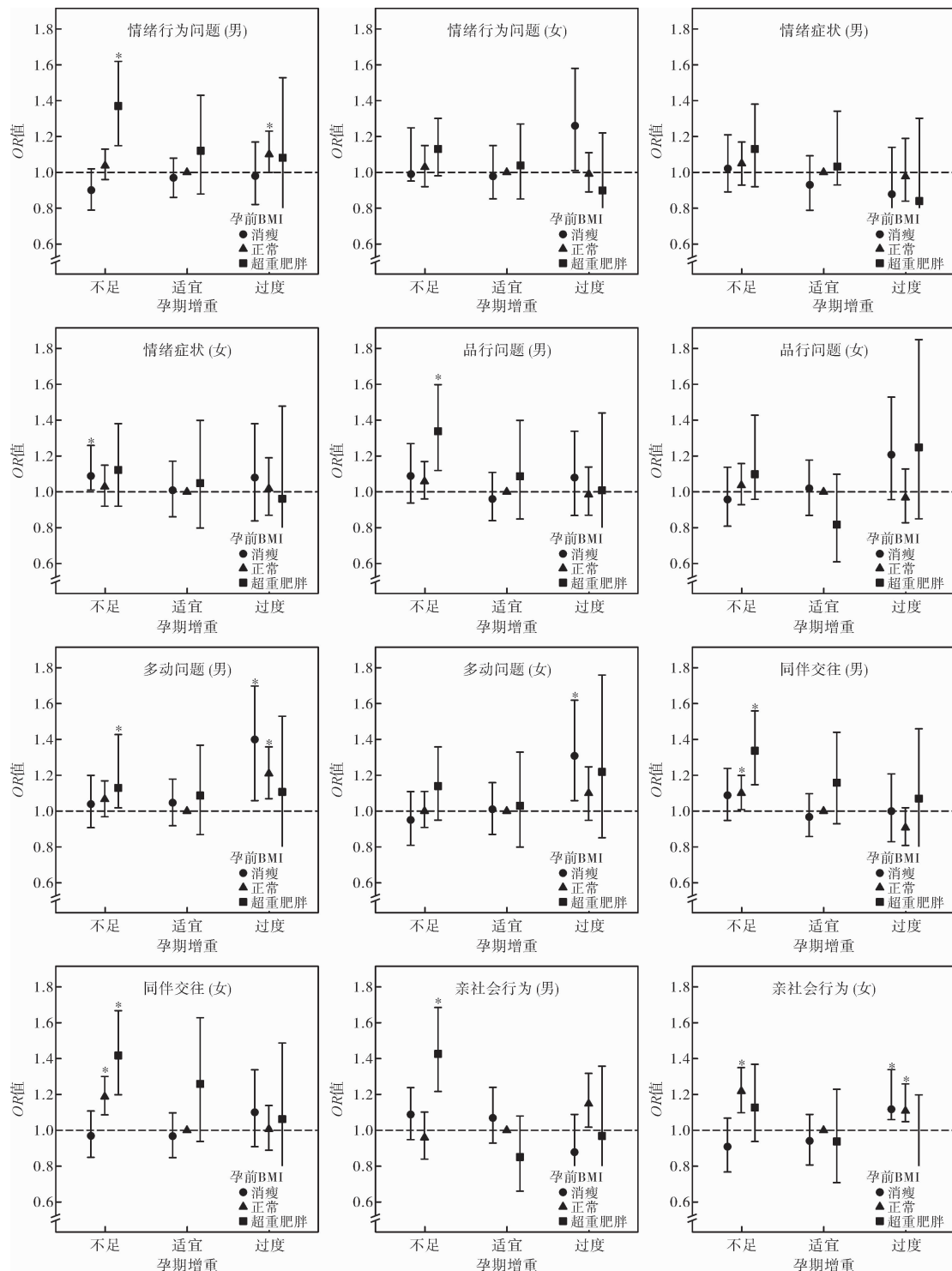
2.5 母亲孕期增重联合孕前 BMI 与学龄儿童情绪行为问题相关性的性别差异 控制混杂因素后,按学龄前儿童性别分层,结果显示,男童的情绪行为问题更为显著。与孕期增重适宜且孕前 BMI 正常组相比,男童中母亲孕期增重不足合并孕前超重肥胖是情绪行为问题的危险因素($OR=1.34, 95\%CI: 1.13\sim1.61$);从各个维度分析发现母亲孕期增重不足联合孕前超重肥胖是男童品行问题、多动、同伴交往及亲社会行为的危险因素($P<0.05$);孕期增重过度联合孕前消瘦及 BMI 正常是男童多动的危险因素($P<0.05$);母亲孕期增重不足联合孕前消瘦是女童情绪症状的危险因素($P<0.05$),母亲孕期增重过度联合孕前消瘦是女童多动、亲社会行为的危险因素($P<0.05$),孕期增重不足及过度联合孕前 BMI 正常是女童亲社会行为的危险因素($P<0.05$),母亲孕期增重不足联合孕前正常及超重肥胖是女童同伴交往的危险因素($P<0.05$)。见图 2。

3 讨论

本研究发现,南通市学龄前儿童在同伴交往问

题(30.32%)、多动(29.60%)、亲社会行为(26.0%)、品行问题(22.62%)和情绪症状(18.00%)方面的异常检出率高。与上海(18.29%)^[17]、深圳(21.3%)^[18]、北京市(6.01%)^[19]、安徽省(10.8%)、芜湖市(8.72%)^[20]等地区相比,南通市学龄前儿童情绪行为问题的异常检出率处于较高水平,需要进一步关注和干预。

3.1 母亲孕期增重和孕前 BMI 与学龄儿童情绪行为问题的相关性 全球育龄妇女肥胖率上升,孕前及孕期肥胖对后代行为结果的影响机制尚未完全明确^[21]。已有研究指出,孕前肥胖和孕期增重过度可能通过慢性炎症、氧化应激等途径影响胎儿大脑发育。本研究发现,孕前超重肥胖和孕期增重过度显著增加学龄前儿童情绪和行为问题的风险,尤其在品行问题、多动和同伴交往问题方面。此外,孕期增重不足与品行问题、同伴交往问题和亲社会行为相关。先前的研究表明,怀孕前肥胖的母亲所生孩子的行为问题风险更高^[22-23],这与本研究结果一致。然而,Menting 等^[24]的研究发现,母亲孕前超重肥胖与儿童总体行为问题和多动/注意力不集中问题相



注: * 与孕期增重适宜且孕前 BMI 正常组相比, $P < 0.05$ 。

图 2 母亲孕期增重联合孕前 BMI 与学龄儿童情绪行为问题相关性的性别差异 (OR, 95% CI)

Fig. 2 Gender differences in the association between maternal weight gain during pregnancy, pre-pregnancy BMI, and emotional/behavioral problems in school-aged children (OR, 95% CI)

关,但与情绪、行为和同伴关系问题的关联不显著,这与本研究的发现有所不同。因此,母亲孕前 BMI 及孕期增重对于学龄前儿童情绪和行为问题的影响可能是复杂且多维度的,需要进一步研究以深入理解其潜在的生物和环境机制。

3.2 母亲孕期增重联合孕前 BMI 与学龄儿童情绪行为问题相关性的性别差异及可能的机制 本研究发现,母亲孕前 BMI 和孕期增重对儿童情绪和行为发育的影响具有显著的性别差异,特别对男童影响更大。相比于孕期增重适宜且孕前 BMI 正常的母

亲,孕期增重不足联合孕前超重肥胖、孕期增重过度联合孕前消瘦的母亲,其子代学龄前儿童在情绪行为问题方面的风险显著增加。特别是孕期增重不足与孕前超重肥胖的母亲,子代在品行问题、多动、同伴交往和亲社会行为问题方面的风险较高。性别分层分析发现,男童的情绪行为问题与孕期增重不足和孕前超重肥胖相关,这与 Deardorff 等^[25]研究结果一致。子宫内的代谢暴露对胎儿的影响可能因性别不同而有所差异,可能由于雄性胎儿更易受到宫内代谢暴露的影响^[26]。

3.3 研究的局限性与展望 本研究存在一定局限性:首先,本研究采用横断面调查,无法确定母亲情绪症状与儿童情绪行为问题之间的因果关系;其次,出生体重超重是儿童情绪行为问题的高风险因素,但本研究 190 例大于 4kg 的儿童都有情绪行为问题,可能是由于母亲报告儿童情绪问题时存在信息偏倚;最后,本研究主要评估孕前 BMI 和孕期增重对儿童情绪行为问题的单独影响,未探讨二者的交互作用。未来研究需深入探讨孕前 BMI 和孕期增重的联合影响及其机制,特别是性别差异对情绪行为问题的潜在调节作用。同时,应加强家庭心理健康教育和母亲情绪管理,以减少学龄前儿童的情绪行为问题,促进儿童身心健康。

综上所述,母亲孕期增重不足或过度及孕前 BMI 异常与学龄前儿童的情绪行为问题显著相关。针对性改善孕期体重管理、控制孕前 BMI 及个体化指导,将有助于降低儿童情绪行为问题的发生风险。建议孕妇进行定期体重监测,并接受专业的营养和健康指导,以促进儿童的心理健康发展。

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