

Impact of maternal body mass index and gestational weight gain on maternal and fetal outcome in twin pregnancies

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Objectives

When the Institute of Medicine (now "National Academy of Medicine") introduced guidelines for weight gain during pregnancy in 2009, the guidelines for twin pregnancies were provisional. Therefore, our aim was to investigate the impact of body mass index (BMI) and gestational weight gain on maternal and neonatal outcomes of twin pregnancies in Hessen (Germany) by means of the federal state perinatal data base.

Methods

Between 2000 and 2015, 13.679 twin pregnancies were documented. After applying inclusion criteria (mothers' height >120cm, first examination before 12 completed weeks registered, delivery after at least 24 gestational weeks) 10.387 twin pregnancies remained (Tab.1). Within this study group, the mean maternal weight gain was corrected by gestational age, divided into 3 groups by quartiles (Q1:<419,4 g/week, Q2 up to Q3: 419,4–692,3 g/week, Q4:>692,3 g/week). The interaction between early maternal BMI and weight gain during pregnancy and associations with perinatal mortality, preterm birth, NICU admissions of at least one twin, or maternal hypertension in pregnancy (HIP) were calculated by uni- and multivariate regression.

	ALL N=10387	UNDERWEIGHT N=315	NORMAL WEIGHT N=6177	OVERWEIGHT N=2451	OBESITY N=1444	p-overall
Mean Maternal Age	32.1 (5.09)	31.1 (5.75)	32.3 (5.08)	32.1 (5.02)	31.5 (5.04)	<0.001
Mean Maternal Height	167 (6.40)	168 (6.56)	168 (6.24)	167 (6.60)	167 (6.63)	0.001
Week Of First Examination	8.84 (1.79)	8.30 (1.82)	8.55 (1.77)	8.67 (1.84)	8.21 (1.80)	0.008
Mean Maternal Weight Gain	0.57 (0.23)	0.56 (0.20)	0.59 (0.21)	0.56 (0.24)	0.47 (0.27)	<0.001
Gestational Age at Birth	35.8 (2.80)	35.6 (2.82)	35.8 (2.83)	35.8 (2.77)	35.8 (2.72)	0.743
Mean Birth Weight	2397 (575)	2290 (535)	2379 (570)	2432 (581)	2436 (590)	<0.001
Sex of Newborns						0.293
mf	3748 (36.1%)	103 (32.7%)	2248 (36.4%)	852 (34.8%)	545 (37.8%)	
ff	3310 (31.9%)	99 (31.4%)	1959 (31.7%)	790 (32.2%)	462 (32.0%)	
m	3327 (32.0%)	113 (35.9%)	1970 (31.9%)	808 (33.0%)	436 (30.2%)	
mm	0.10 (0.30)	0.11 (0.32)	0.10 (0.30)	0.10 (0.30)	0.08 (0.28)	0.181
Single Mothers						<0.001
German	8472 (81.6%)	244 (77.5%)	5084 (82.3%)	1940 (79.2%)	1204 (83.4%)	
Partly	1915 (18.4%)	71 (22.5%)	1093 (17.7%)	511 (20.8%)	240 (16.6%)	
Other						<0.001
0	5896 (57.0%)	198 (63.1%)	3712 (60.4%)	1295 (53.1%)	691 (48.1%)	
1	3139 (30.4%)	83 (26.4%)	1847 (30.0%)	787 (30.2%)	472 (32.9%)	
2	896 (8.67%)	22 (7.01%)	437 (7.11%)	277 (11.4%)	160 (11.1%)	
3	275 (2.66%)	7 (2.23%)	111 (1.81%)	81 (3.2%)	76 (5.29%)	
4	85 (0.82%)	1 (0.32%)	27 (0.44%)	32 (1.31%)	25 (1.74%)	
>4	47 (0.45%)	1 (0.36%)	14 (0.23%)	18 (0.74%)	12 (0.84%)	
Profession						<0.001
house wife	2765 (37.9%)	90 (43.3%)	1467 (34.7%)	736 (41.2%)	472 (44.0%)	
education	128 (2.03%)	7 (3.37%)	92 (2.17%)	28 (1.57%)	21 (1.96%)	
worker	2431 (33.6%)	6 (2.86%)	123 (2.95%)	51 (2.85%)	41 (3.92%)	
employee	2629 (36.4%)	60 (28.8%)	1562 (36.9%)	64 (36.6%)	58 (5.7%)	
higher education	1506 (20.6%)	45 (21.6%)	987 (23.3%)	318 (17.8%)	156 (14.5%)	

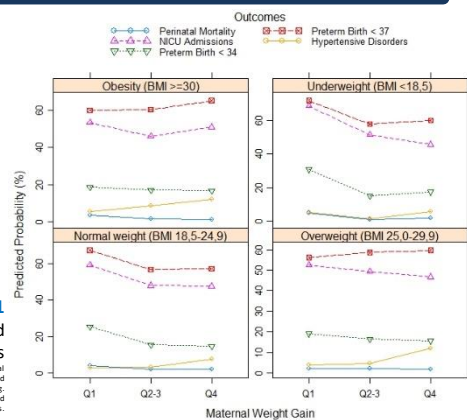
Table 1 Characteristics of the study group (Mean, standard deviation and t-test for continuous variables; absolute and relative frequencies, chi-squared test for categorical variables)

Results

Women with low weight gain (Q1) had significantly higher risks of perinatal mortality, preterm birth and NICU admissions ($p<0,01$) while women with overweight, obesity or a Q4 weight gain had a significantly higher risk of developing HIP ($p<0,001$). For overweight and obese women a low Q1 gestational weight gain resulted in a lower risks of preterm births ($p<0,01$) (Tab.2 and Figure 1).

Covariate	PERINATAL MORTALITY		PRETERM BIRTH <34		PRETERM BIRTH <37		NICU ADMISSIONS		HYPERTENSIVE DISORDERS		
	OR(95%CI)	p-value	Global OR(95%CI)	p-value	Global p-value	OR(95%CI)	p-value	Global p-value	OR(95%CI)	p-value	
Maternal weight gain (quartiles)	reference		reference		<0.0001	reference	<0.0001	reference	<0.001	reference	<0.0001
Q2	2.22 (1.37,3.61)	0.0012	1.88 (1.57,2.24)	<0.0001	1.56 (1.34,1.82)	<0.0001	1.59 (1.37,1.84)	<0.0001	0.88 (0.6,1.29)	0.5048	
Q4	1.08 (0.63,1.87)	0.7774	0.94 (0.78,1.12)	0.4776	1.01 (0.88,1.16)	0.8743	0.98 (0.86,1.12)	0.8038	2.39 (1.84,3.11)	0.0001	
BMI at first examination		0.7134		0.7098		0.5937		0.6056		<0.0001	
Normal weight	reference		reference		reference		reference		reference		
Overweight	1.28 (0.72,2.27)	0.4079	1.09 (0.89,1.33)	0.3904	1.07 (0.92,1.24)	0.3889	1.05 (0.91,1.22)	0.5053	1.52 (1.11,2.1)	0.0098	
Obesity	0.86 (0.34,2.2)	0.7557	1.14 (0.87,1.5)	0.3477	1.14 (0.92,1.41)	0.4376	0.92 (0.75,1.13)	0.4376	2.92 (2.04,4.18)	<0.0001	
Underweight	0.53 (0.07,3.93)	0.5386	0.99 (0.62,1.6)	0.9774	1.03 (0.72,1.46)	0.8878	1.15 (0.81,1.62)	0.4461	0.52 (0.16,1.67)	0.2745	
Year	1 (0.97,1.04)	0.8673	1.02 (1.01,1.03)	0.0013	0.99 (0.98,1)	0.0130	1.01 (1,1.02)	0.0647	0.98 (0.97,1)	0.0763	
Mothers' age	0.99 (0.96,1.02)	0.4843	0.98 (0.97,0.99)	0.0001	0.98 (0.98,0.99)	0.0005	0.98 (0.97,0.98)	<0.0001	1.03 (1.01,1.04)	0.0043	
Smoking		0.3872		0.6533		0.5563		0.2217		0.0117	
No	reference		reference		reference		reference		reference		
Yes	1.32 (0.7,2.48)		0.95 (0.74,1.21)		1.06 (0.88,1.28)		1.12 (0.93,1.35)		0.55 (0.34,0.87)		
Weight gain: BMI (first examination)		0.5648		0.0126		<0.0001		0.0548		0.1844	
Q1:overweight	0.41 (0.16,1.05)	0.0644	0.64 (0.46,0.88)	0.0065	0.58 (0.44,0.75)	<0.0001	0.71 (0.55,0.92)	0.0099	0.92 (0.51,1.66)	0.7778	
Q4:overweight	0.72 (0.25,2.03)	0.5324	1 (0.71,1.41)	0.9858	1.03 (0.8,1.33)	0.8239	0.92 (0.71,1.18)	0.4998	1.12 (0.72,1.75)	0.6160	
Q1:obesity	1.05 (0.34,3.26)	0.9291	0.59 (0.41,0.86)	0.0059	0.63 (0.47,0.85)	0.0027	0.85 (0.63,1.14)	0.2766	0.7 (0.39,1.26)	0.2327	
Q4:obesity	0.69 (0.12,3.94)	0.6801	1.04 (0.66,1.66)	0.8556	1.22 (0.85,1.76)	0.2826	1.24 (0.87,1.76)	0.2417	0.59 (0.34,1.03)	0.0621	
Q1:underweight	2.4 (0.23,24.78)	0.4625	1.32 (0.66,2.67)	0.4354	1.18 (0.63,2.22)	0.6009	1.29 (0.7,2.39)	0.4094	3.63 (0.8,16.43)	0.0949	
Q4:underweight	2.08 (0.12,35.75)	0.6144	1.26 (0.55,2.89)	0.5795	1.08 (0.57,2.05)	0.8160	0.81 (0.43,1.52)	0.5056	1.5 (0.32,7.1)	0.6089	

Table 2 multivariate data analysis



Conclusions

It seems that in twin pregnancies, low maternal weight or a gestational weight gain in the lowest quartile are associated with neonatal complications. A high BMI or gestational weight gain in the highest quartile result in maternal HIP. Mothers with a high pre-pregnancy BMI should be advised to control their weight gain accordingly.

Figure 1

Predicted probability of considered outcomes

For each outcome we fitted a logistic regression model with an interaction term for maternal BMI and weight gain during pregnancy and the additional covariates year, maternal age and smoking. The predicted probability was calculated for each combination of the two variables BMI and weight gain using the observed mean values for all covariates.