The effect of maternal overweight and obesity on offspring size at birth and pregnancy outcome

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Introduction

- Obesity reaching epidemic proportions.
- GDM and PIH risk increased with increase in weight.
- Increased maternal morbidity and CS.
- Increased risk of macrosomia.
- Increased risk of induction of labour.
- Increased risk of shoulder dystocia and neonatal morbidity.

Normal pregnancy

- Where GDM and PIH excluded:
  - High risk of CS and induction of labour.
  - Macrosomia and shoulder dystocia.
  - Most work included both overweight and obese women in the same group.
  - Increased risk of postpartum haemorrhage.
- Unanswered questions:
  - What is the effect on fetal growth?
  - Are obesity and overweight similar?

Methods

- Settings: obstetric unit in UK.
- Data source: large comprehensive database.
- Inclusion criteria: primparas, no antenatal complications, full term (≥ 37 weeks), booking before 20 weeks, BMI available, cephalic presentation, singleton pregnancy, no pre-pregnancy disease.

Outcome measures

- Duration of pregnancy.
- Mode of delivery.
- Postpartum haemorrhage.
- Shoulder dystocia.
- Placental weight.
- Fetal anthropometry:
  - Weight, Crown-Heel length, Pondral index (weight in Kg/length^3), Head circumference.

Statistics and analysis

- BMI: weight (kg) / height (m^2).
- Division into 4 groups according to BMI: underweight, normal weight, overweight and obese according to WHO criteria.
- Multiple linear and logistic regression analyses and ANOVA.
- P value < 0.05 considered significant.
- SPSS for Windows.

Results

- 12934 women included.
- 30% of the database.
- 938 underweight (7.2%).
- 7488 normal weight (57.8%).
- 3542 overweight (27.4%).
- 966 obese (7.5%).

Maternal Characteristics

	Underweight (N=938)	**Normal weight** (N=7488)	**Overweight** (N=3542)	**Obese** (N=966)	*P-trend*
Maternal variables:					
Mother's age (y)	24.6 (24.3-24.9)	26.3 (26.2-26.4)	26.7 (26.6-26.9)	26.6 (26.3-26.9)	*<0.001*
Pregnancy weight gain (kg)	11.9 (11.6-12.1)	11.9 (11.8-12)	12.2 (12-12.4)	10.2 (9.8-10.6)	*<0.001*
Systolic BP (mmHg)	108 (107-109)	111 (111-112)	114 (113-114)	119 (118-119)	*<0.001*
Diastolic BP (mmHg)	64 (63-64)	65 (65-65)	67 (67-67)	71 (71-72)	*<0.001*
Gestation at delivery (weeks)	39.9 (39.8-40)	40.0 (40.0-40.1)	40.1 (40.08-40.2)	40.2 (40.1-40.2)	*<0.001*

Mode of delivery

	Underweight (N=938)	**Normal weight** (N=7488)	**Overweight** (N=3542)	**Obese** (N=966)	**P-trend*
Spontaneous Vaginal	606 (64.6%)	4616 (61.6%)	1983 (55.9)	495 (51%)	*<0.001*
Instrumental vaginal	232 (24.7%)	1976 (26.4%)	951 (26.8%)	235 (24%)	*0.3*
Caesarean (all)	93 (9.9%)	858 (11.5%)	594 (16.7%)	235 (24%)	*<0.001*
Caesarean (elective)	11 (1.2%)	113 (1.5%)	75 (2.1%)	27 (2.8%)	*<0.001*
Caesarean (emergency)	82 (8.7%)	745 (9.9%)	519 (14.7%)	208 (21.5%)	*<0.001*

Delivery complications

	Underweight (N=938)	**Normal weight** (N=7488)	**Overweight** (N=3542)	**Obese** (N=966)	*P-trend*
Blood loss > 500 mls					
SVD	22 (3.6%)	144 (3.1%)	87 (4.4%)	28 (5.7%)	*0.003*
Forceps	25 (10.8%)	226 (11.4%)	124 (13.0%)	35 (14.9%)	*0.06*
LSCS	22 (23.7%)	232 (27.0%)	163 (27.4%)	80 (34.0%)	*0.04*
*Overall OR**	*0.97 (0.74-1.24)*	*1.0*	*1.17 (1.01-1.35)*	*1.22 (1.09-1.35)*	*<0.001*
Shoulder dystocia					
SVD	1 (0.2%)	16 (0.3%)	5 (0.3%)	1 (0.2%)	*0.8*
Forceps	1 (0.4%)	4 (0.2%)	4 (0.4%)	2 (0.9%)	*0.2*
*Overall OR**	*0.78 (0.18-3.34)*	*1.0*	*1.02 (0.46-2.23)*	*1.17 (0.64-2.14)*	*0.6*

Fetal anthropometry

	Underweight (N=938)	**Normal weight** (N=7488)	**Overweight** (N=3542)	**Obese** (N=966)	*P-trend*
Birth weight (g)	3250 (3224-3276)	3349 (3339-3358)	3432 (3419-3446)	3513 (3487-3539)	*<0.001*
Head circ. (cm)	34.5 (34.4-34.6)	34.7 (34.6-34.8)	34.9 (34.9-35.0)	35.1 (35.0-35.2)	*<0.001*
Birth length (cm)	52.8 (52.6-53.0)	53.2 (53.1-53.2)	53.5 (53.4-53.6)	53.8 (53.6-54.0)	*<0.001*
Ponderal index (kg/m^3)	22.2 (22.0-22.5)	22.4 (22.3-22.5)	22.6 (22.5-22.7)	22.7 (22.5-22.9)	*<0.001*
Placental weight (g)	648 (614-682)	656 (653-659)	718 (697-738)	721 (689-752)	*<0.001*

Conclusions

- Confirm:
  - Obesity associated with increased risk of CS.
  - Obesity associated with postdates.
  - Obesity associated with increased morbidity.
- Did not confirm:
  - Obesity and shoulder dystocia.

Conclusions: New findings

- Overweight also associated with increased risk of CS, postdates and maternal morbidity.
- Both overweight and obesity associated with proportionally bigger babies.
- The mechanism behind the symmetrically larger babies is not known but cannot be explained based on subtle higher insulin resistance alone.

Future work

- Similar study in developing world population is needed.
- Prospective study to address the mechanism.
- Long term development of children born to overweight and obese mothers.
- Financial and health burden of the increasing obesity and overweight.