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Secular increase in placental weight in Saudi Arabia

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ABSTRACT

Background: Ramadan is an annual period of day-time fasting during which people in Saudi Arabia, including pregnant women, change their diets and physical activity. We recently reported that among babies who were in the second or third trimester of gestation during Ramadan placental growth slowed. We also found that, over the four years of the study, placental weight increased by 29 g per year. We have now extended our data collection in order to examine this trend in more detail.
Methods: We studied the birth records of 17 660 singletons born in King Saud Hospital, Unizah, Saudi Arabia, over a ten year period. The records included birth weight, placental weight and gestational age.
Results: During the first six years of the study period mean placental weight rose by more than 100 g while mean birth weight was unchanged. This secular increase in placental weight was accompanied by a change in the placenta's response to Ramadan. During the first half of the study period babies who were in their second or third trimester of gestation during Ramadan had reduced placental weight (475 g and 476 g compared with 484 g, $p < 0.001$ for both). During the second half of the study period babies who were in their first trimester of gestation during Ramadan had reduced placental weight (533 g compared with 539 g, $p = 0.03$).
Conclusions: We suggest that the secular increase in placental weight reflects changes in maternal body composition. These have altered placental responses to the dietary changes during Ramadan. The biological processes underlying these responses are not known.

1. Introduction

We recently reported on a series of 7083 births in a maternity hospital in Unizah, a small city 350 km to the north of Riyadh, the capital city of Saudi Arabia [1]. We found that among babies who were in the second or third trimester of gestation during Ramadan placental growth slowed but fetal growth was sustained, presumably by an increase in placental functional capacity.

In Islam, Ramadan is an annual period of day-time fasting. It lasts for one month and occurs at different seasons in different years because the Arabic calendar depends on the moon. Therefore the hours of daily fasting will depend on the season. During Ramadan people in Saudi Arabia change their life style. They take no food or water from dawn to sunset, when they break their fast by eating sweet and fried meals. The next meal is "Sahoor" which is usually eaten before dawn and comprises fat-rich foods. People reduce their activities during the day, but are more active at night. Studies have shown that body weight and body mass index (weight/height^2) are reduced during Ramadan in both men and women [2,3]. This may reflect the changes in diet and pattern of eating rather than the effects of fasting. Although pregnant women are allowed to defer fasting until after the pregnancy in Saudi Arabia they usually prefer to share the spiritual and social experiences of Ramadan with their families.

Placental function is a major influence on fetal programming, the process whereby nutrition and other influences during gestation permanently change the structure and function of the body in ways that affect long-term health [4]. People who were born at term but whose birth weights were towards the lower end of the normal range are at increased risk of cardiovascular disease and type 2 diabetes [4,5]. Both fetal and placental size at birth are associated with the later risk of chronic diseases [6].

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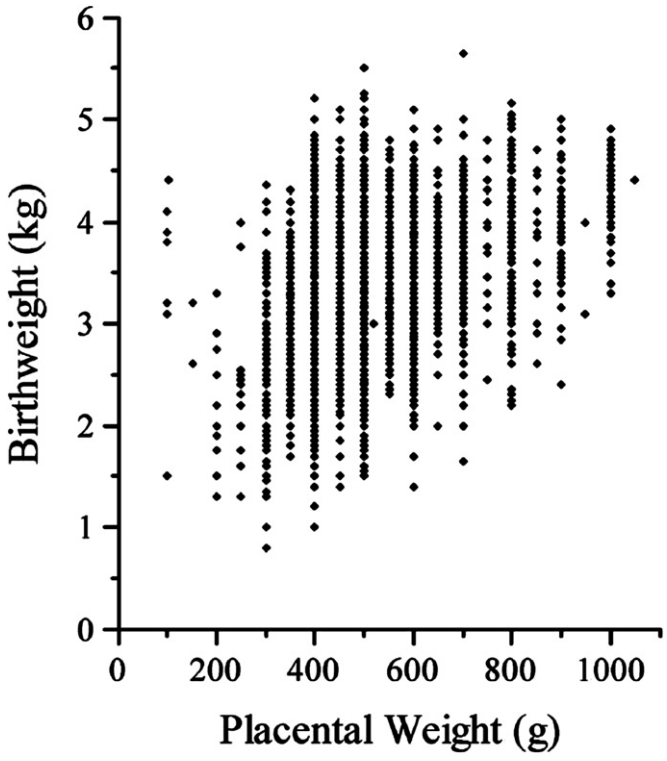

Fig. 1. Birth weights and placental weights of 17 660 singleton babies born at term.

In our previous analysis we found, unexpectedly, that while birth weights remain constant throughout the four years of the study, placental weight increased by 29 g per year [1]. The ratio of placental weight to birth weight therefore rose. We have now extended our data collection to an additional six years of births to ascertain whether the increase in placental size continued. We also examined whether the secular increase in placental size changed the placenta's response to Ramadan. Secular changes in placental size and its responses to Ramadan could change fetal programming, and could therefore have long-term implications for the health of the next generation [6].

2. Methods

In our previous study [1] we examined the birth records of 7083 babies born in King Saud Hospital, Unizah, Saudi Arabia during Arabic years 1421–1424 (western years August 2000–April 2004). We have now added 10 577 birth records for 1425 to 1430 (western years May 2004–April 2009). Unizah is a small city 350 km to the north of the capital city, Riyadh. It is an agricultural and administrative centre with a population of 140,000. The King Saud Hospital is one of two maternity centres in the city. We restricted our data collection to singletons born to Saudi nationals at term (37 weeks of gestation or more). These were the only exclusion criteria. The data were abstracted from the maternity log-books. Ramadan is the ninth month of the Muslim year. The months are determined by the lunar cycle, rather than the solar cycle which determines the years in the western calendar. During the ten year period of our study Ramadan occurred in different western calendar months, from late November through to early September. We calculated whether each baby was in utero during Ramadan and, if so, during which trimester. The maternity log-books included date of birth, maternal age, parity, birth weight, placental weight and gestational age, estimated from the date of the last menstrual period. Pregnant women are first seen around 40 days after their expected menstrual period did not occur. Women in Saudi Arabia are careful in knowing their menstrual cycles as menstrual bleeding affects religious practices. The majority of the mothers were born in Unizah. The techniques for trimming and weighing the placenta are similar to those used in Europe and the United States. They remained unchanged throughout the study period and were supervised by the same midwife.

2.1. Statistical methods

We defined four groups of exposure to Ramadan using the date of birth and the duration of gestation estimated from the date of the last menstrual period. For example, births in months one to three (Muharram, Safar and Rabi'al-awwal) were treated as exposed to Ramadan in the second trimester. We analysed birth weight, placental weight and the ratio of placental to birth weight using multiple linear regression, adjusting for gender, time through the study and gestational age, by including them as predictors. We included in the regression dummy variables for the trimester of exposure to Ramadan to assess trimester-specific effects, treating the group not exposed to Ramadan in pregnancy as the baseline group for comparison. We used SPSS version 18 to analyse the data.

3. Results

There were 17 660 birth records (8933 boys, 8727 girls). Placental weight was correlated with birth weight ($r = 0.34$, Fig. 1) and with gestational age ($r = 0.05$). Table 1 shows the mean birth weight, placental weight, gestational age and maternal age for boys and girls. Boys had higher mean birth weights and placental weights than girls but the ratio of placental weight to birth weight was lower. Fig. 2 shows the trend in birth and placental weight through the years of the study. The mean values are unadjusted. While babies' birth weights remained constant throughout the ten years of the study, their mean placental weights rose steeply during the first six years so that the ratio of placental weight to birth weight rose. The trends were similar in boys and girls.

In Table 2 the babies are divided according to whether or not they were in utero during Ramadan and if so, whether it was during the first, second or third trimester of gestation. The mean values for birth and placental size are adjusted for baby sex, length of gestation and year of birth. Among all babies those who were in utero during Ramadan had similar birth weights to those who were not in utero during Ramadan. Those in utero during the second or third trimester had lower placental weights and lower placental to birth weight ratios than those who were not in utero during Ramadan. Those in utero during the first trimester had lower placental to birth weight ratios. In Table 2 the babies are further divided according to whether they were born during the first or second half of the study period: the dividing point was in early 1426. Among babies born during the first half of the period those who were in the second or third trimester during Ramadan had lower placental weights and lower placental birth weight ratios than those who were not in utero during Ramadan. In contrast, among babies born during the second half of the period, those who were in the first trimester during Ramadan had reduced placental weights and placental to birth weight ratios. We examined the statistical

Table 1
Mean birth size and gestational age in boys and girls.

Measurements	Boys		Girls		*p* value for difference
	Mean (SD)	*n*	Mean (SD)	*n*	
Birth weight (kg)	3.28 (0.48)	8916	3.18 (0.46)	8710	<0.001
Placental weight (g)	512 (93)	8859	505 (89)	8668	<0.001
Placental/birth weight (%)	15.8 (3.0)	8859	16.1 (3.0)	8668	<0.001
Gestational age (weeks)	39.7 (1.1)	8916	39.8 (1.1)	8710	0.03
Mother's age (years)	29.5 (6.3)	8795	29.5 (6.1)	8587	0.92