

ABSTRACT

Portugal is characterized by a high prevalence of overweight and obesity among women, whose weight increases most rapidly in early adulthood. Individual genetic features and behaviours, along with social, cultural and environmental factors interact and produce complex relationships with body weight and with its variation throughout time.

Motherhood may trigger obesity and it remains unclear how this and other reproductive health factors can influence the associations between excessive weight and several other determinants.

With this thesis, we aimed to assess how pregnancy and other reproductive factors influence the association between body weight and biological, psychological and social factors in Portuguese women. To accomplish this objective, five studies were performed using different data sources and several methodologies. The next paragraphs briefly describe the specific objective pursued in each study, as well as the methods used and the main results.

1. To characterize weight differences between women and weight change over time in adult women from the general population and to assess the association of sociodemographic, reproductive and lifestyle characteristics with such variation (Paper I).

This study comprised 1040 women from a population-based cohort of adults from Porto, Portugal, assembled in 1999-2003 and re-evaluated in 2005-2008 (median follow-up 5 years). We fitted a mixed-effects model for longitudinal analysis of body weight on time, with random intercepts and random slopes. Multivariate-adjusted coefficients with 95% confidence intervals (95% CI) were computed for the determinants of weight at baseline and weight change between visits.

There was an average crude increase of 0.11 kg of measured weight per calendar year. Years of fertile life were associated with a larger annual weight gain: - 0.36 kg per year for women until 21 years of fertile life, whereas after that, weight increased progressively more with increasing fertile time up to 0.45 kg per year above 41 years. Height, age, education, marital status, residential neighbourhood deprivation, number of children delivered and use of oral contraceptives influenced interindividual weight variation at baseline, but not weight change from baseline to follow-up.

For the following objectives, we used data from mothers of the Portuguese birth cohort Generation XXI that comprises 8647 infants, corresponding to 8495 mothers. Families were evaluated at baseline (2005-2006) and follow-up visits 4 (2009-2011) and 7 (2012-2014) years after delivery and, of the total sample of mothers, 5729 (67.4%) and 5616 (66.1%) attended a face-to-face evaluation at 4 and 7 years, respectively. In the face-to-face interviews at baseline and follow-up evaluations, information was collected by interviewers, using structured questionnaires concerning the child's and mother's health. Also, an anthropometric evaluation of both family members was performed during the follow-ups by the interviewers.

2. To characterize weight differences between women and weight change over time in fertile women within seven years after the delivery of a liveborn, and to assess the effects of sociodemographic, reproductive and lifestyles characteristics with such variation (Paper II).

This study comprised 4475 mothers of Generation XXI evaluated in 2009-2011 (Visit 1) and 2012-2014 (Visit 2) (median follow-up: 2.8 years). We fitted a mixed-effects model for longitudinal analysis of body weight on time, and computed multivariate-adjusted coefficients with 95% CI for the determinants of weight at Visit 1 and weight variation between visits.

Weight increased on average 0.27 kg per year. A model with random intercepts and random slopes to account for different individual trajectories, as well as fixed effects, explained 12.2% of the weight change from Visit 1 to Visit 2 and 12.6% of the between-women weight differences at Visit 1. Independent determinants of higher weight at Visit 1 were higher height, lower education, having a partner, not being employed, higher number of pregnancies, not using hormonal contraceptives, never smoking and higher intake of soft drinks. Not having a partner, never smoking and lower intake of soft drinks remained independent predictors of weight gain between visits.

3. To assess the impact of body image satisfaction before pregnancy, using current and desired body size, on body mass index (BMI) 4 years after delivery (Paper III).

We analyzed 3612 mothers with prepregnancy BMI $>18.5 \text{ kg/m}^2$ reevaluated 4 years after the birth of a child. Body image satisfaction (BIS) was defined as the difference between perceived and ideal body size before pregnancy, assessed by Stunkard Silhouettes after birth. The associations of BIS with BMI change (continuous) and BMI classes at 4 years, based on measured weight and height, were estimated using linear and multinomial regression, respectively. Among women with normal prepregnancy BMI, those who felt too small regarding their ideal, had a 0.25 kg/m^2 smaller increase in BMI within 4 years and a lower likelihood of becoming overweight or obese than those satisfied with body image. Feeling too large was associated with a 0.41 kg/m^2 larger increase in BMI and a higher risk of becoming overweight or obese. A similar, non-significant, trend was observed for overweight women. Obese women who felt too large had a non-significant decrease in BMI.

4. To explore the relation of childhood, adulthood socioeconomic position (SEP) and social trajectory with body image satisfaction immediately before pregnancy in primiparous and multiparous mothers (Paper IV).

We used information from 5470 women assessed at baseline. Women's and their parents' education were used as indicators of adulthood and childhood SEP, respectively. Social trajectory was classified as stable-high, upward, stable-low, downward, according to both education variables. BIS was assessed with Stunkard Silhouettes immediately after birth as the difference between perceived body size before the index pregnancy and ideal body size. Odds ratios (OR) and 95% CI between social trajectory and BIS were computed using multinomial logistic regression (women satisfied with body image were the outcome reference category), adjusting for age and prepregnancy BMI.

In primiparous women, no association was found between childhood SEP, adulthood SEP or social trajectory and BIS. Downward social trajectory was associated with a higher likelihood of dissatisfaction with body image in multiparous women.

5. To characterize a healthy excessive weight in women 4 years after delivery concerning its prevalence, fat characteristics and identification of sociodemographic, genetic, reproductive or lifestyles factors that can be associated with this phenotype (Paper V).

We evaluated 1847 mothers who attended a face-to-face evaluation 4 years after the index pregnancy and provided a fasting blood sample. A healthy metabolic profile was defined as absence of hypertension, diabetes, dyslipidemia, C-reactive protein <3mg/l and being below the second tertile of HOMA-IR (Homeostasis model assessment of insulin resistance). Adjusted OR and 95% CI were computed using multinomial logistic regression for excessive weight (healthy/ not healthy) and obesity (healthy/ not healthy), taking women with normal BMI as the reference category of the outcome.

Four years after delivery, 47% of women had normal BMI, 33% were overweight and 20% obese. In each BMI class, 61%, 33% and 12% presented a healthy metabolic profile, respectively. Family history of CVD/cardiometabolic risk factors was associated with a higher probability of obesity with a not healthy metabolic profile. Women who breastfed the enrolled child for >26 weeks and practiced physical exercise were less likely to be obese and metabolically unhealthy, with no effect on healthy excessive weight.

This thesis emphasizes that different stages of reproductive life have an effect on women's body weight and its variation throughout time and that this relationship is markedly influenced by several biological, psychological and social factors. Moreover, a life course approach for weight management is essential, since factors associated with weight variation are not always the same throughout life. By gaining a better understanding of how biological, psychological and social factors interact with women's weight, findings from this dissertation provide important clues for better weight control recommendations.