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Is early or late biological maturation trigger obesity? A machine learning modeling research in Turkey boys and girls

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Biological maturation status can affect individual differences, sex, height, body fat, and body weight in adolescents and thus may be associated with obesity. The primary aim of this study was to examine the relationship between biological maturation and obesity. Overall, 1,328 adolescents (792 boys and 536 girls) aged 12.00±0.94–12.21±0.99 years, respectively (measured for body mass, body stature, sitting stature). Body weights were determined with Tanita body analysis system and adolescent obesity status was calculated according to the WHO classification. Biological maturation was determined according to the somatic maturation method. Our results showed that boys mature 3.077-fold later than girls. Obesity was an increasing effect on early maturation. It was determined that being obese, overweight and healthy-weight increased the risk of early maturation 9.80, 6.99 and 1.81-fold, respectively. The equation of the model predicting maturation is: $\text{Logit}(P) = 1 / (1 + \exp(-(-31.386 + \text{sex} - \text{boy} * (1.124) + [\text{chronological age} = 10] * (-7.031) + [\text{chronological age} = 11] * (-4.338) + [\text{chronological age} = 12] * (-1.677) + \text{age} * (-2.075) + \text{weight} * 0.093 + \text{height} * (-0.141) + \text{obesity} * (-2.282) + \text{overweight} * (-1.944) + \text{healthy weight} * (-0.592)))$). Logistic regression model predicted maturity with 80.7% [95% CI: 77.2–84.1%] accuracy. In addition, the model had a high sensitivity value (81.7% [76.2–86.6%]), which indicates that the model can successfully distinguish adolescents with early maturation. In conclusion, sex and obesity are independent predictors of maturity, and the risk of early maturation is increased, especially in the case of obesity and in girls.

KEYWORDS

adolescent, childhood, puberty, overweight, body mass index, noncommunicable diseases

1. Introduction

Childhood obesity is one of the most serious public health challenges of the 21st century (1). Overweight and obesity are defined as “abnormal or excessive fat accumulation that presents a risk to health” (1). Overweight and obesity are associated with metabolic diseases that increase the risk of noncommunicable diseases such as cardiovascular disease and diabetes (2, 3). Childhood or adolescence obesity is associated with higher risk of weight-related morbidity and premature death in adulthood (4, 5). Overweight and obesity cause at least 2.6 million deaths each year (1). The World Obesity Federation reports that there has been a dramatic increase in childhood overweight and