Steroid hormone 20-hydroxyecdysone disturbs fat body lipid metabolism and negatively regulates gluconeogenesis in Hyphantria cunea larvae

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Abstract The steroid hormone 20-hydroxyecdysone (20E) has been described to regu- late fat body lipid metabolism in insects, but its accurate regulatory mechanism, especially the crosstalk between 20E-induced lipid metabolism and gluconeogenesis remains largely unclear. Here, we specially investigated the effect of 20E on lipid metabolism and glu- coneogenesis in the fat body of Hyphantria cunea larvae, a notorious pest in forestry. Lipidomics analysis showed that a total of 1 907 lipid species were identified in the fat body of H. cunea larvae assigned to 6 groups and 48 lipid classes. The differentially abun- dant lipids analysis showed a significant difference between 20E-treated and control sam- ples, indicating that 20E caused a remarkable alteration of lipidomics profiles in the fat body of H. cunea larvae. Further studies demonstrated that 20E accelerated fatty acid β- oxidation, inhibited lipid synthesis, and promoted lipolysis. Meanwhile, the activities of pyruvate carboxylase, phosphoenolpyruvate carboxykinase, fructose-1,6-bisphosphatase, and glucose-6-phosphatase were dramatically suppressed by 20E in the fat body of H. cunea larvae. As well, the transcriptions of genes encoding these 4 rate-limiting gluco- neogenic enzymes were significantly downregulated in the fat body of H. cunea larvae after treatment with 20E. Taken together, our results revealed that 20E disturbed fat body lipid homeostasis, accelerated fatty acid β-oxidation and promoted lipolysis, but nega- tively regulated gluconeogenesis in H. cunea larvae. The findings might provide a new insight into hormonal regulation of glucose and lipid metabolism in insect fat body.

Key words 20-hydroxyecdysone; Hyphantria cunea; fat body; lipidomics analysis; lipid metabolism; gluconeogenesis