

## Abstract

The progress of postnatal ontogeny depends upon the external and internal environmental factors of growing mammal. Among internal factors, gonadal factors are believed to have a crucial role, especially in modulating the function of the hormonal axes of offspring. The impact of the external environmental factors depends most of all on sustaining and interruption of psychoemotional and physiological ties between mother and offspring. Weaning is pivotal event in postnatal ontogeny. It may cause stress and contribute to the change in physiology of growing infants.

We hypothesized that early weaning (6<sup>th</sup> week of age) influences the hypothalamic–pituitary–adrenal axis (HPA) and somatostatin–growth hormone (GH) system activity in lambs of both sexes. We assumed that the early weaning has a sex–specific and long–term effects.

The study was performed on 36 lambs of Polish Longwool breed of both sexes. Lambs were assigned to three experimental groups according to sex: I group 5–week old lambs (40<sup>th</sup> day of life) staying with the mother (♀ n=6; ♂ n=6); II group 16–week old control lambs (112<sup>th</sup> day of life), weaned at 9<sup>th</sup> week of age (64<sup>th</sup> day of life) (♀ n=6; ♂ n=6); III group 16–week old stressed lambs (112<sup>th</sup> day of life), weaned at 6<sup>th</sup> week of age (40<sup>th</sup> day of life) (♀ n=6; ♂ n=6). The radioimmunological assay and immunohistochemical methods were performed after the serial blood collection, and the hypothalamus and the anterior pituitary gland dissection. The lambs were weighed on the days before serial blood collection.

After early weaning increased amount of corticotropin–releasing hormone (CRF) in paraventricular nucleus (PVN) and decreased amount of CRF in median eminence (ME) in 16–week old stressed male lambs were shown. Furthermore, diminished population of adrenocorticotrophic cells in pituitary gland of early weaned juvenile male lambs was observed. Increased in 9–week old lambs and decreased in 12– and 16–week old lambs cortisol release were observed in male lambs under the influence of early maternal deprivation. After stress increased amount of CRF in PVN in juvenile female lambs was noticed. In 9– and 16–week old female lambs early weaning caused increased cortisol secretion. In 16–week old lambs of both sexes increased amount of CRF in PVN, ME and increased population of adrenocorticotrophic cells in the pituitary gland were observed compared to 6<sup>th</sup> week of life. In 5–week old

female lambs compared to male increased population of CRF neurons in PVN and ME were observed. Population of adrenocorticotrophic cells in the pituitary gland of 5-week old female lambs was higher than in males. Mean concentration of cortisol was higher in female lambs compared to male in all researched developmental stages.

The early maternal deprivation caused increased population of somatostatin neurons in periventricular nucleus (PEV) and ME in 16-week old lambs. On the pituitary level the decreased amount of GH during juvenile period was observed. In plasma of male lambs, being under the influence of early maternal deprivation stress, the increased concentration of GH in 9-week old lambs and decreased concentration of GH in 16-week old lambs were noticed. The inhibiting impact of maternal deprivation on GH pulse frequency and stimulating impact on GH amplitude in 9-week old male lambs were observed. In female lambs early stress caused the increase of somatostatin perykaria in PEV and decrease of somatostatin amount in ME in 16-week old animals. In pituitary cells of early weaned animals increased population of somatotrophic cells in 16-week old was observed. An increase in GH release in 9- and 12-week old lambs life and decrease in GH secretion in 16-week of lambs life were observed. Early weaning stress contributed to the increased pulse amplitude of GH in early juvenile period in female lambs. Body weight was not different between early weaned and control lambs of both sexes. Daily weight gain was higher in 9- and 16-week old lambs and lower in 12-week old lambs after early maternal deprivation in both sexes.

In the juvenile period, sex-differences in the HPA axis activation after early maternal deprivation concerns all researched levels of this axis, besides PVN. In the somatotrophic axis, impact of the early weaning, stimulating in the infantile and inhibiting in the juvenile period, is exerted through different mechanisms for male and female lambs on the ME and pituitary gland levels, after infantile period. Changes in the GH release after stress are more prominent in male lambs than in female, according to sex-differences in GH secretion. The result of this sexual dimorphism is greater body weight in male lambs. Early maternal deprivation stress does not contribute to the body weight changes but influences daily weight gain in infantile and juvenile periods in lambs of both sexes. Decreased daily weight gain after stress in lambs, only in male lambs is the consequence of the diminished GH secretion. The infantile and the juvenile periods are time for morphological and

functional HPA axis development. Sex-differences in the HPA axis reaction to stress were shown, which are more marked in the juvenile period. The result of this dimorphism is greater HPA axis reaction after stress in female lambs than in male lambs.

Obtained results partially confirms the assumption of the research hypothesis. Early maternal deprivation influences the HPA axis and somatostatin-GH system in lambs. Long-term effect of early maternal deprivation was observed. The sex-specific effect of the HPA axis activation in the juvenile period in response to early weaning was shown. Obtained results show that the impact of the early weaning contributed to the sex-differences in GH secretion and somatic growth after infantile period. Sex-specific stress reaction after early maternal deprivation has a long-term consequences on the somatostatin-GH system in lambs during postnatal ontogeny.