Summary

Lamb ontogeny is determined by the genetic blueprint and regulated by intrinsic and extrinsic environmental factors. Presence of the mother during the neonatal and infantile phase of the postnatal ontogeny is pivotal extrinsic environmental factor controlling growth and sexual development of a lamb. It can in some extent abolish the effect of other external cues. Weaning, e.i. braking of the psychobiological bond between progeny and its mother is considered as a stressful factor that affects the physiology and behaviour of the offspring. Changes in the secretion of reproductive axis hormones in response to maternal deprivation seem to be part of an endocrine mechanism that leads to the beginning of sexual maturation process. In sheep timing of puberty is sexually differentiated. In polish Longwool Sheep breed testicular maturation process begins and continues after weaning at 9 weeks of age. Whereas females begin the ovarian maturation process at the same time as males, but due to inadequate photoperiod conditions there is juvenile hiatus in sexual development and the process is restarted 20 weeks later in acquiescent environmental conditions. It was decided to investigate the effect of early maternal deprivation on the hormonal mechanisms that are involved in gonadal maturation processes in sheep. It was hypothesized that weaning at the beginning of the sixth week of lamb’s age would have long term effect on the secretion of gonadotrophic hormones in the pituitary, testosterone and cortisol in sexually differentiated manner. Furthermore, due to gender dependent timing of testes and ovaries development in sheep it was decided to check when the effect of early maternal deprivation on the secretion of LH and FSH emerges during female postnatal ontogeny. To evaluate aforementioned assumptions the following experiment was conducted. Eighteen male and 40 female lambs were randomly assigned to groups in accordance with division of postnatal ontogeny into phases: infantile (until 9 weeks of age), and juvenile (after 9 weeks of age). Six males and 6 females during mother rearing period were allocated to 5-week old (37 days) control group. The rest of lambs were weaned at the 39th (early maternal deprivation - experimental groups) or 65th (control groups) day of life and assigned to male and female age dependent groups. Six early weaned and 5 females remaining with the dam were allocated to 9 week old (63 days) experimental and control group respectively. Another 6 maternally deprived and 5 females weaned at 81 65th day were assigned to 12 week old (86 days) experimental and control group respectively. The remaining males and females were allocated to 16 week old (112 days) maternally deprived and control group that were studied during postnatal development at 9-, 12-, and 16-week of age (n=6 per every experimental and control, male and female group). Changes in gonadotrophins, testosterone and cortisol secretion were assayed using hybridohistochemistry, immunohistochemistry and radioimmunoassay. The study showed that early maternal deprivation changes pulsatile cortisol release during infantile and juvenile phase of postnatal ontogeny of male and female sheep. The pattern of cortisol release is dramatically different in maternally deprived lambs compared to the control. The cortisol concentrations increase gradually during the development in male and female control groups, wherein the basal cortisol levels are greater in control

females than males after 9th week of age. Early maternal deprivation stimulates cortisol release in infantile males and females. However, during the juvenile phase cortisol release is inhibited in males, contrary to females where it is stimulated by early maternal deprivation. Furthermore, mean concentrations, basal levels and pulse amplitude of cortisol are greater in juvenile early weaned females compared to males. This stress contributes to changes in LH and FSH secretion in the pituitary of lambs. Luteinizing hormone synthesis, storage and release is inhibited by early maternal deprivation stress in juvenile males. That's the result of earlier increase of testosterone release in maternally deprived males (9-week olds) compared to control lambs (12-week olds). Contrary to LH synthesis and release of FSH are stimulated at the expense of its accumulation in stressed males after 12th week of age. In contrast to males, there was increase in LH secretion and at the same time decrease in FSH secretion in maternally deprived infantile females. And then decrease in synthesis, accumulation and release of LH and only in accumulation of FSH in stressed juvenile females. While, the decreased LH secretion during juvenile phase of ontogeny caused by early maternal deprivation is observed both in males and females. This inhibition of LH secretion in males is enhancing whereas in females is diminishing during juvenile phase. It can be elucidated by the fact that in male lambs the onset of juvenile phase is related to activation of efficient negative testosterone feedback on LH secretion while in females it is related to increase of LH release at the cost of its accumulation at this time. In comparison to LH, synthesis and release of FSH is stimulated by early maternal deprivation during the juvenile phase in males whilst in females it has no impact on FSH secretion. 82 In summary, early maternal deprivation evokes stress reaction in lambs. It contributes to long term changes in pulsatile cortisol release during lambs postnatal ontogeny. Moreover, from the start of juvenile phase these changes are sexually differentiated. The stress experienced over mother rearing period alters the secretion of LH and FSH from pituitary during lambs postnatal development. Changes in gonadotrophic hormones secretion distinctive for the beginning of testicular maturation and juvenile hiatus in ovaries development are accelerated by the stress of maternal deprivation. At a cellular level changes in LH and FSH secretion under the influence of early weaning in females are manifested already during the infantile phase of ontogeny. Hence, the effect of early maternal deprivation on the gonadotrophin secretion is sexually differentiated yet in infantile phase. The outcomes of the study allow to formulate hypothesis which states that the rupture of mother - infant bond is a stressful stimulus initiating juvenile phase of ontogeny. In males as a result of stimulation of testosterone release, i.e. at a peripheral level of hypothalamic-pituitary-testicular axis. Whereas in females juvenile phase of postnatal development begins with stressful stimulation of LH secretion at the central level of hypothalamic-pituitary-ovarian axis. In conclusion, to a great extent results confirmed the study assumptions. Early maternal deprivation alters release of cortisol and testosterone, and inhibits secretion of LH in lambs. These effects are long-term and sexually differentiated. Except for effect of stress of maternal deprivation on the FSH secretion which in males is long-term and stimulatory, while in females short-term and inhibitory. It confirms hypothesis that FSH is an important feature of hormonal mechanism controlling sexual development during juvenile phase of ontogeny, when testicular maturation proceeds and at the same time the ovaries development is inhibited.