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18/MHS05/010

Physiology

PHS 204

1. Discuss lactation and gestation period in a normal female with more on the physiology of lactation and details on the physiology of pregnancy in a normal woman.

ANSWER.

 **Lactation** is the maternal physiological response whereby milk is secreted from the mammary glands to feed the infant. In this article we will cover the synthesis and regulation of milk production and also the let-down reflex that releases milk.

 **Pregnancy** is the time from fertilization of an egg, also known as conception, to birth. Getting pregnant and growing a human from scratch is a very complicated biological process that takes a lot of resources. As a result, pregnancy can have a wide range of effects on the mother, both physically and emotionally. Each egg that is released during a menstrual cycle travels to your uterus. However, unlike unfertilized eggs that proceed unaltered and then disintegrate when they get there, a fertilized egg develops into a tiny human embryo on the way. On reaching the uterus, the embryo implants itself in the uterine wall, develops into a fetus, and steadily grows, until about nine months later it is ready to emerge into the outside world as a newborn baby.

**During Pregnancy**

 During pregnancy there is significant hypertrophy of the ductular-lobular-alveolar system, prominent lobules form and from mid-gestation alveolar cells differentiate to be capable of milk production. During pregnancy there is little milk secretion due to the high**progesterone: oestrogen ratio** which favors growth rather than secretion.

**Lactogenesis**

 The alveolar epithelial cells responsible for milk production are polarized, highly differentiated cells and their function is to accumulate, synthesize, package and export the components of milk:

|  |  |
| --- | --- |
| Water | 90% |
| Lactose | 7% |
| Fat | 2% |
| Protein | 1% |
| Minerals | 0.2% (Ca2+, Fe, Mg, K, Na, P, S) |
| Vitamins | A, B, B2, C, D, E, K |
| pH | 7.0 |
| Energy Value | 27 MJ.I-1 |

Table 1 – The composition of mature milk

Soon after birth the breasts produce 40ml/day of **colostrum**. This has less water soluble vitamins, fat and sugar than mature milk but contains more proteins (particularly immunoglobulin’s) and fat soluble vitamins.

**Development**

During puberty, lobule type 1 is formed. Changes in the level of estrogen and progesterone during each menstrual cycle stimulate lobule 1 to produce new alveolar buds and eventually evolve to more mature structures, known as type-2 and type-3 lobules. Once puberty is complete, no further changes occur to the female breast until pregnancy.

During pregnancy, stage-II mammogenesis (alveolar development and maturation of the epithelium) occurs largely in response to higher levels of progesterone. The increased volume of breast tissue during pregnancy is a result of the proliferation of secretory tissue. In early pregnancy, lobule type 3 is formed due to the influence of chorionic gonadotropin. These newly formed lobules have larger size and number of epithelial cells composing each acinus. In late pregnancy, the proliferation of new acini are reduced, and the lumen becomes distended with secretory material or colostrum.

During labor and lactation, further growth and differentiation can be seen in the lobule along with milk secretion. The glandular component of the breast has now increased to the point where it is mainly formed of epithelial elements and very little stroma. This will persist throughout lactation.

Finally, the involution of mammary glands occurs with the cessation of lactation and requires a combination of lactogenic hormone deprivation and local autocrine signals that signal apoptotic cell death and tissue remodeling. Full regression does not occur, and pregnancy causes a permanent increase in the size and number of lobules. Following lactation, there is always the potential of the glands to produce milk in response to regular stimulation.

**Clinical Significance**

The normal development of the female breast is the foundation for mammogenesis, lactogenesis, and lactation. Clinicians who possess an understanding of the physiology of lactation will have the tools necessary to educate their patients to maximize chances of successful breastfeeding.