Evolving effect of ovarian Folliculogenesis and the need of nutritional aspects in cattle

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ABSTRACT

In general many technologies have been found over the world in the field of reproductive system in cattle. Some of them are artificial insemination, transformation of embryo and they give the great impact in this field. Such technologies are used not only for the purpose of increasing fertilization but also it improves the rate of genetically change over the cattle and diary livestock. This paper proposed the concept of folliculogenesis and defines some of the recent applications to reproductive biotechnology. The significance of the ovarian follicular reserve is deliberated for fertility and reproductive parameters, as well as some demands about the existence of multi-oocyte follicles in mature ovaries. Nowadays, the method of transferring embryo in cattle is an advantageous one both in practical and commercial manner. Due to lack of nutritional management on farms in bovine, the embryo transplantation is not possible. This situation has been overcome by giving effort in the field of providing nutritional food to the cattle. The nutritional attributes improves the follicles by adapting the nutrition either by a direct or by an indirect way. The metabolic hormones such as urea, glucose, etc. are in effect the direct conscious in amending the development of ovarian follicles of the animal. The changes in the growth of reproductive hormones ultimately affect the folliculogenesis due to lack of nutrition. Moreover, we surely admit that nutrition has the high influence in the growth of follicles at the ovarian stage. Hence we conclude that the development of fertilized oocyte is mainly depends on the better nutritional behaviour of the bovines. Sinceoocyte quality influences reproductive consequences such as fertilization and pregnancy rates. Even though several analyses describe nutritional parts in reproduction, the principal motivation of this paper is the effect of nutritional aspects on folliculogenesis in cattle. A better understanding of this impact may enable nutritional handling in order to develop fertility in cattle in a cost-effective yet very capable way.

Keywords: *artificial insemination, embryo transfer, folliculogenesis, ovarian follicular reserve, multi-oocyte follicles, cattle.*

1. INTRODUCTION

The widely held of livestock across the world are raised mainly based on the pastured systems, so the accessibility and excellence of greenery impacts cattle performances, including growth, reproduction and production of meat and milk. The main foundation base of the performance of reproduction is nutrition. Consequently, it is obvious that nutrition plays a significant role in augmenting productiveness in cattle. Nevertheless, the influence of nutritional approaches on reproduction is exposed to debate. Thus the fertility can be enhanced through nutritional organization; however, the study established on the result of fish meal or n-3 fatty acids on ovarian and uterine underlying forces specifies no effect of such diets on ovarian purpose. Reliable with this, described that nutritional approaches do not proliferates the productivity of bovine super ovulation. However, deal with that high-plane nourish does develop the quality of oocyte and embryo. In addition, under nutrition has an adverse effect on fertility proposing that sufficient supply of nutrients is very essential for normal reproduction performance in livestock. A worthy example is dairy cattle during the transition period, when postnatal cows may agonise from a negative energy balance. This consequences principally in harmful effects on reproduction in generally high-yielding animals since all nutrients are essential prior to milk production. Even though the roles of nutrition in reproduction are frequently problematical and investigational results have been unpredictable, several studies have struggled to reveal the functions of metabolites and metabolic hormones in regulation of folliculogenesis. For example, the role of growth hormone and insulin-like growth factor-1 (IGF-1) systems are used in directing ovarian folliculogenesis.

Moreover, the effect of nutrition is either direct or indirect. Distributed research covers principally the role of gonadotropin hormones (GnRH) in amending the development of follicles. Here, we define the interrelationship between nutrition and follicular development in cattle. Gratitude of this complex relationship would enable improved manipulation of reproduction though enhanced nutritional approaches. The importance in both applied and basic concerns connecting to folliculogenesis has improved suggestively in the recent decades. Many points may explain this improved concern. In commercial features, the industry of embryo production, most remarkably in vitro embryo production, has intensely increased universally. Some other improved biotechnologies, such as scheduled artificial insemination, cloning and transgenic animals have been broadly used, due to their remunerations on animal breeding or human health. Though, many features in follicular physiology persist unfamiliar, principally the role of the ovarian follicle reserve and fertility in cattle. Concerning basic study, certain new concepts are offered on the follicular pool, providing fascinating discussion son follicle basis and the mechanisms complicated in their recruitment and development. The determination of this object is to review current studies focusing on how the follicle reserve is related to the improvement of reproductive efficiency.

2. FOLLICULOGENESIS IN CATTLE

Then folliculogenesis in cattle is an important and also an essential view in the field of veterinary science. It has been explained in detail in many other researches. The female of the animals have these responsibilities in nature. By birth, the female might be containing a lot of immature, primordial follicles. The chief responsibility of the follicle is to support oocyte. Each of this oocyte must comprise of same immature primary oocyte. At the stage adolescence and initiation of first mensuration, a clasp of follicles creates folliculogenesis, starts the development field which is end in death or in the period of ovulation. Over a period of ten days of follicular development, moreover the original clusters of follicles have been died. This process is also known as atresia. The residual group of follicles arrives into the menstrual cycle, contending with each other while waiting for only one follicle is left. This left over follicle which is known as the late tertiary or pre-ovulatory follicle, breaches and releases the oocyte concluding folliculogenesis. It continues for around 375 days. It happens together with thirteen menstrual cycles.

The procedure activates incessantly which means the ovary comprises follicles at all phases of growth at any time, and finishes when a developed oocyte leaves from the pre-ovulatory follicle in a practice called ovulation. The developing follicles have permitted to enter the resulting distinctive phases that are defined by assured structural characteristics. In a greater perception, the entire folliculogenesis, from primordial to pre-ovulatory follicle, goes to the phase of ootidogenesis of oogenesis.

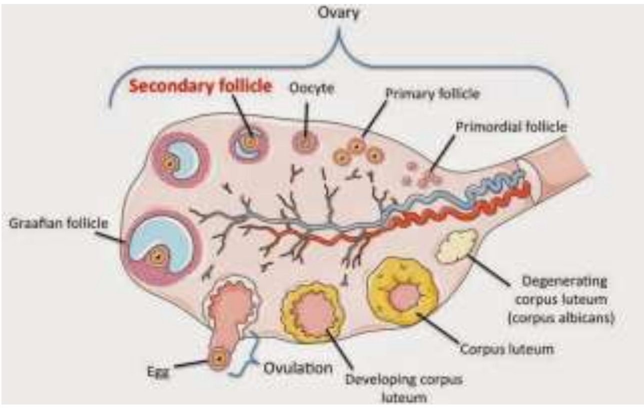

Fig.1: Overview of folliculogenesis

Folliculogenesis is demonstrated as "a sophisticated process that encompasses the proliferation and separation of both somatic and germ cells". It is synchronized by metabolic hormones and native aspects like IGF-1 systems. Initially primordial follicles formed during the foetal lifecycle of a living thing. Nevertheless, it is essential to note that primary folliculogenesis and the start of primordial follicle development are not subjective by GnRH. They conserve that anti-Mullerian hormone (AMH), resultant from the granulose cells of emerging follicles, reflects the ovarian follicular reservoir. They compete that a two-wave pattern or three-wave pattern of follicular growth is anticipated and repeatable within a particular oestrous cycle in cattle. In the course of a follicle wave, each unit of follicles permits through three stages: growing; static; and regressing. In the growing stage, enrolment of follicles is organized by follicle-stimulating hormone. In this phase, the growth rates of employed follicles around 4 days are similar, and the change occurs during the resultingfixed stage when growing follicles progress through deviation. It is well established that the first follicle requiring luteinizing hormone receptors becomes the dominant follicle while the others depending on FSH regress in response to decreasing concentrations of circulating FSH. They showed that the difference in growth rates between the largest subordinate follicle and the future dominant follicle is accounted for by the time taken for deviation or early static stage. They found that the decisive stage occurs at approximately 8 mm and that the dominant follicle produces inhibit hormone which suppresses development of subordinate follicles, resulting in their apoptosis. Moreover, a developing dominant follicle secretes oestrogen that is involved in initiation of luteolysis at the end of the luteal phase. Consequently, the frequency of LH pulses leads to the ovulation of a selected dominant follicle. It is apparent that GnRHplays a key role in modulation of folliculogenesis.

3. NUTRITIONAL EFFECTS ON OVARIAN FOLLICULOGENESIS

The nutritional effects on ovarian folliculogenesis in animals have been classified into two types. They are indirect and direct method.

3.1 INDIRECT EFFECTS

It is obvious that metabolic hormones interrelate with GnRH to control ovarian follicular improvement. The nutrition secondarily governs folliculogenesis by varyingstages of GnRH. It has been shown that a range of metabolic hormones, such as insulin, leptin and IGF-1, may also facilitate reproduction. Leptin is a peptide concealed by adipose matters, which executes essential roles in control of feed consumption and body weight. In addition, leptin is deliberated a mediator that is receptive to nutritional stress. In a study of goats, we confirmed that leptin and its receptor articulated at mRNA and protein levels are present in all components of antral follicles, with predominantly high levels in granulosa cells. However, it has been recognized that leptin is synchronized by insulin and GH, and that under nutritionindicates to reduce of insulin plasma concentration. They defined that both rumen-digestible starch and rumen-bypass starch are effective at remarkably, IGF-1 in association with GH and insulin also plays an indirect role in folliculogenesis in cattle. On the behalf of working with Brahman cattle, showed that administration of GH or GH plus insulin elevates significantly circulatory concentrations of IGF-1. However, it appears that IGF-1 has a local influence in follicular growth, and this is discussed in detail below. In précis, orchestrated by gonadotropins, metabolic hormones regulate bovine folliculogenesis. It is in this context that the question can be posed of whether nutritional factors can directly modulate folliculogenesis maintaining plasma insulin and ovarian function.

3.2 DIRECT EFFECTS

Nutrients are necessary for cell maintenance, reproduction and growth. Metabolic hormones utilize a straight impact on folliculogenesis at the ovarian level. It is competed that nutrition openly regulates ovarian development via the hepatic system. It is noted that feed intake may affect the hepatic clearance rate of steroid hormones and that consequently circulatory levels of these hormones may influence folliculogenesis. Metabolic hormones such as leptin, insulin and IGF-1 either destroy or motivate emerging follicles in a concentration-dependent method. It might be emphasized the local effect of IGF-1 on follicles. The author investigated with inoculation of IGF-1 into dominant follicles. Remarkably, they found that treatment of the second follicle led to an inhibitory effect on the growth of the largest follicle by decreasing its growth rate, and thereby measured diameter, signifying that IGF-1 increases development of the follicle during the deviation period. This may clarify why reductions in insulin and IGF-1 stay the oestrus cycle and impair the quality of oocytes and corpus luteum function. This is reliable with the report of displaying that the size of the dominant follicle is interrelated with IGF-1 concentrations in peripheral blood, and that IGF-1 motivates development of a larger dominant follicle. Furthermore, the follicle revealed that IGF-1 stimulates bovine granulosa cell proliferation. In postnatal cattle, unembellished NEB losses hepatic expression of insulin-like growth factor binding proteins (IGFBP)-3, -4, -5 and -6, but increases levels of IGFBP-2. Synthetic IGF-1 is depressed by severe NEB. A self-motivated activity of the IGF system is essential for follicular selection and progression before the pre-ovulatory phase.

In accordance with the inspiration of glucose and lipid, protein may also play a role in follicular development. Cattle that are fed regularly with high levels of dietary urea are thought to tolerate the toxicity of urea due either to rumenal micro flora increasing methane production through their ammonia absorption or to a change in the cows' hepatic metabolism. The process that investigated the effect of excess intake of rapidly degradable nitrogen on metabolism and reproduction in lactating cows, reported that addition of 250 g urea per cow per day neither significantly increases milk yield nor elevates plasma concentrations of insulin and IGF-1. It is concluded that although supplementation of high dietary rudimentary protein for non-feeding heifers results in dissemination of urea into pre-ovulatory follicles, this does not damage the structures of such follicles. In extensive cultivation systems, in spring an imbalance in protein absorption may have a potentially profound impact on the quality of bovine oocytes. Nevertheless, extra protein supplementation would perform to cause a harmful influence on the developing capability of oocytes. That system distinguished that urea damages the maturity of oocytes and reductions their quality. This is categorized by a regular reduction in dry matter consumption by cattle and their deployment of body fat investments, causing in an increase in NEFA but with repeatedly perceived insulin reduction.

4. NUTRITIONAL POLICIES TO DEVELOP THE PERFORMANCE OF REPRODUCTION IN CATTLE

Further to deliberation of the direct and indirect effects of metabolites and nutrients on the process of fertility in cattle, it is clear that nutritional approaches should be required to develop follicular capacity and superiority. It is revealed that complements of dietary n-3 polyunsaturated fatty acids increase IGF-1 concentrations, leading to development in fertility. Combination of temporary nutritional supplementation into artificial reproductive technologies such as artificial insemination and embryo transfer may develop outcomes. They described that for dairy heifer's addition of short-term nutritional propylene glycol results in a series of changes in metabolites, metabolic hormones, plasma progesterone and small follicle population, causing stimulation of follicular growth. In pasture-based systems, it is advantageous to complement a highly nourishing diet for multiparous cows in the prepartum period as this approach improves ovarian resumption and motivates the onset of ovulation after calving.

Improved provision of nutritive starch leads to a rise in plasma insulin, generating analteration in oocyte quality. Under pastoral circumstances of low quality grass and availability of a cereal-based supplement corresponding to a 0.9% of live weight concentration is crucial to supply energy, which endorsesraised insulin concentrations in blood. In divergence, it seems that in cattle with a high nutritional status, represented by a high BCS, the effects of nutritional supplementation on reproductive performance remain unclear. It is noted that in moderately underfed non-lactating cows nutritional supplementation can enhance the quality of oocytes and embryos. Nevertheless, considerable research on nutritional additions for well-fed cattle has shown that such approaches may not be effective to enhance super-ovulatory yields.Follicles comprising two or more oocytes have been termed in the ovaries of adult females of numerous mammalian species. These organizations have been called multi-oocyte follicles (Fig.2) and their influence to ovulation and productiveness in adult females in not presently known. Follicles with more than one oocyte have been well recognized during foetal growth. In this period, the ovarian cords are designed, which tube-like structures are encompassing germ cells surrounded by pre-granulosa cells. Though, the existence of these structures in adult ovaries is a fascinating physiologic occurrence.

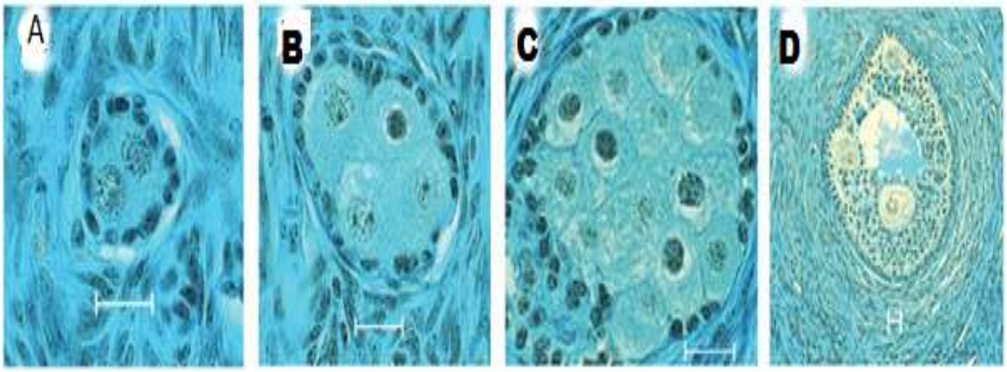

Fig.2: Preantral and antralmultioocyte follicles heifer (A-D) ovaries at the primary stage with two (A), four (B) and 13 oocytes (C), and at the antral stage with three oocytes (D).

As briefly termed, folliculogenesis remains as a universe to be reconnoitred. In spite of the unexpected progress we have seen in the last years, there are several gaps to be occupied, particularly in the preantral phase. Neo-oogenesis can still be deliberated as a hypothesis. Though, it appears practical to deliberate that the follicle formation may have new models not assumed so far. For example, we need to increase our knowledge about the multi-oocyte follicles and the follicular cords in adult females. Heifers can be designated based on calculating antral follicles using ultrasonography. Its practise in the field is motivating, since ultrasonography is an easy and fast tool that can be smeared and that should not change management conditions. Consequently, more oocytes/embryos per donor may be acquired. On the other hand, the genetic influence of choosing cattle with high AFC remains to be reflected; especially taking into account the large number of descendants that can be produced by IVF from a single donor.

CONCLUSION

It has been concluded that the nutritional effects of the cattle ovarian function. Additionally we also dealt with the outcomes of nutrients as well as hormones which concerns on folliculogenesis happen both by direct and indirect methods. On the other hand, proposed the development of the concept in the ovary of the concern animals. Hence, the regimen of cattle possibly changes the improvement of follicular growth, resulting in instabilities in the throughput of follicles. The mechanism of ovarian regulation of metabolic hormones rests vague, proposing that extra inquiries are necessary to explain this underlying metabolic pathway. Nutritional developments to pasture and forage plants should be deliberated since they are a very cost-effective way to enhance animal reproductive performance.

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