Rate of response to estrus synchronization in Egypt native and mixed breeds of cattle measured by ovarian hormonal profiles and ultrasonography of ovarian structures

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"فَأَمَّا الزَّبَدُ فَيَذْهَبُ جُفَاء وَأَمَّا مَا يَنفَعُ النَّاسَ فَيَمْكُثُ فِي الأَرْضِ كَذَلِكَ يَضْرِبُ اللّهُ الأَمْثَالَ"

سورة الرعد الآية رقم ١٧

Dedication

This work is dedicated to
My father, mother, brothers
and sisters

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First of all, my deepest thanks to our merciful ***GOD****, who gives me the power and chance to fulfill this work*

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1. INTRODUCTION

In dairy herds using AI after a detected estrus to breed lactating dairy cows, estrus detection is a limiting factor for achieving reproductive efficiency in a dairy operation. Inadequate estrus detection protocols as well as decreased frequency and duration of estrus behavior exhibited by lactating dairy cows attenuate estrus detection efficiency **(Nebel et al., 1997)**. Lack of accuracy in detecting estrus not only increases time to first AI, but it can increase the average duration of intervals between inseminations to 40 to 50 d **(Stevenson and Call 1983).** Expression of estrus behavior may also be adversely affected by for example increase in milk production **(Fonesca et al., 1983; Harrison et al., 1990, and Nebel and McGilliard 1993)**. Thus, estrus detection efficiency will probably continue to affect reproductive efficiency in dairy operations as genetic selection and management practices continue to increase milk production per cow.

Several factors including large herd size make the detection of estrus difficult and expensive. In some artificial insemination (AI) programs, only 50% of cows are correctly identified when in estrus **(Barr, 1975 and Heersche and Nebel 1994).** Moreover, progesterone assay of milk has indicated that between 5% and 25% of cows were not actually in estrus at the time of insemination.

(Reimers et al., 1985 and Nebel et al., 1987) Estrus induction can facilitate AI in cattle by reducing the time and cost of estrous detection. Scheduled uses of PGF2α can induce estrus among cows, resulting in less time spent on estrus detection and fewer veterinary visits for pregnancy examinations **(Ferguson and Galligan. 1993)**. When PGF2α is used as a luteolytic agent for a group of cows, estrus synchronization and subsequent detection of estrus is enhanced because many cows are in estrus simultaneously **(Hurnik et al., 1975).**

Unfortunately, estrus is not precisely synchronized because the follicular population varied at the time of luteal regression; thus, some cows take longer to mature a dominant follicle for ovulation. If cows selected for the PGF2α protocol were in diestrus, 90 to 95% of the cows should be in estrus by 7 days after injection, and 70 to 90% of these estruses should occur on day 3 to day 5 after PGF2α administration **(Ferguson and Galligan 1993).**

Treatment with GnRH and PGF2α is a practical routine method for controlling ovarian follicular and luteal functions and increasing the precision of estrus synchronization in cyclic and acyclic heifers and postpartum cows. This method reduces considerably the period of time needed for estrus detection; it synchronizes the estrous cycle of 70 to 80% of the cyclic cows to within a 4-day interval without any detrimental effect on the fertility rate (65 to 85%). Moreover, resumption of ovarian activity and normal fertility in acyclic cows is favored **(Twagiramungu et al., 1995).**

Progress toward reducing reliance on estrus detection for managing reproduction in lactating dairy cows was realized by combining timed AI with a protocol for synchronization of ovulation that can be initiated at a random stage of the estrous cycle **(Pursley et al., 1995).** This protocol, commonly called Ovsynch capable to synchronize follicular development, luteal regression and time of ovulation, thereby allowing for timed-AI after the second GnRH injection **(Pursley et al., 1995).** Furthermore, timed AI after synchronization of ovulation in lactating dairy cows results in pregnancy rates similar to those of AI to a standing estrus **(Burke et al., 1996 and Pursley et al., 1996).**

The main purpose of an estrous synchronization/ovulation protocol is to place a relatively large population of cows and/or heifers into a specific physiological stage of the estrous cycle, and therefore allow mass breeding within a short period of time and for this purpose the present work aimed to:

1. Compare the effectiveness of an estrus synchronization protocols based on GnRH + PGF2α(GP) with that of a standard, 1 or 2 injections of PGF2α, in dairy cows.
2. A second aim was to obtain more information on the protocols, consisted of inducing estrus after synchronization of ovulation by PGF2α +GnRH (GP) or by PGF2α +GnRH+PGF2α (PGP)
3. Also to obtain information on the protocols consists of Timed AI and synchronization of ovulation by Ovsynch or Cosynch.
4. Efficacy when decreasing the dose of GnRH.
5. Effectiveness of Ovsynch in anestrous cows and effect of treatment on serum progesterone (P4) concentrations.
6. Progesterone and estradiol assays for the purpose of assessment in all tried protocols of synchronization.
7. Rectal palpation together with ultrasonography methods where also used for assessment or follow up the changes in ovarian status after using different protocols of synchronization.

2. Review of Literature

2.1. Estrous cycle in cow

The main purpose of an estrous synchronization/ovulation protocol is to place a relatively large population of cows and/or heifers into a specific physiological stage of the estrous cycle, and therefore allow mass breeding within a short period of time and to distinguish its value in treatment of some reproductive disorders like anoestrum and postpartum cystic ovarian disease.

The bovine female is polyestrous, with a relatively uniform distribution of estrous cycles throughout the year that are not influenced remarkedly by season **(Kilen and Schwartz, 1998).**The bovine estrous cycle averages 21 day in length. There are two major phases of the cycle. These, are differentiated primarily by the dominant structures present on the ovary within each stage **(Senger, 2003).**

The follicular phase is the period from regression of the corpus luteum (CL) to ovulation. CL encompasses about 20 % of the length of the cycle. The dominant ovarian structures are growing dominant follicle, and the female genital tract is primarily under the hormonal influence of estradiol (E2), which is responsible for preparing the cow for mating **(Senger, 2003).**

The luteal phase is the period from ovulation until corpus luteum (CL) regression. This phase encompasses about 80 % of the length of the cycle; the most dominant structure is the CL, which produces the dominant progesterone hormone that promotes the uterus of the cow for successful receiving and favour potential conceptus to maintain until full term (**Senger, 2003).**

The cow is polyestrus i.e. estrous cycles continue throughout the year, unless the cow becomes pregnant. For many breeds of cows the duration of estrus is on average 15 hours, although there is good evidence for modern Holstein that is much less. The length of the other estrous periods is more difficult to define. LH surge take place during the first 6-12 hours of estrus initiating the processes leading to ovulation .which normally occur during the first hours of the metestrus, i.e. about 24 hrs to 30 hrs after the onset of estrus. Corpus luteum begins to develop from the cells originating from the walls of the ovulated follicle, and after a couple of days it starts gradually to produce more and more progesterone. At the end of diestrus, the endometrium begins to secret prostaglandins F2α (PGF2α), which cause CL regression (luteolysis), during proestrus ,the maturing dominant follicle produces increasing amount of E2 ,which causes with simultaneous absence of progestional condition of genital tract follicular development which is is recurrent during the estrous cycle i.e. it occur as so–called follicular waves. During a normal cycle, two or three (Sometimes four) waves can be detected, thus smaller and larger, growing and regressing follicles can be seen practically at any time during the cycle **(Trimberger, 1948 and Taponen et al., 2003).**

2.2. Pattern of follicular development during the estrous cycle of the cow

Follicular growth in cattle occurs in a wave-like fashion and that the majority of estrous cycles in cattle are comprised of two or three waves. Follicular wave emergence in cattle is characterized by the sudden (within 2–3 days) growth of 8–41 small follicles that are initially detected by ultrasonography each have a diameter of 3–4 mm **(Fig. 1) (Adams and Pierson 1995; Adams, 1999; and Adams et al, 2008).**

The growth rate is similar among follicles of the wave for approximately 2 days, while one follicle is only selected to continue growth (dominant follicle), and the remainder follicles become atretic and regress (subordinate follicles). Results of these early studies of follicle dynamics gave rise to the hypothesis that the dominant follicle suppresses the growth of the subordinates in the existing wave, and the emergence of the next follicular wave. Support for this hypothesis was provided in a series of studies involving systemic treatment with the proteinaceous fraction of follicular fluid and by electrocautery of the dominant follicle **(Adams et al., 1992).** The applied implications of these findings were immediate and far-reaching, and marked a new era for ovarian synchronization and superstimulation in cattle **(Bo GA et al., 1995 and Adams, 1998).**

The majority of bovine estrous cycles (i.e., >95%) are composed of either two or three follicular waves **(Adams, 1998).** In both two- and three-wave estrous cycles, emergence of the first follicular wave occurs consistently on the day of ovulation (day 0). Emergence of the second wave occurs on day 9 or 10 in two-wave cycles, and on day 8 or 9 in three-wave cycles. In three-wave cycles, the third wave emerges on Day 15 or 16. Under the influence of progesterone (e.g., diestrus), dominant follicles of successive waves undergo atresia. The dominant follicle present at the onset of luteolysis becomes the ovulatory follicle, and emergence of the next wave is delayed until the day of the ensuing ovulation. The CL begins to regress earlier in two-wave cycles (day 16) than in three-wave cycles (day 19) resulting in a correspondingly shorter estrous cycle (19–20 days versus 22–23 days). Hence, the so-called 21-day-estrous cycle of cattle exists only as an average between two- and three wave cycles **(Fig. 1: Adams et al, 2008).**

Predictive factors associated with a two- versus three wave pattern may provide insight into mechanisms controlling the pattern, and have important implications on breeding management and the development of effective protocols for ovarian synchronization. Pregnancy rates in cattle with two- versus three-wave pattern were compared based on the notion that the preovulatory follicle in the two-wave pattern grows for a relatively longer period and may contain a relatively aged oocyte.

However, results are contradictory and the pregnancy rates did not differ between two- versus three-wave cycles in some studies **(Ahmad et al., 1997 and Bleach et al., 2004)**, whereas a lower pregnancy rate was reported for two-wave cycles in another study **(Townson et al ., 2002).** There appears to be no breed- or age specific predilection for a given wave pattern in B. Taurus cattle. An increase in the proportion of three-wave patterns has been associated with a low plane of nutrition and heat stress **(Adams, 1998 and Bo GA et al., 2003).**

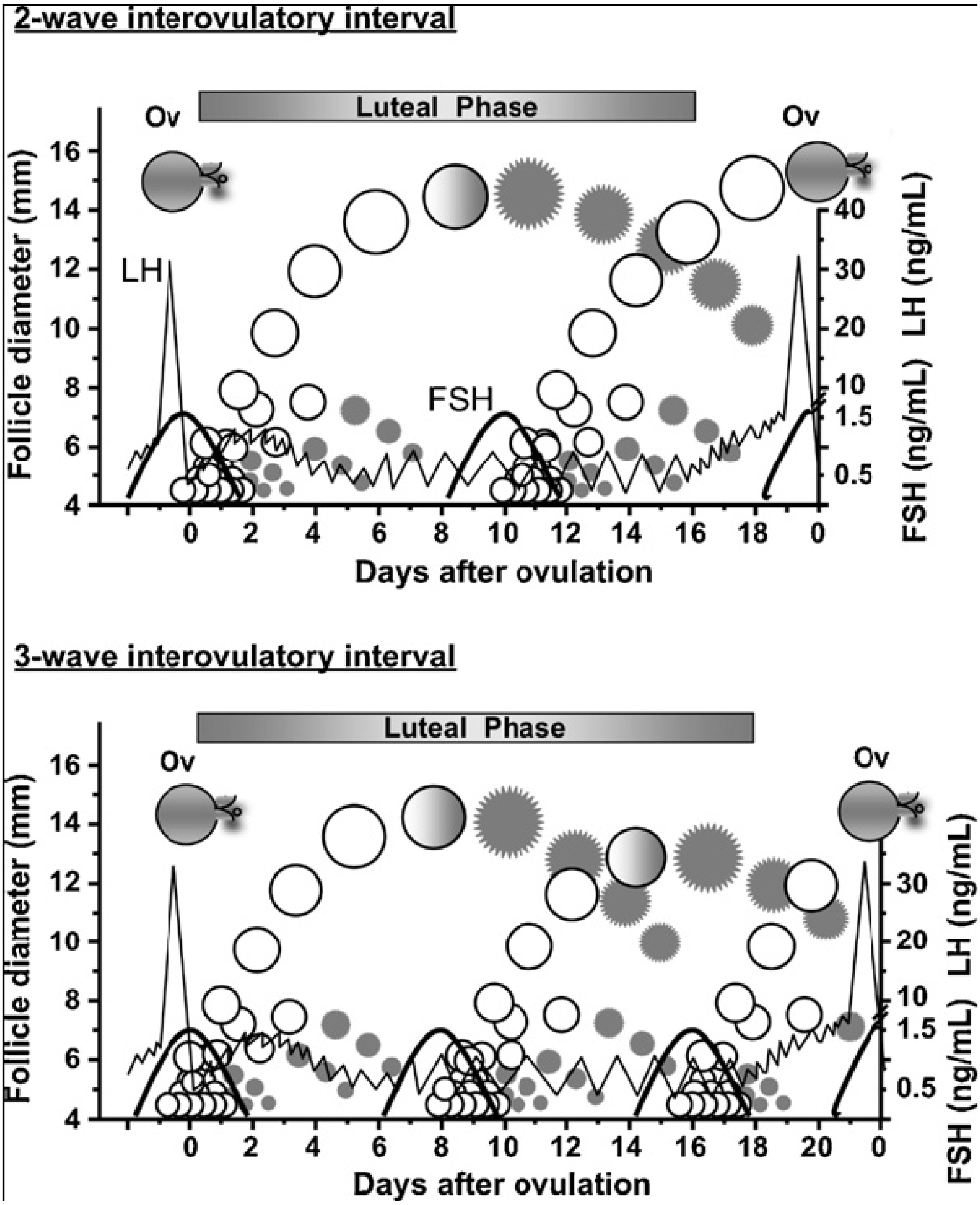

Fig.1. Dynamics of ovarian follicular development and gonadotropin secretion during two- and three-wave estrous cycles in cattle. Dominant and subordinate follicles are indicated as open (viable) or shaded (atretic) circles. A surge in circulating FSH concentrations (thick line) precedes emergence of each wave. A surge in circulating LH concentrations (thin line) precedes ovulation. The LH surge is preceded and succeeded by a period of high-LH pulse frequency as a result of low-circulating progesterone concentrations (i.e., period of luteolysis and luteogenesis, respectively (**Adams et al, 2008)**